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**Road vehicles — Map data physical
storage format for car navigation systems**

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Foreword

This translation has been made based on the original Japanese Industrial Standard established by the Minister of Economy, Trade and Industry, through deliberations at the Japanese Industrial Standards Committee according to the proposal of establishing a Japanese Industrial Standard from Japan Digital Road Map Association(DRM)/ Kiwi-W Consortium / the Japanese Standards Association(JSA), with a draft of Industrial Standard based on the provision of Article 12 Clause 1 of the Industrial Standardization Law.

Being in conformance with this Standard may come under the use of the following patent rights:

- Denomination of invention Map display System
Date of registration of invention Dec. 5th, 1997
- Denomination of invention Map display controlling System
Date of registration of invention Feb. 26th, 1996
- Denomination of invention Car-mounted Map display System
Date of registration of invention Nov. 5th, 1996
- Denomination of invention Car-mounted path search System
Date of registration of invention Dec. 17th, 1996
- Denomination of invention Map data base System
Date of registration of invention May. 16th, 1997
- Denomination of invention Navigation system and path search method
Date of registration of invention May. 23rd, 1997
- Denomination of invention Navigation system
Date of registration of invention May. 15th, 1998
- Denomination of invention Map data base System
Date of registration of invention Jun. 26th, 1998
- Denomination of invention Navigation system for vehicles
Date of registration of invention Sept. 4th, 1998
- Denomination of invention Navigation system and Map display System
Date of registration of invention Sept. 4th, 1998
- Denomination of invention Car-mounted Map data base System
Date of registration of invention Sept. 11th, 1998
- Denomination of invention Navigation system
Date of registration of invention Dec. 18th, 1998
- Denomination of invention Navigation system
Date of registration of invention Nov. 12th, 1999
- Denomination of invention Navigation system and information storage device
Date of registration of invention May. 16th, 2003
- Denomination of invention Map Data base
Date of registration of invention Oct. 20th, 2000
- Denomination of invention Navigation system and storage media
Date of registration of invention Dec. 8th, 2000
- Denomination of invention Address range data and position coordinate calculation program
recorded storage device
Date of registration of invention Apr. 20th, 2001
- Denomination of invention Registered location searching data recorded storage device
Date of registration of invention Apr. 20th, 2001

D 0810 : 2004

Denomination of invention Navigation system

Date of registration of invention Nov. 30th, 2001

Denomination of invention Indicator for road map for vehicle

Date of registration of invention Feb. 8th, 2002

Denomination of invention Car-mounted Navigation System

Date of registration of invention Mar. 22nd, 2002

Denomination of invention Navigation System

Date of registration of invention Jul. 5th, 2002

Denomination of invention Indicator for road map for vehicle

Date of registration of invention Oct. 4th, 2002

Denomination of invention Navigation system and storage device

Date of registration of invention Jun. 20th, 2003

Denomination of invention Map information formulating method, formulation System and navigation system

Date of registration of invention Jul. 30th, 2003

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Road vehicles — Map data physical storage format for car navigation systems

Introduction This Japanese Industrial Standard establishes, in order to specify a map data storing system in the car navigation systems for planning at promotion of the compatibility between a car navigation systems and a map database.

1 Scope This Standard specify the physical data organization for data format (physical storage format : PSF) is stored in physical media, such as CD and DVD, in a car navigation systems.

Physical data organization is shown in Fig. 1

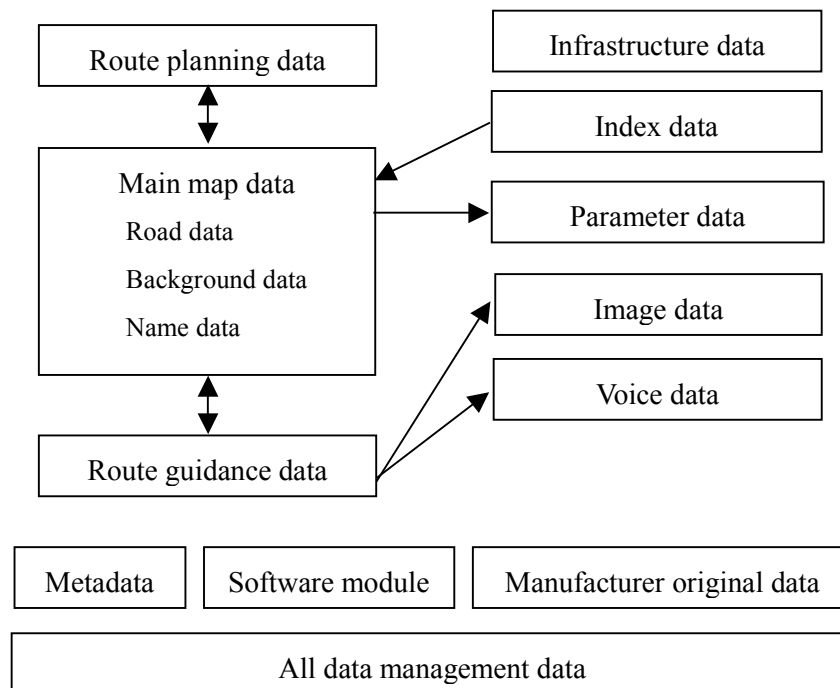


Fig. 1 Data structure of a format

2 Normative references The following Standards contain provisions which, through reference in this Standard, constitute provisions of this Standard. If the indication of the year of coming into effect is given to these referred standards, only the edition of indicated year constitutes the provision of this Standard but the revision and amendment made thereafter are not applied. The normative references without the indication of the year of coming into effect apply limiting only to the most recent edition (including the amendment).

ISO 9660:1988 Information processing — Volume and file structure of CD-ROM for information interchange

ISO/IEC:8859-1 Information technology — 8-bit single-byte coded graphic character sets — Part 1: Latin alphabet No. 1

3 Definition of terms The definitions of terms used in this Standard are described below:

- a) **file** A set of information treated as a unit for storing and managing data
Remarks : A file consists of frames, tables, lists, or blocks, depending on the set of information to be managed.
- b) **signature** A character-type symbol used to declare data and fields
- c) **attribute header** The attribute header is placed at the top of the frame, and describes the attributes and positions of data groups
- d) **distribution header** The distribution header is placed at the top of a frame, and contains descriptions about locations and sizes of the lists or tables stored in the frame
- e) **table** The table is a sequence of fixed-length records
- f) **field** The field is the minimum unit for storing data
- g) **frame** The frame is made up of multiple tables or lists
- h) **list** The list is a sequence of variable-length records
- i) **record** The record is a group of fields to be handled as a single unit of data
- j) **volume** The volume is a group of data made up of the media identification information and the storage data configuration information
- k) **node** The node is interchange point or end-point
- l) **route information** The information for setting the pass for an integrated node
- m) **integrated node information** The information for managing integrated intersections
- n) **parcel** The parcel is a rectangular area used as a unit for storing map data
Remarks : In the main map data and the route guidance data, parcels with the same management level are the rectangles of the same area.
- o) **block/block unit** The block or the block unit is a unit for managing multiple parcels efficiently
- p) **block set** The block set is a unit for managing multiple block units efficiently
- q) **region** The region is a polygon area used as a unit for storing the route planning data
Remarks : A region is further divided as the level goes down. On a lower level, any region must not extend over the region boundary of the corresponding higher level region.
- r) **DAL** Acronym of data access library (data acquisition processing)

4 Terms used for constants and variables The definitions of constants and variables used in this Standard are described below:

- a) **Latitude and longitude** The first bit of the first word is the flag to show north/south and east/west. The north latitude and east longitude is shown positive and the south latitude and west

longitude is shown negative. The longitude and latitude are represented in seconds with the following 20 bits. The next 3 bits show the longitude and latitude in units of every 0.125 s (1/8 s). The remaining 8 bits are for future expansion.

- b) **Offset** O1, O2...FREE Description for the offset when the offset position for an item is not fixed. When the offset position is optional, it is indicated with “FREE”.
- c) **Data source identifier** The data source identifier indicates a value of 1/100 of the denominator of a scale for a data source.
- d) **Multiplication constant** The value of n of the n -th power of 2 by which the X-axis coordinate offset and the Y-axis coordinate offset are multiplied.
Remarks : $0 \leq n \leq 7$ (n is an integer)
- e) **Normalized latitude** The integer part of the value of the normalized latitude within a parcel multiplied by 4 096.
- f) **Normalized longitude** The integer part of the value of the normalized longitude within a parcel multiplied by 4 096.
- g) **Passage code** This code is used to specify conditional traffic regulations.
- h) **Node ID number** The node ID number is not stored in the record. The node ID number is defined as the order of the storage of the node data of which an assumed value is set 0. “ID” in the term is omitted, and it is sometimes described “a node number” in this Standard.
- i) **Display scale flag** The display scale flag is the flag showing the scale to display.

Remarks : Display scales can be selected according to the background levels.

Example : The display scale flag and the associated scale for the background level 1

Display scale flag	Scale
1	1/10 000
2	1/20 000
3	1/30 000

- j) **Block set number** The number of a block set that manages a group of blocks on the same level.
Remarks : The value range is from 0 to 254, and 255 is assigned to “NULL”.
- k) **Block number** The number assigned to each block within the same block set.
Remarks : The value range for each block set is from 0 to 65534, and 65535 is assigned to “NULL”.
- l) **Divided/integrated parcel identifier** This identifier indicates whether the relevant parcel data is a segment of a divided basic mesh or consists of integrated basic meshes.

Remarks : When the relevant parcel is the result of division, this identifier indicates a relative location within the mesh. When it is the result of integration, this identifier indicates the parcel size. When the relevant mesh data is a divided mesh, its relative location within the basic mesh is indicated. A mesh can be divided into up to 256 (16×16).

When the relevant mesh data is an integrated mesh, the parcel size with reference to the lower left mesh is indicated. Up to 256 (16×16) meshes can be integrated.

- m) **Point indication string** A character string type used for setting a character string with the indicated point as the rotation center and with awareness to the real position.
- n) **Link ID number** The link ID number indicates an absolute number within a medium, concerning a multilink consisting of the node (the multilink intermediate point, multilink start point, or multilink end point) indicated with the link ID number and the next node. The link ID number is assigned according to the road data used for the main map and route planning. The link ID number is specified with the following two items.
 - 1) **Link direction (2 bits)** 0 to 3: Directions for relating the integrated links on the higher level to the lower-level links, with reference to the higher-level link shape directions
 - 0: Simple network link without a complex representation on the higher level
 - 1: Forward simple network link with a complex representation on the higher level.
 - 2: Backward simple network link with a complex representation on the higher level
 - 3: Network link with a complex representation(For 1, 2, 3 of the above, the link number is the same.)
 - 2) **Link number (30 bits)** 0 to 1073741823: This number shows the link number within a medium (0: RESERVED, 1073741823: Not determined).
- o) **Link type** The following link types are available.
 - 1) **Main road (no separation between two-way traffic) link**
 - 2) **Main road (separation between two-way traffic) link**
 - 3) **Connection road (between main roads) link**
 - 4) **Link within the intersection**
 - 5) **Connection road (ramp) link**
 - 6) **Slip road alongside a main road**
 - 7) **Link road to a service area**
- p) **Adjacent node ID number** The node number of a node adjacent to the current node.
Remarks : The value range is from 0 to 8091.
- q) **Level number:** The level managed by the block set management record.
Remarks : The value range is from -31 to $+31$, and -32 is assigned to "NULL".

5 Structure of the map data physical storage format

5.1 Conventions for file names and directory names Conventions for file names and directory names shall conform to ISO 9660 Level 1 that specifies the logical format for CD-ROM in order to

guarantee compatibility between different machines and systems.

To be more specific:

- a) A file name shall consists of 1 to 8 characters and an 3-character extension (the 8.3 format similar to the MS-DOS FAT).
- b) A directory name shall consists of 1 to 8 characters.
- c) A hierarchy of directories shall have up to 8 levels.
- d) Characters usable for a file name and directory name shall be alphanumeric and underscores(_):
ABCDEFGHIJKLMNOPQRSTUVWXYZ_0123456789

This Standard does not specify conventions for volume descriptors, path tables, and some others since they depend on system media.

6 General structure of the map data physical storage format Data groups to be stored on the media are classified as follows:

- a) **All data management frame**
- b) **Parcel-related data management frame**
- c) **Main map data frame**
- d) **Route guidance data frame**
- e) **Region data management frame**
- f) **Route planning data frame**
- g) **Index data frame**
- h) **Parameter frames**
- i) **Infrastructure data frame**
- j) **Image data frame**
- k) **Voice data frame**
- l) **Manufacturer original data frame**
- m) **Metadata frame**
- n) **Software loading module frame**

Fig. 2 shows the storage configuration.

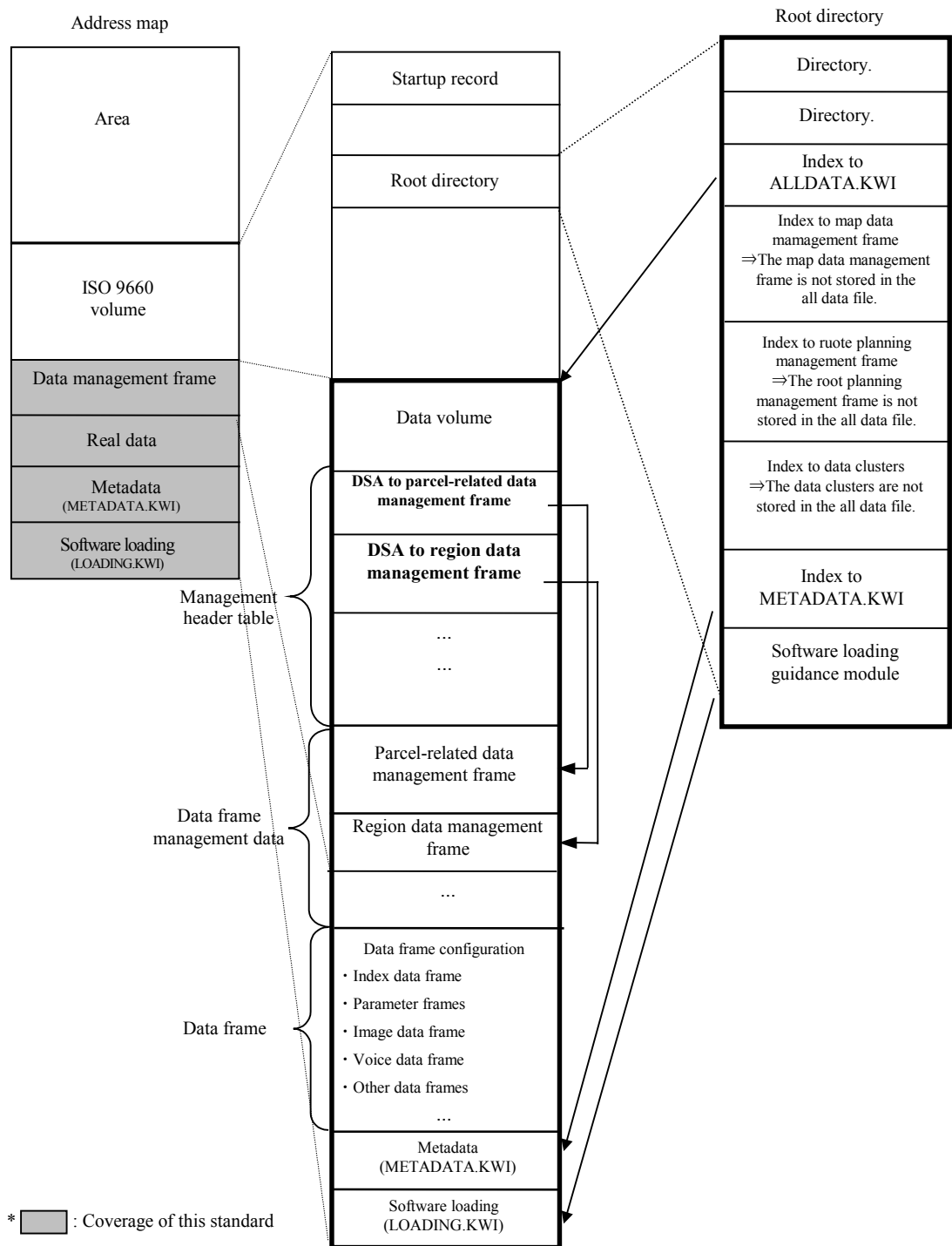


Fig. 2 Physical data storage configuration (For storing all data in "ALLDATA.KWI")

6.1 All data management frame The all data management frame contains the management data for the data stored on the media.

For an efficient data management, the all data management frame is composed of the data volume and the management header table. Particularly for the map and the road network, the all data man-

agement frame is configured so as to point to the related data management frame (the parcel-related data management frame or the region data management frame).

This data frame is stored in the file named “ALLDATA.KWI”. This file can also store other data frames.

Metadata and the loading module frame are not stored in this file.

6.2. Parcel-related data management frame The parcel-related data is classified into two types: the main map data for representing maps and the route guidance data used for route guidance. The parcel-related data management frame contains the information for managing each type of data in order to realize an efficient data access.

6.3 Main map data frame This frame contains the data for representing a map, such as roads, backgrounds, names, and symbols. This data frame stores data on a parcel basis and therefore multiple main map data frames exist.

6.4 Route guidance data frame The route guidance data frame stores various data necessary for route guidance. The voice data and image data, however, are stored in different frames. The ADPCM voice data for voice guidance is stored in the voice data frame. The image data for guidance is stored in the image data frame and also in the landmark data frame of parameter frames depending on the application type and the data type. This data frame stores data on a parcel basis and therefore multiple route guidance data frames exist.

6.5 Region data management frame The region data consists of data for route planning. The region data management frame contains the information for managing the data in order to realize an efficient data access.

6.6 Route planning data frame This data frame contains the data concerning nodes, links, costs, passage codes, and the hierarchical relationship between levels. This data frame stores data on a region basis and therefore multiple route planning data frames exist.

6.7 Index data frame This data frame contains the search data and the management data for searching.

For an efficient data access, some items of index data are stored in other frames and files. The specifications of this data frame are open for enabling it to include manufacturer original data. The format for manufacturer original data is contained in the definition frame for the management data frame and the POI information frame.

This data frame consists of the following:

- Data management frame
- Search frame
- POI information frame

Each frame can be composed of multiple data frames and multiple files.

6.8 Parameter frames This frame contains the parameter data for colours and styles for drawing and the icon data for landmarks and symbols. This data frame consists of the distribution header and the data frames for each contents.

Types of parameter information to be stored are:

- Drawing parameter information

- 3D symbol information
- Road number display-frame information

Each data frame can contain the character data used for display and pronunciation.

6.9 Infrastructure data frame The infrastructure data frame contains the location reference data for the traffic information data. Because the traffic information systems differ from country to country, this specification defines only the data frame but not individual record format.

6.10 Image data frame this data frame consists of the real drawing data and the image service information which is used to plot the information on the drawn image. The image data is classified in accordance with the image data ID. For the image the following computer graphic data formats are available: CLUT image, GIF, BMP, TIFF, EPSF, RIB, JPEG, and vector.

6.11 Voice data frame This data frame stores the real voice data (general-purpose voice data and specific voice data). The general-purpose voice data is classified based on the voice data ID. This data frame can also store manufacturer original data for announcement. For the voice data the following audio data formats are available: CDDA and MPEG.

6.12 Manufacturer original data frame This frame stores the data original by the system, application, DAL, or PSF manufacturers. Multiple data frames can be defined.

6.13 Metadata frame This frame is stored in a file named “METADATA.KWI” and contains metadata written in the Backus Form.

6.14 Software loading module frame The loading module frame contains the software loading modules for the system, application and DAL. This frame is stored in the file named “LOADING.KWI”.

Fig. 3 shows the outline structure of the PDO.

All data management frame		Index data frame	
	Data volume		Data management frame
	Level management information		Data management header
	Management header table		User field
	Data management header 1 (parcel-related data management frame)		Volume management table
	Data management header 2 (region data management frame)		POI information management table
			Search frame (l)
	Data management header 47		Management frame of the search frame
	Data management header 48		Category definition frame
			Matching data definition frame
			Category data frame
Parcel-related data management frame		Search frame (j)	
	Parcel-related data management distribution header		Matching data frame
	Header information		Search frame (j)
	A sequence of level management records		POI information frame (l)
	A sequence of block set management records		Management frame of the POI information frame
	A sequence of block management tables		POI information definition frame
	Parcel management list		POI information data frame
	Main map parcel management list		POI information frame (k)
	Route guidance parcel management list		Parameter frames
Main map data frame		Parameters distribution header	
	Main map distribution header		Drawing parameter data frame
	Main map basic data frame		Drawing parameter distribution header
	Road data frame		Color palette table
	Background data frame		Line style palette table
	Name data frame		Drawing parameter data frame corresponding to the map element
	Additional data A/B frame		Landmark data frame corresponding to the category code
	Extended data frame		Landmark distribution header corresponding to the category code
			Landmark pattern table
Route guidance data frame			Name and reading information data list
	Route guidance distribution header		3D symbol data frame
	Route guidance basic data frame		3D symbol distribution header
	Guidance data frame		Landmark data frame corresponding to the 3D code
	Character string data frame		Landmark distribution header corresponding to the 3D code
	Shape data frame		3D landmark pattern table
	Pattern data frame		Name and reading information data list
	Extended data frame		Road number display-frame data frame
			Road number display-frame distribution header
Region data management frame			Landmark data frame corresponding to the code
	Region data management distribution header		Landmark distribution header corresponding to the code
	Region management record information		Landmark pattern table
	Common traffic condition table management information		Name and reading data list
	A sequence of level management records		Infrastructure data frame
	Region management table		Image data frame
	Common traffic condition table		Image management distribution header
			Palette set data frame
Route planning data frame			Color table data frame
	Route planning distribution header		Image data frame
	Route planning basic data frame		Image service information data frame
	Node data frame		Voice data frame
	Link data frame		Voice distribution header
	Link cost data frame		A sequence of general-purpose real voice data
	Data frame corresponding to the upper level node		A sequence of specific real voice data
	Data frame corresponding to the upper level link		Metadata frame
	Passage code data frame		Metadata
	Statistical cost data frame		Software loading module frame
	Node coordinate data frame		Software loading module management field
	Road reference data frame		Software loading module main body
	Route planning basic data frame		Manufacturer original data frame
	A sequence of route planning extended data frames		User identifier
			Data identifier
			Real data

Fig. 3 General structure of data

7 Data structure of each data frame The data structure of each data frame is described below.

7.1 All data management frame The all data management data frame consists of the data volume

and the management header table.

The order of the data volumes and the management header tables are fixed. The size of the data volume and the management header table is fixed to 2K bytes for each.

7.1.1 Data volume The data volume contains the information for identification and management of media.

One medium shall not contain more than one data volume.

The data volume consists of the followings:

- System-specific identification
- Data author identification
- System identification
- Format version number
- Data version number
- Disk title
- Data contents
- Media version number
- Data coverage
- Logical block size
- Sector size
- Default background data
- Level management information

a) Level management information The level management information consists of the number of data types and the information about each level. The number of data types is currently defined as "3" in metadata. Those are the main map data frame, the route guidance data frame, and the route planning data frame. For future expansion, the format has the field to define the number of data types to allow new data frames to be added.

7.1.2 Management header table The management header table consists of 48 management header records.

The management header table consists of the header address field, the size field, and the file name field of the data frame and shows the storage position and size of the corresponding data frame. The file name field is used when the data management frame and/or data block frame are included in a file other than "ALLDATA.KWI".

a) Basic block The first 16 management header records is used as follows:

- 1) The management header 1 points to the parcel-related data management frame.
- 2) The management header 2 points to the region data management frame.
- 3) The management header 3 points to the index data management frame of the index data frame.

- 4) The management header 4 points to the parameter distribution header of the parameter frame.
- 5) The management header 5 points to the infrastructure data frame.
- 6) The management header 6 points to the image management distribution header of the image data frame.
- 7) The management header 7 points to the voice distribution header of the voice data frame.
- 8) The remaining headers are for future expansion.

The order of management headers and the management header numbers (1 to 16) are fixed by the metadata.

- b) **The second 32 management header records of the management header table** The second 32 management header records are used for management of the data created by the system developers, DAL providers, data developers, and PSF developers. The management header record consists of the storage location field and the size or file name field of the actual data stored in the manufacturer original data frame. If the management header record is not used, “FF(16)” is set in the address field and “00(16)” is set in the size field or the file name field.

7.2 Parcel-related data management frame

7.2.1 Parcel-related data management method to manage the map data (it includes main map data and the route guidance data), the following structures and methods are used.

- a) The parcel-related data is managed by a tree structure configured by levels, block sets, blocks, and parcels.

Information : Take a 1/25 000 scale map issued by Geographical Survey Institute for example, huge amount of maps are necessary to cover the whole country. For 1/5 000 scale maps, the number of maps necessary is more than huge, causing management of maps almost difficult. If these maps are structured hierarchically, (for example, one map for each (basic) parcel, a block for each prefecture, a block set for each district, and a level for the whole country), data access will be much more efficient. This hierarchical structure is also applicable to a larger area such as Europe. The number of hierarchical levels is theoretically indefinite just like scales of hard-copy maps, but normally is up to eight. It is not practical that every district has the same number of levels for parcel data. Taking an example of hard-copy maps, the smallest scale map for cities is 1/1000, while that for rural districts is 1/25 000. Similarly, the lowest level of parcel data depends on the district.

- b) Each level consists of more than one block set. The level management information contains the number of latitudinal/longitudinal block sets in the format of $(a \times b)$, where a and b take a value of 1, 2, 4, 8, and 16.
- c) Each block set consists of more than one block unit. The level management information contains the number of latitudinal/longitudinal block units in the format of $(c \times d)$, where c and d take a value of 1, 2, 4, 8, 16, 32, 64, 128, and 256.
- d) Each block unit consists of more than one parcel. The level management information contains the number of latitudinal/longitudinal basic parcels in the format of $(e \times f)$ where e and f take a value

of 1, 2, 4, 8, 16, 32, 64, 128, and 256.

- e) The area for each parcel can integrate several basic parcels or can be divided equally into several areas. Integration is possible for up to eight parcels in the latitudinal/longitudinal direction. Division is made by setting the number of divided parts ($n \times m$) in the parcel management information, where n and m take a value of 2, 4, 8, and 16. Up to three division patterns can be set. Integration is performed when parcels contain smaller amount of data, while the division is made when the parcel contains larger amount of data.
- f) The divided parcel information shall not be further divided nor integrated again.
- g) The area size of the basic parcel of a certain level shall be the size equal to the equally divided parts ($n \times n$) of the basic parcel of the upper level, and also the size equal to the integrated parts ($m \times m$) of the basic parcels of the lower level. This size is stored in the level management information. The values of n and m are any of 1, 2, 4, 8, 16, and 32. Usually in Japan, the size of the basic parcel of each level is determined by using the a 1/25 000 scale map (the secondary mesh: 300 s LNG $\times$ 450 s LAT) issued by Geographical Survey Institute as the basic unit.
- h) This Standard shall not specify the order in which parcels are stored.
- i) The data stored on a parcel basis includes the map data and the route guidance data. Even though it is possible to divide or integrate parcels for the map data and the route guidance data independently, this shall be prohibited. That is, if the map data and the route guidance data have an identical parcel number, they shall have the same area size.
- j) If the map data extends over several parcels, it shall be truncated on parcel boundaries and included in each parcel. For the road data, a node called a boundary node is generated on the truncated position.
- k) Four parcel management types are set for the parcel data management.
 - Type 1 clearly specifies the address and size of the data to be contained in each parcel. By default, this type is used.
 - Type 2 clearly specifies the size of the basic data frame of each parcel.
 - Type 3 clearly specifies the size of the road data frame of each parcel.
 - Type 4 is used when each parcel is divided and stored in different files other than “ALL-DATA.KWI”.

Relationship between levels, block sets, blocks, and parcels is shown in Fig.4.

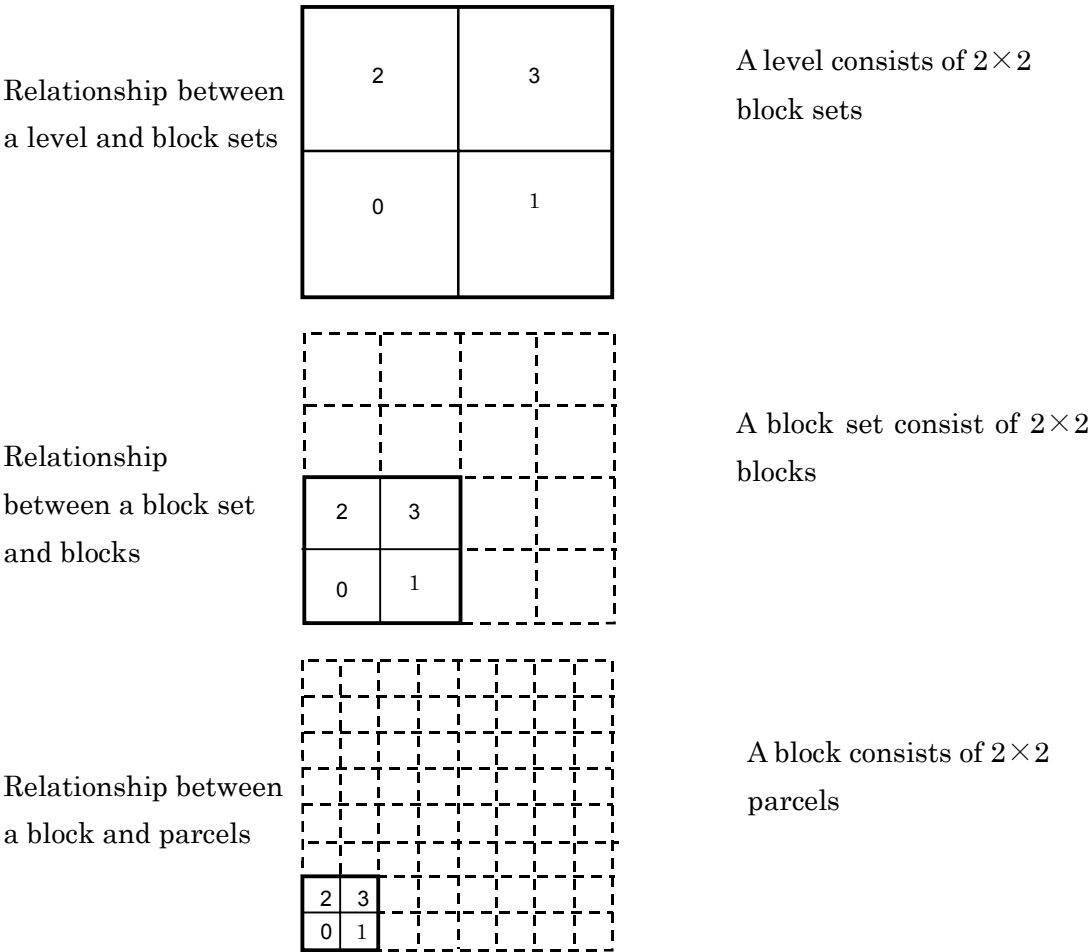


Fig. 4 Relationship between levels, block sets, blocks, and parcels

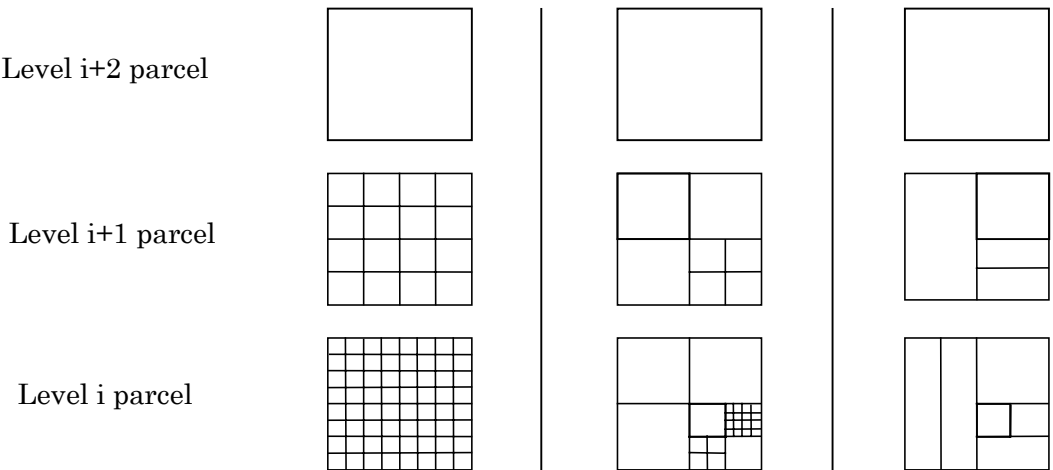


Fig. 5 Example of divided map parcels

7.2.2 Structure of parcel-related data management frame The parcel-related data management frame consists of **a)** and **b)**. Fig.6 shows the structure and the relationship between the components.

a) Parcel -related data management distribution header The parcel -related data management distribution header consists of the followings:

- Header size
- File name specification
- Coverage area
- Size of the level management record
- Size of the block set management record
- Size of the block management record
- Total of level management records
- Total of block set management records
- A sequence of level management records
- A sequence of block set management records
- A sequence of block management tables

b) Parcel management list The parcel management list consists of the followings:

- Parcel management type
- Offset to the route guidance parcel management list
- Main map parcel management list
- Route guidance parcel management list

The management records composing the map and the route guidance parcel management list have different formats depending on the parcel management type.

1) Main map parcel management list The main map parcel management list is available in the following four types:

Type 1 : The first address and the size of the main map data frame

Type 2 : The first address, the size of the main map data frame, and the size of the map basic data frame

Type 3 : The first address, the size of the main map data frame, and the size of the road data frame

Type 4 : The first address, the size of the main map data frame, and the size of the file name

2) Route guidance parcel management list The route guidance parcel management list is available in the following three types:

Type 1 : The size of the first address and the route guidance data frame

Type 2 : The size of the first address and the route guidance data frame, and the size of the route guidance basic data frame

Type 3 : The size of the first address, the route guidance data frame, and the file name

The route guidance data is basically for the nodes of the lowest level main map; therefore the route guidance parcel management list belongs only to that level.

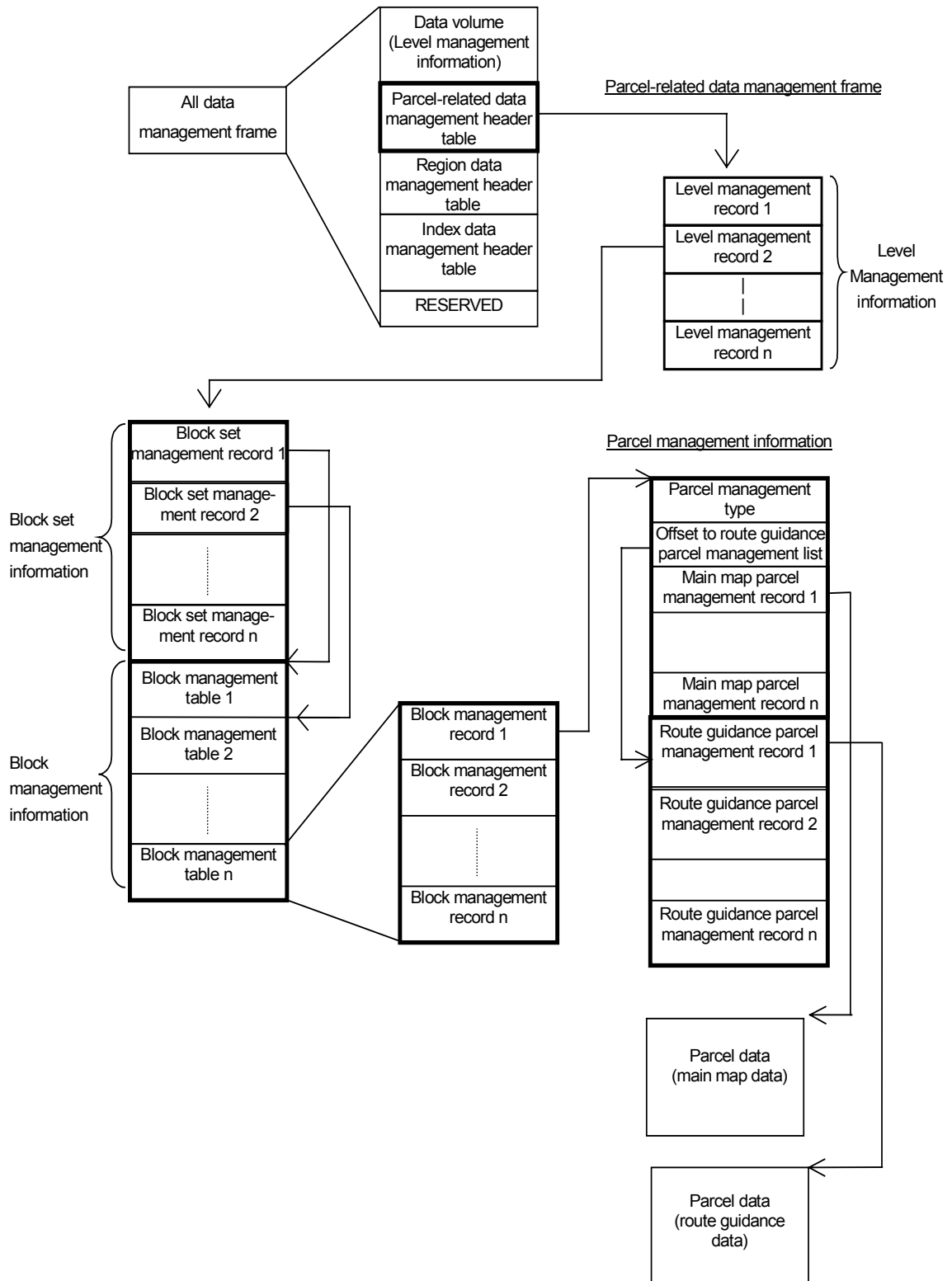


Fig. 6 Parcel-related data management frame

7.2.3 Parcel-related data storage method

7.2.3.1 Basic guideline for storage The data shall be stored in the following manner for an efficient data management which allows the application to draw the roads, backgrounds, and names in map in order of stored data.

- a) The parcel-related data consists of multiple main map data frames and multiple route guidance data frames. Either of them is composed of a distribution header and several data frames. The main map basic data frame contains the road data, the background data, and the name data. The route guidance basic data frame contains the guidance data, the character string data, and the shape data.
- b) The road data, the background data, and the name data are classified into defined display classes. For the road class, maximum 16 display classes are defined by the metadata. The background data is provided with maximum 32 display classes and the name data has maximum 16 display classes.
- c) The background data is classified into type codes that are defined by the metadata. The background data has symbols, points, lines, and areas types.
- d) The name type code is defined by the metadata.
- e) The road data is stored in the corresponding data frame in order of display classes.
- f) The background data is stored in the corresponding data frame in order of display classes.
- g) The name data is stored in the corresponding data frame in order of display classes.
- h) The road data is stored with the multilink structure.

7.2.3.2 Multilink structure Generally roads are represented with continual link information and the node information. The link information is normally represented with the node information, shape points information, and the attribute data. The roads are drawn with lines. The line shape to draw roads and the sequential links which represent a road have a lot of items in common, thus sharing the common data. The multilink consists of a single attribute data and a multiple shape points including multiple nodes. The multilink structure is used by road data of all levels. Fig.7 illustrates the multilink structure.

- a) The multilink data record consists of the header section and the data section.
- b) The data section consists of the multilink shape information, the node/link connection information, the additional node information, the altitude information, and the traffic regulation information.
- c) The multilink shape information consists of the the start node coordinates, the intermediate point coordinates, and the attributes.
- d) The node/link connection information is also called the node information generally. This is the information to identify the same node across multiple multilinks and the change information of the additional node information.

- e) The additional node information consists of the link number, the lane and road width information, the reference to the guidance data, the reference to the name data, the reference to the traffic regulation information, and the region number.
- f) The altitude information presents the altitude of nodes in the multilinks. It is separated from the space coordinates (X-, Y- and Z-coordinates) because of historical and gathering data reason such as it isn't easy to collect an altitude data.
- g) The traffic regulation information only exists in the lowest level. The elements composing this information are the same as the traffic regulations of the route planning data.
- h) A multilink must not extend multiple parcels. If a road extends over multiple parcels, specify two multilinks both having dummy nodes set on the parcel boundaries as the start and end points. The multilinks which are integrated into one multilink in upper level shall have a consecutive ID numbers.

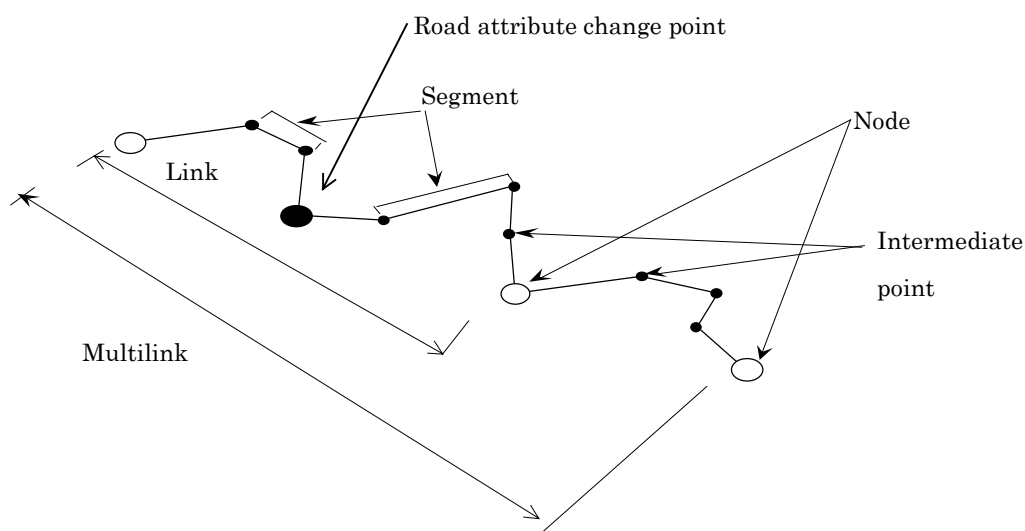
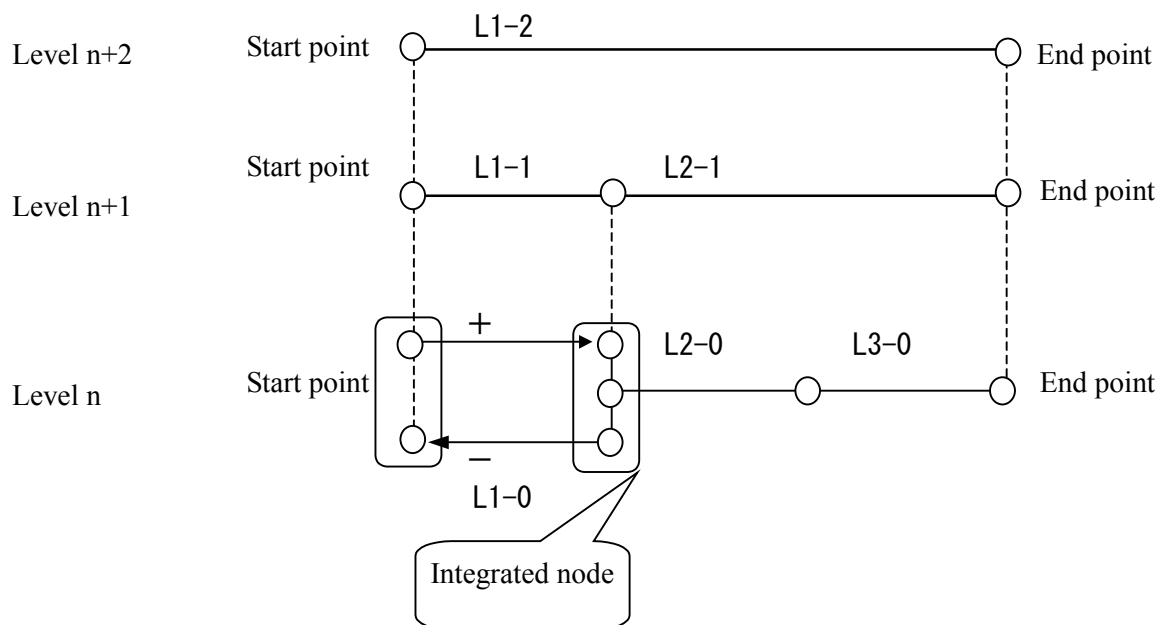


Fig. 7 Multilink structure

7.2.3.3 The link identification number and the node identification number Normally each data item is given a unique number for identification. In this format, only the links are assigned ID numbers (link IDs). Nodes are given no ID numbers. For identification of nodes, sequence numbers assigned on parcel basis are used. Fig.8 illustrates the link ID structure.

Link IDs are assigned to nodes (links) sequentially from the start point of the multilink. If the same road exists in the upper level, the same link IDs are assigned to the upper level links to make association between the levels. The multilink of the road data for the parcel is related to the link of the route planning data for the region by this link ID. For the multilink of the road data of the lowest level, the road which is not the target of the route planning data (i.e., the road for which only drawing is made) can be specified. In this case, it is not necessary to store the link information and the node information of that road in the route planning data frame of the lowest level. Therefore, the link ID is not assigned. However, it is possible to perform the route planning to a link or node having the link ID with the road data of the lowest level.



Link ID configuration:

Link direction + Start point link number + Difference of end point link number

Fig. 8 Link ID configuration

7.3 Main map data frame The main map data frame contains the map data. The stored positions can be identified by the main map parcel management record of the parcel management list of the parcel-related data management frame.

The main map data frame consists of the main map distribution header and the basic data frame for maps.

7.3.1 Main map distribution header The main map distribution header consists of the followings:

- Header size
- ID number of the lower left reference parcel
- Position code of the lower left reference parcel in a block
- Divided/integrated parcel identifier
- Practical management code
- Data source flag
- Real-length data in the normalized longitudinal direction
- Real-length data in the normalized latitudinal direction
- Geomagnetic strength data
- Geomagnetic declination data
- Address of the route guidance data frame
- Size of the route guidance data frame

- Number of the route planning data regions
- A sequence of route planning data region numbers
- A sequence of basic data frame management records
- A sequence of extended data frame management records
- Adjacent area address information
- Expansion (Main map distribution header)

The basic data frame management record contains the storage positions (offsets) and sizes of the road data frame, background data frame, and name data frame of the basic data frame.

Also, as options, the basic data frame management record can contain the storage positions (offsets) and sizes of the extended data A frame and the extended data B frame. The number of the basic data frame management records is stored in the level management record of the parcel-related data management frame.

The adjacent area address information includes the offset to the adjacent area data. Normally one parcel borders eight parcels. If an adjacent parcel is divided, the adjacent area address information includes the divided adjacent area address information. This information is used to access the main map data frame of the adjacent area without referencing to the main map parcel management record.

7.3.2 Main map basic data frame The main map basic data frame consists of 7.3.3 to 7.3.6.

The position information of each data frame is indicated by the map basic data frame management record. For the frame without an entity, x0000 is set as the data frame size.

7.3.3 Road data frame The road data frame consists of a) to d). Fig.9 illustrates the road data frame structure. The road data lists are classified according to the display classes.

The passage code data frame and the composite node data frame are options.

a) Road data distribution header The road data distribution header contains the management information of each data frame in the frame.

The road distribution header consists of the followings:

- Header size
- Number of intersections
- Number of display class management information items
- Number of additional data management information items
- Level of the route planning data corresponding to this parcel data
- A sequence of display class management information records
- A sequence of additional data management information records
- Expansion (the road data distribution header)

A sequence of display class management information records is used for the road data list classified by display class. The number of display class management records is the same as the number of display classes. The display class management information record consists of the offset to the first multilink record of the road data and the number of multilink records.

A sequence of additional data management information records is used for the optional passage code data frame and integrated node data frame. An additional data management information record consists of the size of and the offset to the additional data frame.

- b) Road data list** The road data list consists of multiple road data items classified by display class. Each item of the road data consists of the display scale flag and the multilink record.

The multilink data record consists of the followings:

- Multilink header
- Multilink shape information
- Node/link connection information
- Additional node information
- Altitude information
- Traffic regulation information
- Temporal information
- Street address information

The multilink header consists of the management header and the link attribute of each of the information items composing the multilink.

The multilink shape information consists of a sequence of link shape data of the multilink.

The node/link connection information consists of a sequence of node records that compose a multilink. The node record contains the crossing information that is called same node information. The same node information consists of the display class, multilink number, and node number.

The additional node information is an additional information of a node such as the guidance data, the street name, the street address, and the offset to the name data.

The altitude information is a sequence of altitude information records collected for the multilink shape data which does not contain altitude information.

The traffic regulation information consists of traffic regulation information records corresponding to nodes. This information is stored only in the lowest level road data.

The street address information consists of a sequence of street address information records. This information is contained only in the lowest level road data. The street address information is for the Western style addressing. This item is specified for the purpose of global coverage of this format. Even though the format of this Standard has the field for street address information, no actual data is stored on the media for the Japanese market.

The street address information record is composed of the street side information and the house number information.

The node/link connection information, the additional node information, the altitude information, the traffic regulation information, the temporal information, and the street address information are optional.

- c) Passage code data frame** The passage code data frame consists of the passage code data header, the size of the passage condition records, and the passage condition table.

The passage code data header consists of the followings:

- The first value of the passage code
- Number of the passage condition records

In the passage condition table, parcel-specific passage codes are defined

The format of the passage condition record is the same as that of the common condition record.

d) Composite node data frame Most of large intersections consist of multiple nodes. A composite node refers to a group of multiple nodes combined into a single intersection.

A composite node data frame consists of a sequence of composite node information.

A composite node record is composed of the followings:

- Number of nodes composing a composite node
- A sequence of node offset records

In each node offset record, the offset address of the corresponding node record is set.

This data frame is optional.

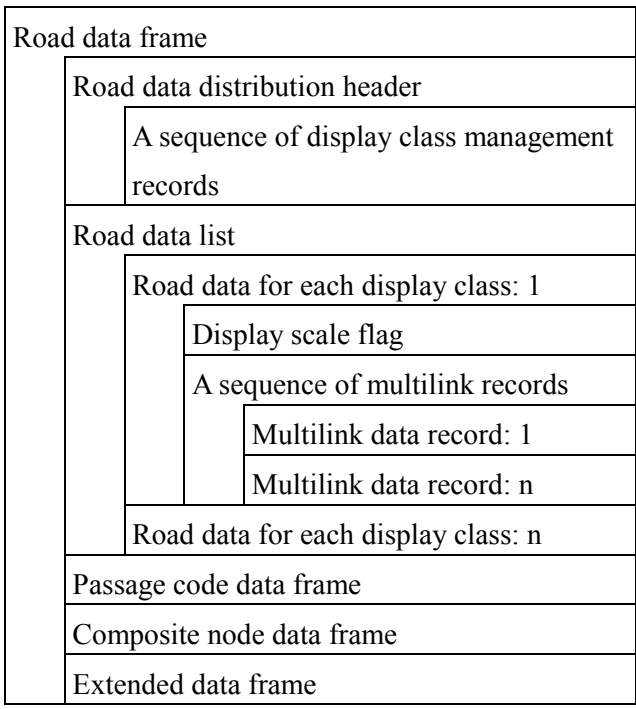


Fig. 9 Road data frame structure

7.3.4 Background data frame The background data frame contains the background data of a main map and its management data.

The background data frame consists of **a) to c)**. Fig.10 shows the structure of the background data frame.

The background data are often classified according to the display class, the background type code, etc. For a drawing application it is efficient that the data is organized in order of drawings. The large category of data classification is the item management information, and the middle category is the background type.

The minimum graphics data record of the background data can have the pointers to the auxiliary data and the name data.

a) Background distribution header The background distribution header consists of the followings:

- Background distribution header size
- A sequence of element management information
- Extended data (background distribution header)

Each item of element management information contains the address and size of the element unit background data for each category.

b) A sequence of element unit background data The element unit background consists of the followings:

- Number of background types
- A sequence of background type unit header
- A sequence of minimum graphics data lists

The background type unit header contains, for each background type, the offset to the minimum graphics data list, the number of records, and the shape classification .

The minimum graphics data list consists of data records for each shape classification.

The minimum graphics data record consists of the header, the display scale flag, the type code (background type code), the attribute flag, the coordinate information element point, the altitude information, the name data pointer, the auxiliary data, the additional background information pointer, and the temporal information.

The format of the coordinate information element point depends on the shape classification (symbols or points) of the header.

The altitude information, the pointer to the name data, the auxiliary data, the additional background information pointer, and the minimum drawing data record are options. Options are shown by the attribute flag and the corresponding background type unit header of the record.

The additional background information pointer is used to reference the additional data frame A/B.

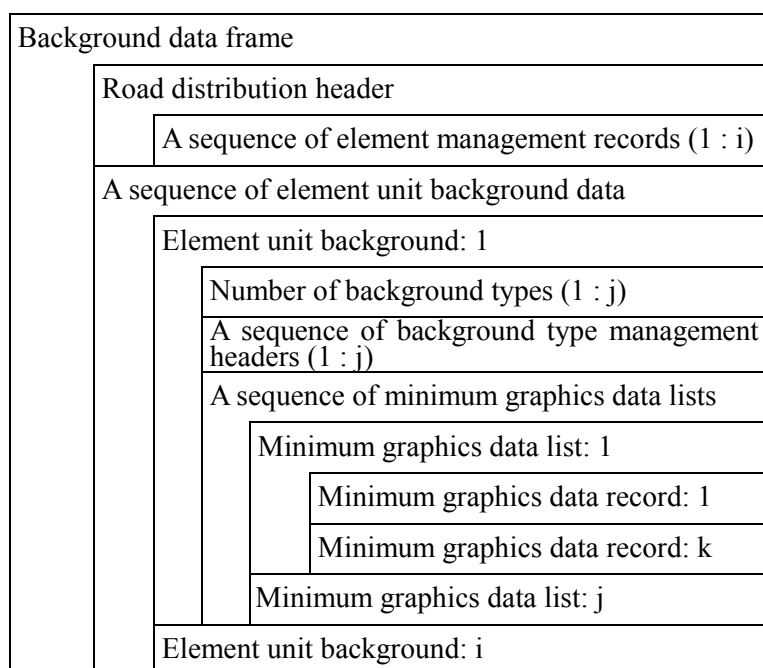


Fig. 10 Background data structure

7.3.5 Name data frame The name data frame is managed for each of the display classes defined by metadata.

This frame contains the name data to be displayed on a map, such as the place name and the facilities name. The reference from other data frames is made by specifying the offset from the beginning of the data frame to the name data record to be referenced.

The name data frame consists of **a)** and **b)**.

The name data can be classified according to arbitrary storage conditions. For each classification, the data management information is created.

a) Name distribution header The name distribution header consists of the followings:

- Header size
- A sequence of name data management information
- Extended data (the name distribution header)

The name data management information consists of the number of name data records and the offset to the name data list for each management unit.

b) A sequence of name data list The name data records are classified and stored according to the name display classes.

The name data record consists of the followings:

- Name attribute header
- Character string data record
- Auxiliary data
- Additional background information pointer
- Temporal information

The auxiliary data, the additional background information pointer, and the temporal information are options.

The 3D symbol code is defined in the auxiliary data field.

The character string data record supports multiple languages and contains the display position information and the style information specific to the string type.

The format of the character string data record depends on the name attribute header and the string type. The string type is currently available in seven types.

7.3.6 Additional data A/B frame This frame is assumed to be used when application programs can use the manufacturer original data stored in parcels for the purpose of adjacent search or the automatic guidance when cars are coming near to the facilities. This frame is effective for the search using the location coordinates as a key.

This frame defines only the structure only for the data management. The data structure and other details are defined by the index data frame. It also has the data structure concerning the same identification as the manufacturer original data.

7.4 Route guidance data frame The route guidance data deals with the route guidance information with the emphasis on the nodes of the road data frame. Therefore, in most cases, this frame exists only in the lowest level parcel. Even if a node exists, the route guidance data may not exist.

The route guidance data frame consists of the followings:

- Route guidance distribution header
- Route guidance basic data frame
- Route guidance extended data frame

The route guidance data is referenced from the node additional record of the node.

7.4.1 Route guidance distribution header The route guidance distribution header consists of the followings:

- Header size
- Parcel ID number
- Lower left parcel position code in a block
- Divided/integrated parcel identifier
- Practical management code
- Basic flag
- A sequence of basic data frame management records
- A sequence of extended data frame management records

The route guidance basic data frame management record consists of the locations and sizes of the guidance data frame, the character string data frame, the shape data frame, and the pattern data frame of the route guidance basic data frame. The number of management records is set in the level management record of the parcel-related data management frame.

7.4.2 Route guidance basic data frame The route guidance basic data frame consists of the followings:

- Guidance data frame

- Character string data frame
- Shape data frame
- Pattern data frame

The character string data frame contains feature names such as road names, intersection names, and direction names used for the route guidance. The shape data frame contains the display data for road structures which is composed of lines and areas. The pattern data frame contains the drawing data for spot guide, such as magnified intersection view. The drawing data is configured in a computer graphics format such as BMP, TIFF, and JPEG. The guidance data contains the offset for referencing the character string data, the shape data, and the pattern data.

7.4.3 Guidance data frame The guidance data frame consists of the basic data for each node for which route guidance is performed. The basic data consists of **a)** to **i)**. Guidance data is managed on the basis of node records of the road data frame. Basically each node shall have the guidance data. For the same node, however, more than one guidance data can be associated to that node. For referencing the guidance data from the road data, the node additional record contains the offset from the beginning of guidance data frame to the basic data. Referencing the road data from the guidance data uses the node information of the basic header.

Fig.11 illustrates the structure of the guidance data frame. This Standard does not specify the order of storing basic data items.

- a) Basic distribution header** The basic distribution header contains the basic data size, the data existence information, the node information, the offset to each data table/list, and the number of records.
- b) Intersection name data table** This table contains intersection names used for route guidance.
A intersection name record consists of the attribute header and the offset to the character string data.
- c) Road name data table** This table contains the road name data used for route guidance.
A road name data record consists of the attribute header and the offset to the character string data.
- d) District name data list** This table contains district names and location names used for route guidance.
A district data record consists of the attribute header, the distance information, and a sequence of guidance point management records.
 - The district name attribution header contains the link direction and a sequence of guidance point management records.
 - The distance data indicates the distance between nodes.
 - The guidance point management record contains the attribute of the signboard, the offset to the name data, and the connection node information.
- e) Spot guide data list** This list contains the information and images used for the maneuver guidance, traffic direction guidance, and location guidance.

A spot guide data record consists of the attribute header, the distance information, the number of index point management records, the index point management list, the initial location information, the near-side connection node information, and the offset to the character string data.

- f) Direction guide data list** This list contains the number of lanes at an intersection and the angle of exit direction (12 partitions).

The direction guide data record consists of the direction guide attribute header, the number of the index point management records, and the index point management list. An index point management record consists of the index point management attribute header, the number of connected nodes in the exit direction, the intersection information, the offset to the character string data, and the connection node information table.

- g) Road structure data list** The road structure data is the information about the structures composing roads, such as tunnels, bridges, and skyways.

The road structure data record consists of the road structure attribute header, the distance information, the offset distance, the height information, a sequence of intersections, and the offset to the character string data.

- h) Building and facility data list** A building and facility data record consists of the building and facility attribute header, the category code, the facility bar centric coordinate, the approach direction limit information, the optional coordinate, the offset to the character string data, the offset to the shape data, the auxiliary data, and the entrance and exit information.

The building and facility data is the information about the buildings and facilities that exist along the roads used for route guidance.

- i) Caution point data list** This Standard specifies only the outline format. Items and data format for caution points will be defined in the near future.

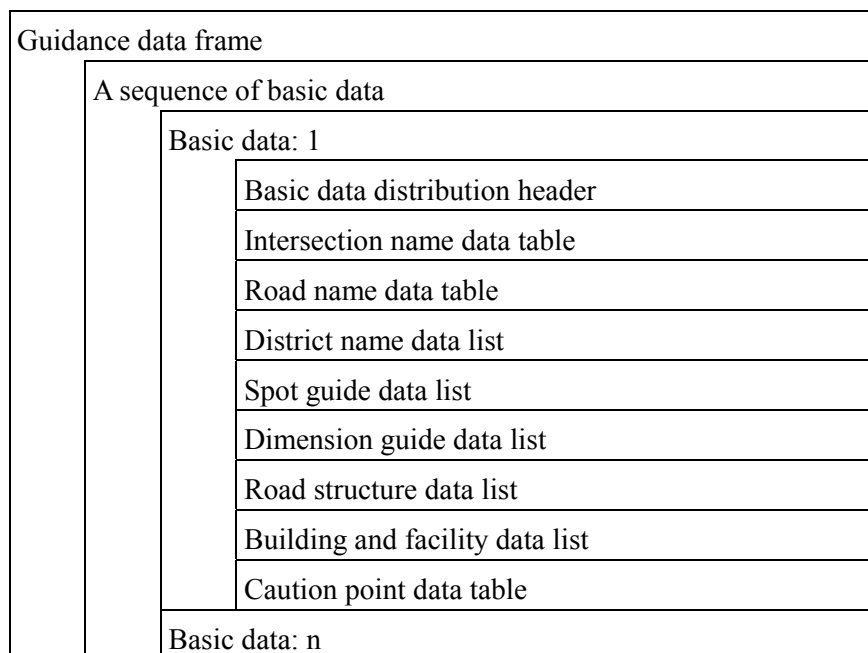


Fig. 11 Guidance data frame structure

- 7.4.4 Character string data frame** The character string data frame is used to store the character

string data for the route guidance. This Standard does not specify the order for storing the data items. However, this frame shall have the structure that allows manufacturers and data users to store the data in a desired order. This frame contains indexes to the pronunciation data and the accent data.

The character string data frame consists of **a)** and **b)**.

The data which references a character string data record contains the offset to that record from the beginning of the character string data frame.

- a) String distribution header** The string distribution header consists of the header size, the number of string data management information items, and a sequence of string data management information items.

The character string data management information consists of the offset to the character string data and the number of records.

- b) Character string data list** This list consists of the character string data record size, the language-specific offset pointer table, and the language-specific character information list.

- 1) Language-specific character information list** The language-specific character information record consists of the character string attribute header, the display string, the pronunciation string, sequence of accent information records, and the information related to natural voice data.

7.4.5 Shape Data Frame The shape data frame consist of **a)** and **b)**.

- a) Shape data distribution header** The shape data distribution header consists of the header size and a sequence of shape data management information items that control a sequence of detailed shape data records.

- b) Shape data list** A detailed shape data record consists of the shape classification, the number of offset coordinate records, the element point coordinate information, and a sequence of height information records.

The data that references the shape data contains the offset from the beginning of the shape data frame to the relevant shape data record.

7.4.6 Pattern data frame The pattern data frame is used to store the drawing data such as magnified intersection view for route guidance. The pattern data, handled with an image ID, contains the route data used to draw the route on the guidance map. The pattern data frame can handle the CLTU, image, Vector Picture, GIF, TIFF, EPSF, RIB, and JPEG formats.

The pattern data frame consists of the image management distribution header, the palette set data frame, the colour table data frame, and **a)**.

The data that references the image data contains the offset from the beginning of the pattern data frame to the relevant image data record.

- a) Image data frame** The image data frame consists of the followings:

- Number of image data management information items
- A sequence of image data management information items
- A sequence of image of image data records

- 1) Image data record** An image data record consists of the followings:

- Image data attribute header
- Image data
- Padding for adjusting
- Route data

7.5 Region data management frame

7.5.1 Route planning data management method The route planning data is configured on multiple levels for efficient route planning. In this configuration, detail maps have all roads, but smaller-scale maps have only main national roads. Detail road network data is placed on the lowest level, and each road network that is more important than another is placed on a higher level.

The route planning data is managed as described below.

- a) The route planning data on all levels from the highest to the lowest is managed in a tree structure (see Fig.12).
- b) Regions on each level are numbered sequentially starting with 0.
- c) Regions always have consecutive numbers on the level of interest if they are integrated on an upper level.
- d) Regions on the level of interest are numbered in ascending order with respect to the region numbers of those configured on a lower level.
- e) In the region management table, management records are arranged in ascending order of the level and region numbers.
- f) If there are two or more regions on the highest level, their management records are identified by setting up a dummy level as a root for them, assigning —32 as their level number, and setting the latitude and longitude of the top, bottom, left, and right ends of the dummy level to FFFFFFFF(16).
- g) If there is no region on a lower level, the first lower-level region number field of the management record is set to FFFF(16) to indicate that no lower-level regions exist. If there are regions in some areas on a lower level, the management record indicates only the existing regions.

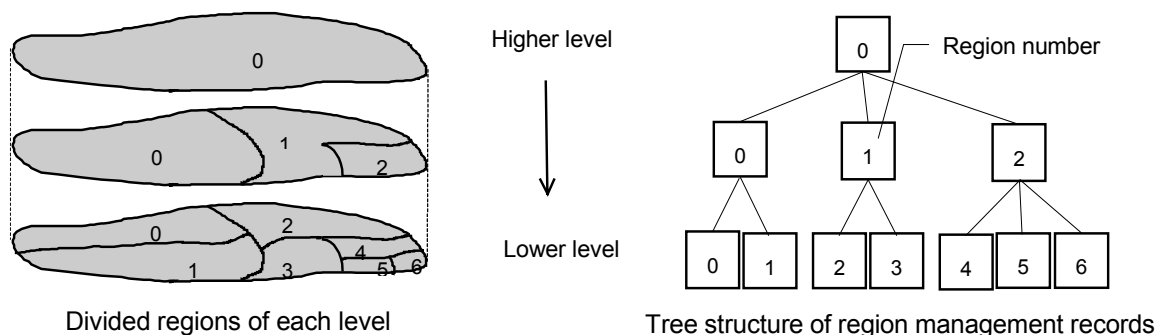


Fig. 12 Tree structure for the route planning data management

7.5.2 Configuration of the region data management frame The region management data frame consists of **a)** to **c)**. Fig.13 shows the configuration of the route planning management data.

a) Distribution header The distribution header consists of:

- Header size
- Region management record information
- Common traffic condition table information
- Level management information
- A sequence of level management records

There are as many level management records as the number of levels. Each level management record consists of a level number, region management record information, and the size of each record forming a route planning basic data frame.

b) Region management table The region management record consists of:

- Region coverage area coordinates
- Upper-level region number
- The first lower-level top region numbers and their quantity
- Data storage location record

The format of the data storage location record varies depending on the type number for the region management record.

c) Common traffic condition table The common traffic condition table holds passage codes common to all route planning data frames.

Generally, defining the traffic regulation data requires at least 48 bits. So, storing the traffic regulation data without modification requires a large amount of memory. To solve this problem, a 1-byte code is used to represent each type of traffic regulation, thereby reducing the required amount of memory. This method can define up to 128 traffic regulations. Those regulations are classified into two types: one for the common traffic codes in the database and the other for the passage codes effective only in an individual region area. The common traffic condition table defines common traffic codes. Traffic regulation (for example, no left-turn) that applies to an individual intersection is stored to a traffic regulation record (multilink data record) and regulation record in the link data frame link table.

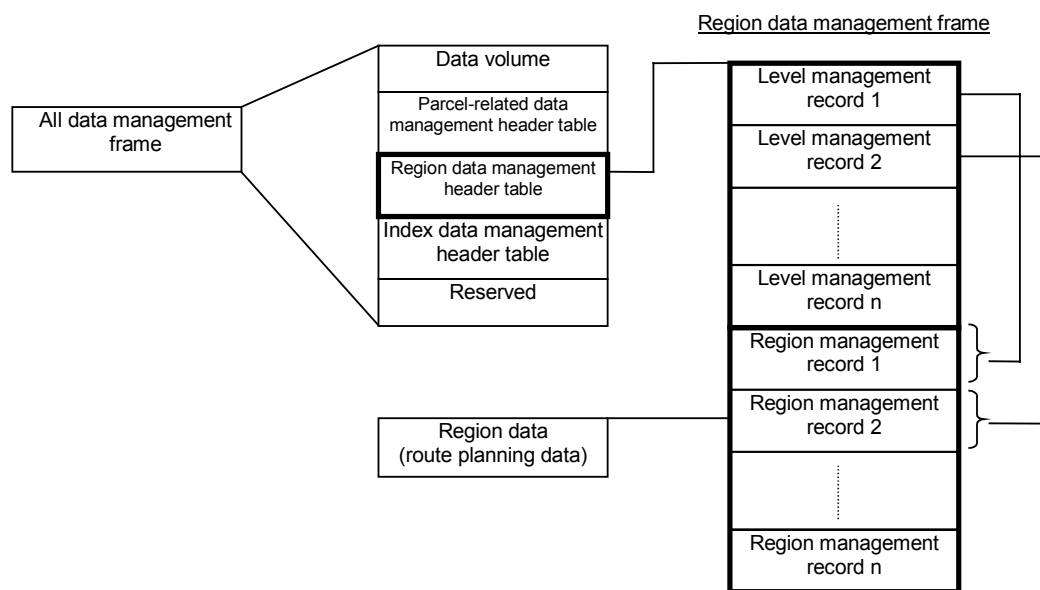


Fig. 13 Configuration of the route planning management data

7.6 Route planning data frame The route planning data is stored in region units to the respective route planning data frames.

Each route planning data frame consists of:

- Route planning distribution header
- Route planning basic data frame
- Route planning extended data frame

7.6.1 Route planning distribution header The route planning distribution header consists of:

- Header size
- Region number
- Practical management record
- A sequence of basic data frame management records
- A sequence of extended data frame management records

The practical management record holds a number for referencing information (such as passage category) defined with metadata for an individual local area.

A sequence of basic/extended data frame management records and their quantity are set in the metadata and level management record.

7.6.2 Route planning basic data frames Each route planning basic data frame consists of:

- Node data frame
- Link data frame
- Data frame corresponding to Upper-level node

- Data frame corresponding to Upper-level link
- Link cost data frame
- Passage code data frame
- Node coordinate data frame
- Road reference table
- Statistical cost data frame

Each data frame and a sequence of data tables are defined with the metadata that corresponds to the storage sequence.

7.6.3 Node data frame The node data frame holds information related to nodes required for route planning.

It consists of **a)** and **b)**.

- a) Node distribution header** The node distribution header consists of a header size, the total number of node records, the total number of links, the number of rank management information items, and a sequence of rank management information.
- b) Node data table** The node record consists of a node attribute, link record location, the number of inter-link regulations, the number of inter-link costs, and an extended node record field.

The node data is identified with a storage sequence number, because no separate identification number is available. In this Standard, therefore, a field named node ID or node number indicates the storage sequence number of the node data table.

7.6.4 Link data frame The link data frame holds information about the relationships among nodes and traffic regulations.

In the link data frame, information about each link connected to a node is stored in node units (link table). The link table consists of **a)** to **f)**.

- a) Link record** The link record consists of an adjacent-node ID number, link cost record number, link record attribute, region number, and extended link record field.
- b) Regulation record** The control record consists of an inter-link in/out number, regulation identification flag, passage code, and extended regulation field.
- c) Inter-link cost record** The inter-link cost record consists of an inter-link in/out number, general intersection flag, link length unit, average travel time unit, link length, average travel time, and extended inter-link cost field.
- d) Upper-level node record number** This data is set up if the same record in the node record of interest is on one or more upper levels.
- e) Boundary link upper-level table** The boundary link upper-level table is generated under the following conditions:
 - 1) The node of interest is a boundary node.
 - 2) An upper link is connected to an upper node. There is no further upper node, however.

There is an upper link for the link of adjacent connected regions.

The boundary link upper-level table consists of a size and a list of records corresponding to a boundary link upper level.

- f) A sequence of offsets to statistical cost tables** These records contain offsets to statistical cost records. The format of the statistical cost table is yet to be fixed.

7.6.5 Upper-level node data frame The upper-level node data frame represents the node relationships between levels with respect to the nodes on the level of interest. Therefore, it holds information about nodes for which there is an upper-level node.

The upper-level node data frame consists of a distribution header and upper-level node table.

Each upper-level node record consists of adjacent information, upper-level node ID number, and offset to an upper-level link record.

7.6.6 Upper-level link data frame The upper-level link data frame holds a link that is connected to a node even on an upper level (that is, a link that exists also on an upper level). The upper-level link record is indexed from an upper-level node record.

The upper-level link data frame consists of a sequence of upper-level link records holding link record numbers.

7.6.7 Link cost data frame The link cost data frame holds a link length, average travel time, and link attribute used in route planning.

The link cost data frame consists of a link cost header and a sequence of link cost records.

The link cost record consists of a link ID number, information about upper levels on which the same link exists, link passage status flag, link charge flag, bypass flag, the number of traffic signals, link attribute, link length, connection node ID number, average travel time, road status flag, speed limit, and sub-link type code. The stored data records are arranged according to whether there is average travel time and in ascending order of the link ID.

7.6.8 Passage code data frame The passage code data frame consists of a passage code data header, passage code record size, and passage condition table.

Each passage condition record holds a passage code specific to the region of interest. If there is no passage code specific to the region, therefore, this data frame is not generated.

This passage code and the passage code for a common passage condition record in the ALL data management frame define information about traffic regulation, such as vehicle type and time. The regulation record in the link data frame holds an index (code) for this passage code.

7.6.9 Node coordinate data frame Because the node coordinates are rarely used in route planning, whether to store them is optional. They are not treated as a node record attribute. Instead, they are stored in a coordinate data frame separately.

The node coordinate data frame consists of a node coordinate distribution header, node coordinate reference grid location table, and node coordinate table. The stored node coordinate records are arranged in ascending order of the node record in the node data frame.

The node coordinates are represented as normalized coordinates (12 bits) in reference to the lower left corner. The reference grid location record holds absolute coordinates.

7.6.10 Road reference data frame The road reference data frame holds integrated node informa-

tion, which consists of the number of integrated nodes and a list of integrated node information. If there is no integrated node in the region of interest, this road reference data frame is not generated.

The integrated node information consists of a size, integrated node number, the number of configured links, the number of route information items, the number of subordinate node information items, a sequence of subordinate node numbers for external link connection, padding, a sequence of configured links, a sequence of subordinate node information, and route information.

The integrated node number is the node number in a node data frame representing the integrated node of interest. The subordinate node information holds the relative coordinates of the other nodes (subordinate nodes) that comprise the integrated node. The route information holds the connection relationships of links within the integrated node.

7.6.11 Statistical cost table The statistical cost table will be used in the near future to hold statistical cost data related to links. Its format is yet to be fixed, however.

7.6.12 Route planning extended data frame This extended data frame consists of a user ID, data identification code ID, and a sequence of extended data.

7.7 Index data frame

7.7.1 Index data management method The index data frame is used to search for an index object and service object.

If a database contains hundred thousand street names, for example, it would take several minutes or more without an efficient search method to search the database for a single street. A telephone number-based destination search would involve forty million telephone numbers.

The required search time varies depending on the number of involved records, the record size, and the algorithm of DAL/applications. It is the total of medium access time, DAL processing time, and application processing time. Using index data can reduce it greatly. For this reason, the index data frame consists of a data frame that contains search target data and an indexing data.

Generally, many searches require index data and location data formats that match respective searches. To search for a gas station, for example, the system must have index data such as the shop name, place name, telephone number, and brand name of the gas station. A list of the index data almost cannot be used in common to other searches. It depends on the search target. So, multiple index data formats are necessary.

In addition, some data type fields, location data, and index data attributes rarely match the characteristic or preference of application users. To meet search requirements for the system, the formats of point data and index data must have quite many items and a large size.

Therefore, defining the detail record formats for point data and index data is left to the consortium's hand. It is not covered by this Standard. To maintain mutual operability, however, the format of the entire record shall be defined in the definition frame.

7.7.2 Structure of the index data frame The index data frame consists of three frames. Its structure is shown in Fig.14.

- a) **Search management frame (data management frame)** A unit of data for managing search data needed for an individual search target is called a volume. It holds the index volume management data for managing the volume and the POI information management data for managing POI information.
- b) **Search frame** The search frame holds data that works as search index data, category data for