

**SPECIFICATIONS
FOR
Danish
TECHNICAL
MAPS**

TK99

**A committee under the
Association of Local Authority Technical Directors**

2. Edition February 2000

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**AaU, DSFL, KMS, KTC, FULS,
Municipalities, Counties and
A committee under the
Association of Local Authority Technical Directors**

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English version. Translated by Birthe Nørskov and Ole Brande.

We do not guarantee the quality of the translation.
Compare with the Danish version

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INTRODUCTION

This specification replaces the "Specifications for digital technical maps" from May 1993.

The technical development and experiences with the production and use of digital maps imply a current need to adapt and extend the specification in several fields. At the same time there is, however, a strong wish that the specification is not changed all the time, as each change requires adaptations of systems and the work routines of users and producers. The previous version of the specification is from 1993 and has thus been functioning unchanged for six years.

The changes aim to continue the development towards procuring geographic data with greater applicability in the geographic information systems (GIS) of the municipalities.

As regards contents, the following has happened:

- § A new paragraph on conclusion of agreements has been introduced.
- § A new paragraph on updating of digital technical maps has been introduced, and at the same time the original appendix on updating has been maintained as instruction material.
- § In the paragraph on rights and duties 5.2 has been revised.

As to the technical contents of the specification the following development has taken place:

- § A considerably more detailed object specification with more precise measuring instructions has been prepared. At the same time, rules for upgrading have been described for each single object. These object descriptions can be found in appendix C.
- § It has been attempted to incorporate a greater connection between the technical maps and TOP10DK, but an actual common specification of objects has not been obtained with this specification.
- § The demands for a greater geometric connection in data (bases of surface formation, topology and GIS) have continuously been increased.
- § The geometry type AREA has been introduced.
- § Double registration has been legalised between areas as well as between the areas Lake and Water Hole in relation to the lines Hedge, Building and Quay Edge.
- § The use of splines has been limited. For example, splines must not occur in areas.
- § In connection with updating, the existing map data must be considered to the greatest possible extent.
- § As compared to TK93, the following objects have been **introduced**:
Structure Harbour, Speed control installations, Road Centre Line Various, Drive Centre Line, Watercourse Centre B 2.5 m, Watercourse Centre A 2.5 m, Forest Polygon, Town Polygon, Municipal

Boundary, Radio-TV Mast, Signal Stanchion and Sign Portal.

§ As compared to TK93, the following objects have been **abolished**:

Closing Line, Lake Point, Pylon, Invisible Road, Signallized Technique and Hydrant.

For historical reasons, the specification is based on the photogrammetric production method, but can also be used as a guide for other methods. It is under consideration to supplement with a paragraph on land surveying later.

This revision of the specification has been made by a committee under the Association of Local Authority Technical Directors. The commission consists of the following persons coming from a broad spectrum of organizations:

| | |
|------------------------------|---|
| Claudio Pannicelli, Chairman | The Municipality of Høje-Taastrup, The Association of Local Authority Technical Directors, |
| Flemming Hjort | The National Survey and Cadastre |
| Jens Juhl | Aalborg University |
| Søren Buch | Blominfo |
| Lars Flemming | Kampsax Geoplan |
| Frits Frandsen | Grundkort Fyn |
| Vagn Hyldgård | FULS, Natural Gas Company Midt/Nord |
| Kim Frandsen | FULS, Galten Power Station |
| Per Johansen | Jutland/Funen Mapping group, the Municipality of Kolding |
| Aimée Ena Petersen | IKS-group, the municipality of Vordingborg |
| Birthe Jacobsen | Ekko, The Municipality of Høje-Taastrup |
| Susi Finkelmann | The municipalities of Copenhagen and Frederiksberg |
| Christian Bennetzen | The Association of County Councils, Ribe County |
| Vagn W. Laursen | Danish Society for Photogrammetry and Surveying, DFSL |
| Kurt Forbech Toft | Scankort, Secretary of the Committee. |

The committee is permanent, with the task to perform a running update of this specification.

The committee should be pleased to receive proposals for improvements. These proposals should be forwarded to the secretary, Kurt Toft, Scankort and will be presented to the committee members.

This specification can, free of charge, be downloaded from the internet from: www.scankort.dk as a PFD-file.

2nd edition February 2000

After a hearing among the members of the committee in January 2000, the standard has been corrected for misspellings, formulation errors, discrepancies and inconsequent object descriptions.

These corrections exist both as cancel pages and as a new edition of TK99. Both versions can, like the previous edition, be drawn free of charge from: www.scankort.dk as PDF files.

Reading instructions

One of the main objectives of this map specification is to be able to refer to it in connection with contracts between customer and map producer. In this connection it shall be stressed that the distribution of work between customer and producer indicated in the specification is the most common, but that it can of course be changed in the specific agreement.

Chapter 1 contains a description of the photogrammetric mapping method, including the demands on aerial photography, control point surveying and aerotriangulation. The chapter is of greatest interest for those who wish to have more detailed knowledge of the photogrammetric mapping method and its influence on quality and economy in connection with negotiations on mapping projects.

Chapters 2 and 3 define the accuracy standard of the map database and describe how this is checked. These paragraphs are therefore basic knowledge in connection with choice of map type.

In **chapter 4** the basic rules for registration of data for digital maps are discussed, and the individual TK map types are defined as regards purpose, accuracy and contents. There exists also a detailed description for registration of the different object types. This description (Chapter 4.4) is found in appendix C. The chapter contains moreover a paragraph about standardized additional outputs which may be of interest if a customer has special wishes for a map product.

This chapter must be considered the important part of the specification and will in most connections be decisive in connection with choice of map type and when agreements are concluded between customer and map producer.

Matters concerning rights and duties in connection with agreements between customer and map producer are stated in **chapter 5**. This paragraph may enter as a special appendix in connection with contracting between two parties.

Chapter 6 is new with a guidance for entering into contracts between customer and map producer.

Chapter 7 is also new with more specific guidance lines for map updating as most of today's mapping is updating and upgrading of maps.

Appendix A: Updating of base maps is, as mentioned before, a guidance only and has as such no binding effect.

Appendix B: Has definitions of some of the terms used in this specification

Appendix C: Has a detailed description of all the objects mentioned in this specification.

1. PHOTOGRAMMETRIC MAPPING

1.1 Photo flight

1.1.1 Signalization

If natural control points are not available in sufficient numbers and quality a signalization of horizontal control points is organized by the customer.

As basis for the signalization work, the photogrammetric company can forward a map showing the planned flight lines for photography.

All relevant national reference trig points (GI points) in the area are signalized. A suitable number of other known co-ordinated points is signalized, among these the best points from the trig point register at the KMS (National Survey and Cadastre).

If it is not possible to obtain a satisfactory coverage in this way, supplementary points are signalized and surveyed to be used as control points.

Furthermore the customer can choose to signalize technical installations and cadastral reference points (MV points), possibly in cooperation with the KMS.

A signalization manual can be asked for at the photogrammetric companies or the KMS.

1.1.2 Aerial photography

Aerial photography is undertaken by a photogrammetric company.

The photography shall take place under clear weather conditions in the period from 15 March to 5 May, or after agreement.

Photography is not permitted with a sun angle under 30E, unless other agreement.

Flying height, and thus the photo scale, lens type, film type and filters are decided in cooperation between the customer and the photogrammetric company. The photo scale is determined from considerations of accuracy.

The photo flight shall have a forward overlap of 60% ∇ 5% and a side lap of 20% ∇ 10%.

The photogrammetric company must immediately after the flight develop and control if the negatives have a satisfactory quality, to reveal areas with a bad photo quality or lacking coverage that needs re-photography.

It is the responsibility of the photogrammetric company that the photographs are suitable for the planned purpose. If this is not the case, the customer must be warned of possible loss of accuracy and completeness.

1.1.3 Contact copies

3 to 8 weeks after the photo flight the photogrammetric company delivers 1 set of contact copies supplied with photo numbers and a photo index shown on a suitable map, showing photo centres, photo numbers and flight lines.

Bad copies, due to the copying process, can be claimed re-copied free of charge.

1.1.4 Photo identification

The photo identification is made by the customer after agreement with the photogrammetric company. If nothing else is agreed, the identification must take place following the identification specification from KMS, dated January 1992.

After ending the project, the used contact copies, control point sketches etc are returned to the customer, if desired.

1.2 Control point survey

The customer provides the needed control points.

The points should be classified as described in "User guide for Denmark's geographical reference network" (1988), type 1 for fundamental networks and type 2 for smaller networks. Other demands must be discussed for each project.

Control points chosen by the photogrammetric company, perhaps in cooperation with the customer, must be co-ordinated in the reference system GI-34/DNN(GM/GI), being tied to GI points or points of a similar quality (type 1). The number, siting and coverage must be sufficient for the needs of the project.

Height control is surveyed in a network with redundancy which must be tied to at least two bench-marks. Or surveyed by GPS with a comparable quality.

In case of mapping from small photo scales it can be agreed that no height control is surveyed, but height information is taken from the national register of benchmarks.

The survey in plane and height must have such extent and quality that errors in observations, co-ordinates and heights can be ascertained, and that the required accuracy can be documented.

1.2.1 Co-ordinates

Producing co-ordinates for control points is the responsibility of the customer. It is the customer's responsibility that the selected points are surveyed, and that the produced co-ordinates and heights have an accuracy corresponding to the needs of the project. If it is not possible to fulfil the specified accuracy, the customers must be made aware of the consequences for the resulting project. It is often possible to find alternative solutions in cooperation with the photogrammetric company.

1.2.2 Accuracy of the field survey

The point accuracy is defined as follows:

$$\sigma_P = \sqrt{\sigma_Y^2 + \sigma_X^2}$$

Horizontal control points determined by land survey for digital mapping must have the following accuracy, assuming a homogeneous reference network:

| Photo scale | Plane accuracy σ_P | Height accuracy σ_Z |
|-------------|------------------------------|-------------------------------|
| 1: 5 000 | 5 cm | 5 cm |
| 1:10 000 | 10 cm | 8 cm |

Fig 1.1. Accuracy of field survey

If a coordination of new trig points or a network densification (renovation) is taking place, where the new points shall have an accuracy better than 5 cm, the control points must have a correspondingly better accuracy, that is 2 to 3 cm.

1.2.3 Co-ordinate lists

After the survey of control points the photogrammetric company receives a copy of the co-ordinate lists, computations, network sketches and control point sketches for all control points.

1.3 Aerotriangulation

The photogrammetric company usually performs an aerotriangulation before digitizing.

A coordination of other signalized points (i.e. utility) can be agreed.

Information on the triangulation computation is sent to the customer for orientation. The customer can ask for a full documentation of the triangulation.

1.3.1 Accuracy of the aerotriangulation

Points determined by aerotriangulation will have an accuracy depending on the photo scale.

With reference to the photo scale, the accuracy will be better than or equal to the following values:

| Photo scale | Plane accuracy σ_P | Height accuracy σ_Z |
|-------------|------------------------------|-------------------------------|
| 1: 5 000 | 7 cm | 10 cm |
| 1:10 000 | 14 cm | 20 cm |
| 1:20 000 | 30 cm | 50 cm |
| 1:25 000 | 40 cm | 60 cm |
| 1:30 000 | 50 cm | 75 cm |

Fig. 1.3 Accuracy after aerotriangulation

2. ACCURACY OF THE MAP DATABASE

This chapter describes the accuracy the customer can expect when a map is produced following this specification (TK99).

In the chapter accuracy is defined in 4 groups:

- Geometric accuracy
As geometric accuracy is understood the accuracy on a co-ordinate of the single point in the map. This is valid for plane and heights.
- Thematic accuracy
In this specification thematic accuracy is defined as a expression of whether the objects are registered as the correct object type.
- Logical accuracy
The logical accuracy is an expression of whether data fulfil the demands to the internal structure.
- Completeness
By completeness is understood the percentage of registered objects compared to the number of objects seen in the photogrammetric model.

By a total update of a map the treshold values are used on the total amount of data, as it is assumed that the existing map fulfils the quality demand at the time of registration/upgrading.

By update where the changes are pointed out by the customer the sae rules are valid as for a total update, only for the areas pointed out.

2.1 Geometric accuracy

As geometric accuracy is understood the accuracy on a co-ordinate of the single point in the map. This is valid for plane and heights.

The accuracy of a point is defined in chapter 3.1.1.

The geometric accuracy of a database is an important factor for its register of origin and accuracy. The geometric accuracy must therefore be indicated either as a “reliable registration”, “unreliable registration” or as an “undefined registration”.

Reliable registration

Will for photogrammetrically well defined points be within the accuracies described in the figure 2.1 depending on the photo scale. For “not well defined” registrations like forests, coastlines and similar, a considerable higher

value can be expected. In the accuracy information these objects will still have a value as well defined registrations.

Unreliable registrations

will appear where the method of registration and the conditions in nature makes it impossible to obtain the accuracy otherwise possible. This can be the case for instance under the shadow of trees and buildings. Unreliable registration is given an accuracy 10 times less than otherwise, see figure 2.1.

Undefined registrations

The term is used when the method of registration does not give a usable co-ordinate, e.g. the elevation when making a plane digitizing. Undefined registrations are given an accuracy of 99.00. The elevation of an undefined registration is given the value -99.00 m.

There must be a logic relation between the method of registration, the visibility of the object and the value of the accuracy.

Data can **only** be exchanged with the accuracy values given in the tables in figure 2.1 and 2.2, plus the value 99.00 for undefined accuracy.

The accuracy of data produced by landsurveying (DSFL method LL) can also be given the value 5 cm.

2.1.1 Plane accuracy

The accuracy of the single objects will depend on the photo scale, the image quality, the accuracy of the control points, the position of the control points in the models, the form and definition of the objects, and the instrument and operator.

The accuracy of a line is defined as the plane distance between the line in the terrain and the database.

With reference to the photo scale the accuracy will be better or equal to the following values:

| Photo scale | Plane accuracy σ_P | Unreliable σ_P | Line accuracy σ_{line} |
|-------------|------------------------------|--------------------------|----------------------------------|
| 1: 5 000 | 10 cm | 100 cm | 20 cm |
| 1:10 000 | 20 cm | 200 cm | 40 cm |
| 1:20 000 | 70 cm | 700 cm | 125 cm |
| 1:25 000 | 85 cm | 850 cm | 150 cm |
| 1:30 000 | 100 cm | 1000 cm | 200 cm |

Fig. 2.1 Plane accuracy of the map database

The shown accuracies are only valid for photogrammetrically well-defined points like signalized

points, drain grating and similar. For buildings digitized in large scale photos a σ_P of approximately twice the size is expected. For less well-defined objects like trees, hedges and unsurfaced roads the accuracy can be considerably less. Labile lines like coastlines, lakes and land use boundaries can only be related to the time of exposure.

2.1.2 Accuracy in height

The considerations mentioned under 2.1 for accuracy of objects are also valid for height determination.

Accuracy of contour lines and Digital Elevation Models are expressed by the accuracy of points interpolated from contour lines or DEMs. The accuracy of the deviation in height of a line is only valid when the lines are to be included as breaklines or structure lines in a DEM, and thus only for lines usable for this purpose (see 4.5.5).

Line accuracy in height is the deviation in height between lines in the terrain and in the database.

With reference to the photo scale the accuracy of heights will be better or equal to the following values:

| Photo scale | Accuracy of heights σ_P | Unreliable σ_P | In case of DEM $\sigma_{\text{contour}}, \sigma_{\text{DEM}}, \sigma_{\text{line}}$ |
|-------------|--------------------------------|-----------------------|---|
| 1: 5 000 | 15 cm | 150 cm | 25 cm |
| 1:10 000 | 30 cm | 300 cm | 50 cm |
| 1:20 000 | 75 cm | 750 cm | 125 cm |
| 1:25 000 | 85 cm | 850 cm | 140 cm |
| 1:30 000 | 100 cm | 1000 cm | 175 cm |

Fig. 2.2 Accuracy in height of the map database

The shown values are valid for wide angle photography ($c = 152$ mm). For normal angle photography ($c = 305$ mm) the values for height accuracy must be doubled.

Contour lines as mentioned above are either digitized directly or generated from a DEM.

2.2 Thematic accuracy

In this specification thematic accuracy is understood as an expression of whether the objects are registered as the correct object type.

| | Thematic accuracy |
|---|-------------------|
| Network topology: a) Road, centre line b) Path, centre line c) Stream, centre line d) Coast/Quay/Structure – Harbour (boundary to lake) | 99% |
| All object types individually | 97% |

Figure 2.3 Thematic accuracy of the map data base

For network, as defined in the table, the demands are tightened up. All object types in the network must have an thematic accuracy of 99%. As a network is understood objects with a logic coherence in a network within the groups a, b, c and d.

2.3 Logical accuracy

Logical accuracy is a term to express whether data fulfils the following demands to internal structure.

| | Definition | Logical accuracy |
|---|--|------------------|
| Snap | See chapter 4 | Min 97% |
| Object coincidence | Two or more objects partially or completely coincident. Excluded multi coding | Max 1% |
| Area overlap | Areas can not cut or cross other area objects, but can have a common area boundary. An area can be placed a 100% within another area, e.g. a building in a forest. | Max 1% |
| Object overlap | Road -, Path -, and stream centre lines must be registered inside the parallel boundaries of the object, e.g. stream centre line inside stream-canal. | 100 % |
| Network topology | Full topology within the single object class. | Min 99% |
| Origin | Objects can have only one origin | 100% * |
| Correct data/type statement (point/line/area) | Se chapter 4 | 100% ** |

Figure 2.4 Logical accuracy of the map data base

* The minimum content is the DSFL basic exchange format statement (version 970901) and information on origin of new production, update og upgrade.

** Areas (building/water hole) can however cut following wishes from the customer. Also where areas cut the limit of the mapping area can a 100% not be fulfilled.

2.4 Completeness

By completeness is understood the percentage of registered objects in relation to the objects found in the photogrammetric models.

The map shall appear homogeneously, and possible missing objects (which are clearly visible in the photos) must be randomly distributed.

There are many things which influence the completeness, for example: the photo quality, photo scale, contrasts, shadow, growth and density of the objects.

The content of the map must correspond to the map type required (cf. paragraph 4.3) with possibly supplementary outputs.

The content of the map must correspond accurately to what you can see in the available photos. Each object must be visible in the two successive photos which together create the photogrammetric model.

The percentage of completeness must as a minimum be like this:

BBR = National Building Register CPR = National Person Register

| Object | Completeness |
|--------------------------------------|--------------|
| Buildings with a BBR address | 100 % * |
| Other buildings | 97 % |
| Roads in the CPR road register | 100 % * |
| House numbers with a CPR reference | 100 % * |
| Road names with a CPR road reference | 100 % * |
| Wind mills | 100 % * |
| Signalized utility | 95 % * |
| Other objects, each separately | 95 % |
| | |

Fig 3.1 Completeness of the map

- in relation to the manuscript delivered by the customer, see chapter 6.

The percentage of objects that are only sparsely represented in the data set or have a very characteristic physical placement is expected to be 100%.

3. CHECKING OF MAPS

This chapter describes the control of ordered data. The check can be performed by the municipalities, by a consultant of the municipality, or be ordered from the actual or an alternative producer. The responsibility for the quality of the data is always by the producer.

The make the control in 3.1 supplementary survey in the field is necessary.

The control in 3.2 and 3.4 is made by the use of the actual used photographs. In the production running control of thematic accuracy and completeness is performed. Still a following check can be made .

- Points are counted by number
- Lines are counted by their total length. The length of missing objects are measured by digitizing on a map in 1:5000 to 1:25000.
- Network is counted by number of objects from node to node.
- Areas are counted by the length of the circumference, buildings by number.

The check 3.3 is mainly made computational.

3.1 Check of geometric accuracy

By the geometric accuracy is understood the accuracy of co-ordinates of the single point in the map. This is valid for plane as well as height.

3.1.1 Check of the relative plane accuracy

To provide a satisfactory basis for estimation of the plane accuracy, at least 25 independent distances are surveyed, evenly distributed over the database to be controlled.

The relative point accuracy is:

$$\sigma_{\text{punkt}} = \sigma_{\text{afstand}} = \sqrt{\frac{\sum (s_m - s_k)^2}{n}}$$

- n: number of distances
s_m: distance measured in the field
s_k: distance computed from points in the database

Gross errors (max. 5%) will exist. They are defined as 3 times the accuracy of the points. They are not included in the accuracy computation.

The relative point accuracy can also be checked by surveying 25 well-defined points. The surveying must be made with a superior accuracy. The computed local co-ordinates are transformed conformally (only parallel translations and rotation) over the co-ordinates of the database. The transformation accuracy will correspond to the relative point accuracy.

3.1.2 Check of the absolute plane accuracy

Usually the relative plane accuracy is close to the absolute plane accuracy (with reference to the GI points).

A check is often costly to make. This is due to the fact that the total accuracy of the control observations in relation to the GI network must be at least three times better than the expected accuracy of the objects checked.

A check should comprise at least 25 well-defined objects like e.g. signalized points and detached drain gratings.

3.1.3 Check of the accuracy of elevations

The elevation accuracy in the database is checked by determining the elevation of at least 25 independent control points which are also determined in the database.

Elevation accuracy

$$\sigma_z = \sqrt{\frac{\sum (K_m - K_k)^2}{n}}$$

- n: number of control points
- K_m : elevation determined in the field
- K_k : elevation from map database.

Gross errors (max. 5%) may exist. They are not included in the accuracy computation.

The levelling has to be carried out with an accuracy of the control points at least three times better than the expected accuracy of the control points in the map database.

3.1.4 Check of the accuracy of elevations and digital elevation model, DEM

The contour line accuracy is checked in the same way whether the lines are digitized directly or generated from a DEM.

The contour line accuracy may in practice be expressed through the accuracy of control points, interpolated linearly between contour lines and bilinearly in an elevation model.

In every section that is to be controlled at least 25 independent control points, located in at least three profiles altogether cutting at least 20 contour lines, should be surveyed and the elevation

determined. The elevation of the same points are interpolated between contour lines or in DEM, and the accuracy is computed like under 3.3.

3.2 Check of thematic accuracy

The thematic accuracy is checked by visual comparison of the map data with the aerial photograph.

In a representative rectangular area, holding at least 200 objects of the same type, all registered objects are counted. Within the area is all objects with a wrong code are counted, using the aerial photograph. The percentage is computed and compared to the limits shown in chapter 2.2.

In networks the number of objects within the network is counted, see table 2.3.

3.3 Check of logical accuracy

The structure of the data as prescribed in the specification is controlled by checking that only areas are registered as areas, object types defined as lines must be registered as lines and object types defined as points must be registered as points.

Network object classes: road -, path -, and stream centre lines, coast/quay/structure/harbour is checked for correct object structure and snap.

3.4 Check of completeness

The map shall appear homogeneously, and possible missing objects (which are clearly visible in the photos) must be randomly distributed. Errors that are not random must be corrected unconditionally.

In a representative rectangular area holding at least 200 objects of the same object type all registered objects are counted. By using the photograph missing objects in the same areas are counted. The percentage is computed and compared to the limits shown in chapter 2.5

If it is not possible to find 200 objects of the same type there are two possibilities:

- 1) The length of the missing objects are compared to the total length of the registered objects. This is relevant for area and network objects with a clearly defined object structure.

- 2) The following size of areas is given as a guidance for a check of completeness. The number of missing objects is compared to the number of registered objects.

| Photo scale | Size of control area |
|-------------|----------------------|
| 1 : 5 000 | 2 km ² |
| 1 : 10 000 | 6 km ² |
| 1 : 20 000 | 24 km ² |
| 1 : 25 000 | 24 km ² |

Fig. 3.1 Size of control area

If it is not possible to make the control area rectangular because of coastlines or municipality boundaries the control area is defined so that it physically is covering the wanted area.

4. REGISTRATION

4.1 Basic conditions for registration

Co-ordinate system.

The photogrammetric company has to register, store and deliver coded three-dimensional co-ordinates Y, X and Z for the digitized objects with the specified accuracy.

The co-ordinates should be stated in metre with 2 decimals in System 34 Jutland / DNNGM, System 34 Seeland / DNNGI and System 45 Bornholm / DNNGI, respectively.

If the elevations can not meet the required accuracy in the specified accuracy class, a “dummy spot height” of -99.00 m **has to** be indicated. In case of new mapping with FF or LL “dummy spot heights” **must not** occur, except for texts and area symbols. This requirement is **only** valid for objects with “reliable” registration. Other objects can have “dummy spot height”.

Geometry types.

Registrations are made with the following four types of geometry:

- Point An object without extent defined by 1 set of co-ordinates. Or example mast and manhole.
- Line An object with an extent defined by more than 1 set of co-ordinates, also called a polygon. Between the registered points is drawn a line, either a straight line, a spline, an arc of a circle or a full circle. For example landuse boundary and top of a slope.
- Area An object with an extent defined by more than 1 set of co-ordinates, also called a polygon. Between the registered points is drawn a line, either a straight line, an arc of a circle or a full circle. An area must have exact identical co-ordinates in all three co-ordinates of the first and last point in the object. For example greenhouse and lake.
- Text An object without extent defined by 1 set of co-ordinates. To the co-ordinate is linked a text. For example road name and house number.

When recording straight lines and curves, the number of registrations must be as small as possible, at the same time observing the accuracy. Tanks, containers and similar round objects should be recorded as arcs of circles or full circles. An arc of circle is fixed by three points on the circle arc, while a full circle is fixed by four points on the circumference, where the first and last points are identical.

Curves can be registered as splines passing through the registered sets of co-ordinates. A spline must have at least 3 sets of co-ordinates. When a spline, following the specification, is not allowed in the final set of data, the

data must be converted to straight lines before delivery. This has to be done by computing plane co-ordinates to intermediate points and interpolating their elevation. The interpolated elevations are related to the same accuracy class as the points they are computed from.

Origin and accuracy

Information on origin and accuracy has to be linked to all registered objects. It must be possible by means of the accuracy to distinguish between registrations, where all three co-ordinates meet the specified accuracy in consideration of the definition of the object (reliable registration), and registrations, where not all co-ordinates meet the accuracy (unreliable registration).

In case of upgrading, the existing data must keep their origin in the following cases:

- when changing the object code
- when converting splines to straight lines, included new computed points.
- when snap
- when structuring network data (for example snap, intersection, moving)

Priority

Sometimes a line/curve sequence may have more meanings, for example a crash fence can coincide with the top of a terrain slope. There are two priorities, a primary and a secondary

Primary.

A line has to be coded in such a way that objects in TK1 are more important than objects in TK2, and objects in TK2 are more important than objects in TK3.

Secondary.

After this priority a line is coded after the following order of priority, where the general rule is that "soft objects give way to harder objects":

1. Building and installations.
2. Road, path and track.
3. Boundaries and topography.
4. Water.
5. Slope.

A line can have more meanings if the distance between two lines is less or equal to the line accuracy in the plane of the least accurately defined line.

Hedges must for example be coded as HEDGE when coinciding with a traffic lane edge, as hedge is a TK1 object while traffic lane edge is a TK2 object (the primary priority) although roads have a higher priority than hedge in the secondary priority.

4.2 Data structure

Snap

Within and between the objects indicated with an **S** in an object class, registration has to be undertaken, where two or more lines meet - also called "to snap".

As a principal rule, this is done by connecting end points within the indicated objects in the object class (objects marked with an **S** in the diagram in chapter 4.3) with other end points or lines lying within the specified line accuracy (versed sine) in the plane. In case of snap on a line, the common point has to appear in both lines. Within each object class the object order in the diagram indicates the order of priority, here the lower give

place to the upper ones.

For snapped points in the plane a snap also has to be made in the height. If the height difference is less than the specified accuracy in the height, one of the heights is kept (3D snap). If the height difference is larger, the registered/interpolated heights are kept (2D snap). Exceptionally, snaps have to be made between objects from different object classes. In such cases this will be specified explicitly in the object descriptions.

As afterprocessing of data, the photogrammetric companies may perform snap computations. Whether snap calculations are carried out or not, the above-mentioned snap rules for objects marked with an **S** have to be observed. The indicated snap tolerances for snap calculations must not be exceeded, as otherwise there is a great risk that the data are distorted. In figure 4.2 a factor is indicated. The snap tolerance is found by multiplying this factor with the point accuracy in plane and height for the relevant photo scale (see also chapter 2.1). Where both the plane and height tolerance can be observed, a 3D snap is carried out. Where only the tolerance in the plane can be observed, a 2D snap is performed. If the plane tolerance cannot be observed, no snaps are carried out.

Line ends from objects mentioned in the horizontal lines snap actively (=move) in relation to the passive objects in the vertical columns (= do not move).

At first a point snap with the calculated snap tolerance as radius is attempted. Next a line snap with the same radius is attempted.

The stated snaps are carried out automatically, for which reason unfavourable/misleading snaps may occur.

| passive active | Build | Greenh | Tank | Struct | Quay | Coast | Lake W.hole | Stream Cent. l. | Stream | Hedge | L.use bound |
|-------------------|-------|--------|------|--------|------|-------|----------------|--------------------|--------|-------|----------------|
| Structure | 2 | 2 | 2 | 2 | | | | | | | |
| Quay | 2 | | | 2 | 2 | | | | | | |
| Coastline | 2 | | | 2 | 2 | 2 | | | | | |
| Stream c. line | | | | | | 2 | 2 | 2 | | | |
| Stream | 2 | | 2 | 2 | 2 | 2 | 2 | | 2 | | |
| Hedge | 1.5 | 1.5 | 1.5 | 1.5 | 2 | | 2 | | 2 | 2 | |
| Landuse bound | 1.5 | 1.5 | 1.5 | 1.5 | 2 | 2 | 2 | | 2 | 2 | 2 |

Figure 4.2 Snap table

Various

As a standardised additional output area symbols can be limited by an area or by connected line segments, which as a minimum are snapped 2D.

Furthermore, the following applies to the data structure:

- 2 Area objects must not cross themselves
- 2 Area objects must not contain splines
- 2 Area objects must only overlap, if they are lying entirely within each other
- 2 Area objects are exchanged in the DSFL-format as %**F**. If surfaces of an area boundary are cut in connection with the delivery, the cut surface will be delivered as %**L**, and possible area holes in the cut

surface will be delivered as %L, too

2 Road, path and stream centre lines must not cross themselves in 3D

- 2 Road, path and stream centre lines, lake and coastline must only contain straight lines
- 2 Where other objects cross themselves, there must be a common point
- 2 Point symbols are oriented west-east (%VV=200), unless otherwise agreed.

4.3 Review of objects for the three standard map types

Three standard map types - TK1, TK2 and TK3 - are defined, each with their own area of application.

- TK1: General technical map (in open country)
- TK2: Technical base map (in open country)
- TK3: Detailed technical base map (in built up areas)

The description of an object will in general be the same in the three standard maps. The difference is expressed by the number of objects, the accuracy of the registration, and the degree of details. This will be described in the registration guidance in chapter 4.4.

As the degree of details is depending on the accuracy the following relations are shown:

| Map type | Plane accuracy σ_P | Line accuracy in plane σ_{line} | Elevation accuracy σ_Z | When DEM $\sigma_{contour}, \sigma_{DEM}$ σ_{line} |
|----------|------------------------------|--|-------------------------------------|---|
| TK1 | 100 cm | 200 cm | 100 cm | 175 cm |
| TK2 | 25 cm | 50 cm | 35 cm | 60 cm |
| TK3 | 10 cm | 20 cm | 15 cm | 25 cm |

On the following pages is shown a review of which object classes and objects belong to the three standard map types. The type of data - point/line/text - is shown, and the corresponding code in the DSFL-format. For each object is also shown whether snap must be applied (S).

Only objects with X-marking are included in the concerned standard map. Registration of other objects can be agreed on individually.

Objects written in small letters in italics are not registered photogrammetrically, but typically added on an editing workstation.

| OBJECT CLASS | OBJECT | MAP TYPE | | | DATA | S | DSFL |
|---------------------|-----------------------------|----------|-----|-----|-------|---|-----------|
| | | TK1 | TK2 | TK3 | | | |
| | | | | | | A | |
| | | | | | | P | |
| Building | | | | | | | |
| 1.1 | BUILDING, ROOF | X | X | X | Line | S | %KG4%U1 |
| 1.2 | BUILDING, WALL | X | X | X | Line | S | %KG4%U2 |
| 1.3 | GREENHOUSE | X | X | X | Line | S | %KG4%U31 |
| 1.4 | CONTAINER, TANK/SILO | X | X | X | Line | S | %KG4%U56 |
| 1.5 | BUILDING, DETAIL | | | | Line | S | %KG4%U4 |
| 1.6 | BUILDING, DIF.IN HEIGHT | X | X | X | Line | S | %KG4%U481 |
| 1.7 | BUILDING, DIVISION | | | | Line | S | %KG4%U48 |
| Installation | | | | | | | |
| 2.1 | STRUCTURE | X | X | X | Line | S | %KG4%U7 |
| 2.2 | STRUCTURE HARBOUR | X | X | X | Line | S | %KG4%6 |
| 2.3 | QUAY EDGE | X | X | X | Line | S | %KG4%U61 |
| 2.4 | VARIOUS INSTALLATIONS | | | X | Line | | %KG4%U75 |
| 2.5 | SPORT INSTALLATIONS | | | | Line | | %KG6%U42 |
| 2.6 | BREAKWATER | | | X | Line | | %KG4%U63 |
| 2.7 | SVIMMING POOL | | | | Line | | %KG4%U541 |
| 2.8 | MOORING | | | | Point | | %KG4%U67 |
| Road | | | | | | | |
| 3.1 | ROAD, CONSOLIDATED | | X | X | Line | | %KG3%U18 |
| 3.2 | ROAD, UNCONSOLIDATED | | X | X | Line | | %KG3%U19 |
| 3.3 | PARKING | | X | X | Line | | %KG3%U24 |
| 3.4 | INTERN. ROAD, CONSOL. | | X | X | Line | | %KG3%U26 |
| 3.5 | INTERN. ROAD, UNCONSOL. | | X | X | Line | | %KG3%U27 |
| 3.6 | BICYCLE PATH | | | X | Line | | %KG3%U14 |
| 3.7 | TRAFFIC ISLAND | | | X | Line | S | %KG3%U17 |
| 3.8 | TRAFFIC FENCE | | | X | Line | | %KG3%U51 |
| 3.9 | SPEED CONTROL INSTALLATIONS | | | X | Line | | %KG3%U561 |
| 3.10 | ROAD, VARIOUS | | | X | Line | | %KG3%U2 |
| 3.11 | ROAD, CENTRE LINE | X | X | X | Line | S | %KG3%U16 |
| 3.12 | ROAD VARIOUS, CENTRE LINE | | | | Line | S | %KG3%U169 |
| 3.13 | DRIVE, CENTRE LINE | | | | Line | S | %KG3%U168 |
| Path | | | | | | | |
| 4.1 | MAIN PATH | | X | X | Line | | %KG3%U36 |
| 4.2 | PATH, VARIOUS | | | X | Line | | %KG3%U37 |
| 4.3 | PATH, CENTRE LINE | | | | Line | S | %KG3%U35 |
| Rail | | | | | | | |
| 5.1 | RAILWAY TRACK | X | X | X | Line | S | %KG3%U611 |
| 5.2 | TRACK, VARIOUS | | | X | Line | S | %KG3%U61 |
| 5.3 | RAILWAY, RAIL | | | | Line | | %KG3%U621 |

Water

| | | | | | | | |
|-----|---------------------------|---|---|---|------|---|-----------|
| 6.1 | COASTLINE | X | X | X | Line | S | %KG5%U61 |
| 6.2 | LAKE | X | X | X | Line | S | %KG5%U51 |
| 6.3 | STREAM-CANAL | X | X | X | Line | | %KG5%U45 |
| 6.4 | WATER HOLE | | | | Line | S | %KG5%U52 |
| 6.5 | DITCH | | | X | Line | | %KG5%U46 |
| 6.6 | STREAM(B2.5m),CENTRE LINE | X | X | X | Line | S | %KG5%U444 |
| 6.7 | STREAM(A2.5m),CENTRE LINE | X | X | X | Line | S | %KG5%U445 |

Boundaries and topography

| | | | | | | | |
|------|-----------------------|---|---|---|-------|--|-----------|
| 7.1 | HEDGE IN OPEN COUNTRY | X | X | X | Line | | %KG5%U19 |
| 7.2 | HEDGE IN TOWN | X | X | X | Line | | %KG5%U1 |
| 7.3 | LANDUSE BOUNDARY | X | X | X | Line | | %KG5%U32 |
| 7.4 | PLANTATION BOUNDARY | | | X | Line | | %KG5%U33 |
| 7.5 | SLOPE, TOP | | | X | Line | | %KG5%U71 |
| 7.6 | SLOPE, BOTTOM | | | X | Line | | %KG5%U72 |
| 7.7 | DECIDUOUS, SURVEYED | | | X | Point | | %KG8%U511 |
| 7.8 | CONIFEROUS, SURVEYED | | | X | Point | | %KG8%U521 |
| 7.9 | DECIDUOUS, SYMBOL | | | X | Point | | %KG8%U512 |
| 7.10 | CONIFEROUS, SYMBOL | | | X | Point | | %KG8%U522 |
| 7.11 | FOREST POLYGON | | | | Area | | %KG6%U551 |
| 7.12 | TOWN POLYGON | | | | Area | | %KG6%U552 |

Area symbol

| | | | | | | | |
|-----|-------------------------------|---|---|---|-------|--|----------|
| 8.1 | DECIDUOUS FOREST | X | X | X | Point | | %KG6%U11 |
| 8.2 | CONIFEROUS FOREST | X | X | X | Point | | %KG6%U12 |
| 8.3 | WETLANDS/BOG | X | X | X | Point | | %KG6%U2 |
| 8.4 | SCRUB/GROWTH | | | X | Point | | %KG6%U13 |
| 8.5 | MOOR | | | | Point | | %KG6%U14 |
| 8.6 | CEMETERY | X | X | X | Point | | %KG6%U41 |
| 8.7 | GRAVEL PIT/RAW MATERIAL/WASTE | | | | Point | | %KG6%U34 |

Technical installations

| | | | | | | | |
|------|--------------------------------|---|---|---|-------|---|-----------|
| 9.1 | HIGH-TENSION LINE | X | X | X | Line | S | %KG8%U32 |
| 9.2 | HIGH-TENSION PYLON FOUNDATION | | | X | Area | | %KG8%U33 |
| 9.3 | MAST | | | X | Point | | %KG8%U34 |
| 9.4 | RADIO, TV MAST | X | X | X | Point | | %KG8%U36 |
| 9.5 | SIGNAL STANCHION | | | | Point | | %KT1%U725 |
| 9.6 | MAST, BASE | | | X | Area | | %KG8%U37 |
| 9.7 | WINDMILL | X | X | X | Point | | %KG8%U74 |
| 9.8 | DRAIN GRATING | | | X | Point | | %KG8%U12 |
| 9.9 | SEWER MANHOLE | | | X | Point | | %KG8%U11 |
| 9.10 | STATUE-STONE | | | X | Point | | %KG8%U6 |
| 9.11 | INSTALLATION BOX | | | X | Point | | %KG8%U2 |
| 9.12 | VARIUOS SYMBOL | X | X | | Point | | %KG8%U87 |
| 9.13 | VARIOUS TECHNICAL INSTALLATION | | | | Point | | %KG8%U8 |
| 9.14 | MILESTONE | | | | Point | | %KG3%U55 |

| | | | |
|------|----------------------|------|----------|
| 9.15 | TRAFFIC LANE MARKING | Line | %KG3%U58 |
| 9.16 | TRAFFIC SIGNBOARD | Line | %KT1%U82 |

Various

| | | | | | | |
|-------|------------------------------------|---|---|---|-------|-----------|
| 10.1 | <i>Municipality number</i> | X | X | X | Text | %D111 |
| 10.2 | <i>Road code</i> | X | X | X | Text | %D112 |
| 10.3 | <i>Road name</i> | X | X | X | Text | %D131 |
| 10.4 | <i>House number</i> | X | X | X | Text | %D132 |
| 10.5 | <i>Building number</i> | | | | Text | %D115 |
| 10.6 | <i>Arrow in stream</i> | | | | Point | %KG5%U451 |
| 10.7 | <i>Arrow on stairs</i> | | | | Point | %KG4%U411 |
| 10.8 | <i>Place name</i> | | | | Text | %D121 |
| 10.9 | <i>Trig. point</i> | | | | Point | %KG1%U2 |
| 10.10 | <i>Trig. point, text</i> | | | | Text | %D51012 |
| 10.11 | <i>Benchmark</i> | | | | Point | %KG1%U3 |
| 10.12 | <i>Benchmark, text</i> | | | | Text | %D510513 |
| 10.13 | NATURAL CONTROL POINT | | | | Point | %KG1%U4 |
| 10.14 | <i>Natural control point, text</i> | | | | Text | %D51014 |
| 10.15 | TERRAIN ELEVATION | | | | Point | %KG7%U21 |
| 10.16 | <i>Terrain elevation, text</i> | | | | Text | %D161 |
| 10.17 | WATER SURFACE ELEVATION | | | | Point | %KG7%U22 |
| 10.18 | <i>Water surface, text</i> | | | | Text | %D162 |
| 10.19 | SPECIAL ELEVATION | | | | Point | %KG7%U2 |
| 10.20 | CONTOUR LINE | | | | Line | %KG7%U1 |
| 10.21 | STRUCTURE LINE | | | | Line | %KG7%U41 |
| 10.22 | BREAK LINE | | | | Line | %KG7%U42 |
| 10.23 | MASK AREA | | | | Line | %KG7%U51 |
| 10.24 | UNSURVEYED AREA | | | | Line | %KG7%U52 |
| 10.25 | DEM BOUNDARY | | | | Line | %KG7%U5 |
| 10.26 | <i>Path name</i> | | | | Text | %D137 |
| 10.27 | <i>Text, various</i> | | | | Text | %D163 |
| 10.28 | <i>Municipality boundary</i> | | | | Line | %KA1%U1 |

4.4 Description of objects

A detailed description of the objects in this standard is found in appendix: **C**

4.5 Digital Elevation Model (DEM) (standardized additional output no 3)

A DEM describes the elevation of the terrain within a certain area, in such a way that to an arbitrary YX coordinate a Z value for the terrain height can be derived with a given accuracy. A DEM consists partly of a special software, partly of data. In the following the registration for a DEM is described.

4.5.1 Basic data

To secure a homogeneous coverage of the area a set of data is collected in the following ways:

- grid measurement with grid width after need
- selected points describing the terrain
- profile measurement
- digitizing of existing contourline maps
- digitizing of contourlines in a stereo instrument

These basic data will geometrically either be elevation points, parallel lines with varying Z values, or lines with a constant Z values.

4.5.2 Supplementary registrations to strengthen the DEM

The basic data are supplemented with top and bottom points, breaklines and structure lines in such a way that the required accuracy can be obtained in the whole area. Unsurveyed and mask areas should also be added to delimit areas where a DEM is not registered, for example in forests, or where a generation of contour lines is not always desired, for example in buildings.

4.5.3 Re-use of objects from base map data

If base map data are or will be registered in the area, part of these objects can be used in a DEM as terrain points, breaklines or structure lines. A condition for the use of these objects is that they are registered at terrain height, and that the vertical distance from a registered line and the terrain does not exceed the standard deviation of the DEM. The objects that will normally fulfil this condition are listed under point 4.5.5. Buildings and lakes can always be used as mask areas.

Base map data not registered for a DEM can usually not be used, as the vertical difference in height will not fulfil the required accuracy.

4.5.4 Special conditions related to data collection

Registration of data for a DEM demands special care which is usually not needed for base map data.

- a. Two crossing vectors, both forming part of a DEM, must have a common point in the crossing, i.e. Y,X and Z must be identical.
- b. At crossings out of level a special registration must take care of the difference in height. This is made by registering an unsurveyed area. The unsurveyed area must be made in such a way that the area is as small as possible.
- c. Where the Z value is not to be used, a special value (dummy) for Z is agreed on. This is exchanged with a %H9 in the DSFL format.

4.5.5. Review of objects used in a DEM

Special DEM objects:

| | |
|-------------------|-----------------|
| Terrain elevation | Breakline |
| Special elevation | Mask area |
| Contourline | Unsurveyed area |
| Structure line | DEM boundary |

From base map data the following objects can be used in case they are registered with reference to a DEM (see section 4.5.4):

As break or structure lines:

| | |
|--------------------------|--|
| Road consolidated | Path centre line |
| Road unconsolidated | Railway track |
| Internal road, consol. | Hedge in open country |
| Internal road, unconsol. | Landuse boundary (except against forest) |
| Bicycle path | Lake |
| Traffic island | Coastline |
| Parking area | Water hole |
| Road, various | (Ditch) |
| Road, centre line | (Stream/canal) |
| Main path | Slope, top |
| Path, various | Slope, bottom |

As terrain points:

Drain gratings
(Sewer manholes)

As boundaries for unsurveyed areas:

Coastline
Lake
Water hole
Quay edge

As mask boundaries:

Building, roof
Building, wall
Container/tank/silo
Greenhouse

(Objects in brackets must be used carefully)

4.6 Description of standardized additional output

Besides the standardized content of the three standard map types it is possible to make an agreement on the following standardized additional output:

1. Registration of signalized utility installations.
2. Registration of type of fence (hoarding, wall, hedge, stone fence and wire fence).
3. Registration of data for a DEM (see chapter 4.5).
4. Snap (co-ordinate generation and/or merging) following agreement between other object groups than standardized. Individual agreements specifies:
 - Which objects must be snapped.
 - Priority of objects - which are snapped on which.
 - Must the elevation be established by 2D or 3D snap.
 - Snap tolerances for each combination of objects.

This individual output is usually produced through computations, with no interactive possibility. Some inconveniences will occur.

5. Orientation of agreed symbols.
6. Double coding of agreed objects

7. Estimated registration of invisible road centre lines.
8. Registration of building division lines: See chapter 4.4, point 1.7.
9. 3D building modelling. The purpose is to register a digital model of buildings. A sufficient number of lines and closed polygons are registered in such a way that a digital model in 3 dimensions of buildings can be created. It is important to agree in details on how vertical lines must be generated or registered, how many architectonic details should be digitized and how snap is defined.
11. Editing after field revision made by the customer or the photogrammetric company after agreement.
12. All texts attached by the customer.
13. Editing the bordering existing data. This must be agreed on individually under consideration of accuracy and age of the data.
15. Elevation control points taken from a topographical map in 1:25 000 (National Survey and Cadastre).
16. Specification of road centre lines:

| | | |
|--------------------|-----------|-----------|
| Road, centre line | 0 – 3 m | %KG3%U161 |
| Road, centre line | 3 – 4.5 m | %KG3%U162 |
| Road, centre line | 4.5 – 6 m | %KG3%U163 |
| Road, centre line | 6 – 7.5 m | %KG3%U164 |
| Road, centre line | 7.5 – m | %KG3%U165 |
| Road, centre line | 7.5 – 9 m | %KG3%U166 |
| Road, centre line | 9 – m | %KG3%U167 |
| Drive, centre line | | %KG3%U168 |

4. RIGHTS AND DUTIES

This paragraph deals with the general agreement conditions concerning rights, duties, etc. between the customer and the supplier and is valid unless a separate agreement is made. The quality assurance procedures must be organized in such a way that the demands of this specification are met.

5.1 Generally

The foundation of the agreement is ABR-89 with later supplements (general regulations for technical advising and assistance), and these regulations will be valid for the agreement if nothing else has been stated in the present supplement.

5.2 Rights

The customer has the sole rights to the digital data (the database) delivered by the photogrammetric company, and graphical and digital products derived by the customer on the basis of the database.

The photogrammetric company has the sole rights to the aerial photographs taken by the company, following law no 194 of 11.0397 on rights.

The photogrammetric company has monopoly of photogrammetric utilization of aerial photos taken by the company.

The customer can freely – within own business areas – use the for the purpose produced contact copies in connection with establishing and updating of technical maps and key maps of every sort. This gives a right to free distribution of these, with or without payment.

Agreements can have rules for negotiations on extension of the customers right of use.

The photogrammetric company has, because of the rights to the aerial photos, a duty to store and register the photos in an archive. The original film must in principle not be destroyed, but must be stored out of consideration for the customer and for public interest in general.

Material elaborated for the solution of the project belongs to the customer, but is normally kept by the photogrammetric company. Such material may be photo identification, control point calculations, control point sketches, key maps, aerotriangulation calculations, etc.

The material placed at disposal by the customer for solution of the project must not be handed on or reused by the photogrammetric company without the consent of the customer.

5.3 Delivery

The photogrammetric company must be able to carry out a mapping project comprising up to 100 ha within 12 weeks. It is, however, a condition that the customer delivers the control points necessary for the task not later

than 8 weeks before the delivery date of the mapping project.

When the projects are larger, one week is added for each additional 75 ha. Possible errors/deficiencies in the control point material must be communicated to the customer not later than two weeks before delivery so that the project is not unnecessarily delayed.

The photogrammetric company must be able to deliver contact copies, diapositives, extracts from the database etc. at the current price to the customer within three weeks from the time of order.

Based on the wishes of delivery of the customer the photogrammetric company elaborates a schedule comprising signalizing, control point survey, customers delivery of information on house numbers and road names, digitizing and delivery of graphic and digital products. The customer can request a monthly statement report.

Before delivery of digital data the photogrammetric company must forward a control plot for the customer's acknowledgement. This plot must be in a suitable scale, must be carried out with at least four colours, contain various line fonts, and a list of symbols must be enclosed enabling the customer to assess data structure, contents and extent.

Data for the whole delivery/partial delivery are to be delivered assembled, unless something else has been agreed with the customer. The data is delivered at a specified medium.

At delivery follows a list containing:

- Time for production of the file
- Map standard (1, 2 or 3) and edition
- Eventual difference from the agreement
- Other material referring to the standard

5.4 Storage

The photogrammetric company is under an obligation to store the observations of the project on an edp medium so that it is possible immediately to carry out possible recalculations.

Data and material must be kept by the photogrammetric company for at least 5 years after delivery of the project. After the 5 years the company has to inform the customer in writing that the storage duty has expired and that an agreement has to be made on possible further storage against payment.

The photogrammetric company has to keep a back-up copy of all data in the 5 years after delivery of the project in such a way that the possibility of loss is negligible.

In the storage period the photogrammetric company has to carry an insurance comprising fire, burst pipes and tanks, wanton destruction of property, etc.

Data and material kept by the photogrammetric company must be marked with the name of the customer and belongs to the customer in case of bankruptcy, cf. ' 80 in the Law of Bankruptcy.

5.5 Delayed delivery and breach of contract

If an agreement on latest time of delivery for a partial delivery is not observed, the customer can impose fines on the photogrammetric company. In that case the fines are fixed to 1.0% of the contract sum of the partial delivery for each started week of delay.

By partial delivery is understood a part of a mapping project for which a separate delivery term has been agreed. Non-connected mapping areas are always to be considered as independent partial deliveries even if the same term of delivery has been agreed for the whole mapping project.

If the time of delivery is exceeded with more than 12 weeks, apart from force majeure, the customer can denounce the agreement in writing. Hereafter the photogrammetric company cannot advance financial claims for outputs which are executed but not delivered at the time of denunciation. The photogrammetric company has moreover lost its utilization right according to point 5.2 for the photographs that cover the missing delivery areas. The utilization right thus passes to the customer, and the photogrammetric company is under an obligation to deliver all the necessary material to the customer so that he can let the work carry on with another photogrammetric company.

The photogrammetric company can also lose its utilization right according to point 5.2, if the company demands more than the current prices for other outputs, or if the company grossly disregards the stipulations of the agreement.

In case of other sorts of non-fulfilment of the agreement the photogrammetric company is responsible for errors and negligences after the rules in ABR-89, point 6.2.

5.6 Responsibility

The photogrammetric company has a duty to inform the customer in writing if the technical specifications cannot be observed and to indicate the cause and possible consequences. The customer has then to communicate the further progress of the case in writing.

The customer has immediately to report errors and deficiencies to the photogrammetric company who will then, as soon as possible and without unnecessary delay and in view of current projects, correct these things free of charge.

Serious errors and deficiencies may imply that the delivery is considered as delayed, cf. point 5.5.

The liability to pay damages of the photogrammetric company is limited to the maximum per year in force at the time in question of the below-mentioned index-linked insurance.

5.7 Insurance

The photogrammetric company is under an obligation to take out and keep a public liability insurance for which it applies that the maximum amount for the time being totals minimum 1,500,000.- DKK a year concerning

damage to property.

The insurance has to be index-linked and be in force in the 5-year period of responsibility.

The insurance has to be taken out in an acknowledged insurance company with representation in Denmark.

The customer may request a copy of the insurance policy, and the company has to substantiate on request that the policy is kept in force. Denunciation of the insurance within the guarantee period has to be acknowledged by the customer.

5.8 Disputes

It must be endeavoured to settle all discrepancies and disputes originating from the present agreement or else from the agreements and the cooperation which are concluded or started between the parties in connection with the assistance out of court.

If this is not possible, ABR-89, point 9.01 is in force.

This does, however, not apply if a dispute arises at the civil courts between a third party and one of the parties of this agreement. The court competent in such case will also be competent to try a dispute between the consultant and the customer which has arisen in that connection.

The parties can, however, agree that disputes on fees shall in the first instance be tried by the committee mentioned in ABR-89, point 9.03. If this committee is made competent, it must be possible for both the customer and the consultant to refer the decision of the committee to the court of arbitration mentioned in ABR-89, point 9.01.

6. DIRECTIONS FOR CONCLUSION OF CONTRACTS.

The aim of this chapter is to describe some of the matters which must be considered, when an agreement on the production of a map according to this standard is concluded. The idea is that this chapter shall be a draft for matters which should be agreed between the requisitioner and the producer. Generally, it is important that there is a dialogue between the parties to ensure accordance between wishes and product. In general, changes in the agreement should be announced mutually - as quickly as possible.

6.1 General use of a technical map.

The digital technical maps were in principle developed as background for registration of technique in the municipalities. It was mainly a matter of registration of various utility networks. The development has since then implied that the maps are used for many other tasks in the municipalities, including GIS, which requires more and something different of the technical maps than the fulfilment of accuracy demands.

As user one can expect a map product meeting the specifications and standards valid at the time of production. In chapter 2 it can be seen which accuracies etc. are valid with TK98.

| Photo scale | Plane accuracy | Line accuracy | Standard |
|-------------|----------------|---------------|----------|
| 1: 5.000 | 10 cm | 20 cm | TK3 |
| 1:10.000 | 20 cm | 40 cm | TK2 |
| 1:20.000 | 70 cm | 125 cm | TK1 |
| 1:25.000 | 85 cm | 150 cm | TK1 |

Fig. 6.1 Recommended standard

As requisitioner and user of the map it is necessary to realise for which purpose the technical maps are to be used and whether this is possible. Most technical maps are today produced from aerial photography, and there is a difference in flying height according to the chosen map standard. The difference in flying height also causes a difference in the number of objects and details which can reasonably be expected seen and transferred to the map. When using the technical map, it is up to the user to assess whether the map is the best conceivable basis for a given task, or whether another type of map has to be chosen. From figure 6.1 it appears which scale is recommended for the single map types. When observing these guidelines, the user will obtain the best result in the daily use.

The technical map is recommended in connection with the registration of utility networks and other techniques, construction of roads and connected tasks.

In addition, the digital technical map is suitable in connection with GIS, because the addresses of the municipalities are part of the map.

The requisitioner and the user will obtain the greatest advantage when using the digital technical map by following the directions in the TK99 specification

6.2 Conclusion of agreements.

PARTIES

Parties concluding a contract:

Requisitioner and producer (possibly naming of sub-contractor)

Contact persons:

Pointing out of contact person for both requisitioner and producer

Directions:

The contract parties are defined. It is agreed in writing which contact persons are responsible for the task in the single organisations. The pointing out of contact persons is to ensure an improved communication between requisitioner and producer.

TASK DESCRIPTION

The task must be described unambiguously in the following fields:

- The geographic extent of the task
- Status for materials delivered to the producer from the requisitioner
- Map type/photo scale
- Additional output
- Basis for solution of the task, including the updating state of the map
- Has a photo flight to be carried out, and how is the photographing to be made?
- Control point survey/signaling
- Signaling of technique, if any
- Survey of control points
- Is the task an updating, upgrading, remapping or other?
- Is the task to be performed after selection, administratively, thematically or other?
- Photo scale/film type
- Working plan/schedule
- What does the requisitioner expect from the product:
 - a total updating of all objects or
 - only selected objects or
 - other
- Is the map to be used for GIS?
- Are there special conditions to consider?
- Is a special control of the product to be carried out?
- Other special agreements
- etc.

Directions:

It is important to agree on the nature and extent of the task, whether it is a question of remapping, updating, DEM or other, whether a possible updating is administrative, selected or total. Does an upgrading from a previous map standard without correct heights for example contain a correction of these heights, or is it a question of an additional service, which has to be agreed on before the work is initiated?

It must be agreed, how and when the photography has to take place. If there is signalized technique, it should be agreed which signalizing has to take place and how. Photo scale and film type should be chosen on the basis of required accuracy and economy. Besides, there may be special conditions around control points - has the requisitioner signalized these, is an aerotriangulation necessary, and are there points which must be part of this aerotriangulation to obtain a greater accuracy, etc.?

Moreover, it should be agreed whether there are special conditions to consider. Are there for example conditions in the existing map, which are essential to the updating, or are there special conditions like materials on hedges, are the texts to be written with large or small letters, are the texts to be placed in the road or next to it, is the technique to be oriented, etc.? If the requisitioner wishes a control plot or a plot delivered with the digital delivery, scale and other special wishes should be agreed on.

In connection with the preparation of manuscripts it should be agreed how these are to be performed.

If an additional control of the product is required, this must be agreed in advance.

Generally, it is important to agree on all additional output and possible deviations from the standard already when the agreement is made. If a precise and detailed agreement is made from the beginning of a task, it is easier for the producer to arrange the production precisely, and at the same time it is clear to the requisitioner, which expectations he may have to the final product.

TIME LIMITS*Conclusion of contracts:*

Specification of time limits for:

- signalizing
- delivery of contact prints
- supplies from the requisitioner
- supply from the producer
- the response time of the requisitioner as regards serious errors in connection

with the delivery

Directions:

A clear schedule for the task must be prepared. This schedule must contain the time of contracting, signalizing, delivery of contact prints, supplies from requisitioner and producer, respectively, etc. This may also include the time period within which the requisitioner has to react on serious errors. The latter can secure that the requisitioner controls received data within a reasonable time limit so that possible errors and deficiencies can be complained of as quickly as possible.

ECONOMY*Price:*

Prices to be agreed:

- price of agreed work, including specified prices for the single parts of the delivery
- price per hour for time consumption of producer beyond agreement
- price of standardised additional services, including price in connection with additional work
- economy and indexation

Directions:

The price of the piece of work in question forms part of the contract agreement. However, in addition to that it is important already when making the agreement to lay down what has to happen, if the supply does not take place or is delayed.

DELIVERY*Contents of delivery:*

Mutual deliveries are agreed in advance:

- times
- medium of delivery
- format of delivery
- plots
- manuscripts
- cutting
- systems information
- used codes, origin, etc.

Directions:

Finally, it is good, if the conditions around deliveries are agreed. It is both a question of supplies from the requisitioner to the producer and vice versa. Conditions like medium of delivery, format, plots, cutting, etc. Possible changes are communicated mutually.

7. UPDATING OF DIGITAL TECHNICAL MAPS.

7.1 Introduction

In the previous map standard the paragraph on map updating was only of a guiding nature. As Denmark is at present being 100% mapped with digital, technical maps, the mapping tasks now increasingly tend towards maintenance and upgrading of existing map series. Therefore there is an increasing demand for more specific guidelines for the concept map updating so that firm limits can be laid down as to what the requisitioner can demand, and what the producer has to observe.

There has also been a wish for a kind of memo or standard draft for use in connection with conclusion of updating agreements. The following definitions, technical requirements, procedure for conclusion of contracts, etc. are an attempt to concretize the expectations from the performance of the task of the requisitioner and the producer.

7.2 Definitions

Map updating means a revision of one or more objects within a given locality in the digital map series. In the updating, the current changes are incorporated in the map standard ("gas", T or TK), which is the basis of the updating. This means updating with the same object definition, accuracy, etc. as the existing map data. Thus, the updating comprises no upgrading to the newest map standard!

A map updating also comprises preparation of so-called consequential corrections of the remaining objects of the map. Updating of a new building activity will, for example, typically comprise registration of a new building and new hedges/land use boundaries/road conditions around the building, deletion of existing hedges/land use boundaries/building as well as subsequent editing of new and old map information in the boundary area.

In connection with the map updating, distinction is often made between a selected updating and a systematic updating.

When making a **selected updating**, updates are only carried out within the localities "selected" by the requisitioner. The selected localities are often referred to as specific "events".

An **event** is defined as "a joint/adjoining locality within which new registrations of one or more objects are to be made and/or existing map information is to be deleted". An event may for example be the registration of an extension, a new building and/or carport, an adjoining built-up area consisting of ten detached buildings, a roundabout, a "bus bay", a road transference, etc.

The concept **administrative updating** belongs under selected updating which means collection of geographic data on changes, which are established and registered in the technical maps in connection with an ordinary administration, typically in connection with the building and construction administration of the municipalities. Administrative updating therefore primarily comprises the building and road objects.

In connection with **systematic updating**, a systematic, total updating of one or more object codes within a specific geographic area is made. A **total updating** is "the extremity" for a systematic updating, where the whole map database of the requisitioner is updated for all objects on the map. For the objects undergoing a systematic updating, the demands on the updating will in principle correspond to a new production as regards accuracy, completeness, etc.

7.3 Technical demands on the map updating

On the basis of the above-mentioned superior definitions of the concept map updating, some more technical demands on the map updating will be described in this paragraph, which in relation to the TK99 standard are considered as obligatory, in case no specific deviations have been agreed between requisitioner and producer.

As to accuracy, completeness, etc. a map updating must comply with the demands in relation to the standard of the existing map. As regards completeness it is, however, a demand that all the selected events (single events which are unambiguously indicated on lists/key maps) are registered 100%.

In connection with the updating, single, obvious errors and deficiencies in the existing map database are registered again as regards the relevant objects comprised by the updating. In connection with a selected updating, errors and deficiencies of course only have to be corrected within the specific locality, while obvious errors and deficiencies must be corrected in the entire updating in connection with a systematic updating. General errors and deficiencies (for example lack of all drain gratings in a given neighbourhood) do not have to be registered again.

Also single, conspicuous objects which do not exceed the required registration accuracy (both in plane and height) are updated. General accuracy errors (for example owing to absolute displacements in the reference system) are not to be corrected.

Furthermore, conspicuous code errors in the updating objects should be corrected. It is, however, not necessary to correct general code errors (if for example lakes generally are coded as coastline).

Where the supplier observes essential, general errors and deficiencies in connection with an updating, which the supplier is not bound to correct, the requisitioner should be informed of the extent and potential possibilities and price for correction.

In connection with the updating, the geometry in the existing map data should be considered as much as possible. Especially within the building objects it is important to maintain the geometry of the unchanged points. If, for example, a carport/outhouse or similar is erected up against a detached house, the sides of the house, which are not affected, must not be registered again. When more buildings (for example a detached house and a carport) are changed to one area, cf. the object description 1.1 BUILDING ROOF, this has to take place by reusing the existing co-ordinates. By these methods the demand for rectangularity probably cannot be met. The reuse comprises only the Y and X co-ordinates, if the position of the point falls within the accuracy tolerance for the task in question.

The more "soft objects" (for example hedge and land use boundaries), which of course change from year to year, do not have to be registered again, unless there is no doubt that changes have actually taken place. Only objects, which quite visibly have been removed or changed, are to be deleted.

Objects, which have been registered again or changed, must be provided with a reference to a new, independent class of origin and accuracy, cf. the DSFL Format. The minimum contents correspond to the description in the Basis Edition of the DSFL Format, version 970601. Existing information of origin from "untouched" map data is carried on by delivering them to the requisitioner.

The task of updating is delivered in the same file/map index and with the same DSFL codes as map data are delivered to the supplier.

The supply thus consists of a new "complete" updated database for the field of the given file. If +/- data are required, this has to be agreed separately.

7.4 Procedure for conclusion of specific updating agreements

In connection with the conclusion of a specific updating agreement, it of course has to be agreed, whether it is a selected updating or a systematic updating. For both methods the geographic area for the task has to be fixed. In connection with selected updating an expected or maximum number of events may be agreed (possibly with an additional price per further event).

As part of the definition of the extent of the task it will, beyond the definition of the geographic extent of the task (possibly supplemented with the number of events), be necessary to describe the basis of the updating task, that is a status for the existing map database. This status should as a minimum contain the original map standard of the map series ("gas", T or TK standard) with possible additional services, possible later upgradings, how the map series have been maintained from reproduction till today as well as the time for the latest updating.

Independent of the method of updating it should always appear from the agreement, which objects are quite specifically comprised by the updating (this can only be omitted in connection with a total updating!).

An updating agreement **must** as a minimum contain the following:

- X A description of the basis of the task (status of the map)
- X Definition of the method of updating (selected/systematic)
- X Used method of registration (photogrammetry/surveying)
- X Definition of the geographic extent of the task (area/events)
- X Definition of the objects to be updated
- X Schedule for solution of the task
- X Exchange of map data (format/medium)
- X Economy

Furthermore, an updating agreement **may** be supplemented with the following:

- X Changed demands (for example changed accuracy, completeness, registration with/without elevations)
- X Special system-dependent limitations (for example max. number of vectors in polygons, line information for surface information)
- X Additional new registrations (extra objects)
- X Upgrading for changed map standard
- X Correction of known errors/deficiencies in existing map data
- X Method for delivery of updating data (+/- data, complete database or map plan-wise)
- X Information of the requisitioner on relevant events (lists/key maps)
- X Pre-analysis/data control preceding the task solution
- X Counting of number of occurrences (points, lines, surfaces and texts) per object before and after the task solution.

APPENDIX A: UPDATING OF BASE MAPS - GUIDANCE

A.1 Introduction

The object of updating is to secure the investments made in digital maps by constantly adjusting the map content according to changes in the nature that they describe and/or the standard with which the description is made.

The main questions arising in connection with updating are: Who shall be in charge of the updating? How often? How accurate? Which information? Which method? etc.

The aim of this paragraph is not to give an unambiguous solution to the above questions. This is not possible, because the current solution depends on the map owner and his needs, organization, technical, staff and financial resources as well as co-operation relations to external map users.

The intentions are primarily to lay down definitions and terminologies for the updating process so that 'clear' lines for both producer, customer and external map user can be created in connection with the conclusion of agreements on map updating.

The single phases that an updating project typically goes through will furthermore be described. The description deals with the considerations which should be made in relation to the various solution possibilities as well as possible pitfalls which should be taken special account for.

This paragraph should only be considered as a preliminary treatment of the updating problems. Therefore the entire paragraph should be considered as a **guidance** and not as a standard. This implies that the reflections stated may be used as a starting point for conclusion of agreements between map owners and users and between map buyers and producers, but that it should be specified in each single case what shall apply in the current agreement.

A.2 Main principles for the updating

In this paragraph the different reasons for a map updating are described. Furthermore, the interplay in storage and distribution of map data between the parties involved is described which is the basis of the following paragraphs.

A.2.1 Causes of map updating

The causes of a map updating can be grouped as follows:

a. Physical changes in the field

Current changes take place as a result of building and construction works. The updates may be made more or

less radically. See later.

b. Changed conditions

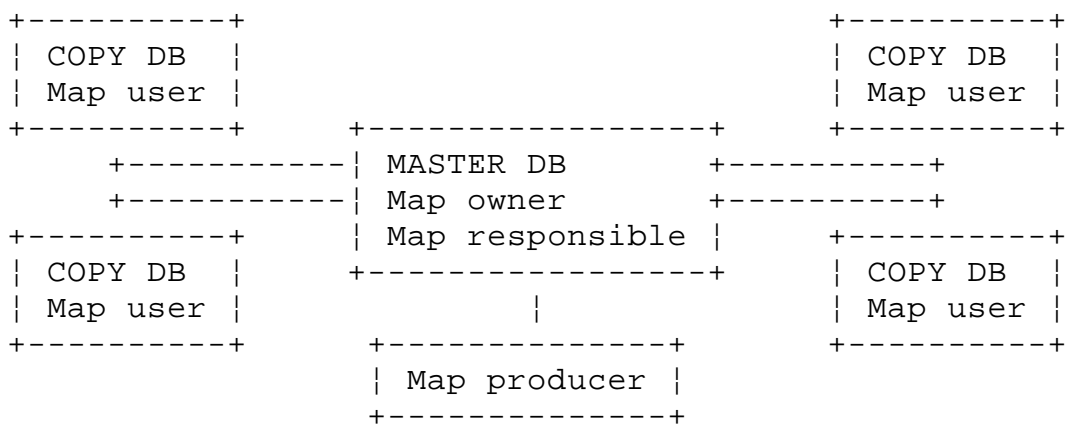
Because of developments within technology and knowledge the conditions for establishment and updating of map databases are under current change. This map specification is a clear example. Among other causes can be mentioned changes in the control point reference system in consequence of improved surveying and adjustment methods, increased demands on structuring of data, etc.

These changed conditions give occasion for some sort of upgrading of the map database, for example through a new division of the information contents, a transformation of co-ordinates, an improved registration accuracy, registration of Z co-ordinates (elevations), structuring of data, etc.

The following description will mainly deal with updating as a result of physical changes in reality, cf. point a.

A.2.2 The interplay between the parties

The interplay between the different parties in the map field can be seen from the figure below:



The map producer

The producers of technical maps are primarily the photogrammetric companies, but also chartered surveyors and others participate in the establishment of the maps. Photogrammetry and surveying will supplement each other in the updating, and this is why the number of map producers will increase in the future.

It is desirable that the producer has a copy of the master database at his disposal to be able to make a complete updating.

The map responsible/the map owner

The map responsible for the master database is typically a municipality, a regional utility owner or KMS and is often the primary user and owner of the maps. The map owner has the property rights to the digital maps and has often stored the digital maps himself in his own database (the Master Database). Some choose, however, to hand over the master database to consultants, for example the map producer. The map owner and the organization that has the responsibility for the map updating are usually identical.

The map user

Map users can conclude an agreement with the map owner on purchase of a right of use for all or parts of the maps (area and/or objects). These users will then receive a copy of the master database for individual use, for example as reference basis for registration of utilities.

Master - copy relations

It is imperative that in a map cooperation you realize and agree who is responsible for the master database for a given area or given objects, and who is the map user who has a copy database as well as which relations are to be between them as regards distribution, updating, economy, etc.

In connection with updating it is taken for granted that all the updating data will be forwarded to and be incorporated in the master database at the map responsible who will then periodically distribute the changes made to the map users who are entitled to it according to the agreements concluded.

A.3 Definitions and terminology

In this paragraph the basic elements will be discussed which together describe the extent and contents of an updating.

A.3.1 Objects (which objects are to be updated and when)

If from financial or practical causes it is desirable to select some object for more frequent updating than others, you can group the objects after importance. The most important objects has to be updated most often, the less important may not need the same actuality. However, ALL objects have to be updated in time.

As grouping and frequency may be individual for the single databases, the map responsible have to decide in cooperation with the agreement parties which objects are to be updated with which intervals. A grouping in object groups may for example look like this:

1: Updating at least once a year

| | | | |
|---------------------|-------------------|----------------|--------------------------|
| Building roof | Main path | Road names* | *Aimed updated currently |
| Building wall | Railway track | House numbers* | |
| Structure | Road centre lines | Road codes* | |
| Road consolidated | | | |
| Road unconsolidated | | | |

2: Updating every 3-5 years

| | | | |
|------------------------------|-------------------------------|---------------------------|---------------|
| Greenhouse | Parking | Landuse boundary | Drain grating |
| Container/Tank | Traffic island | High-tension line | Mast |
| Quay edge | Speed control instal. | High-tension pylon base | Mast, base |
| Internal road consolidated | Bicycle path | | Sewer manhole |
| Traffic fence | Hedge in open country/in town | | |
| 3: Occasional updating | | | |
| Slope top | Coastline | Deciduous tree, surveyed | |
| Slope bottom | Lake | Coniferous tree, surveyed | |
| Forest | Stream Canal | | |
| Internal road unconsolidated | | | |

A partial updating according to such a grouping must be effected with care, as it may imply confusion regarding the quality of the database. A total updating which secures an unambiguous quality in the whole database should therefore be effected at certain intervals.

It is important that the date of the updating is registered with the updating data.

A.3.2 Geographic coverage

The completeness of the updating in a given area can be described in the following way:

- D1: Only updating a few selected areas (i.e. not all known updatings in the mapping area are ordered).
- D2: Updating in selected areas identified administratively by the customer (i.e. all known updatings in the mapping area are ordered).
- D3: Total updating of a given area.

A.3.3 Thoroughness

The updating can be effected with great or less consequence or thoroughness.

- G1: Only new/changed objects are registered.
- G2: New/changed objects are registered and certain corrections in existing data are made. Objects within the selected object group which are affected by these additions are placed correctly (deletion, movement or digitizing).
- G3: New changed objects are registered and all consequential corrections are executed. All objects affected by these additions are placed correctly (deletion, movement or digitizing) whether they belong to the object group being updated or not.

If all objects have to be updated, G2 and G3 are identical.

A.3.4 Registration method

There are several methods for registration of the changes which have taken place. Here the most frequent methods are mentioned:

- R1: Land surveying
- R2: Photogrammetry
- R3: Photogrammetry through superimposition
- R4: Table digitizing based on map material produced differently
- R5: Administrative registration based on current project materials.

A.3.5 Accuracy classes

Abolished

A.3.6 Delivery

There are various ways of delivering data:

- L1: Total delivery of the updated area delimited by a polygon or as whole map sheets.
- L2: Only new data are delivered. Possible information on objects which have disappeared or been changed, is shown on analogue maps.
- L3: Delivery of new and changed data as \forall files, cf. point A.7.

A.4 Change detection

A central problem of updating is to find and delimit changes. This bipartition can be illustrated through the following example: When it is stated that a new roundabout has been established it has to be clarified at the updating how far changes in road course and consequences are stretching. Changes of road junctions will for example typically be stretched out over a longer stretch.

There may be different sources of finding changes, including administrative registers, but the concrete delimitation of changes can only take place through measurement of the situation and by comparing the measurements with existing data.

A.4.1 Administrative sources to find changes

Most larger changes in the terrain depend on permits from public authorities. It will be natural to tap information on future and executed installations from the administration and public registers. It should, however, be noticed that not all changes in the terrain will be registered administratively and 'unknown' changes may be of special interest.

Changes in buildings

The most important administrative source of information on changes in the building theme is the BBR-CS (the change register). When an occupancy permit is given key data are entered into this register under the address. Data in the register comprise a code of nature (new building, rebuilding, demolition), the size and use of the building. This information is useful for the updating of the base map, and efforts should be made to establish an automatic report system to the map responsible of the municipality, if possible in such a way that symbols can automatically be placed in the database at the addresses affected. A condition that this can function satisfactorily is that the address theme is maintained currently.

Use of administrative information for insertion of preliminary data into the database

It may be desirable to have preliminary information on changes entered into the database (layouts, development plans, etc.). When inserting such information distinction should be made between project data and data showing the actual structure in the field. To secure the homogeneity of the database, data inserted this way should be replaced by newly measured data at the next updating.

A.4.2 Change detection by comparing with the situation

The process to identify all changes in the terrain implies that you can compare the existing data with the actual situation. This can be done in different ways and with varying safety.

Distinction can be made between a visual comparison and a comparison including control of the situation.

Visual comparison

At a visual comparison between a plot and inspection in the field or new photos the **completeness** may be checked. The inspector will be able to identify new elements and essential changes that are obvious, like new installations. It can be difficult in this way to catch a movement of elements (for example fences and kerbs) or an extension which keep the form and proportions.

Visual comparison with check of the situation

A check of the situation may be carried out by photogrammetry or land survey. A total updating implies that a check of the situation is made.

At suspicion of changes it is possible by **landsurveying** to take control measures which compared to the database can reveal if changes have taken place.

Photogrammetrically it is possible to superimpose new data 'on top of' new photos and make a systematic and complete control of the situation. Through superimposition in a photogrammetric instrument existing data are shown as a line image on top of the photogrammetric model, and it appears clearly where changes have taken place. As a photogrammetric model is naturally three-dimensional, it is a condition for superimposition that data are registered with good Z values. By using superimposition check, measurement and editing may take place in the same working process.

A.5 Integration of changes

By integration of changes the following fundamental question must be considered:

Should you confine the exchange of data to the proper changes or perform data capture and editing in the most rational way irrespective of the fact that it may imply exchange of certain data which have not been changed?

The question is for example current in areas where so many things have happened that it is faster to re-register all the data.

The answer depends very much on the method of data delivery and the structure of the master database. Restrictions concerning editing and exchange of data may be decided by the wish to secure references to elements in the base map database.

In connection with a new mapping the co-ordinates to existing base map objects may change depending on the geometric accuracy. You should therefore realize that co-ordinates to base map objects can change in relation to for example utility systems.

A.5.1 Technical execution of integration

So far general principles for data integration have only been fixed for buildings. As according to the specification buildings are to be registered as a closed polygon, the rule is that when updating, buildings to which extensions have been added are new-registered as a whole. An exception can be made in case of relatively small extensions to very large buildings, for example housing blocks and groups of industrial buildings. At the editing you should take care not to lose the Z values.

A.5.2 Organization and integration of changes

A distinction should be made between cases where integration of data takes place externally and internally.

In case of external integration at the map producer's a ready product is delivered to the master database, either in the form of a ∇ file or exchange of data in a large or small area.

For some map users it is possible to achieve a simplification in the exchange of data if a total exchange of the data within the updated area is made. For other users it will be a necessity to be able to handle ∇ data, partly to reduce the exchange data quantity, and partly to be free to link information to objects in the map.

In case of internal integration this takes place directly in the master database, i.e. the map producer delivers new data and possibly a plot showing which old data have to be deleted/edited. In that case it is important that newly measured data have a good connection to existing, unchanged data so that they will be no need of creative editing. There may, however, be cases in which changes/deficiencies/open questions cannot be stated until in the editing phase.

If the data capture takes place through superimposition in a photogrammetric instrument, the data integration may be carried out as a natural part of the data capture.

A.6 Information on origin/accuracy

Information about the origin and accuracy of data are either attached to the single object or to an area.

The single object may carry information about the accuracy class of the single co-ordinates, production method, supplier, etc., whereas for example information that an area is updated with a certain object specification (see paragraph 3.1) to a greater extent is related to an area.

The registration of origin and accuracy should make it possible to determine which parts of the map are

updated and in which way. It should thus also be possible to conclude which parts of the map have not been updated, with for example an new object specification.

A.6.1 Area-related data

Such data should be registered in a log, where the description also exist as ordinary text. It may be a database on a computer or a logbook with the notes.

The size of the single areas which are described can be chosen freely according to the conditions, for example a cadastral plan, a village, or part of a town.

The log shall serve as a declaration of contents which can give a buyer a survey of the creation of data, which of the TK1-TK3 standards are used, the general quality and state of updating of data, etc.

A.6.2 Object-related data

Information on for example current accuracy, data of photo and survey method is, however, information connected to the single object. This information is of the type which is typically found as %H and %ND information in the DSFL files.

The single map users may have very different need of such data. The end user typically wish very little information, while the database administrator needs more.

The problem with very detailed information is that you get a very large number of accuracy classes in data.

The following table shows which information should be kept and maintained as a minimum at various map users'.

| | MASTER database | COPY database |
|----------------------------|--------------------|------------------|
| Date of photography/survey | + | + |
| Producer | + | |
| Accuracy group (Y,X,Z) | + | |

A.7 Exchange

Updating data for digital technical maps are exchanged in the form of supply of new objects and deletion or changes of whole or parts of existing objects (∇ files).

A.7.1 Format

The exchange format is the DSFL format.

The DSFL format offers the possibility of exchanging the above-mentioned updating data by means of state codes (%AF, %AT, %AS). The state codes may be indicated (in prescribed order) everywhere in the data

flow.

A.7.2 User groups/methods

The need of volume and complexity in the updating data to be exchanged vary from user to user.

This affects the exchange methods used.

The users can for example be divided into two groups:

1. A group using more complex computer systems and who use data for more purposes, among other things linking to administrative registers.

This group is typically database responsables, municipalities, great utility owners, etc.

The group has often a need of linking origin and accuracy registration, Z values, etc. to the data.

Common to this group is that today nobody can fully handle \forall files in the updating phase which has implied development of different 'provisional' methods, for example

- New objects are registered and only the +file is exchanged via the DSFL format. Consequential deletions at the receiver's.
- New, changed and deleted objects are registered. +file is registered via the DSFL format. A plot is delivered on deleted/changes objects. Consequential deletions at the receiver's.
- New, changed and deleted objects are registered. Replacement file and polygon for previous area deletion are exchanged.

This group should stake on development and implementation of updating by means of \forall files and calculate the consequences of how the use of 'provisional' method influences data, for example the risk of loss of pointers for administrative registers.

2. A group using 'simple' systems and whose need of data is mostly 'common geometry'.

This group is typically local utility owners, interest organizations (farmers), private data users, etc.

Common to these users is that they have no or only little need of information on the origin, accuracy, Z value, etc. of data.

The method for updating of the (copy) databases of these users will most often be a total exchange of data.

A.8 Recommendations

The following recommendations can be derived from this paragraph:

- It must be decided which database is the master database for a given geographic area.
- The interplay with copy databases of the master database has to be fixed.
- Updating procedures have to be established including constitution of a manual or electronic logbook.
- It should be endeavoured not to reduce the quality of the map series on the long view, i.e. Y,X,Z accuracy, completeness, content and actuality have to be maintained and possibly improved.
- Photogrammetric superimposition requires good Z values, and this is why these must not be disregarded when updating the database.
- Collection of changes (possibly automatically) from different public registers should be promoted.
- Provisional data should be exchanged with as-built data at periodical datings.
- Project data should not be part of the official base map.
- Every effort should be made to develop and implement techniques for exchange of \forall updating files.

APPENDIX B: CONCEPT EXPLANATION

| Concept | Explanation | Additional text |
|---------------------|--|---|
| 2D snap | Point in two or more objects with common Y and X co-ordinates, but not common Z co-ordinate. | |
| 3D snap | Point in two or more objects with common Y, X and Z co-ordinates. | |
| Area object | Encircling polygon with at least four points and the geometry type "area", where the starting and terminal points are identical. | |
| BBR address | Address from the Danish Building and Dwelling Register. | |
| Data capture | Collection of data. | |
| Data format | Specific organizing and placing of data in files. Ex. DSFL, DXF, UFO, DGN. | |
| DEM | Digital Elevation Model | Description of the terrain elevation of an area. This may be by S grid measurements with density as required S selected, descriptive points S profile measurements S curves |
| Digitising | Digital collection of point, line and area objects. Either by photogrammetry, GPS, table or screen digitising. | |
| Double registration | The same object registered more times. Exact coincidence of co-ordinates is necessary. | |
| DSFL | Danish Society for Photogrammetry and Surveying | Society with the aim of "promoting the development and use of photogrammetry, remote sensing and other survey-technical theories and methods". |
| DSFL format | Danish data exchange format developed by the society DSFL. | |

| | | |
|----------------------|---|---|
| Own tracé | Centre of a sequence - e.g. railway track or road centre line | |
| EKKO | Digital map cooperation group in the Copenhagen area | The municipalities in the County of Copenhagen, incl. the municipalities of Copenhagen and Frederiksberg. |
| End point | Starting or terminal point in an object. | |
| Surface | See area object. | |
| Distribution network | Superior network in for example a path network. | |
| Photogrammetric | Registration in three co-ordinates by means of stereo photographs. | |
| FULS | Common Committee for Utility owners Cooperation. | Association of utility owners. |
| Common geometry | An identical sequence of geometry, forming part of two or more objects. | |
| Common point | Point appearing in two or more different objects. See 2D snap and 3D snap. | |
| Geocoding | Logical linking between one or more objects in a map database and one or more pieces of information in other databases. | |
| Geometry type | Point, line, area or text. | |
| GF | Base map Funen. | Association of all municipalities in Funen. |
| GIS | G eographic I nformation S ystem. | Program for handling of geographic spatial data with connected information. |
| GPS | G lobal P ositioning S ystem. | Satellite-based positioning system. |
| Green area | Area designated for recreational purposes around residential areas. | |
| Heath | Plant community on poor and sandy soil. | The dominating vegetation of the heath is dwarf bushes. Vegetated dunes are part of heath. |

| | | |
|-------------------|--|---|
| IKS | Interest group for map users in Zealand. | Interest association between the municipalities of Bramsnæs, FREDENSBORG-HUMLEBÆK, Greve, Gundsø, Hvalsø, Høje Taastrup, Køge, Lejre, Ramsø, Ringsted, Roskilde, Skovbo, Solrød, Stevns, Vallø and Vordingborg and the County of Roskilde. |
| JFK | Jutland Funen Map Group. | Interest association between the municipalities of Esbjerg, Frederikshavn, Herning, Horsens, Hjørring, Kolding, Middelfart, Odense, Randers, Silkeborg, Vejle, Aalborg, and Aarhus. |
| KL | The National Association of Local Authorities in Denmark. | Superior political body for all the municipalities. |
| KMS | The National Survey & Cadastre | The national map institution. |
| Nodal point | Point with common end point coordinates from two or more objects. | |
| Map type | An expression for detail level and accuracy of map data. Ex. TK1, TK2, TK3 | |
| Croquis sketching | Marking of control points on a map basis or contact prints of aerial photographs. | |
| KRR | The Cross-Reference Register | Nationwide register connecting address, building, property, cadastral and planning designations from the nationwide basic registers within the property data field. KRR is at present under extension with geographic co-ordinates for the addresses. |
| Cross | Where a point in an object is identical to a point in another object, provided that it is not two starting and terminal points. May occur both as 2D and 3D. | |

| | | |
|-------------------|--|---|
| KTC | Association of Local Authority Technical Directors | Organisation of technical managers from the municipalities. |
| Traffic lane edge | Edge of traffic lane. Bicycle paths, which are only bounded from the roadway by painting, also belong to the traffic lane. | |
| Landsurveying | Object registration by measuring in the terrain with GPS, total station, levelling, plane table surveying or similar. | |
| Line object | Collection of one or more successive vectors for a polygon. A line object may have the same starting and terminal point, but often it does not have. | |
| Deciduous forest | Forest area mainly consisting of deciduous trees. Deciduous trees = large group of trees of widely different family, but with certain common characteristics, such as the flat and generally petiolate leaves. | |
| Manuscript | Model/proposal for registration/editing of data. | |
| Multicoding | More objects using the same 3D geometry. | |
| Network | Line objects connected in a logical sequence and with logical ramification. Ex. road and watercourse centre lines. | |
| Network topology | The designation for the topological rules which make for example road centre lines constituting a coherent network. | |
| Node | See nodal point. | |

| | | |
|--------------------------|--|--|
| Coniferous forest | Forest area mainly consisting of coniferous trees. coniferous tree = large group of trees of widely different family, but with certain common characteristics, such as scales, line or needle-shaped leaves which in most cases are perennial. | |
| Object | A description of an object existing in nature of either physical (building, fence, tree, etc.) or conceptual nature (road centre line, place name, administrative boundaries, etc.). | |
| Object ident | Unambiguous numbering of objects. Previously called key. | |
| Object class | An object class consists of object types, which can be grouped under the same superior description. | |
| Object code | Unique number code connected to the single object types. | |
| Object type | Objects with identical physical or conceptual nature make up an object type. | |
| Overfall structure | Weir for relief of watercourses in connection with unusually strong stream flow. | |
| Single-family house | Building for habitation of one or two families. | |
| Single-family house plot | The private area of utilisation around a detached house, usually encircled by fence or hedge. | |
| Residencial suburb | Area designated for habitation with one or two-family houses. Exist in collective urban areas. | |
| Park | Recreational areas in the nature of garden. Not always with public access. Ex. of parks: Gardens around manors, Assistents Kirkegård, Tivoli, Frederiksberg have, recreational urban areas in the nature of garden. | |

| | | |
|----------------------------|---|---|
| Line accuracy, versed sine | The deviation between the actual sequence of a line and the corresponding registered/interpolated sequence. | |
| Point | Y, X, Z co-ordinate. | |
| Point object | Object consisting of only one co-ordinate Y, X, Z. | |
| Salt water | Areas with connection to the sea (the North Sea, the Kattegat, the Belts, the Baltic). | |
| Signallizing | Marking in the terrain of control points or special objects for photogrammetric registration. | |
| Intersection | Where objects pass each other without 2D or 3D common points in one or both objects. | |
| Snap | That two or more objects have a common point. See 2D snap and 3D snap. | |
| Bypaths | Secondary paths connecting the roads with the superior paths. | |
| Technical maps | A map prepared on the basis of this specification. | A technical map is targeted at the municipalities and the utility owners need of maps. |
| Thematic accuracy | Object code correctness. | |
| TK93 | "Specifications for technical maps" also called "The TK-standard". | Published by a committee under the Association of Local Authority Technical Directors. March 1993 |
| TK99 | Revision of TK93. | Published by a committee under the Association of Local Authority Technical Directors. 1 January 1999. |
| TK object | Object contained in the TK standard. | |

| | | |
|------------------|---|--|
| Topology | How the single geometric units cohere and create objects and describe how the single objects cohere and create structures. In the topology there is no information contained as to where an object is lying or how large it is, but only information about the connection to other objects. | |
| Track | Centre of a road or a railway sequence. A road track is registered on the road centre line. Where the road is divided by a centre strip, two road centre lines are registered. A railway track is registered at the centre of two rails in a track. | |
| Unmarked address | Administrative address description cf. The KRR Register. Address unsuitable for co-ordinate fixing. | |
| Vector | The line between two points. | |
| Wetland | Area which can neither be frequented on foot or in boat. Primarily bog, wet meadows, reed forests in lakes and marsh. | |

APPENDIX C: OBJECT DESCRIPTION

TK99 OBJECT DESCRIPTION

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All measures and treshold values in the following are normative for estimation at registration.

1 BUILDING

1.1 BUILDING, ROOF

Objekt definition

Outline of adjoining building sections. Ajoining buildings are defined as **one** BUILDING ROOF, independent of roof material, roof construction, height differences or the like.

Measuring instruction

Registrations are made at the extreme edge of the roof. Elevation at the roof edge. When difference in height there are no rules for which elevation to measure. The elevation must be at least the height of the lowest part of the building.

BUILDING ROOF must not have common lines with other objects of the same type.

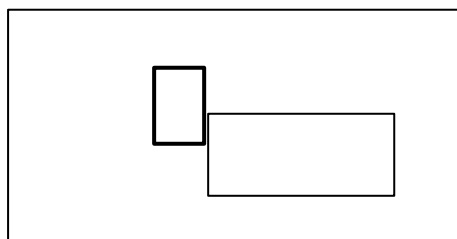
Holes in buildings (like an atrium) are registered as an independant BUILDING inside the surrounding building.

Buildings that seemes to be right-angled must be corrected to be rectangular.

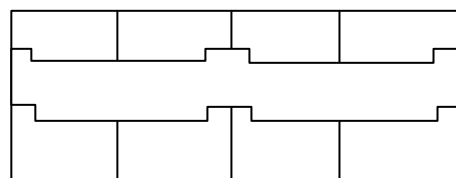
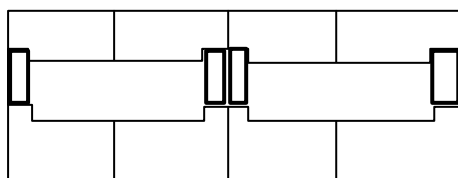
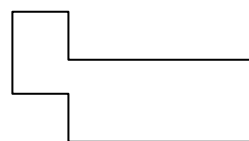
Delimitation of building sections within a building with a height difference larger than 5 metres must be registered as BUILDING, DIFFERENCE IN HEIGHT.

Shifts in the roof construction in the same elevation, less than 3 times the plane accuracy, are not registered.

In the field:



In the registration:



—— Carport —— Building

Details

Under BUILDING ROOF are also garages, carports, verandas, glas extensions, sheds, pent roofs, platform roofs and the like.

Stairs, shelter walls and the like are registered as BUILDING DETAIL.

Free hanging balconies, sunblinds and coverings at shops are not registered.

Buildings under construction / demolition are registered as STRUCTURE if only foundation or walls are visible.

TK1: Buildings smaller than 25 m² are not registered.

TK2-TK3: Buildings smaller than 10 m² are not registered.

Connection with other objects

Objects must be snapped (2D/3D) with other objects within the object class building.

BUILDING ROOF must have (2D/3D) common geometry with other area objects and STRUCTURE HARBOUR and QUAY EDGE when occuring. The common geometry must occur in both objects.

Upgrading

BUILDING ROOF must be assembled to areas.

1.2 BUILDING, WALL

Object definition

Same object definition as BUILDING ROOF.

BUILDING WALL is not measured photogrammetrically.

Measuring instruction

Registrations are made at the wall face with an elevation at the footing. When difference in elevation there are no rules as to where the elevation is measured.

BUILDING WALL can not have common lines with other objects of the same type.

Holes in buildings (like an atrium) are registered as an independant BUILDING WALL inside the surrounding building.

Buildings that seemes to be right-angled must be corrected to be rectangular.

Delimitation of building sections within a building with a height difference larger than 5 metres must be registered as BUILDING, DIFFERENCE IN HEIGHT.

Details

Under BUILDING WALL are also garages, carports, verandas, glas extensions, sheds and the like.

Stairs, shelter walls and the like are registered as BUILDING DETAIL.

Free hanging balconies, sunblinds and coverings at shops are not registered.

Buildings under construction / demolition are registered as STRUCTURE if only foundation or walls are visible.

TK1: Buildings smaller than 25 m² are not registered.

TK2-TK3: Buildings smaller than 10 m² are not registered.

Connection with other objects

Objects must be snapped (2D/3D) with other objects within the object class building.

BUILDING WALL must have (2D/3D) common geometry with other area objects and STRUCTURE HARBOUR and QUAY EDGE when occuring.

Upgrading

BUILDING WALL must be assembled to areas.

1.3 GREENHOUSE

Object definition

Commercial greenhouses perceived as a joint unit.

Ajoining greenhouses are defined as **one** greenhouse independently of change in roof construction, height differences and the like.

Measuring instruction

Registrations are taken at the extreme edge of the roof with the elevation of the roof edge. When difference in height, there are no rules for which elevation to measure. The elevation must be at least the height of the lowest part of the building.

GREENHOUSES are not registered on single-family house plots.

A GREENHOUSE must not have a common line with other objects of the same type.

Holes in a GREENHOUSE (like an atrium) are registered as an independant GREENHOUSE.

Greenhouses that seemes to be right-angled must be corrected to be rectangular.

Shifts in the roof construction in the same elevation, less than 3 times the plane accuracy, are not registered.

Details

Glas buildings at nurseries, botanical and zoological gardens are registered as GREENHOUSE.

Passages between greenhouses are always registered as GREENHOUSE.

Glas extensions at single-family houses, railway stations, stadiums, swimming baths, shopping centres are **not** GREENHOUSE but are registered as BUILDING ROOF.

GREENHOUSES smaller than 25 m² are not registered.

Connection with other objects

Objects must be snapped (2D/3D) with other objects within the object class building.

A common line (2D/3D) with other area objects must occur in both objects.

Upgrading

Glas extensions, that are not any longer GREENHOUSE are renamed BUILDING ROOF.

GREENHOUSE on single-faily house lot and GREENHOUS smaller than 25 m² are deleted.

GREENHOUSEs with a passage are joined to one GREENHOUSE.

GREENHOUSES must be assembled to areas.

1.4 CONTAINER - TANK/SILO

Object definition

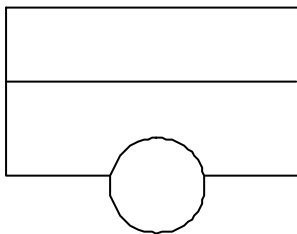
Outline of container with the character of a building.

Measuring instruction

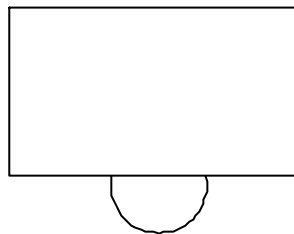
Is registered at outline of roof, elevation at roof edge.

If CONTAINER – TANK/SILO is lying partly inside a building, the building must be registered first. Next the CONTAINER – TANK/SILO is registered with 2-D snap on the building, so that the CONTAINER – TANK/SILO will be shown as a semicircle, where one line is common with the building.

In the field:



In the registration:



Water towers are registered at the largest circumference.

Details

Under CONTAINER – TANK/SILO is oil, chemical, gas tanks, grain silos, manure tanks and similar.

Are also registered on agricultural holdings.

TK1: Objects smaller than 25 m² are not registered.

TK2-TK3: Objects smaller than 10 m² are not registered.

Connection with other objects

Objects must be snapped (2D/3D) with other objects within the object class building.
A common line (2D/3D) with other area objects must occur in both objects.

Upgrading

CONTAINER – TANK/SILO must be assembled to areas.

1.5 BUILDING, DETAIL

Object definition

Larger, not building-like objects.

Measuring instruction

No rules for registration of elevations

.

Details

BUILDING DETAIL can include larger ramps, stairs and shelter walls in connection with buildings and shelters at bus stops. It must be agreed on in each single case.

Building details smaller than 3 times the plane accuracy are omitted.

Connection with other objects

Objects must be snapped (2D/3D) with other objects within the object class building.

Upgrading

On special agreement.

1.6 BUILDING, DIFFERENCE IN HEIGHT

Object definition

Delimitation between building parts in BUILDING ROOF and BUILDING WALL with a difference in elevation larger than 5 metres.

Measuring instruction

The height difference is measured from roof edge to roof edge, not from roof top to roof top or from roof top to roof edge.

There are no rules for which elevation to register. The elevation must be at least the height of the lowest part of the building.

Details

BUILDING DIFFERENCE IN HEIGHT is not registered at small entrance areas. Typically 1 to 3 metre wide areas in house blocks.

BUILDING DIFFERENCE IN HEIGHT is not registered around chimneys inside buildings, irrespective of height.

BUILDING DIFFERENCE IN HEIGHT is not registered between BUILDING-ROOF and other objects next to each other or built together. As an example CONTAINER – TANK/SILO and GREENHOUSE.

Connection with other objects

Objects must be snapped (2D/3D) with other objects within the object class BUILDING ROOF and BUILDING WALL.

Upgrading

Is deleted if included in other objects than BUILDING ROOF or BUILDING WALL.

1.7 BUILDING, DIVISION

Object definition

Visible lines inside BUILDING ROOF and BUILDING WALL separating different building parts (functional or ownership) from each other. These lines can be used to separate BBR units.

Measuring instruction

Is registered when visible delimitation lines between individual buildings are found in a large group of buildings.

Registered to the best judgement concerning geometric course and completeness. Elevation at roof edge.

Details

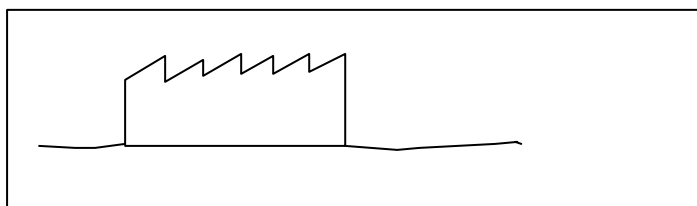
Examples of cases that **must be registered**:

- Lines between different properties built together in the property boundary, with visible differences in roof construction e.g. linked houses, garages, carports and similar.
- Lines between residence and other buildings, e.g. residence / garage, carport, shed, covered terrace, veranda and the like.
- In house blocks low extensions are registered if they are not registered as BUILDING – DIFFERENCE IN HEIGHT.
- Visible difference in roof construction e.g. change from pitched roof to flat roof, fire wall, building extensions and similar.
- Between large building units of institutions, public buildings and commercial buildings.
- Is registered at buildings with obvious different use like residence contra garage, workshop, farm buildings and similar.

Examples of cases that **should not be registered**:

- Lines between garages and sheds.
- Extensions where the use is the same as in the original building.
- Lines between terrace (row) houses with no visible difference in the roof construction.
- When difference in roof construction at industrial and office buildings where the lines does not exist in the buildings.
- Where a BUILDING – DIFFERENCE IN HEIGHT is registered.

Example on a roof construction, where a building – division is not registered:



Connection with other objects

Objects must be snapped (2D/3D) with other objects within BUILDING ROOF and BUILDING WALL.

Upgrading

2 INSTALLATION

2.1 STRUCTURE

Object definition

Large installation which can not be categorized as building.

Measuring instruction

Registered by outline, elevation at top edge.

Detached chimneys with varying diameter at top and bottom (difference larger than 1 metre) are registered as two objects. One object with diameter and elevation at top and one object with diameter and elevation at bottom.

Details

Edge of bridge, pumping station, retaining wall, large statues, large installation boxes, detached chimneys, ruins, foundations, windmill foundations, purifying plants, fountains, water basins and similar.

Concrete constructions in harbours with no contact to water are registered as STRUCTURE.

Retaining walls around single-family house plots are registered as STRUCTURE if they are more than 2 metres high.

Retaining walls are registered as **one** lineirrespective width.

Other STRUCTURE is registered by centre point. If wider than 2 metres the outline is registered.

Buildings under construction/demolition are registered as STRUCTURE if only the foundation or walls are visible.

TK1: STRUCTURES smaller than 25 m² are not registered.

TK2-TK3: STRUCTURES smaller than 10 m² are not registered.

Connection with other objects

Structures built together with buildings must be snapped (2D/3D) with these.

Upgrading

Existing data must be snapped following the new rules.

2.2 STRUCTURE - HABOUR

Object definition

Non-natural boundary between land and sea where it is not possible to moor. In connection with harbours.

Measuring instruction

Non-vertical edges are measured at water edge, others at top.

Details

Construktions in harbours, not used as mooring space are registered as STRUCTURE HABOUR.

All breakwater installations in connection with harbours are registered.

Connection with other objects

STRUCTURE HABOUR must have (2D/3D) common geometry with BUILDING ROOF, BUILDING WALL and LAKE when occurring. The common geometry must occur in both objects.

QUAY EDGE, COASTLINE and STRUCTURE HABOUR must be snapped, to constitute the boundary to the lake.

Upgrading

Extensive re-coding in harbour areas, where STRUCTURE, COASTLINE and QUAY EDGE must be controlled.

STRUCTURE HABOUR must be snapped to COASTLINE and QUAY EDGE.

A common geometry must be established where buildings are next to STRUCTURE HABOUR.

2.3 QUAY EDGE

Object definition

Landing stage where the boundary between land and sea consist of a massive and vertical structure.

Measuring instruction

Registered at the outer edge towards the water, on top of the object.

Details

Harbour and wharf against sea (e.g. concrete, sheet piling or wooden palisades), and similar installations at lakes.

QUAY EDGE is not used at wooden landing stages or pontoon bridges. These are registered as VARIOUS INSTALLATIONS.

Connection with other objects

QUAY EDGES must have (2D/3D) common geometry with BUILDING ROOF, BUILDING WALL and LAKE when occuring. The common geometry must occur in both objects.

QUAY EDGE, COASTLINE and STRUCTURE HARBOUR must be snapped, to constitute the boundary to the sea.

Upgrading

Extensive re-coding in harbour areas, where STRUCTURE, COASTLINE and QUAY EDGE must be controlled.

QUAY EDGE must be snapped to COASTLINE and STRUCTURE HARBOUR.

A common geometry must be established where LAKE and BUILDING is next to QUAY EDGE.

2.4 VARIOUS INSTALLATIONS

Object definition

Small walls, manhole covers, overfall, detached stairs, small bridges, permanent bathing jettys and septic tanks.

Landing stages made by wood in harbours and lakes.

Foundation for crane track (where the track is raised over ground).

Measuring instruction

Registered at outline on top of object.

Details

Constructions raised over ground are only shown by foundation on terrain.

Not registered at single-family house plots and agricultural holdings.

Connection with other objects

Upgrading

2.5 SPORT INSTALLATIONS

Object definition

Outline of playing fields, running and jumping tracks, shot-putting etc.

Measuring instruction

Elevation is measured at terrain.

Details

SPORT INSTALLATIONS are only registered at stadiums and schools where the sport installation has a stadium-like nature.

There must be a clearly visible edge or change in surface.

Fence around a tennis court is not registered as SPORT INSTALLATION but as FENCE.

Painted lines around playing fields are not registered.

Bunkers, greens and other objects at golf courses are not registered as SPORT INSTALLATION, but if desired as PLANTATION BOUNDARY or SLOPE.

Motoring tracks are not registered under SPORT INSTALLATIONS but are shown with their own codes.

Connection with other objects

Upgrading

2.6 BREAKWATER

Object definition

Breakwater installation perpendicular from or parallel to COASTLINE.

Measuring instruction

Centre line is registered, elevation at top. Wider than 2 metres the outline is measured.

Details

Breakwater installations in connection with harbours are not registered as BREAKWATER but as STRUCTURE HARBOUR.

No registrations under sea level.

Connection with other objects

Upgrading

2.7 SWIMMING POOL

Object definition

Swimming pools at single-family house plots.

Measuring instruction

Elevation at terrain.

Details

Open-air swimming pools are registered as STRUCTURE.

Connection to other objects

Upgrading

2.8 MOORING

Object definition

Bollart, dolphin, etc.

Measuring instruction

Elevation at terrain.

Details

Connection to other objects

Upgrading

3 ROAD

Roads and paths are given mutual priorities as follows:

ROAD, CONSOLIDATED
ROAD, UNCONSOLIDATED
PARKING
INTERNAL ROAD, CONSOLIDATED
INTERNAL ROAD, UNCONSOLIDATED
BICYCLE PATH
MAIN PATH
ROAD, VARIOUS
PATH, VARIOUS

Neighbouring roads/paths with the same priority, are registered at the physical edge.

When roads and paths in the mentioned priority are neighbouring or crosses, the main rule is, that the road/path with the highest priority is registered unbroken. This means that road/path lines from the highest priority road/path are registered continuously without any stop. Following this rule it means that the road/path with a lower priority ends at the higher priority road/path.

An extra rule is that a higher priority road is not registered continuously, if the adjoining ROAD, PARKING or INTERNAL ROAD has the same surface and there is no physical edge. The purpose is that e.g. adjoining asphalted roads for cartographic reasons can be represented as one, unbroken road.

Another supplementary rule is, that where a consolidated road/path crosses an unconsolidated road/path with a higher priority, the consolidated road/path is registered unbroken, so that the edges crosses.

The purpose is that distinctive differences in surface are shown, e.g. when an asphalted bicycle path crosses an unconsolidated road. In this case the unconsolidated road and the consolidated bicycle path are both registered unbroken.

An adjoining road/path is always registered right to the higher priority road/path, inclusive a possible curve, that is right to the tangent point.

Registration of objects from the objekt class road apart from centre lines are not made underneath other objects like bridges, in tunnels or under roof overhang.

3.1 ROAD, CONSOLIDATED

Object definition

Outer road surface edge on consolidated roads, which are open to the public.

As road, open to the public, is understood all roads (including bridges and squares) perceived to be open for ordinary traffic as well as access road (drive) to **more** than one property (building with an address).

By consolidated is understood: asphalt, concrete, paving cobbles and similar.

Measuring instruction

Road consolidated is registered at edge of road surface, e.i. typically kerbs in town areas and typically asphalt edge in rural areas.

Road consolidated delimits "consolidated area", i.e. without considering road striping. Painted edges are not used in the definition of ROAD CONSOLIDATED.

Bus stops, parking, bicycle paths and emergency lanes are registered as ROAD CONSOLIDATED, if they are only separated from the traffic lane by striping.

Traffic islands, longer than 10 metres, centre strips, and inner circles in roundabouts (delimited by kerbs) are registered as ROAD CONSOLIDATED.

If a bicycle path / pedestrian crossing is built "through" a centre strip, the traffic lane edge is registered along the cycle path / pedestrian crossing edge.

If a bicycle path / pedestrian crossing is built "passing over" a centre strip, the traffic lane edge is registered without any break.

At speed control installations (like humps) ROAD CONSOLIDATED is always registered unbroken at the traffic lane estimated or real extension behind the installation.

Road consolidated can be registered even if there is no visible delimitation in the field. This can take place in the following cases:

- Where an adjoining road is registered passing a sidewalk/bicycle path to snap to the larger road.
- Where a ROAD CONSOLIDATED is closed passing a bicycle paths at the end of this.
- Where a ROAD CONSOLIDATED is closed, passing a consolidated entrance crossing (on highways).
- Where a centre strip is registered as ROAD CONSOLIDATED is broken by a bicycle path / pedestrian crossing.

Details

By photogrammetric registration ROAD CONSOLIDATED is not measured underneath other objects like bridges, in tunnels under roof overhang and similar invisible places.

ROAD CONSOLIDATED is registered as unbroken continuous lines in spite of sporadic blurs caused by gravel at the road side, curves at entrance roads and similar.

Consolidated access roads longer than 20 metres leading to parking areas are registered as ROAD CONSOLIDATED.

Connection to other objects

Upgrading

Because of uncertainty in earlier editions of this specification (with following interpretation varieties) agreement-specific re-coding and adjustments must be made to ensure full conformity with the new edition of the specifications.

3.2 ROAD, UNCONSOLIDATED

Object definition

Outer traffic lane on unconsolidated roads, open to the public.

By roads open to the public is meant all roads (including bridges and squares) perceived to be open for ordinary traffic as well as access road, drive, to **more** than one property (building with an address).

By unconsolidated road is understood dirt road, gravel road and similar.

Measuring instruction

ROAD UNCONSOLIDATED is registered at outer traffic lane edge.

ROAD UNCONSOLIDATED is used for registration of:

- Gravel roads in summer cottage areas
- Field lanes, serving as access road to more than one property
- Field lanes, serving as connecting road between farms or public roads.

Unconsolidated roads longer than 20 metres leading to PARKERING are registered as ROAD UNCONSOLIDATED.

Unconsolidated roads in forest districts are not registered as ROAD UNCONSOLIDATED but as INTERNAL ROAD UNCONSOLIDATED.

Details

By photogrammetric registration ROAD UNCONSOLIDATED is not registered underneath other objects like bridges, in tunnels, under roof overhang and similar invisible places.

ROAD UNCONSOLIDATED CONSOLIDATED is registered as unbroken continuous lines in spite of sporadic blurs caused by gravel at the road side, curves at entrance roads and similar.

Connection to other objects

Upgrading

Because of uncertainty in earlier editions of this specification (with following interpretation varieties) agreement-specific re-coding and adjustments must be made to ensure full conformity with the new edition of the specifications.

3.3 PARKING

Object definition

Outline of independantly delimited parking areas including internal distribution roads and approach and exit roads shorter than 20 metres.

Measuring instruction

Registration is made at road surface edge.

Registration of PARKING is a question of evaluation, with the following as a guidance:

PARKING is registered in connection with ROAD, but never in connection with INTERNAL ROAD.

Approach and exit roads shorter than 20 metres to parking areas are registered as PARKING.

Details

As PARKING in connection with ROAD is registered:

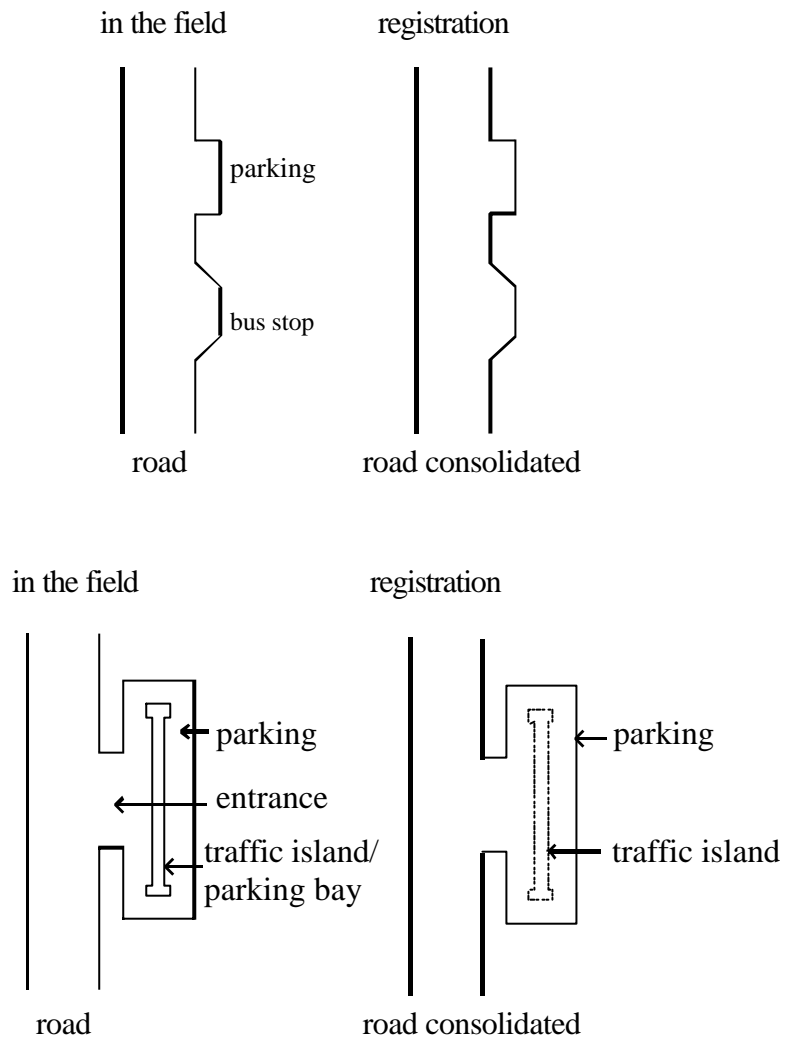
- Parking areas in connection with larger unities: Institutions, shopping centres, sport installations, railway stations, tourist sights etc.
- Parking areas on squares and in town centres.
- Parking areas in connection with block of houses, terrace houses and similar.
Independant delimited parking areas, with own access road to ROAD CONSOLIDATED.

But not:

- Parking areas on industrial properties.
- Parking areas along roads.
- Bus stops.
- Parking areas on single-family house plots.

Traffic islands, parking bays and similar arrangements on parking areas are registered as TRAFFIC ISLAND if they have a delimitation like kerbs, plantation or similar. Striping or change in surface at same level is not considered as delimitation.

By photogrammetric registration PARKING is not registered underneath other objects like bridges, in tunnels under roof overhang and similar invisible places.



Upgrading

Because of uncertainty in earlier editions of this specification (with following interpretation varieties) agreement-specific re-coding and adjustments must be made to ensure full conformity with the new edition of the specifications.

3.3 INTERNAL ROAD, CONSOLIDATED

Object definition

Outer edge of road surface on roads perceived to give access to a single property, and internal consolidated roads on the property.

By consolidated is understood: asphalt, concrete, paving cobbles and similar.

Measuring instruction

Registration is made at road surface edge.

Details

As INTERNAL ROAD CONSOLIDATED is registered:

- Roads serving as access to only one property
- Roads longer than 20 metres on internal areas at building blocks, institutions, industrial installations, airports, agricultural properties, cemeteries and similar.
- Internal parking areas on industrial plots.
- Squares for use of only collective traffic.
- Consolidated roads in allotment garden areas.

But not:

- Access roads shorter than 20 metres to parking areas. These are registered as PARKING.
- Roads on single-family house plots in town areas
- Roads in allotment garden areas, where the road surface area coincide with HEDGE.

INTERNAL ROAD CONSOLIDATED is not registered underneath other objects like bridges, in tunnels, under roof overhang and similar.

Connection to other objects

Upgrading

Because of uncertainty in earlier editions of this specification (with following interpretation varieties) agreement-specific re-coding and adjustments must be made to ensure full conformity with the new edition of the specifications.

Consolidated MAIN PATHs in cemeteries are re-coded INTERNAL ROAD CONSOLIDATED.

INTERNAL ROAD CONSOLIDATED shorter than 20 metres are deleted.

3.5 INTERNAL ROAD, UNCONSOLIDATED

Object definition

Traffic lane delimitation on unconsolidated roads, perceived to serve as access road to only one property, and internal roads on private properties.

By unconsolidated road is understood dirt road, gravel road and similar.

Measuring instruction

Registered at outer traffic lane edge.

At access roads to agricultural properties the unconsolidated internal road ends at the farmyard/buildings.

INTERNAL ROAD, UNCONSOLIDATED is registered at access roads to agricultural properties, if longer than 20 metres.

INTERNAL ROAD, UNCONSOLIDATED is only registered if they are of a permanent character. Not registered are dirt roads at building sites, tracks from spraying tractors and other wheel tracks only used seasonal a few times a year.

Details

As INTERNAL ROAD, UNCONSOLIDATED is registered:

- Unconsolidated roads (drives) only serving as access road, drive, to a single property.
- Unconsolidated roads longer than 20 metres on internal areas like agricultural properties, in parks, cemeteries and industrial installations, including blind alleys longer than 300 metres and roads longer than 50 metres leading to a TK object.
- Internal parking areas on industrial plots.
- Unconsolidated roads in allotment garden areas.
- Permanent forest roads with details corresponding to the 4-cm maps of The National Survey & Cadastre.

But not:

- Access roads shorter than 20 metres to parking areas. These are registered as PARKING.
- Roads on single-family house plots.
- Roads in allotment garden areas, where the road surface area coincide with HEDGE.

INTERNAL ROAD UNCONSOLIDATED is not registered underneath other objects like bridges, in tunnels, under roof overhang and similar.

Connection to other objects

Upgrading

Because of uncertainty in earlier editions of this specification (with following interpretation varieties) agreement-specific re-coding and adjustments must be made to ensure full conformity with the new edition of the specifications.

Unconsolidated MAIN PATHs in cemeteries are re-coded INTERNAL ROAD, UNCONSOLIDATED.

3.6 BICYCLE PATH

Object definition

Outer edge of surfaced bicycle path along road.

Measuring instruction

Registered at edge.

Bicycle paths are only registered as BICYCLE PATH along roads. Bicycle path in own track is registered as MAIN PATH or PATH, VARIOUS.

BICYCLE PATH is registered at delimitation between bicycle path and road side or between bicycle path and sidewalk.

The limit between bicycle path and road is **not** registered as BICYCLE PATH, as road consolidated has a higher priority. BICYCLE PATH will thus be registered as a single line away from the traffic lane edge or as a double line.

BICYCLE PATH is **not** registered if it is only delimited by striping.

BICYCLE PATH is only passing byroads if there is a change in surface or a physical edge.

Details

BICYCLE PATH is not registered underneath other objects like bridges, in tunnels, under roof overhang and similar.

Connection to other objects

Upgrading

3.7 TRAFFIC ISLAND

Object definition

Outline of traffic island installations in connection with crossroads, pedestrian crossings and on parking areas.

Measuring instruction

Registered at outline.

TRAFFIC ISLAND is only registered if there is a shift in surface or a physical edge.

If a bicycle path / pedestrian crossing is built "through" a traffic island, more traffic islands are registered. If a bicycle path / pedestrian crossing is built "passing over" a traffic island, the traffic island is registered as **one** traffic island.

Traffic islands, parking bays and similar installations on parking areas are registered as TRAFFIC ISLAND if there is a permanent delimitation in the form of kerbs, change in surface and similar. Striping is not considered as permanent.

Details

TRAFFIC ISLANDs longer than 100 metres are registered as ROAD CONSOLIDATED.

Inner circles in roundabouts are registered as ROAD CONSOLIDATED or SPEED CONTROL INSTALLATIONS.

Connection with other objects

TRAFFIC ISLAND is not snapped to other objects than itself.

Upgrading

TRAFFIC ISLAND must be snapped to itself.

3.8 TRAFFIC FENCE

Object definition

Crash fence (steel, concrete, cable) or wire fence at road installations.

Måleinstruks

Wire fence is registered at centre. Crash fence is registered at front line towards the road area.
Elevation is registered at top.

Details

Connection with other objects

Upgrading

3.9 SPEED CONTROL INSTALLATIONS

Object definition

Traffic moderating arrangements lying totally or partly within the road area.

Measuring instruction

Is registered at outline. Elevation at terrain.

Is registered as all single parts of traffic moderating installations like flower jars, flowerbeds, bottlenecks, bus locks, "town gates", shifts in level (humps) and similar.

Is registered at kerb, delimitation of "humps" or similar, delimiting the useful area of the road (traffic lane edge).

Inner circles of roundabouts, only marked by shift in surface are registered as SPEED CONTROL INSTALLATIONS.

Details

Installations with only acoustic or visual warning are not registered.

At speed control installations ROAD CONSOLIDATED is always registered unbroken at the estimated or actual extension of the traffic lane edge behind the speed control installation.

Connection with other objects

Upgrading

Relevant ROAD, VARIOUS are re-named SPEED CONTROL INSTALLATIONS.

Possible supplementary registrations.

3.10 ROAD, VARIOUS

Object definition

Supplementary registrations in connection with roads and squares.

Measuring instruction

Is registered at outline.

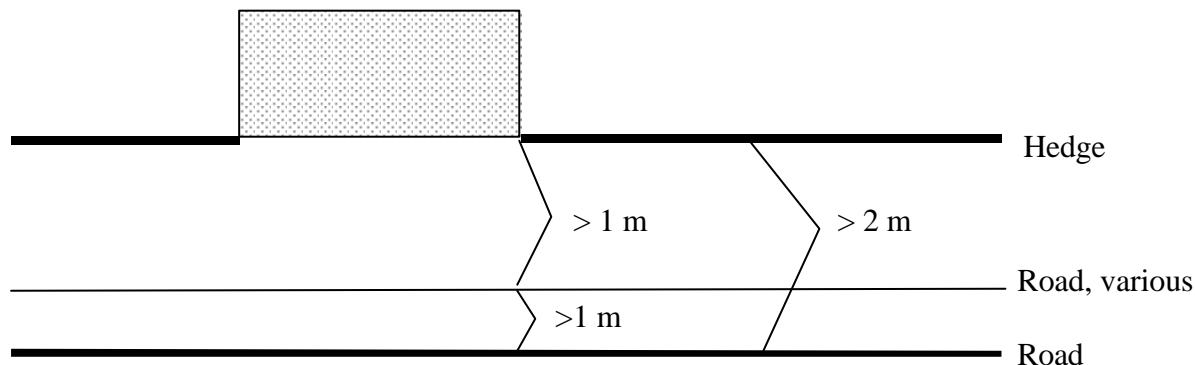
Details

Sidewalk, field access and similar is registered.

In the area between building/hedge and traffic lane is registered one line as ROAD VARIOUS if:

- the width of the area is larger than 2 metres and
- the distance from building/hedge to the sidewalk is larger than 1 metre and
- the distance from the traffic lane edge is larger than 1 metre.

Where it is possible to choose between 2 or more sidewalk lines, the line farthest away from the traffic lane edge is registered as ROAD VARIOUS.



Connection with other objects

Upgrading

Double lines at sidewalks are deleted, although not without accept from the customer.

Humps and similar are re-coded SPEED CONTROL INSTALLATIONS.

Field tracks are re-coded INTERNAL ROAD, UNCONSOLIDATED.

3.11 ROAD, CENTRE LINE

Object definition

The estimated centre line of roads delimited with the code ROAD and INTERNAL ROAD longer than 100 metres and at the same time leading to an address. Roads with an unbroken centre strip is registered with 2 road centre lines – one for each traffic direction.

To ROAD CENTRE LINE is linked information about municipality number and road code, following manuscript.

Measuring instruction

ROAD CENTRE LINE is registered at terrain at the estimated middle of the traffic lane. ROAD CENTRE LINE must not cross or touch the edge of the traffic lane except at byways with unbroken edges of the traffic lane or where road or road centre line ends.

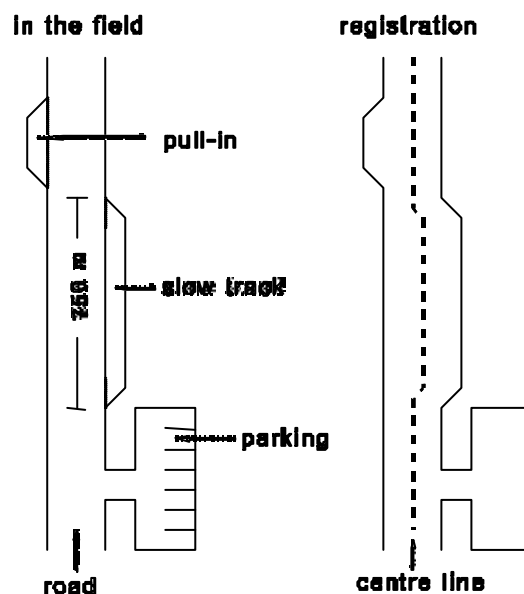
ROAD CENTRE LINE must pass through TRAFFIC ISLAND and SPEED CONTROL INSTALLATION.

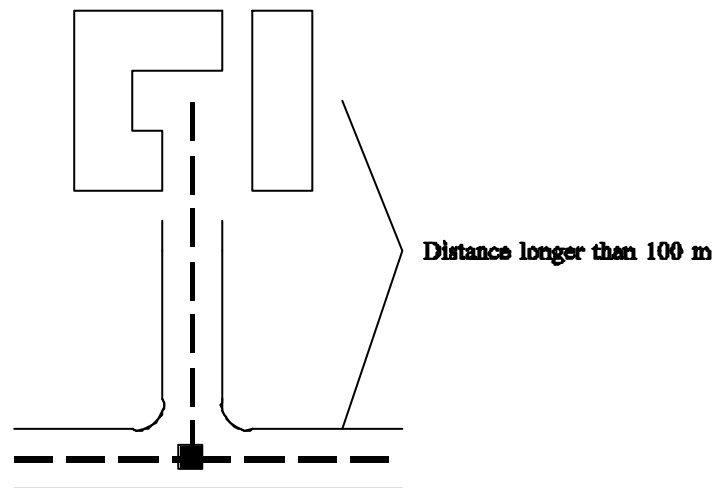
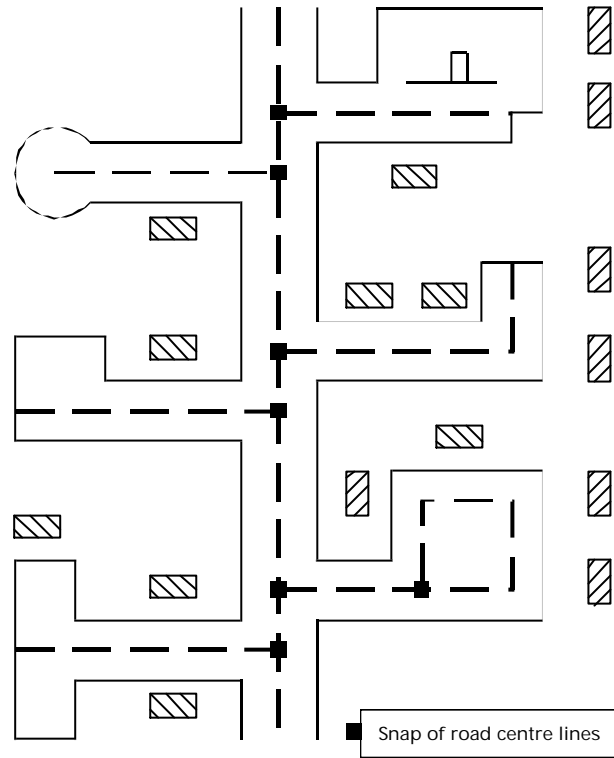
ROAD CENTRE LINE can only have straight lines.

ROAD CENTRE LINE is registered unbroken under bridges, buildings, through tunnels and similar.

At approach and exit ramps at motorways and similar ROAD CENTRE LINE is also registered.

ROAD CENTRE LINE must be registered to the last address at INTERNAL ROAD. To be registered, approach roads to a single address must be longer than 100 metres, from ROAD CENTRE LINE to the middle of the farmyard.





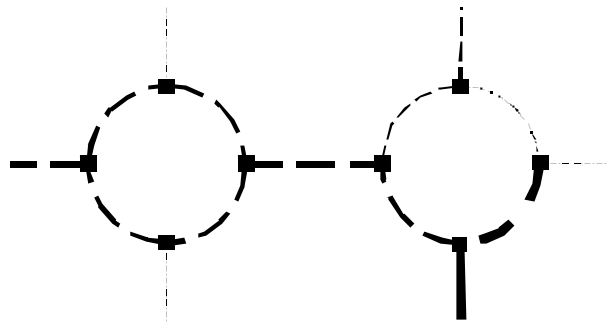
ROAD, CENTRE LINE must end at a farmyard or snap to the line ending a blind alley. Where roads has no sharp endin, the road centre line just end where the roadlines ends.

Details

If a parking place has its own road name ROAD CENTRE LINE is registered to the end/bottom of the parking place.

Roundabouts are given road reference in the following ways:

- If one of the roads to and from the roundabout is of greater importance than the other roads, the road centre line in the roundabout is given the reference of this road.
- If all roads have the same importance, the roundabout is given the reference of all the adjoining roads. This is done by extending the reference of the adjoining road to the right in the roundabout until the next adjoining road. As this takes place for all adjoining roads, all parts of the circle will be given a reference.



The following standardized additional output possibilities are available for ROAD CENTRE LINE: Road width (0-3, 3-4.5, 4.5- 6, 6-7.5, over 7.5, 7.5-9, over 9 metres) and access road centre line (centre lines on roads, leading to only one property and which is a branch to another centre line with the same road code).

Connection with other objects

Where ROAD CENTRE LINES are crossing each other out of level, a 2D common point must be established.

A node is established (stop object, begin a new one) with 3D-snap where ROAD CENTRE LINE meets another ROAD CENTRE LINE, DRIVE CENTRE LINE or ROAD VARIOUS CENTRE LINE in the same elevation.

A 2D common point is established with STREAM CENTRE LINE at crossing.

Upgrading

Road centre lines are changed, following the new definition:

- At blind alleys in town areas centre lines are extended to the end surface edge.
- Road centre lines at parking places with an independant road code.
- Road centre lines are extended to middle of farmyards.
- Establishment of 2D common points at road crossings out of level.
- Roundabouts are re-coded the needed extent.
- More drives caused by changed minimum distance.
- Splines and arc of circles must be changed to straight lines.
- Double road centre lines at roads with centre strip.

3.12 ROAD VARIOUS, CENTRE LINE

Object definition

Road and Parking with no ROAD CENTRE LINE, however not in industrial areas.

Information on municipality number and road code is **not** attached.

Measuring instruction

ROAD VARIOUS, CENTRE LINE is registered at terrain at the estimated middle of the traffic lane edges. ROAD VARIOUS, CENTRE LINE must not cross or touch the road edges except at byroads with unbroken traffic lane edges or where road and centre line ends.

ROAD VARIOUS, CENTRE LINE must only have straight lines.

ROAD VARIOUS, CENTRE LINE is registered unbroken under bridges, buildings, through tunnels and similar.

Details

Connection with other objects

Where road centre lines are crossing out of level, a 2D common point must be established.

A node is established (stop object and begin a new one) with 3D-snap, where ROAD VARIOUS, CENTRE LINE meets another ROAD, CENTRE LINE or ROAD VARIOUS, CENTRE LINE at the same level.

Upgrading

New object.

3.13 DRIVE, CENTRE LINE

Object definition

Road centre lines at drives (access roads) serving only one address and with the same road code as the ROAD CENTRE LINE it is a branch of, and shorter than the minimum valid for ROAD CENTRE LINE.

Information on municipality number and road code must be attached.

Measuring instruction

DRIVE, CENTRE LINE is registered at terrain level where the middle of the traffic lane edges is estimated to be. DRIVE, CENTRE LINE must not cross or touch the traffic lane edges except at byroads with unbroken traffic lane edges or where road and centre lines ends.

DRIVE, CENTRE LINE must only have straight lines.

DRIVE, CENTRE LINE is registered unbroken under bridges, buildings, through tunnels and similar.

Details

Centre lines shorter than 10 m is not registered.

Connection with other objects

Where road centre lines are crossing out of level, a 2D common point must be established.

A node is established (stop and begin a new object) with 3D-snap, where DRIVE, CENTRE LINE meets ROAD, CENTRE LINE at the same level.

Upgrading

New object.

4 PATH

4.1 MAIN PATH

Object definition

Continuous paths in own track, including superior paths, serving as distributing network for side paths.

Measuring instruction

MAIN PATH is registered by outline. Elevation at terrain.

MAIN PATH is passing unbroken over PATH, VARIOUS, irrespective of visible delimitation.

Paths leading over or under roads will often be MAIN PATHs.

MAIN PATH will usually also be used as bicycle paths.

Paths with a name and code must be registered as MAIN PATH.

A path, leading from a parking place, turning space or is access road to surrounding or nearby buildings is **not** a MAIN PATH.

MAIN PATH is registered only at the extreme outline of paths with more functions, including footpath and bicycle paths separated by grass border/change in surface.

Details

Invisible MAIN PATHs under bridges and similar are **not** registered.

An internal path in a green area, parc, cemetery or similar is registered as PATH, VARIOUS.

Paths narrower than 1 metre are registered as PATH, VARIOUS.

Connection with other objects

Where MAIN PATH meets PATH, VARIOUS the line from MAIN PATH is registered unbroken.

Upgrading

MAIN PATH registered by centre line is re-coded to PATH, VARIOUS.

MAIN PATH must be closed where it meets PATH, VARIOUS.

4.2 PATH, VARIOUS

Object definition

Internal path in a green area, parc, cemetery and access from road to building , with the exception of single-family houses.

Measuring instruction

Registered at outline. Elevation at terrain.

Paths narrower than 1 metre are registered at centre line.

Details

Paths to and from green areas, parcs and similar are **not** registered as PATH VARIOUS but as MAIN PATH.

Invisible PATH VARIOUS under bridges and similar are **not** registered.

The surface edge of a PATH VARIOUS, lying closer to HEDGE than 1 metre is **not** registered.

Connection with other objects

Upgrading

Because of uncertainty in earlier editions of this specification (with following interpretation varieties) agreement-specific re-coding and adjustments must be made to ensure full conformity with the new edition of the specifications.

4.3 PATH, CENTRE LINE

Object definition

Centre line of paths registered as MAIN PATH and PATH, VARIOUS connecting MAIN PATH with the road system.

Measuring instruction

PATH, CENTRE LINE must only have straight lines.

Registered at terrain.

PATH, CENTRE LINE is always registered at MAIN PATH. As PATH, CENTRE LINE must have a continuous course, it can be necessary to register PATH, CENTRE LINE where it has been impossible to register MAIN PATH e.g. through consolidated areas, where the main path is not marked or only marked by change in surface or similar.

To PATH, CENTRE LINE is attached information on municipality number and path code following manuscript.

Details

PATH, CENTRE LINE is registered unbroken under bridges, buildings and similar.

Connection with other objects

A node (3D) is established where PATH, CENTRE LINE meets another PATH, CENTRE LINE .

Upgrading

The specified connection with the objects must be established (snap).

Because of uncertainty in earlier editions of this specification (with following interpretation varieties) agreement-specific re-coding and adjustments must be made to ensure full conformity with the new edition of the specifications.

PATH, CENTRE LINE is registered where a registered PATH, VARIOUS connects MAIN PATH with the road network.

5 TRACK

5.1 RAILWAY TRACK

Object definition

A railway track is a pair of rails, constituting a railway track for ordinary railway operation.

Measuring instruction

RAILWAY TRACK is registered at terrain, as middle of the two rails constituting a railway track.

If there is a train on the track, the estimated middle under the train is registered, still with the elevation taken on terrain.

At double track (or more) all the tracks are measured.

At railway stations and shunting yards all tracks are registered.

Details

Invisible tracks (under bridges, in tunnels, under platform roofs and similar are not registered.

Tracks and similar, not in use for ordinary railway operations (crane tracks, dump waggon tracks, tram lines), are **not** registered as RAILWAY TRACKS.

Connection with other objects

All visible lines called RAILWAY TRACK must constitute a coherent network as it does in reality.

RAILWAY TRACK must snap 3D with itself, when meeting at the same level.

RAILWAY TRACK should not snap to other objects than itself.

Upgrading

Snap must be established when lacking.

5.2 TRACK, VARIOUS

Object definition

Rails, like crane tracks, tram lines, dump waggon tracks, building berth, slipway and similar which is **not** used for ordinary railway service.

Measuring instruction

Two parallel running rails for train-like transport are registered at the middle of the two rails. In other cases each rail is registered separately i.e. crane tracks at harbour areas. Elevation is registered at terrain.

Details

Invisible tracks (under bridges, buildings and similar) are **not** registered.

Crane tracks on top of buildings or structures are not registered.

Connection with other objects

Upgrading

5.3 RAILWAY, RAIL

Object definition

The actual rail, where the train wheels are running.

Measuring instruction

Is registered on top of the rail.

Details

Details must be agreed on for each project.

Connection with other objects

Details must be agreed on for each project.

Upgrading

Details must be agreed on for each project.

6 WATER

6.1 COASTLINE

Object definition

The invisible line at the time of foto exposure between land and salt/fresh water.
With the exception of the part of a coastline registered as QUAY EDGE and STRUCTURE, HABOUR..

Islands, estimated to be permanent and larger than 100 m² are registered as coastline.

Measuring instruction

Registered at terrain.

COASTLINE is registered where there is a natural coast in the form of a sandy beach, a natural rocky coast or salt meadow. Artificial coasts (sandy beaches) for recreative purposes are also registered as COASTLINE.

Change to STRUCTURE, HABOUR or QUAY, EDGE will take place where respectively jettys or actual quay begins.

COASTLINE is registered across STREAM-CANAL and DITCH.

COASTLINE is registered as one continuous object from STREAM, CENTRE LINE to STREAM, CENTRE LINE or until change to STRUCTURE HABOUR or QUAY EDGE.

COASTLINE is registered unbroken under bridges.

Details

COASTLINE is registered with as few points as possible.

Connection with other objects

COASTLINE, STRUCTURE HABOUR and QUAY EDGE must together form an unbroken line without any gaps.

Where STREAM, CENTRE LINE is entering the sea, the COASTLINE is split, and end points are established at both objects. Where DITCH is entering the sea, a common point is established for COASTLINE and end point of DITCH.

Upgrading

COASTLINE is established across STREAM-CANAL. End point is established at meeting with STREAM, CENTRE LINE, and common point at meeting with DITCH.

Re-coding of all jettys from COASTLINE to STRUCTURE HABOUR.

6.2 LAKE

Object definition

The visible delimitation at the time of foto exposure between land and fresh water.

Measuring instruction

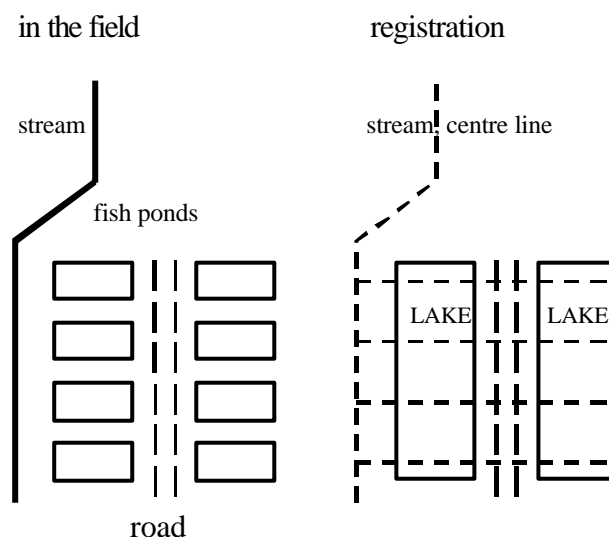
Registered at terrain.

LAKE is registered across STREAM-CANAL and DITCH.

LAKE smaller than 100 m² is registered as WATER HOLE.

Islands, perceived to be permanent, larger than 100 m² and lying in LAKE is registered as LAKE.

At fish pond industry one joint outline of basins not separated by other registered topography is registered as one LAKE. The middle of each basin is registered as STREAM, CENTRE LINE.



Details

Overflow basins are **not** registered as LAKE.

Connection with other objects

3D common points are registered when STREAM, CENTRE LINE and DITCH enter or leave a LAKE. STREAM, CENTRE LINE must have an end point.

LAKE must have (2D/3D) common geometry with other area objects and the objects QUAY EDGE, STRUCTURE HARBOUR, HEDGE IN OPEN COUNTRY and HEDGE IN TOWN when occurring.

Upgrading

Lakes are closed and re-coded area object.

Fish pond industry is registered by outline of more ponds. Centre lines are re-coded to STREAM, CENTRE LINE or re-registered.

6.3 STREAM - CANAL

Object definition

All streams wider than 2,5 metre between top of edges.

Measuring instruction

Registered at top of edge if it exists. If not, stream-canal is registered at water surface.

Details

The minimum width is 2.5 metre, however the registration must continue if only a shorter section of a longer STREAM – CANAL is narrower.

Streams narrower than 2,5 metre are registered as STREAM < 2.5 METRE, CENTRE LINE.

Connection with other objects

Upgrading

STREAM – CANAL registered as stream, centre line must be re-named to STREAM < 2.5 METRE, CENTRE LINE.

STREAM – CANAL in TK 2 and TK3 areas is changed to registration to top edge where the width is > 2.5 metre. Other STREAM – CANAL in TK 2 and TK3 areas is deleted. Where STREAM – CANAL replaces existing LANDUSE BOUNDARY, LANDUSE BOUNDARY is deleted.

6.4 WATER HOLE

Object definition

The visible delimitation at the time of foto exposure between land and water at permanent smaller lakes and water holes, smaller than 100 m².

Temporary flooded areas are not registered.

Measuring instruction

Registered at terrain.

Details

Overflow basins are not registered as WATER HOLE.

Connection with other objects

Upgrading

6.5 DITCH

Object definition

An open, artificial watercourse:

- serving as drainage for roads, railways or
- mainly is under 2,5 metre between top edge and serving as drainage for fields and similar.

Measuring instruction

DITCH is registered at middle line. The elevation is registered at water level.

Details

Watercourses under 2,5 metre, seeming natural, are registered as STREAM < 2.5 METRE, CENTRE LINE.

Ditches with no connection to other ditches or streams are only registered if they are longer than 50 metre and wider than 0,5 metre.

Connection with other objects

DITCH is registered with common points with STREAM - CANAL, STREAM < 2.5 METRE CENTRE LINE, LAKE and COASTLINE.

These points are also end points for DITCH.

Upgrading

Ditches must have common points with STREAM - CANAL, STREAM < 2.5 METRE CENTRE LINE, LAKE and COASTLINE.

These points are also end points for DITCH.

DITCH wider than 2,5 metre is registered as STREAM – CANAL with STREAM > 2.5 METRE, CENTRE LINE.

DITCH existing with 2 lines must be re-registered.

6.6 STREAM > 2.5 METRE, CENTRE LINE

Object definition

Estimated middle of watercourses delimited by the STREAM – CANAL code.

Measuring instruction

The elevation is measured at water level.

The width of the stream is measured at top edge, alternatively at water level.

STREAM > 2.5 METRE, CENTRE LINE must **only** have straight lines, and must **only** cut STREAM – CANAL where the stream ends and i.e. is drained.

STREAM > 2.5 METRE, CENTRE LINE is registered in one joined network with one objects from node to node.

Details

STREAM > 2.5 METRE, CENTRE LINE is registered with as few points as possible.

Connection with other objects

2D common points are registered with ROAD CENTRE LINE at crossings.

STREAM > 2.5 METRE, CENTRE LINE is registered unbroken through the other objects in the classes ROAD, PATH, TRACK and BUILDING.

3D common points (also being end points for STREAM > 2.5 METRE, CENTRE LINE) is registered where it meets STREAM > 2.5 METRE CENTRE LINE, STREAM < 2.5 METRE CENTRE LINE, LAKE and COASTLINE.

Where STREAM > 2.5 METRE, CENTRE LINE is passing a LAKE, the centre line is registered the shortest possible way through the lake, although not over islands, and it must not have other common points with the LAKE than outlet and entrance points.

Upgrading

Splines are re-calculated to straight lines.

Common and end points must be established.

Re-coding depending on width between top edges.

6.7 STREAM < 2.5 METRE, CENTRE LINE

Object definition

Estimated middle of watercourses, streams, brooks and canals, forming part of a drainage system as a natural part of the landscape.

Measuring instruction

The width of the watercourse is registered at top edge, alternatively at water level.

The elevation is measured at water level.

STREAM < 2.5 METRE, CENTRE LINE must **only** have straight lines

Nodes (3D) are registered at DITCHes and other STREAM, CENTRE LINEs.

STREAM < 2.5 METRE, CENTRE LINE is registered in one joined network with one objects from node to node.

Details

STREAM < 2.5 METRE, CENTRE LINE is registered with as few points as possible.

Connection with other objects

2D common points are registered with ROAD CENTRE LINE at crossings.

STREAM < 2.5 METRE, CENTRE LINE is registered unbroken through the other objects in the classes ROAD, PATH, TRACK and BUILDING.

3D common points (also being end points for STREAM < 2.5 METRE, CENTRE LINE) is registered where it meets STREAM < 2.5 METRE CENTRE LINE, STREAM > 2.5 METRE CENTRE LINE, LAKE and COASTLINE.

Where STREAM < 2.5 METRE, CENTRE LINE is passing a LAKE, the centre line is registered the shortest possible way through the lake, although not over islands, and it must not have other common points with the LAKE than outlet and entrance points.

STREAM < 2.5 METRE is forming an internal network and has common points with DITCH.

Upgrading

7 BOUNDARIES AND TOPOGRAPHY

7.1 HEDGE IN OPEN COUNTRY

Object definition

Quickset hedges, stone dikes and ramparts as well as permanent wire fences and hoardings, not situated in or nearby built-up areas with the character of village or larger town.
The boundary between town and land is **not** registered as HEDGE IN OPEN COUNTRY.

Measuring instruction

HEDGE IN OPEN COUNTRY is registered at middle, elevation at terrain.

Details

Measured is: quickset hedges, avenues, permanent wire fences, stone dikes and ramparts, all longer than 30 m, and retaining walls lower than 2 metre. Retaining walls higher than 2 metre are registered as STRUCTURE.

At permanent wire fence is understood interlacing wire fence around transformer substations, barracks, prisons and similar, and also interlacing wire fence around i.e. deer farms and along motorways.

Walls, wider than 1 metre is registered as STRUCTURE.

Stone dikes and ramparts wider than 2 metre are registered by two lines.

Stone dikes and ramparts are only registered as HEDGE IN OPEN COUNTRY if they have a height and width which prevents you to pass over them.

Trees in row and plantations with a width less than 10 metre are registered as HEDGE IN OPEN COUNTRY with one line. Trees in row and plantations wider than 10 metre are registered as LANDUSE BOUNDARY with two lines.

Openings in HEDGE IN OPEN COUNTRY, smaller than 30 metre with a character of LANDUSE BOUNDARY, is still registered as HEDGE IN OPEN COUNTRY. No registration is taken, if the opening serves as a driving through passage, or if it is cultivated.

No HEDGE IN OPEN COUNTRY are registered on single-family house plots, agricultural property building areas, industrial areas, camping place, parks, green areas and cemeteries.

Connection with other objects

HEDGE IN OPEN COUNTRY must have common geometry with the area LAKE.

Upgrading

Avenues, registered as trees is changed to HEDGE IN OPEN COUNTRY.

All HEDGES outside built-up town areas are re-registered as HEDGE IN OPEN COUNTRY.

Hedges on sports grounds are registered as HEDGE IN OPEN COUNTRY if the grounds lies outside town areas.

7.2 HEDGE IN TOWN

Object definition

Quickset hedges, stone dikes, ramparts, permanent wire fences and retaining walls, situated in or nearby built-up areas with the character of village or larger town, summer house areas, allotment gardens and similar.

Under HEDGE IN TOWN is physical hedges and plantations, forming the boundary between town and country.

Measuring instruction

HEDGE IN TOWN is registered at middle, elevation at top. For reasons of object connection, middle of hedge can be adjusted in relation to adjoining LANDUSE BOUNDARY - although not more than 0,5 metre.

Details

HEDGE IN TOWN is **not** registered internal on single-family house plots, camping places, parks, green areas, industrial installations, cemeteries and consolidated areas in residential areas.

HEDGE IN TOWN is not registered across entrance drives.

HEDGE IN TOWN must be unbroken at entrance to house.

Avenues are registered as HEDGE IN TOWN.

Retaining walls higher than 2 metre are registered as STRUCTURE.

As permanent wire fence is understood interlacing wire fence around industrial installations, technical installations, institutions and similar, and along motorways.

Walls, wider than 1 metre is registered as STRUCTURE.

Stone dikes and ramparts wider than 2 metre are registered with two lines.

Stone dikes, ramparts and garden limits are only registered as HEDGE IN TOWN if they have a height and width which prevents you to pass over them.

Connection with other objects

HEDGE IN TOWN must have a common geometry with LAKE.

Upgrading

All HEDGE IN OPEN COUNTRY in built-up town areas must be re-registered as HEDGE IN TOWN.

HEDGE in built-up town areas must be re-coded to HEDGE IN TOWN.

On sports grounds is registered HEDGE IN TOWN.

Avenues registered by trees are changed to HEDGE IN TOWN.

7.3 LANDUSE BOUNDARY

Object definition

Boundaries supplemented by HEDGE IN OPEN COUNTRY and HEDGE IN TOWN giving an idea of the use of the area as garden, parc, forest, field, track, road, path, wetland, plot boundary and similar.

Measuring instruction

LANDUSE BOUNDARY is registered with elevation at terrain.

Boundary to road/track is registered including possible slope areas in the road/track area.

Details

LANDUSE BOUNDARIES between cultivated areas are registered at middle line if the width is smaller than 10 metre. If larger by two lines.

LANDUSE BOUNDARIES towards other objects are registered at cultivation/planting boundary.

LANDUSE BOUNDARY is **not** registered internal on single-family house plots, industrial areas, agricultural property building areas, camping places and consolidated areas in residential areas.

LANDUSE BOUNDARIES stops at entrance drives.

LANDUSE BOUNDARIES is unbroken at entrance to houses or at PATH, VARIOUS.

At watercourse LANDUSE BOUNDARY is only registered between the watercourse and forest, garden areas and similar.

LANDUSE BOUNDARY is **not** registered around temporary garden areas at farms.

LANDUSE BOUNDARY shorter than 50 metre without connection to other objects is not registered in open country.

Internal LANDUSE BOUNDARIES in forests, only separating deciduous and coniferous forest is **not** registered.

Openings, meadow areas and cultivated areas larger than 10.000 m² within a forest area is registered as LANDUSE BOUNDARY.

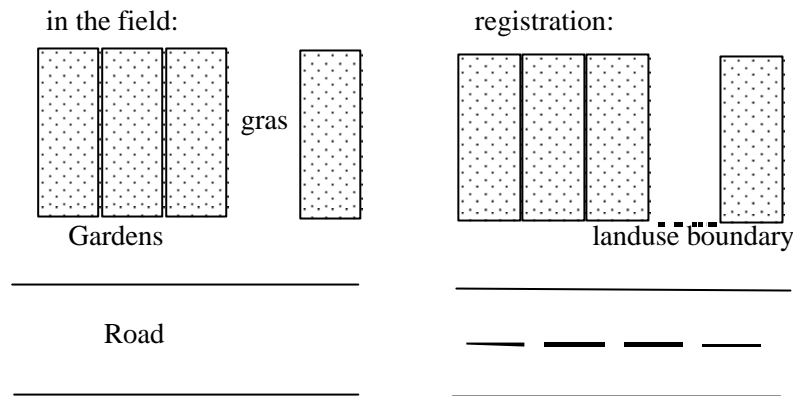
Fire breaks wider than 10 metre in forest are registered as LANDUSE BOUNDARY with two lines.

HEDGE IN OPEN COUNTRY wider than 10 metre is registered as LANDUSE BOUNDARY with two lines.

LANDUSE BOUNDARY is registered around continuous growth (which is not forest), group of trees and similar in the open country, if the width is larger than 10 metre.

Where LANDUSE BOUNDARY is coinciding with road delimitation, only LANDUSE BOUNDARY is registered.

Still LANDUSE BOUNDARY can be registered as immediate extension of adjoining LANDUSE



BOUNDARY, HEDGE IN OPEN COUNTRY or HEDGE IN TOWN, with the purpose to form a continuous course towards road (see drawing).

In coastal areas LANDUSE BOUNDARY is registered at change from beach to foot of dune, or change from beach or dune to more well defined areas like garden, parc, forest, field, road, path, moor and similar.

Connection with other objects

LANDUSE BOUNDARY is snapped 2D/3D to HEDGE IN TOWN and HEDGE IN OPEN COUNTRY.

Upgrading

No comments.

7.4 PLANTATION BOUNDARY

Object definition

Characteristic lines, separating areas like artificial plantation areas in camping places, in parks, green areas, wide road side plantations in town areas and similar, also delimitation of zones with hedges wider than 4 metre.

Measuring instruction

The boundary is registered at terrain.

Outside parcs, green areas and camping places and similar PLANTATION BOUNDARIES are only registered for zones wider than 4 metre.

Inside the mentioned areas PLANTATION BOUNDARIES is always registered, never HEDGE IN OPEN COUNTRY / IN TOWN.

For quickset hedges with a width between 4 and 10 metre, the lines PLANTATION BOUNDARY, HEDGE IN OPEN COUNTRY / IN TOWN, PLANTATION BOUNDARY are registered.

Details

PLANTATION BOUNDARY is **not** registered at single-family house plots and on industrial plots.

Bunkers, greens and other objects at golf courses are not registered as SPORT INSTALLATION, but as PLANTATION BOUNDARY.

Connection with other objects

Upgrading

On sports grounds PLANTATION BOUNDARY is deleted if it represents a hedge. It is replaced by HEDGE IN OPEN COUNTRY / IN TOWN, re-registered at middle.

7.5 SLOPE, TOP

Object definition

Slopes that are important in relation to the surrounding terrain, and slopes separating planes in connection with sports grounds, parks, industrial areas, house blocks and similar.

Measuring instruction

SLOPE TOP is registered at top of slope.

Details

Slopes higher than 2 metre must be registered.

Natural slopes are only registered if they are important – that is higher than 5 metre and so steep, that you can not pass them on foot. I.e. coastal cliffs.

SLOPE TOP is not registered at single-family house plots unless they form part of a longer course.

Top of rainwater reservoir is registered as SLOPE TOP.

Connection with other objects

Upgrading

7.6 SLOPE, BOTTOM

Object definition

Slopes that are important in relation to the surrounding terrain, and slopes separating planes in connection with sports grounds, parcs, industrial areas, house blocks and similar.

Measuring instruction

SLOPE BOTTOM is registered at bottom of slope (where slope changes into normal terrain).

Details

Slopes at ditches are not registered.

Natural slopes are only registered if they are important – that is higher than 5 metre and so steep, that you can not pass them on foot. I.e. coastal cliffs.

SLOPE BOTTOM is not registered at single-family house plots unless they form part of a longer course.

Bottom of rainwater reservoir is registered as SLOPE BOTTOM at waterlevel/bottom.

Connection with other objects

Upgrading

7.7 DECIDUOUS, SURVEYED

Object definition

As a principle rule all larger deciduous trees (stem > 20 cm, or tree crown diameter > 5 m if the stem can not be seen or measured or the tree is supported by laths). Trees in avenues are not given this code.

Measuring instruction

DECIDUOUS, SURVEYED is registered at centre of stem.
The elevation is registered at terrain.

Details

In town areas trees along roads, squares, main paths, paths and similar are registered. Also individual significant trees are registered.

Individual significant trees in open country are registered as DECIDUOUS, SURVEYED, also if they are standing alone at LANDUSE BOUNDARY.

Roadside trees, not being part of an avenue, are registered as DECIDUOUS, SURVEYED.

DECIDUOUS, SURVEYED are **not** registered at single-family house plots, agricultural property building areas, industrial areas, camping place and cemetery.

DECIDUOUS, SURVEYED must not be used as an area symbol.

Connection with other objects

Upgrading

Trees in avenues are re-digitized to HEDGE IN OPEN COUNTRY or HEDGE IN TOWN.

7.8 CONIFEROUS, SURVEYED

Object definition

As a principle rule all larger coniferous trees (stem > 20 cm, or tree crown diameter > 5 m if the stem can not be seen or measured or the tree is supported by laths). Trees in avenues are not given this code.

Measuring instruction

CONIFEROUS, SURVEYED is registered at centre of stem.
The elevation is registered at terrain.

Details

In town areas trees along roads, squares, main paths, paths and similar are registered. Also individual significant trees are registered.

Individual significant trees in open country are registered as CONIFEROUS, SURVEYED, also if they are standing alone at LANDUSE BOUNDARY.

Roadside trees, not being part of an avenue, are registered as CONIFEROUS, SURVEYED.

CONIFEROUS, SURVEYED are **not** registered at single-family house plots, agricultural property building areas, industrial areas, camping place and cemetery.

CONIFEROUS, SURVEYED must not be used as an area symbol.

Connection with other objects

Upgrading

Trees in avenues are re-digitized to HEDGE IN OPEN COUNTRY or HEDGE IN TOWN.

7.9 DECIDUOUS, SYMBOL

Object definition

As DECIDUOUS, SURVEYED where the stem can not be seen. However not trees in avenues.

Measuring instruction

Centre of tree crown is registered, elevation at terrain.

Details

In town areas trees along roads, squares, main paths, paths and similar are registered. Also individual significant trees are registered.

Individual significant trees in open country are registered as DECIDUOUS, SURVEYED, also if they are standing alone at LANDUSE BOUNDARY.

Roadside trees, not being part of an avenue, are registered as DECIDUOUS, SYMBOL.

DECIDUOUS, SYMBOL are **not** registered at single-family house plots, agricultural property building areas, industrial areas, camping place and cemetery.

DECIDUOUS, SYMBOL must not be used as an area symbol.

Connection with other objects

Upgrading

Trees in avenues are re-digitized to HEDGE IN OPEN COUNTRY or HEDGE IN TOWN.

7.10 CONIFEROUS, SYMBOL

Object definition

As CONIFEROUS, SURVEYED where the stem can not be seen. Trees in avenues are not given this code.

Measuring instruction

CONIFEROUS, SYMBOL is registered at centre of tree crown.
The elevation is registered at terrain.

Details

In town areas trees along roads, squares, main paths, paths and similar are registered. Also individual significant trees are registered.

Individual significant trees in open country are registered as CONIFEROUS, SURVEYED, also if they are standing alone at LANDUSE BOUNDARY.

CONIFEROUS, SYMBOL are **not** registered at single-family house plots, agricultural property building areas, industrial areas, camping place and cemetery.

CONIFEROUS, SYMBOL must not be used as an area symbol.

Connection with other objects

Upgrading

7.11 FOREST POLYGON

Object definition

Outline of forest with a total area larger than 10.000 m².

Measuring instruction

FOREST is generated from existing geometry in the data. It is allowed to supplement with new geometry between existing points to form a closed area. This means, that the geometry of a forest often will be registered double in relation to other geometry.

If the total forest area is cut by ROAD, CENTRE LINE, RAILWAY or STREAM > 2.5 METRE, CENTRE LINE, the forest is registered as more closed areas.

FOREST must not cross buildings with their gardens. Individual buildings can form part of FOREST. Other area objects can form part of FOREST, if the total area is lying inside the forest.

FOREST must not be registered inside a FOREST.

Details

All forests, forming a whole larger than 1 hectare (10.000 m²).

Forest areas smaller than 10.000 m² will be a part of the quantity of forest polygons if they are a part of a larger forest area.

Connection with other objects

FOREST must not cross objects specified for TK1 maps.

Upgrading

7.13 TOWN POLYGON

Object definition

Outline polygon of towns larger than 8 hectare.

Measuring instruction

TOWN is generated by straight lines from existing points in other objects. Not all points are necessarily registered, but an estimated representative selection.

TOWN follows the outline of coherent built-up areas.

Green areas, sports grounds and industrial areas forms part of a TOWN.

TOWN is generated crossing roads, railways and water to create one closed polygon.

Details

Connection with other objects

Upgrading

8 AREA SYMBOL

8.1 DECIDUOUS FOREST

Object definition

Symbol in deciduous forest areas larger than 1 hectare.

Measuring instruction

Symbols are only placed in areas delimited by existing geometry.

DECIDUOUS FOREST is not registered at single-family house plots and on cemetery.

DECIDUOUS FOREST must not be registered in LAKE.

The symbol can be mixed with CONIFEROUS FOREST and WETLANDS if there is no clear delimitation.

When mixing of DECIDUOUS FOREST, CONIFEROUS FOREST and WETLANDS inside a delimited area, the individual type must only be delimited if the natural delimitation is significant.

The elevation at the point is not imperative.

Details

The symbols are placed regularly to illustrate the type of the area and typically at approx. 50 m interval.

Connection with other objects

Upgrading

8.2 CONIFEROUS FOREST

Object definition

Symbol in coniferous forest areas larger than 1 hectare.

Measuring instruction

Symbols are only placed in areas delimited by existing geometry.

CONIFEROUS FOREST is not registered at single-family house plots and on cemetery.

CONIFEROUS FOREST must not be registered in LAKE.

The symbol can be mixed with DECIDUOUS FOREST and WETLANDS if there is no clear delimitation.

When mixing of DECIDUOUS FOREST, CONIFEROUS FOREST and WETLANDS inside a delimited area, the individual type must only be delimited if the natural delimitation is significant.

The elevation at the point is not imperative.

Details

The symbols are placed regularly to illustrate the type of the area and typically at approx. 50 m interval.

Connection with other objects

Upgrading

8.3 WETLANDS / BOG

Object definition

Symbol in wetlands larger than 1 ha. Areas like bog, meadow, marsh where it is neither possible to move on foot nor by boat.

Measuring instruction

Symbols are only placed in areas which can be delimited by existing geometry.

WETLANDS is not registered at single-family house plots and on cemetery.

WETLANDS must not be registered in LAKE.

The symbol can be mixed with DECIDUOUS and CONIFEROUS FOREST if there is no clear delimitation.

When mixing of DECIDUOUS FOREST, CONIFEROUS FOREST and WETLANDS inside a delimited area, the individual type must only be delimited if the natural delimitation is significant.

The elevation at the point is not imperative.

Details

The symbols are placed regularly to illustrate the type of the area and typically at approx. 50 m interval.

Connection with other objects

Upgrading

8.4 SCRUB / GROWTH

Object definition

Symbols in areas mainly covered by bushes and trees, not having the character of a forest. Often occurring along traffic installations, technical areas, in parcs, green areas, recreational areas, sports grounds and similar town- and road related areas.

Measuring instruction

SCRUB / GROWTH will usually be delimited by PLANTATION BOUNDARY, HEDGE or ROAD.

SCRUB / GROWTH is not registered at single-family house plots and on cemetery.

SCRUB / GROWTH must not be registered in LAKE

The elevation at the point is not imperative.

Details

The symbols are placed regularly to illustrate the type of the area and typically at approx. 10 m interval.

Connection with other objects

Upgrading

8.5 MOOR

Object definition

Symbol in moor areas larger than 1 hectare.

Measuring instruction

Symbols are only registered in areas delimited by existing geometry.

MOOR is not registered at single-family house plots and on cemetery.

The elevation at the point is not imperative.

Details

The symbols are placed regularly to illustrate the type of the area and typically at approx. 50 m interval.

Connection with other objects

Upgrading

8.6 CEMETARY

Object definition

Symbol in cemeteries.

Measuring instruction

Symbols are only registered in areas delimited by existing geometry.

CEMETARY is not registered at single graves.

The elevation at the point is not imperative.

Details

The symbols are placed regularly to illustrate the type of the area and typically at approx. 50 m interval.

The symbol must not be placed in buildings.

Connection with other objects

Upgrading

8.7 GRAVEL PIT / RAW MATERIAL / WASTE

Object definition

Symbol in areas larger than 1 hectare used as gravel pits, other raw material working and refuse dumps.

Measuring instruction

Symbols are only registered in areas delimited by existing geometry.

Registration of elevation at the point is not imperative.

Details

The symbols are placed regularly to illustrate the type of the area and typically at approx. 50 m interval.

Connection with other objects

Upgrading

9 TECHNICAL INSTALLATIONS

9.1 HIGH TENSION LINE

Object definition

High tension lines on steel or pairs of wooden pylons.

Measuring instruction

Are registered as one straight line at top of pylon / centre of masts.

Details

High tension line is registered at each individual pylon and where the line ends.

Connection with other objects

Upgrading

9.2 HIGH TENSION LINE, PYLON BASE

Object definition

Concrete foundation on which all or part of a high tension pylon is resting.

Measuring instruction

Is registered if the diagonal of each base is longer than 1 metre.

Is registered at terrain.

Details

All foundation units are registered at outline.

Connection with other objects

Upgrading

9.3 MAST

Object definition

Centre of mast for electricity and lamp standard.

Measuring instruction

Is registered at centre.

Elevation is registered at terrain.

Details

MAST is not registered at single-family house plots, industrial and railway areas.

Only masts taller than 3 metre is registered.

Only masts for road lighting and electricity supply are registered.

Connection with other objects

Upgrading

MAST is divided in MAST, SIGNAL STANCHION and RADIO- TV-MAST.

Public flagpoles, signs and boards are deleted or re-coded to VARIOUS TECHNICAL INSTALLATIONS.

9.4 RADIO - TV - MAST

Object definition

Masts for communication purpose like radio/TV transmitting aerials, communal aerials and telephony masts.

Measuring instruction

Registered at centre. Elevation at top.

Details

RADIO – TV - MASTs are not registered at single-family house plots.

Connection with other objects

Upgrading

MAST is divided in MAST, SIGNAL STANCHION and RADIO – TV – MAST.

Must be controlled for correct elevation.

9.5 SIGNAL STANCHION

Object definition

Masts and stanchions for traffic regulating light signals.

Measuring instruction

Registered at centre. Elevation at top.

Details

SIGNAL STANCHION is not registered on single-family house plots, industrial areas and railway areas.

Connection with other objects

Upgrading

MAST is divided in MAST, SIGNAL STANCHION and RADIO – TV – MAST.

9.6 MAST, BASE

Object definition

Concrete foundation on which all or part of a radio – TV - mast is resting.

Measuring instruction

Is registered if the diagonal of each base is longer than 1 metre.

Is registered at terrain.

Details

All foundation units are registered at outline.

Connection with other objects

Upgrading

MAST, BASE is deleted where it does not carry a RADIO - TV - MAST.

9.7 WINDMILL

Object definition

Windmills for production of electricity.

Measuring instruction

Is registered at centre of windmill tower. Elevation is registered at top.

Larger foundations are also registered as STRUCTURE.

Details

All windmills are registered.

Connection with other objects

Upgrading

Must be controlled for correct elevation.

9.8 DRAIN GRATING

Object definition

Grating for outlet of surface water.

Measuring instruction

Registered at centre. Elevation is registered at terrain.

Details

All drain gratings are registered.

Connection with other objects

Upgrading

9.9 SEWER MANHOLE

Object definition

Cover for descent to sewer, district heating and similar.

Measuring instruction

Registered at centre. Elevation is registered at terrain.

Details

All sewer manholes are registered.

Connection with other objects

Upgrading

9.9 STATUE – STONE

Object definition

Statue, memorial, stone on burial mound or exceptionally large natural stone.

Measuring instruction

Registered at centre. Elevation is registered at terrain.

Large foundations are also registered as STRUCTURE.

Details

STATUE – STONE is not registered on single-family house plots.

Connection with other objects

Upgrading

9.10 INSTALLATION BOX

Object definition

Telephone box, cable-end box, electrical box, transformer and similar.

Measuring instruction

Registered at centre. Elevation is registered at terrain.

Details

Registered if the diagonal is longer than 0.6 metre..

Connection with other objects

Upgrading

9.12 VARIOUS SYMBOL

Object definition

Important topographical objects like transformers, statues, monuments, burial mounds, large single trees and similar.

Measuring instruction

Registered at centre. Elevation is registered at terrain.

Details

Connection with other objects

Upgrading

9.13 VARIOUS TECHNICAL INSTALLATION

Object definition

Technical installations, separately agreed upon, including signalized technical installations.
Fire hydrants, stop cock, district heating manhole cover, gas valves, public flagpoles, traffic signs, traffic boards, parc light masts and similar.

Measuring instruction

Object codes after agreement

Details

After agreement.

Connection with other objects

After agreement.

Upgrading

9.14 MILESTONE

Object definition

After agreement

Measuring instruction

After agreement

Details

After agreement.

Connection with other objects

Upgrading

9.15 TRAFFIC LANE MARKING

Object definition

After agreement

Measuring instruction

After agreement

Details

After agreement.

Connection with other objects

Upgrading

9.16 TRAFFIC SIGNBOARD

Object definition

Portal across the traffic lane, carrying traffic signboard.

Measuring instruction

Registered at the centre of both ends of the portal. Elevation is registered at top.

Details

Connection with other objects

Upgrading

10 VARIOUS

- 10.1 Municipality number** Number code from the Ministry of the Interior. Integer, 3 digits.
- 10.2 Road code** From the CPR-register. Integer, 4 digits.
- 10.3 Road name** From the CPR-register. Municipality number and road code must be attached. The road name is placed outside the road area. The road name is placed parallel to the road. The direction of the road name must fulfil the rule that the deviation from west to east is smallest possible. The name is placed at approx. 500 metre interval in town areas and approx. 2.000 metre interval in the open country and in such a way that there can be no doubt about the correct name of a road. At least one name per road is registered. The customer must deliver the needed information, among other things to delimit the course of the individual road.
- 10.4 House number** In areas where the address project of the Ministry of Housing is finished, the numbering of houses must be in accordance with the cross-reference register, however excluded U-marked addresses. For multi-storey buildings with more addresses in areas where the address project is not finished, only stairway entrance addresses of are registered. To the house numbers is linked municipality number and road code. The number is placed at the estimated main building. The centre of the house number (inclusive possible letters) must be placed 3 m inside the building in the middle of the longest side toward the adjoining road. The house number is placed parallel to this side. The direction of the house number must fulfil the rule that the deviation from west to east is smallest possible. On properties without buildings the house number is placed as if all the plot was one building. The house number (incl. References) must appear only once, and all house numbers must be shown. It is not allowed to give intervals of numbers for row houses or blocks and similar. If there is no room for the numbers, the rule of placing can be deviated. A house number must however never be placed outside the building. The customer delivers the needed information.
- 10.5 Building number** In accordance with the BBR-register. Integer with 3 digits. Placed in the middle of the building area, although shifted from the house number. Reference is linked after agreement.
- 10.6 Arrow in stream** Oriented after downgrade.
- 10.7 Arrow on stairs** Oriented after downgrade for stairs larger than 5 m.
- 10.8 Place name** Important place names. The customer delivers the needed information.
- 10.9 Trig. point**
- 10.10 Trig. Point, text**
- 10.11 Benchmark**
- 10.12 Benchmark, text**
- 10.13 NATURAL CONTROL POINT**

10.14 *Natural control point, text*

10.15 **TERRAIN ELEVATION** Registered points (Y,X,Z), describing the terrain surface.

10.16 *Terrain elevation, text*

10.17 **WATER SURFACE ELEVATION**

10.18 *Water surface elevation, text*

10.19 **SPECIAL ELEVATION** Minimum, maximum and saddle point.

10.20 **CONTOUR LINE** Digitized or derived contour lines incl. Z value. The elevation of the contourline is given as terrain elevation, text (10.16).

10.21 **STRUCTURE LINE** Lines describing characteristic soft changes in the terrain, i.e. a ridge.

10.22 **BREAK LINE** Lines describing characteristic sharp breaks in the terrain, i.e. the top of a constructed steep slope.

10.23 **MASK AREA** Area inside the DEM area where contour lines are not always desired drawn, i.e. buildings and lakes.

10.24 **UNSURVEYED AREA** Area inside the DEM area where, with the used data collection method, it has not been possible to register with a sufficient density to obtain the specified accuracy, i.e. in forests. A DEM will not be generated in this area.

10.25 **DEM BOUNDARY** Boundary surrounding the registered DEM.

10.26 *Path name* The customer delivers the needed information for the wanted area. The name is placed as road names. Information on municipality number and possible path code is attached.

10.27 *Text, various*

10.28 *Municipality boundary* A polygon of straight lines, showing the course of the municipality boundary. Until an official municipality boundary is available, the boundary must be agreed upon by the individual neighbouring municipalities.

