Publishing of Digital Topographic Map 25000

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Abstract

The Geospatial Information Authority of Japan [formerly the Geographical Survey Institute of Japan] (GSI) began the publication of Digital Maps (Basic Geospatial Information) on July 30, 2012 as a survey result of vector data mainly composed of 'Digital Japan Basic Maps', the data sets of maximum-scale geospatial data covering the whole of Japan.

Since Digital Maps (Basic Geospatial Information) are basically provided online, they can offer new information on a daily basis as a result of surveys that reflect major changes to the land, compared to traditional survey results. However, it is necessary to use special software in order to utilize Digital Maps (Basic Geospatial Information) as map data. So the online publishing of 'Digital Topographic Map 25000' (hereinafter referred to as 'Digital Topographic Map') began on August 30 2012 so that map information that immediately reflects major changes to the land can be used more conveniently as a survey result in a raster image file format on a 1:25,000 scale level.

Using this Digital Topographic Map, maps can be created that optimize the benefits of online publication by selecting the display range and size, as well as some display colors of map symbols and representations according to the intended use of the purchasers. Another feature is the ability to always provide the latest version of map images, as the images are generated from the Digital Japan Basic Map of Japan database as soon as the order is received from the purchaser, rather than from archived images.

This paper presents the concept and specifications of the 'Digital Topographic Map' as the new survey result, and an overview of the content of the development of the system being provided.

1. Introduction

GSI has compiled, published and updated the 1:25,000 scale topographic map (hereinafter referred to as 'Topographic Map') as the maximum scale paper basic map covering the whole of Japan except for a part of the Northern Territories. Furthermore, topographic maps are being compiled for the Northern Territories with the aim of completing the 1:25,000 scale paper topographic maps covering the entire country.

If a map is paper-based, it has to go through a process of printing and distribution. This is convenient in the sense that the map can be provided to users outside an IT environment. On the other hand, since it has been necessary to print substantial amounts in terms of cost efficiency and in terms of logistics efficiency with inventory control at the point of sale, it has proved difficult to revise and update each edition at will.

In addition, the topographic map must be published according to the previously specified borders and printed according to pre-determined map representation. For this reason, if a user needs a map of an area which is bisected by the borders, he has to purchase as many maps as necessary to compile the relevant area map. Moreover, it has been impossible to satisfy the needs to change colors or display contents depending on the intended use.

In the meantime, pervasion of information technology (IT) relating to geospatial information has been drastic with expanding bandwidth of the communication lines, generalizing the use of maps via Internet and now it is possible to offer downloadable map information online.

In order to facilitate this, GSI has even developed its own online map services, such as 'Watchizu' and 'Digital Japan Web', which provide scrollable capability using map image tiles prepared in advance. Thus, the latest and most up-to-date map information free from border divisions has become available. However, since 2011, when the map information to be provided was switched to the new product based on the Digital Japan Basic Map, Japan's new standard map replacing the traditional topographic map, a lot of criticism has been directed against the omission of planimetric features such as transmission lines and there have been complaints that the map representation has become confusing.

Therefore, in order to respond to the criticisms and opinions directed against Digital Japan Basic Map, GSI has considered countermeasures such as setting up the 'Advisory Committee on Digital Japan Basic Map' and has decided, as a result, to start providing new map information that includes the following features;

1) The ability to establish borders freely in contrast to traditional map borders
2) The ability to select paper size
3) The ability to change display contents and display color to some extent
4) The provision of the most up-to-date map information in an image format downloadable online

The addition of these features resulted in the "Digital Topographic Map" launched on August 30 2012.

In order to implement this new policy, the Digital Topographic Map requires a new system that generates map images according to any specific requests by a user, in contrast to the previous type of map services such as 'Watchizu' and 'Digital Japan Web System' which offer images prepared beforehand in tile form. This paper describes the concept and specification of the Digital Topographic Map and the development of their delivery system.

2. Digital Topographic Map

2.1 Digital Topographic Map Concept

The Digital Topographic Map is one of the survey results created based on the data of the Digital Japan Basic Map (Map Information) and, as stated previously, its delivery concept is described as follows:

1) Borders can be set freely
   A user can set borders by freely selecting the center position of his or her map regardless of the topographic map's borders.
2) Paper size and orientation can be chosen freely
   A user can select paper sizes ranging from A0 to A4 as well as portrait or landscape orientation.
3) Display contents and display colors can be changed to some extent
   A user can opt to display or omit certain map symbols and change display colors and symbols.
4) Downloadable map images
   Publication is solely through internet download. Printed editions are not available.
   In addition, based on the interim recommendations offered by the 'Advisory Committee on Digital Japan Basic Map':
5) Map representation based on the 1:25,000 topographic scheme
   Make some improvements to the map representation in terms of user friendliness based on the well-established symbols of topographic maps that are familiar to many users.

Furthermore,

6) New maps optimizing online delivery
   Always deliver the most up-to-date map information available at the time of order by generating the map images dynamically from the Digital Japan Basic Map database immediately after the order for the map image is placed.

Digital Topographic Maps realizing this concept can maintain the user-friendliness of the paper map at the same time as delivering the most up-to-date map information.

2.2 Digital Topographic Map Specifications

2.2.1 Borders and Marginal Information

The format of the Digital Topographic Map can be selected from 10 types of A-size from A0 to A4, with portrait or landscape orientation. In addition, since it is possible to set the borders anywhere between 20 and 46 degrees north latitude, margins may become too large at high latitudes if a user fixes the borders by longitude and latitude width. In order to avoid this, borders that specify the map display range are set as a fixed-sized rectangle for each paper size with the changing longitude and latitude width that is displayed. For example, in the case of a portrait A4 sheet measuring 210mm in width x 297mm in height, as shown in Fig. 1, the map display range fixed within a border measuring 182mm in width x 235mm in height always displays a range of 4.55km x 5.875km, whereas the actual width of the latitude and longitude displayed on maps is variable.

Marginal information displays a variety of items such as legends and position diagrams on topographic maps for users. Nevertheless, different display contents could be required by different users so it is impossible to fix a set of legends for every user. Moreover, in A4 format in particular, map display ranges become too small. Therefore, the decision has been made to display the minimum marginal information sufficient for a user to learn the specifications of the map such as scale bar and height standard and to prepare a standard set of legends separately and to include it in the delivery package. In addition, since Digital Topographic Maps are only available online as downloads so purchasers have to print paper versions of them using their own printers, etc., the actual scale on paper might not turn out to be exactly 1:25,000. Therefore only the title 'Digital Topographic Map "25000" ' is used to show the representation level of the map, rather than the representation of a ‘1:25,000’ scale.

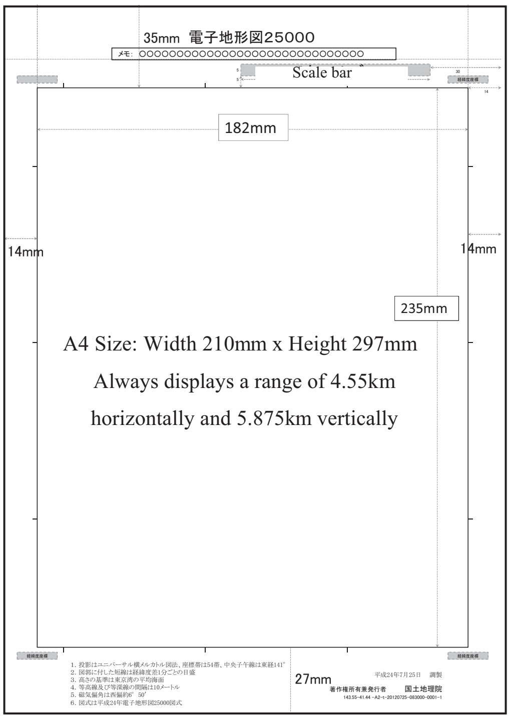

Fig. 1 Borders of Digital Topographic Map in A4 Portrait Format

Furthermore, purchasers can set the borders of topographic maps freely so there is no predetermined map title. Therefore, our system allows users to freely set a character string in the ‘memo’ field so that users can easily identify the map.

2.2.2 Map Projection

As Digital Topographic Maps are based on 1:25,000 topographic maps, the Universal Transverse Mercator (UTM) projection is adopted. However, while the paper map’s latitude lines on the top border are rotated to become horizontal, the latitude lines in the middle of the border of the Digital Topographic Map are rotated to become horizontal. As the border is rectangular, the displayed map has a slightly wider longitude at the top compared to that at the bottom border.

2.2.3 Map Information Level and Road/Rail Center Lines

The map images of Digital Topographic Maps are created with the data of currently available Digital Japan Basic Maps. Since the data of the Digital Japan Basic Map is designed based on Fundamental Geospatial Data, the map information level of recorded data varies between urban planning areas and other areas. Therefore, Digital Japan Basic Maps have some map information levels in dataset. Specifically, the map information level of urban planning areas is less than 2500, whereas the map information level of all other areas is, in principle, 25000. Therefore, the images of Digital Topographic Maps are created at a scale of 1:25,000 while the information items of Fundamental Geospatial Data of urban planning areas are displayed with the symbols of Map Information Level 2500.

However, this mixture of map information levels causes problems especially for urban areas; when all roads obtained at map information level 2500 are displayed at a scale of 1:25,000, map-reading becomes a problem. Moreover, in areas outside of urban planning areas, road edges are displayed using the predetermined road symbols of topographic maps. So if an area is partially updated at Map Information Level 2500 where the road edges are displayed with actual road widths which are more narrow, the same road may be displayed with a different road. Therefore, roads on Digital Topographic Maps have additional road center line data, compared to those of Digital Japan Basic Maps, obtained by adjusting to the road edges positions while road width symbols are set for roads that are to be displayed at a scale of 1:25,000. At the same time, there is an attribute value of the 'display limit for map information level' indicating whether or not to display the roads at the 1:25,000 scale, and they are automatically displayed as road symbols. However, in the case of paper maps, editors have implemented the displacement in order to make the symbols easier to see whenever roads are close to each other, yet in the case of Digital Topographic Maps, the priority is the true position of the symbols based on Fundamental Geospatial Data, and displacements are not implemented.

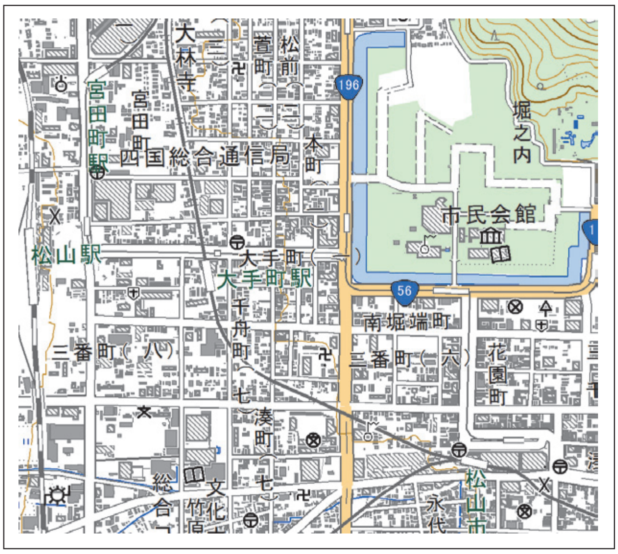

Fig. 2 Display Example of Roads and Railroads on Digital Topographic Maps

Similarly, in the case of displaying railroads, Railway Center Lines are added to the Digital Japan Basic Map data in order to display Digital Topographic railroad symbols, due to the fact that it is difficult to display symbols between sections of double track along with the center line of the track from Digital Japan Basic Maps. Since this piece of data is specific to the 1:25,000 scale, this railroad center line is the only data that is allowed to be displaced in the Digital Japan Basic Map.

2.2.4 Map Symbols

The map symbols of the Digital Topographic Maps are based on the map symbols from the 2009 Topographic Maps on a 1:25,000 scale, which were partially updated in 2012.

The main modifications added to the map symbols of the 2009 Topographic Maps at a scale of 1:25,000 in the 2012 of Digital Topographic Map 25000 are as follows:

1) Default display colors are set for several map symbols so that users can change color settings. Furthermore, a mask is added for highway and prefectural roads. Symbols with changeable color setting are highway masks, national road masks, prefectural road masks and contour lines.
2) Users can select a show/hide option for map symbols not included in the Digital Japan Basic Map, such as monuments, transmission lines, power stations, substations, radio towers, etc. These are treated as appendices and are not featured on Digital Japan Basic Maps.
3) For national road numbers, 2 types of symbols may be selected by users; one is the national road mark denoted by an inverted triangle commonly used by private map services and the other is the representation similar to that used in Topographic Maps.
4) As for railroad symbols, users can choose to display separate symbols to distinguish between JR and private railroads (like that of topographic maps) or select a symbol to be used to display both types of railroads without distinction.
5) The traffic-related annotations are amended to a shade of green.
6) Contours on the back of cliffs were previous hidden in Topographic maps, but they are displayed by default in The Digital Topographical Maps. Users can also choose not to display this.

These are the specifications of the Digital Topographic

Maps. In order to publish Digital Topographic Maps, the above specifications are adopted to dynamically create map images from The Digital Japan Basic Maps. The system has therefore been developed to achieve this.

3. Developing a Digital Topographic Map Generating System

3.1 Development Policy

In order to develop a Digital Topographic Map generating system, it has been decided to use the existing system as much as possible rather than developing a completely new system, in order to reduce the lead-time and cost. The rendering engine of the ‘New Topographic Map Information System (NTIS) Editing Software’ developed by GSI Japan in FY2001-2002, which was utilized in updating the topographic map work until FY2008, was used as the core map image generating engine, with the necessary functions to formulate the Digital Topographic Map specifications and to make online delivery possible.

3.2 New Topographic Map Information System (NTIS)

NTIS is a map information system developed independently by GSI in FY 2001-2002 in order to update topographic maps using the full-vector method. It was configured with editing software that loads the original topographic map data and draws map symbols of complex topographic maps on screen at the same time as editing data confirming the image of the map to be published and to manage raw topographic data, as well as a database to load the original topographic map data. The editing software became the main foundation for the new Digital Topographic Map generating system.

This editing software contains the map-rendering engine which provides the information necessary to draw map symbols as an attribute (property), and to calculate connecting relationships and determine which map symbols are to be displayed from vector data created to meet the geometric conditions regarding the surface and line topology configuration. The map-rendering engine uses the map symbol-generating technology whose patent is jointly held by GSI and two other organizations involved in developing the editing software for the ‘Map Information System with Map Symbol Generating/ Topology Implicating Data’ (Patent No. 3702444).

The editing software temporarily saves the raw topographic data represented by text as an internal file converted to intermediate format data specific to the rendering of map symbols. The intermediate form classifies data as layer groups having properties such as color, line thickness, symbol shape and line display patterns necessary for display as map symbols by using 8 types of basic data patterns. Whereas topographic maps used to store map symbols divided into a total of about 1,000 layers, Digital Topographic Maps have about 1,500 layers due to the addition of new symbols such as national road number symbols and display color selection functions. All topographic maps based on the 2002 map symbols of Topographic Maps at a scale of 1:25,000 are print-outs of the map image data created by this editing software.

Furthermore, NTIS editing software improved in 2006 develops intermediate files held by the software in an internal format as file groups separated by rectangular compartments divided by 30 seconds longitude and latitude and stored rather than storing them in an external database. Thus the range partition function is now held internally and the DBMS external database is no longer required. The Digital Topographic Map generating system inherits this range partition function with 30-second unit internal format file groups making the external database unnecessary.

3.3 Layers

The Digital Topographic Map generating system sets layers for each map symbol and draws according to layers. When representations with even the slightest differences are included, layers must be divided; for example, as shown in Fig. 3, the triangulation point symbol is divided into three layers, i.e. the triangulation point symbol, as well as the integer and fractional parts of the altitude results have to be rendered. The reason that altitude value is divided into 2 layers is due to the difference between the display sizes of integers and fractionals. The basic concept of the layer is still the

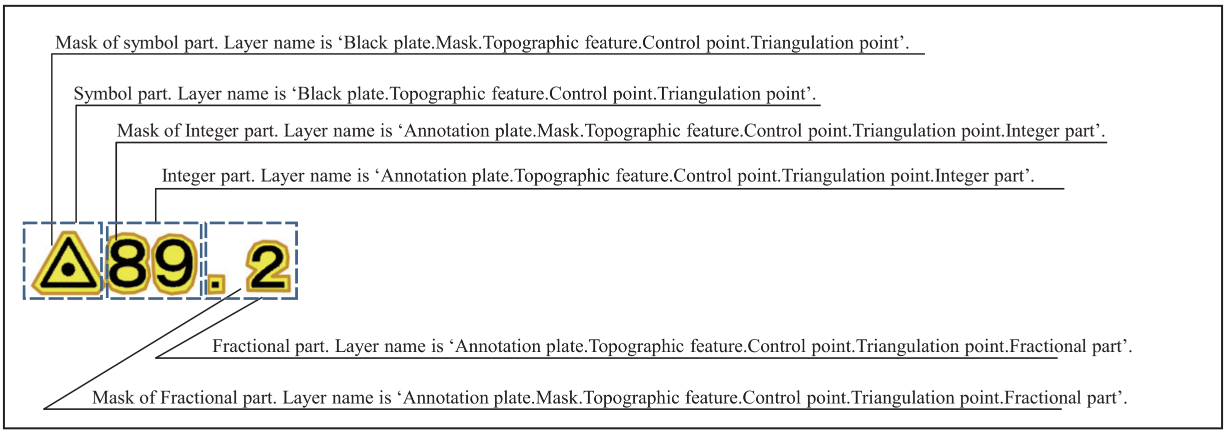

Fig. 3 Layer Configuration for Triangulation Point Symbol

same as that of NTIS, but it has been improved in order to execute property settings more precisely, and when the property value is omitted, a default value is applied.

Layer names are displayed with a string of characters connecting components using dots so that the layer's hierarchical structure is represented. Since NTIS was a system used to generate the printing data of paper maps, the printing plate's name is at the initial position of the layer name. Apart from that, the initial part of the layer name thus formed becomes the structure for the layer group abstracted during the development of the Digital Topographic Map. For example, the 3 layers constituting the aforementioned triangulation point are defined as follows:

1) Black plate. Topographic feature. Control point. Triangulation point
2) Annotation plate. Control point. Triangulation point. Integer part
3) Annotation plate. Control point. Triangulation point. Fractional part

So that symbols are easier to see if it overlaps with other map symbols, the following layers are used so that the outer border portion of the altitude value and symbols can be masked:

4) Black plate. Mask. Topographic feature. Control point. Triangulation point
5) Annotation. Mask. Control point. Triangulation point. Integer part
6) Annotation. Mask. Control point. Triangulation point. Fractional part

Users can set up properties according to each basic data type to be rendered, such as line width and color. Based on these property values, map symbols are generated by layer and symbols are positioned at coordinates according to the individual data contained in the layer to create map images.

3.4 Rendering Order

Displaying the Digital Topographic Map cannot be done sufficiently by rending the map symbols from the layer settings alone. This is because map representation of Digital Topographic Map inherits the majority of the topographic map's representation and it is necessary to represent the display priority of each planimetric feature specified by topographic map symbols. For example, if a road symbol is overlapped by a water area or by buildings it is displayed at the top whereas if a contour crosses a road symbol or water area, it is displayed above the road but underneath the water area (Fig. 4).

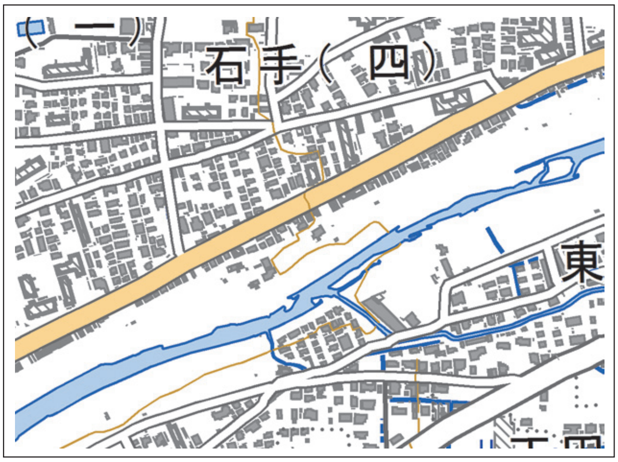

Fig. 4 Rendering Order of Roads, Water Areas, Buildings and Contours

The display priority between map symbols is determined using this complex process. On 1986's 1:25,000 scale Topographic Maps, the map symbols' display priority table is attached at the end. Since this is nearly identical to the rendering order of the Digital Topographic Map, it should be referenced by those who are interested.

In order to reproduce this complex rendering order, the same method used for NTIS has been applied to the layer rendering definition, which can be manipulated via the "Plane File".

Digital Topographic Maps have a two-step rendering order system: the overall rendering of map symbols is divided into 12 planes in order to define the rendering order between each plane and the layer's rendering order is defined within each plane (Fig. 5). In this case, the display color according to the layer's rendering definition is regarded as it passes through the white area (with RGB value 255) so that the map symbols beneath the white area of overlapping map symbols can be seen. If a user wishes to overlap the map symbols having lower priority with white, he or she must use the color with RGB value 254.

3.5 Components of the Digital Topographic Map Generating System

The components of the Digital Topographic Map generating system is shown in Fig. 6:

3.5.1 Intermediate Format File (Map File)

The intermediate format file is a file in which map symbol data divided into layers is stored as an internal file in order to reproduce digital map images of Digital Topographic Maps (which will be the product) more quickly. It is filed in units of ranges separated by 30 seconds latitude/longitude and stored in folders by longitude to realize the same range partition function as NTIS. The map images can be speedily, generated regardless of the range requested, and specific needs, such as rendering colors, can be met dynamically by creating the intermediate format files immediately prior to the map symbol parameters being determined, by property controls in addition to the above-mentioned range partition function.

Furthermore, the intermediate format file enables data loading at very high speeds because it is output as a binary file of memory images from the map image rendering engine, which will be described later.

In addition, Digital Topographic Maps have map symbols that require lines or repeated symbol patterns within a specific surface range to be displayed, such as the black-and-white dotted line intervals of railroad symbols (so-called flagpole symbols) and the filling-

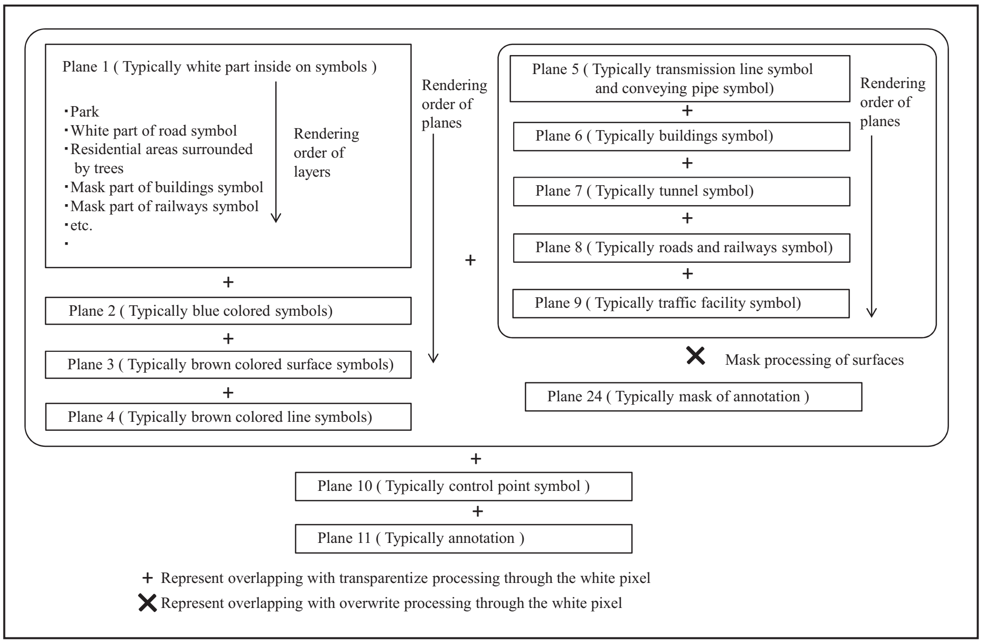

Fig. 5 Plane Rendering Order and Rendering Order Within Planes

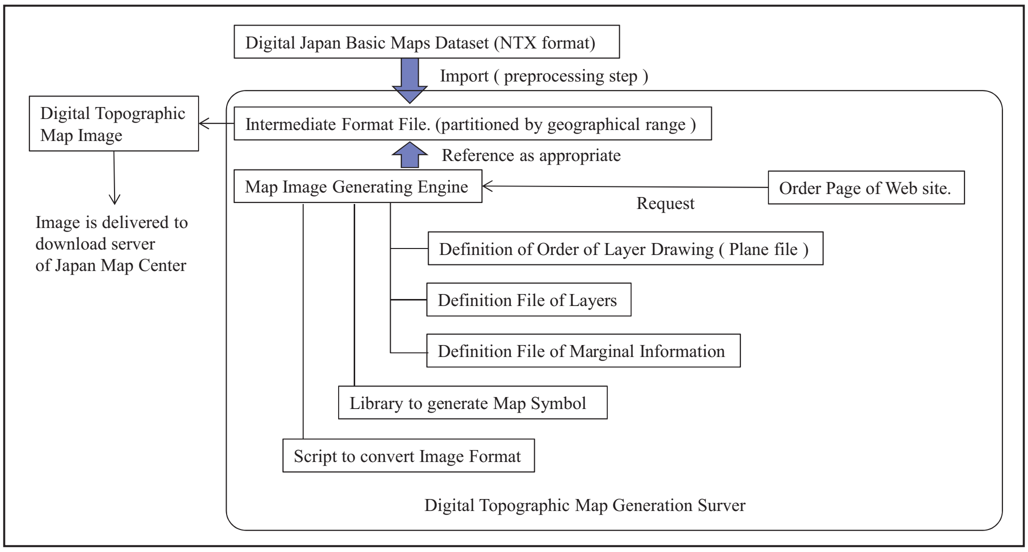

Fig. 6 Development of Digital Topographic Map Generating System

in patterns for wetlands or heavily built-up areas. In order to solve the above problems, intermediate format files are made to maintain continuity; in order to meet the continuity requirement of map symbols, data is set to be maintained beyond the necessary range even it is 30-second area data from intermediate format data. Map projection is not implemented within the intermediate format and the data is maintained as seamless rendering data under the latitude and longitude coordinates for the whole 30-second frame tile group. Fig. 7 shows the data recording status of an internal format file. As internal formats do not deliver map symbols, here they are displayed as map symbols with standard parameters. It is, however, possible to see that the data is kept beyond the 30-second frame where necessary in order to maintain continuity of map symbols.

Incidentally, the map image generating engine loads data individually from control points (GNSS-based control station, triangulation point, benchmarks and traverse points) to convert them to map symbols without going through the intermediate format because the data is not sourced from Digital Japan Basic Maps but from recorded data of ‘Control point GIS’ created for the provision of control point survey results by GSI.

3.5.2 Map Image Generating Engine

The map image generating engine of the Digital Topographic Map generating system is built up of parts

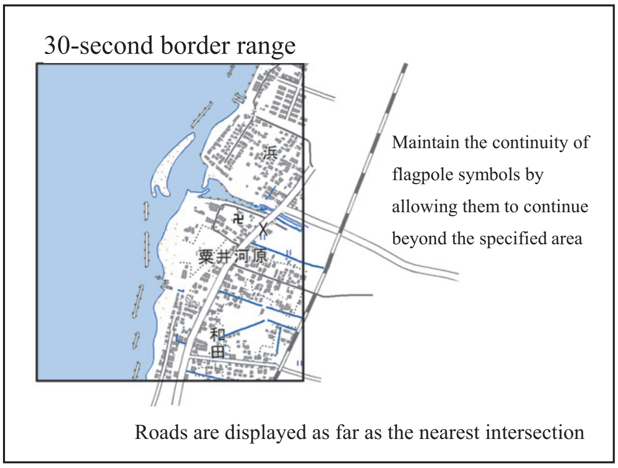

Fig. 7 Example of Digital Topographic Map Generating Internal Format File

to process different parameters for each image generating request as scripts written in Tcl and of parts in which typical process need to be conducted speedily using Window’s GDI rendering function as a library written in C++.

The map image generating engine performs the image generating process according to the following sequence:

1) Load to the memory of intermediate format files necessary for map rendering, from map center position, paper size and orientation,
2) Load control point data within requested area
3) Generate map symbols from layer setting and property values then generate vector-based map

images according to data position

4) Project using UTM and process rotation in order to make horizontal latitude lines pass through the center of the map
5) Generate map images without marginal information by rasterization based on the requested image resolution
6) Create world file
7) Add marginal information based on the requested paper size and orientation
8) If delivery format is specified as GeospatialPDF, convert the file to GeospatialPDF accordingly

When constructing the map image generating engine, high-speed processing was specifically targeted so that an A4 300dpi image could be produced in 1 or 2 seconds and an A0 508dpi image within almost 10 seconds.

4. Digital Topographic Map Generating System Operating and Publication Process

4.1 Creating Intermediate Files for Faster Image Generation

Digital Japan Basic Maps (Map Information), the raw data of the Digital Topographic Map, is text data whose format is defined as NTX.

The Digital Topographic Map generating system uses intermediate format files to perform the image generating process as described above. The Digital Japan Basic Map data is processed by first ‘importing’ it, then storing in the image generating server system as an intermediate format file group.

This import process is executed in two steps.

Firstly, the NTX format is converted to NTS format so that NTIS editing software can read it. NTX is a format simplified using the NTS format’s property according to type as type code so that interconversion is possible. However, the coordinate resolution of NTX is in units of 10^{-6} seconds in latitude and longitude whereas NTS is in units of 10^{-4} seconds so the two-digit resolution will be omitted. For example, approximately 0.03mm unit coordinate resolution in reality will become about 3mm unit resolution; when a Digital Topographic Map is output for 508dpi, the size of a pixel will be larger than 1 square meter so the effect of digit omission is negligible.

Next, the topology from NTS format is calculated and map symbol layers are assigned according to the type code and property before being converted to an intermediate format file. NTS format is defined with 2002 map symbols at a scale of 1:25,000 but with regard to new planimetric features such as national road number symbols and platforms, new map symbol codes are assigned in order to create new layers. This process takes 1-2 hours for urban areas and 30-40 minutes for mountainous areas per 6 units of secondary mesh (about 600km^2).

Digital Topographic Map image generation is prepared by copying the intermediate format file after completion of the import process to the internal deployment folder of the Digital Topographic Map generating system.

4.2 Input of Image Generating Parameters

Parameters for Digital Topographic Map generation can be changed by external operations on layer properties included in the intermediate format data, and the Digital Topographic Map images can be generated in various ways. Furthermore, a new function is added to change the display map symbol itself by dynamically modifying the layer assigned in the intermediate format. Intermediate format data is divided into 8 basic data, yet within a basic data type it is possible to change the applicable layer. Using this function, the map image of national road number symbols can be generated by selecting a display method such as 2 types of symbols shown in Fig. 8 whereas railroad symbols can be selected from the flagpole symbols used in the JR line display in topographic maps and private railroads symbols.

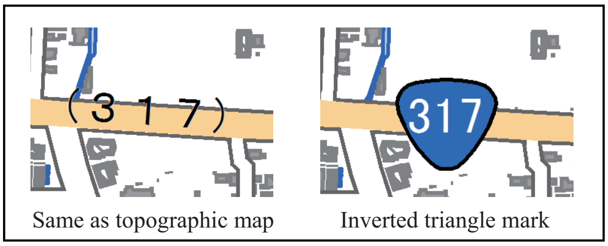

Fig. 8 Options for National Road Number Symbols for Digital Topographic Maps

As of December 2012, the changeable map symbols for Digital Topographic Maps are as follows:

1) Fill-in color for highways
2) National road number symbols
3) Railroad symbols
4) Display color of index/intermediate contour

In addition, the display/hide option can be selected for the following map symbols:

1) Transmission lines
2) Power plants and substations
3) Radio towers
4) Monuments
5) Border line of vegetation
6) Residential areas surrounded by trees
7) Index contour at cliffs
8) Intermediate contour at cliffs

In addition, as of December 2012, when the function to color symbols separately is not provided, the fill-in colors of the following items may be changed:

• for national roads
• for prefectural roads
• for other roads

There is also an image generating function for covering the entire area with grey scale.

Although display colors and fill-in colors can be freely set for each of the 256 steps of RGB, the menu available in the case of Digital Topographic Maps contains 2-3 colors to assist selection.

Furthermore, the following parameters are necessary for image generation:

1) Longitude and latitude of the center of the map image to be generated
2) Character string to be displayed in the title field as memo (maximum 60 characters)
3) Format of image to be generated (GeospatialPDF, TIFF, and JPEG. A world file is attached to TIFF and JPEG)
4) Size and orientation of image to be generated (A0-A4, portarait or landscape)
5) Image resolution (300dpi or 508dpi for products, 72dpi for thumbnail images)

These parameters are transferred from the web page of the Digital Topographic Map generating system as values for image generation via a script.

4.3 Digital Topographic Map Image Generation

When parameters necessary for rendering are transferred to the Digital Topographic Map generating system from the web page, the image-generating engine is used to render map symbols of the Digital Topographic Map to generate images for delivery.

As for the created image for delivery, if the requested image is a thumbnail, it will be placed in a specified folder under the web server. At the same time, users can display and confirm the thumbnail image on their client (user) page as the thumbnail image's file name is returned to the client who requested the image. If the requested image is for the product to be purchased, it will be packed in a ZIP file with a legend file then delivered to the file server of Japan Map Center, which is contracted to distribute replicas as a download service to purchasers of the download service.

Purchasers can obtain a copy of Digital Topographic Map images by clicking the URL emailed from the Japan Map Center for downloading. An example of a Digital Topographic Map (in portrait A4 format) is shown in Fig. 9.

The above description concerns the publication process of Digital Topographic Maps published using the Digital Topographic Map generating system.

5. Conclusion

Digital Topographic Maps aimed at balancing the speed of updating which is reflected by the changes based on Digital Japan Basic Map data and improved usability of paper maps based on representations of topographic map were first published for the Hokkaido region on August 30, 2012 then for the Shikoku and Okinawa regions on October 30, 2012. A range expanded to cover the entire country is planned.

Crucial differences between Digital Topographic Maps and topographic maps currently exist. While Digital Topographic Maps provide accurate map information and true positions without dislocation or generalized representation, topographic maps include map information with additional dislocation and generalization where necessary at 1:25000 scales. Moreover, Digital Topographic Maps always offer the most up-to-date map information whereas paper maps only provide information available at the time of printing. They are the results of different surveys with both advantages and disadvantages depending on the intended use.

However, in the future it is believed that Digital Topographic Maps and paper maps should become identical in terms of survey results and the mutual integration of the two formats by studying how to eliminate differences between the two is the ultimate aim. In the case of Digital Topographic Maps, limited trial of multi-scale rendering using 1:2500 scale data in urban planning areas in order to produce 1:25000 scale maps has begun. In the medium term, research and development is ongoing in an effort to offer a series of Digital Topographic Maps that includes map image generation for 1:50,000 and 1:200,000 scales.

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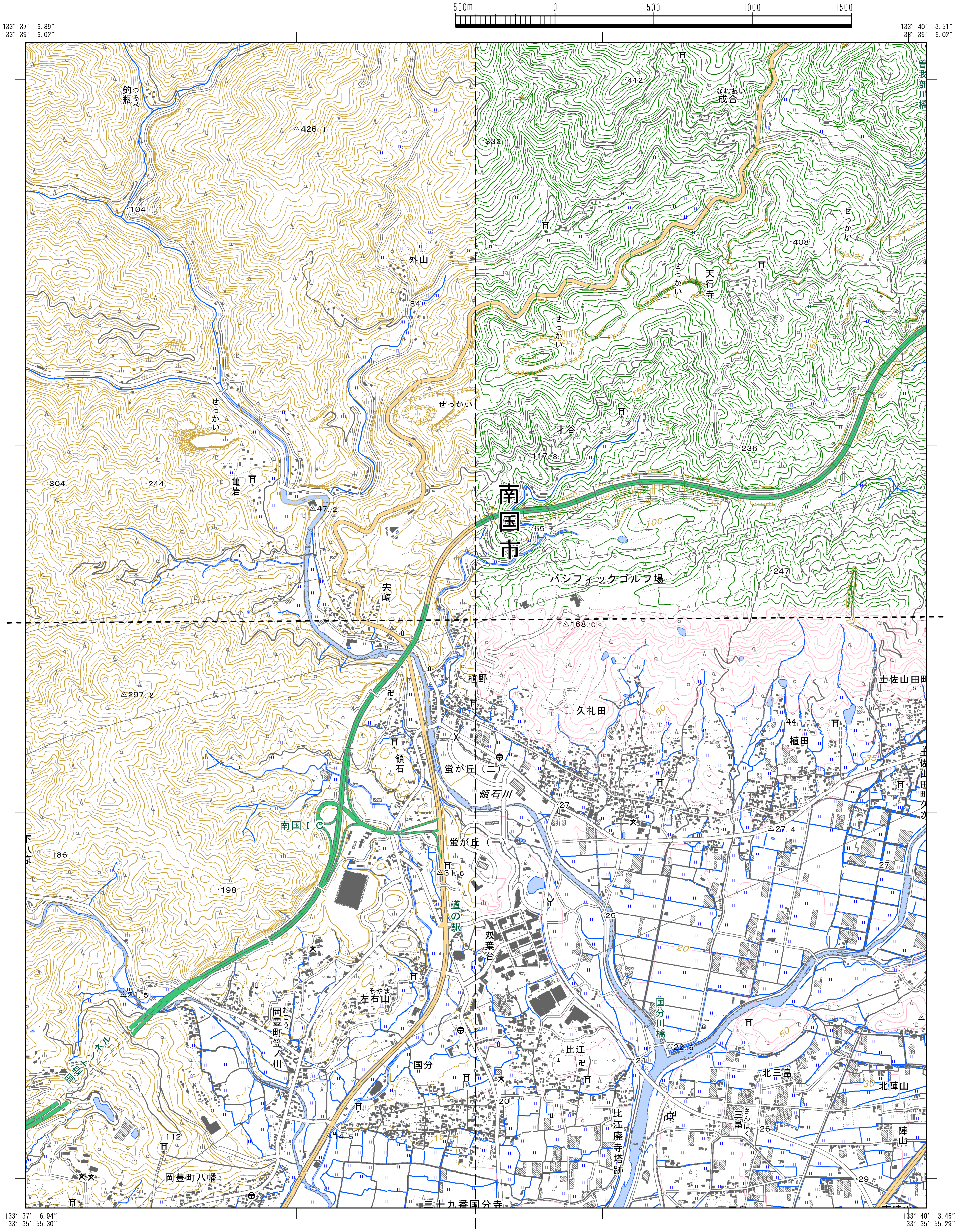
Yoshiyuki MIZUTA, Hiroyuki OHNO, Kiyoaki NAKAMINAMI, Takeshi ISHII (2002): Vector Revising Software, Journal of the Geospatial Information Authority of Japan, 98, 87-96.

Fig. 9

電子地形図25000

Example displaying traditional topographic map references, green contours, Digital Topographic Map references, pink contours similar to those of topographic maps in the following order: upper left, upper right, lower left and lower right



1. 投影はユニバーサル横メルカトル図法、座標帯は第53帯、中央子午線は東経135°
2. 図郭に付した短線は経緯度差1分ごとの目盛
3. 高さの基準は東京湾の平均海面
4. 等高線及び等深線の間隔は10メートル
5. 磁気偏角は西偏約7° 0′
6. 図式は平成24年電子地形図25000図式

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著作権所有兼発行者　国土地理院

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