

7.A Description for Road Data

7.A.1 Road Type

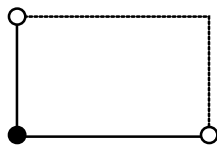
7.A.2 Divided/Integrated Parcels (added in future)

7.A.3 Coordinate Representation (added in future)

7.A.4 Data Extracted Range

Road data in the main map is extracted by parcel. The standard that specifies a parcel to which a node or link on a boundary of parcels belongs is as follows:

Data extracted range for road data boundary

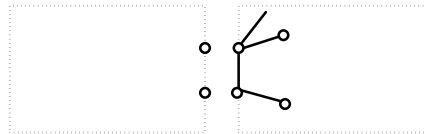


In the figure at the left, links and nodes in the parcel and a node and links on the solid lines (except for nodes and links circled) belong to the target parcel.

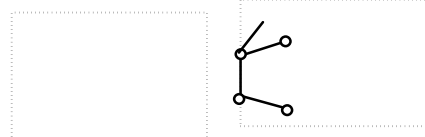
For links that traverse the parcel boundary, cut them on the parcel boundary, then set the nodes on the boundary.

Do not set isolated nodes on the parcel boundary.

Do not set nodes as shown in the figure at the right (for neighboring parcels).



Set nodes as shown in the figure at the right (for neighboring parcels).

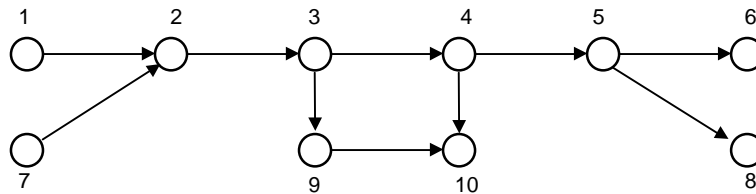


7.A.5 Sequential Line(Multilink) Data Generation

This section describes the conditions for connecting links to create a string of links.

- a) Connect roads whose link IDs are the same type and sequential.

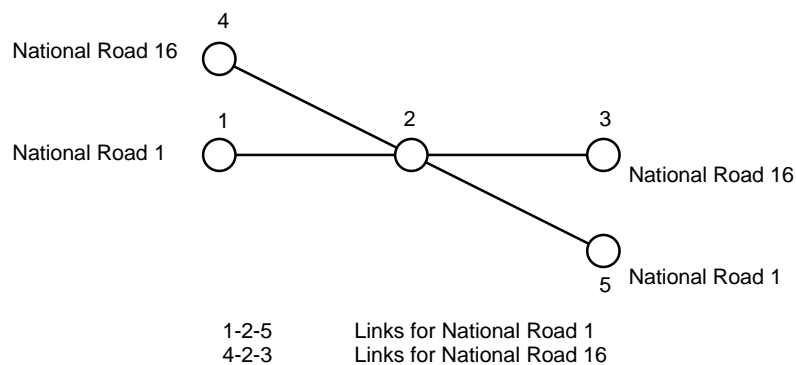
Example 1: When there are main roads, service areas (SAs), and connection roads (ramps) on an intercity highway



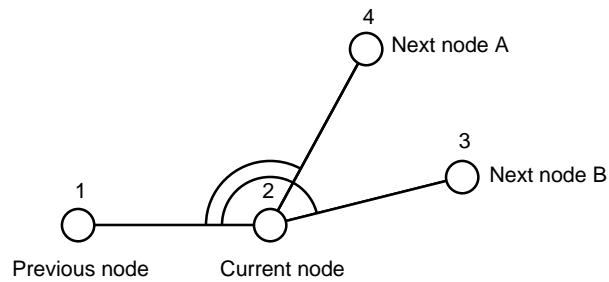
1-2-3-4-5-6
3-9-10-4
7-2
5-8

Main road link
SA link
Connection link
Connection link

Example 2: Connect roads with identical national road numbers or prefectural road numbers.



- b) When there are multiple roads of the same type, connect links as linear as possible.

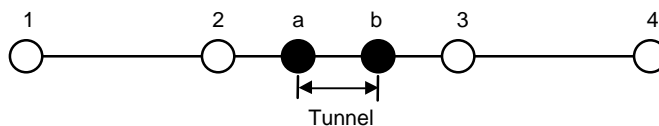


1 - 2 - 3: Links to be connected (Node B is closer to .)

The angle is made up of segments of lines connecting nodes.

- c) Connect tunnels, skyways, and bridges as links continuously.

Example 1: When there is a tunnel between link 2 - 3



In this example, points a and b are link attribute change points.

- d) Do not cut narrow roads even if they pass over basic roads.
- e) Do not cut links at attribute change points. However, set the following points as nodes, then cut the links at such points.
- Point where the road type changes
 - Origin point/destination point of a route
 - Origin point/destination point of a vehicle-only road segment
 - Origin point/destination point of a toll road segment
 - Change point other than the 4 types of points above where a link must be cut due to a reason relating to the format.
- f) Do not create data for any two-way intersection.

However, handle attribute change points described at "e" above where links must be cut as nodes even if the nodes are two-way intersections. Also, handle two-way intersection dummy nodes as nodes.

g) Handle nodes to be linked with the following priorities:

Priority 1: Set links for nodes that compose a loop. (1)

First set a string of links for a loop. (Note : It is not allowed to make a loop with one link.)

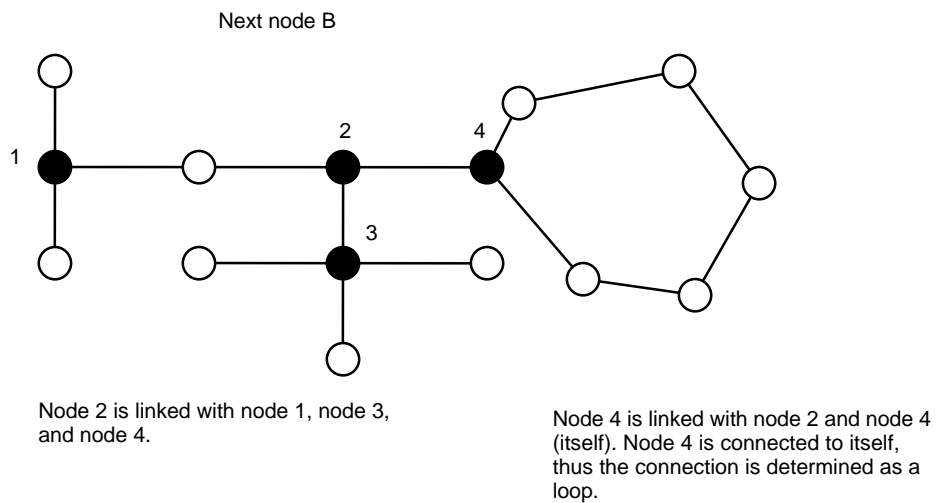
Priority 2: Set links from nodes at dead-ends (edge points).

Priority 3: Set links from points on the parcel boundary.

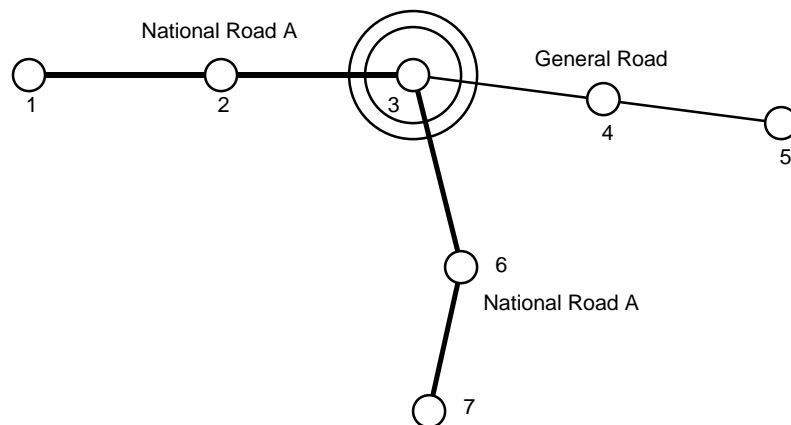
Priority 4: Set links between nodes that are not included in the priorities 1 to 3 above.

You can connect links independent of how a node is selected as the connection origin point by following the priorities above.

(1)



- h) Links of the same type must be connected first. Therefore, it is necessary to select links as linear as possible only when there are multiple roads of the same type.



(Results)

Roads of the same type are connected regardless of linearity.
Links 1-2-3-6-7 and links 3-4-5 are created.

- i) When a string of level-1 links (such as 2.5-degree mesh or 2.5-degree mesh quartered) is created, the string of links is separately created in the order in which nodes and intermediate points in the string of level-2 links (such as 2-degree mesh) are displayed (in the forward direction or opposite direction).

7.A.6 Link Shape Data Representation

Detailed example for a multilink

- : Node (intersection)

: Attribute change point

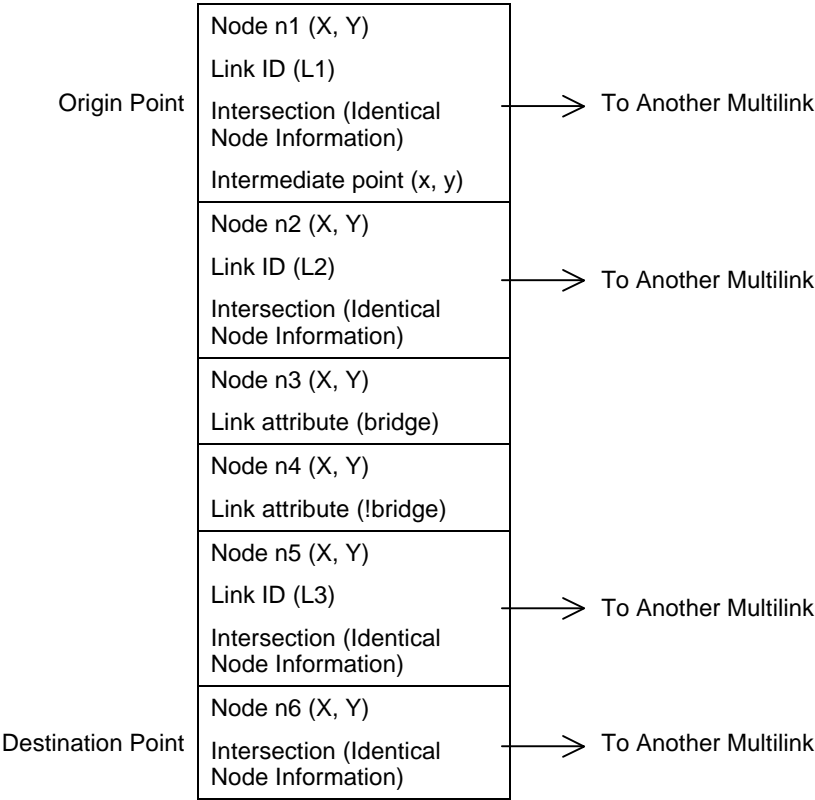
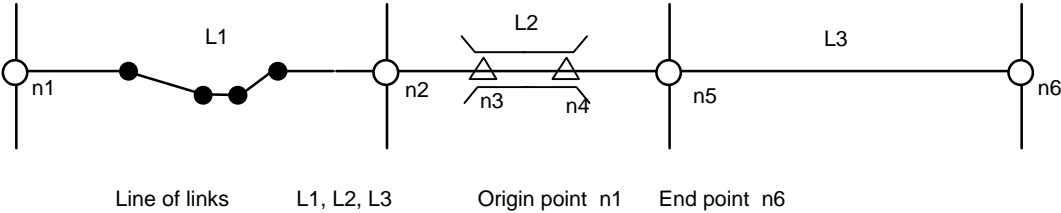
: Intermediate point (normalized value)

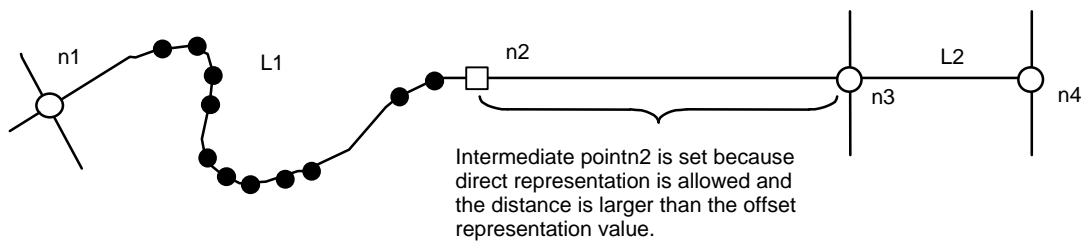
⊗: Altitude change point (a type of intermediate point)

: Intermediate point (offset value)

}

Information added point

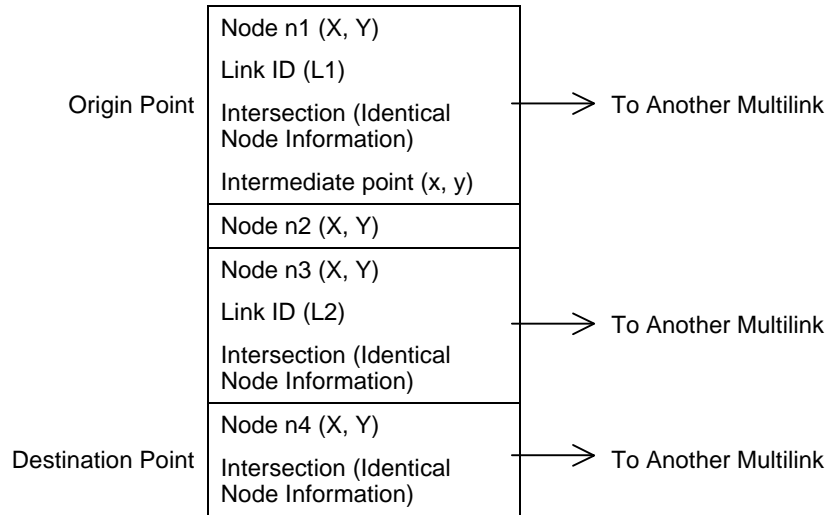


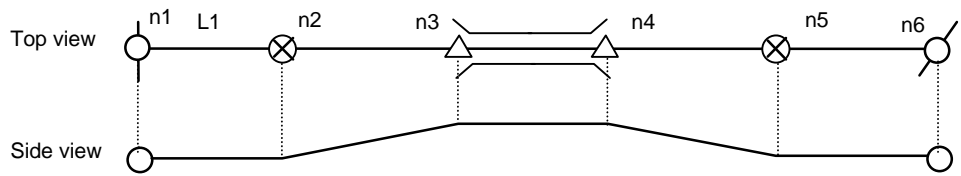


Multilink L1, L2, L3

Origin Point $n1$

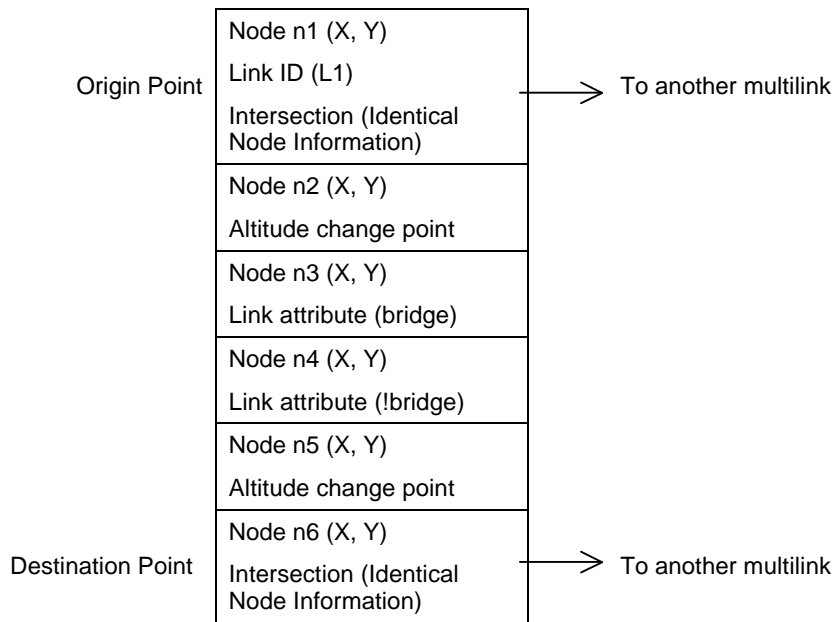
Destination Point $n4$





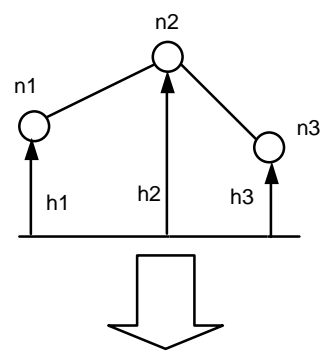
Multilink L1 Origin Point n1 Destination Point n6

n2 and n5 may be intermediate points.



Altitude Information		
Continuous element point	Altitude	
2	h1	Altitude between n1 and n2: Fixed at h1
2	h2	Altitude between n2 and n3: Changes h1 h2
2	h3	Altitude between n3 and n4: Fixed at h2
2	h3	Altitude between n4 and n5: Changes h2 h3
		Altitude between n5 and n6: Fixed at h3

Altitude Information



Continuous element point	Altitude
2	h1
2	h2
2	h3

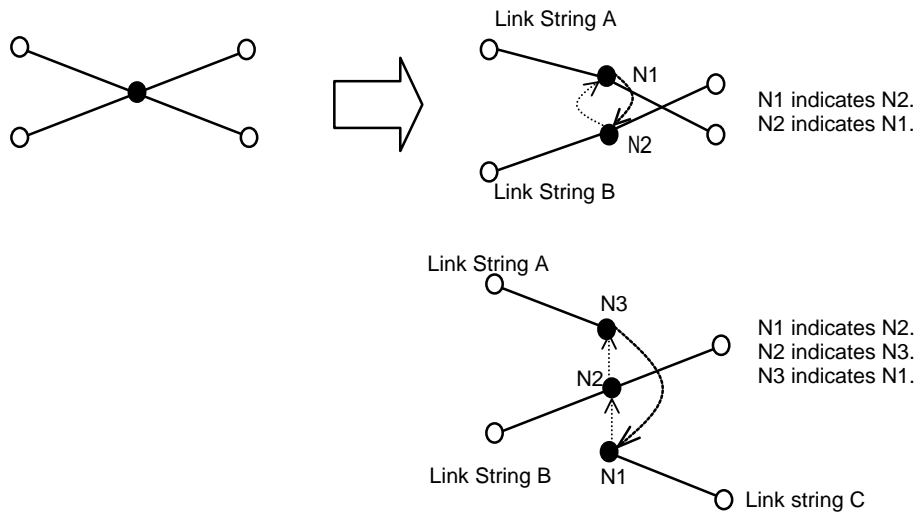
Altitude between n1 and n2: Changes h1 h2

Altitude between n2 and n3: Changes h2 h3

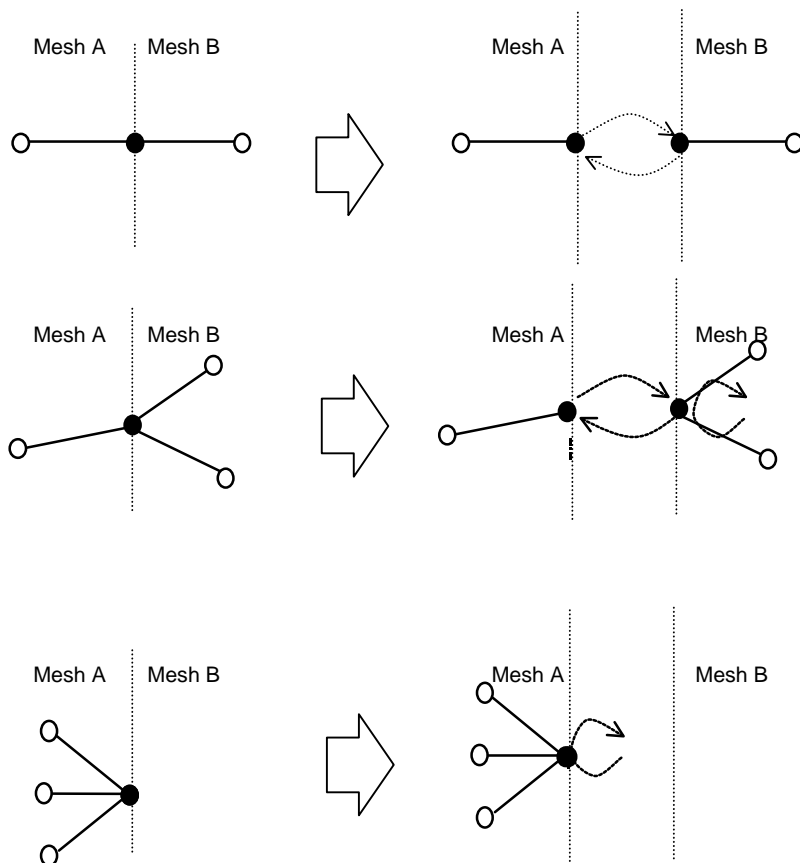
7.A.7 Identical Node Information

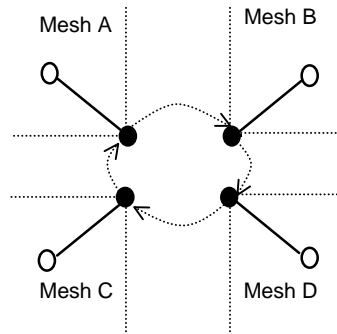
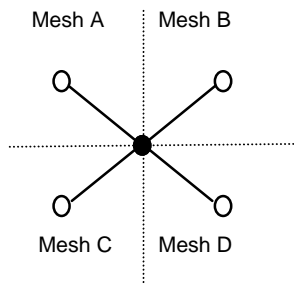
The word "mesh" is the same with the word "parcel" in this section.

In a mesh



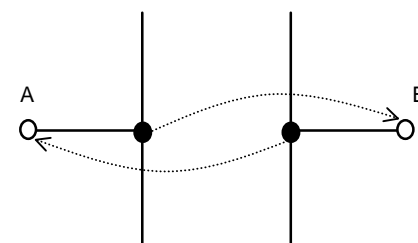
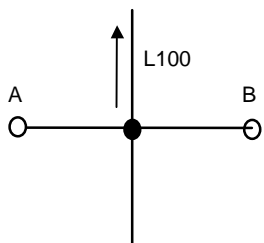
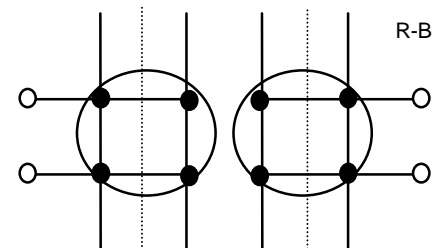
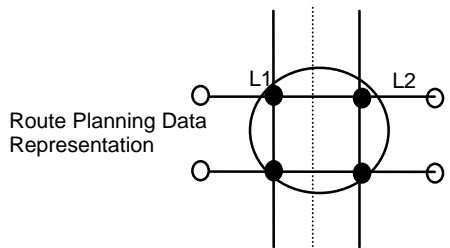
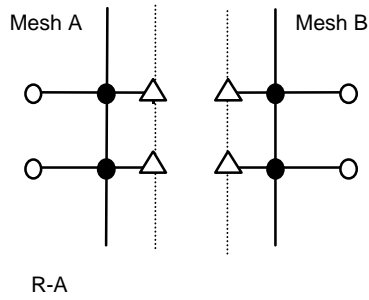
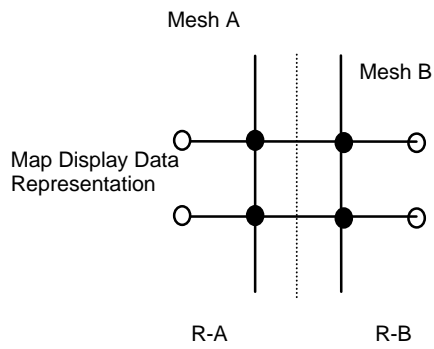
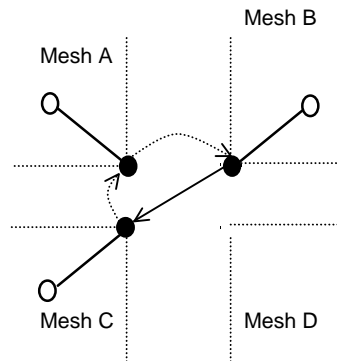
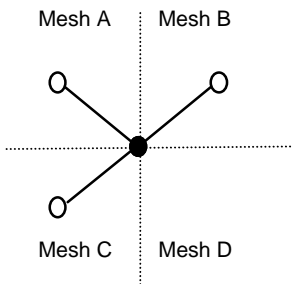
On the Mesh Boundary





The arrows are indicated as an example.

The order is not fixed.



7.A.7.1 Direction of Parcel Edge on Where Identical Node Exists

"Direction of parcel edge" represents the physical relationship of parcels, not of nodes.

- a) When the same node exists on boundaries of four parcels located two by two:

In the example shown below;

The direction from n1 to n2: Right (the direction from n1 to Parcel pcl2 where n2 exists)

The direction from n1 to n3: Bottom right (the direction from n1 to Parcel pcl3 where n3 exists)

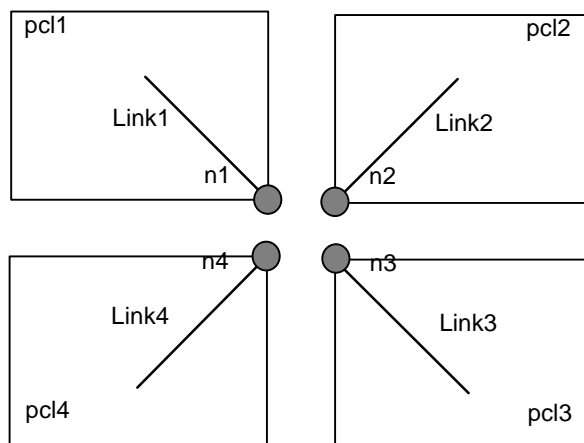
The direction from n1 to n4: Bottom (the direction from n1 to Parcel pcl4 where n4 exists)

Similarly,

The direction from n2 to n3 = Bottom; n2 to n4 = Bottom left; n2 to n1 = Left

The direction from n3 to n4 = Left; n3 to n1 = Top left; n3 to n2 = Top

The direction from n4 to n1 = Top; n4 to n2 = Top right; n4 to n3 = Right



b) When the same node exists on boundaries of three parcels located in a T shape:

In the example shown below;

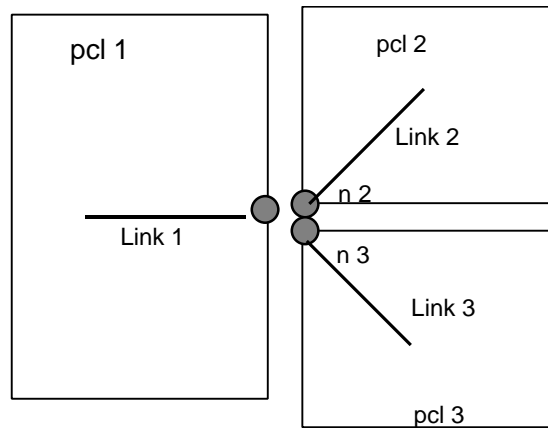
The direction from n1 to n2: Top right (the direction from n1 to Parcel pcl2 where n2 exists)

The direction from n1 to n3: Bottom right (the direction from n1 to Parcel pcl3 where n3 exists)

Similarly,

The direction from n2 to n3 = Bottom; n2 to n1 = Left

The direction from n3 to n1 = Left; n3 to n2 = Top



	Top side	Top right corner	Right side	Bottom right corner	Bottom side	Bottom left corner	Left side	Top left corner
Top side	-	-	-	Top left	Top	Top right	-	-
Top right corner	-	-	-	Top	Top	Top right	Right	Right
Right side	-	-	-	-	-	Top right	Right	Bottom right
Bottom right corner	Bottom	Bottom	-	-	-	Right	Right	Bottom right
Bottom side	Bottom	Bottom left	-	-	-	-	-	Bottom right
Bottom left corner	Bottom	Bottom left	Left	Left	-	-	-	Bottom
Left side	-	Bottom left	Left	Top left	-	-	-	-
Top left corner	-	Left	Left	Top left	Top	Top	-	-

7.A.8 Link ID Number

A link ID number is the absolute number in the medium that indicates a link of links between the node for which the link ID number is described (multilink intermediate points, multilink origin point, and multilink end point) and the next node.

Link ID numbers are specified according to road data that is used for main maps or route planing.

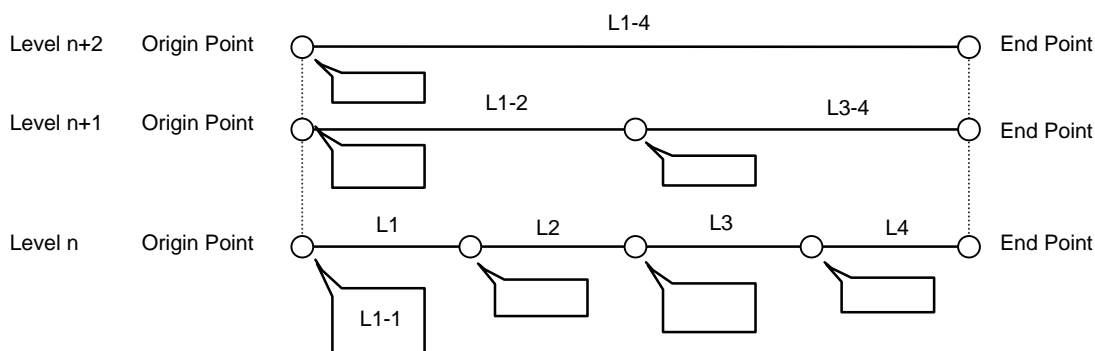
The following two items identify link ID numbers:

- Link direction (2 bits), 0 to 3: Indicates the direction based on the direction of a link shape at higher levels so that links integrated at higher levels correspond to the links expanded at lower levels.
 - 0: Simple Network link without complex representation used at higher levels
 - 1: Forward Simple Network link that is allowed to use complex representation at higher levels
 - 2: Reverse Simple Network link that is allowed to use complex representation at higher levels
 - 3: Network link with complex representation used (Link numbers are the same for 1, 2, and 3.)

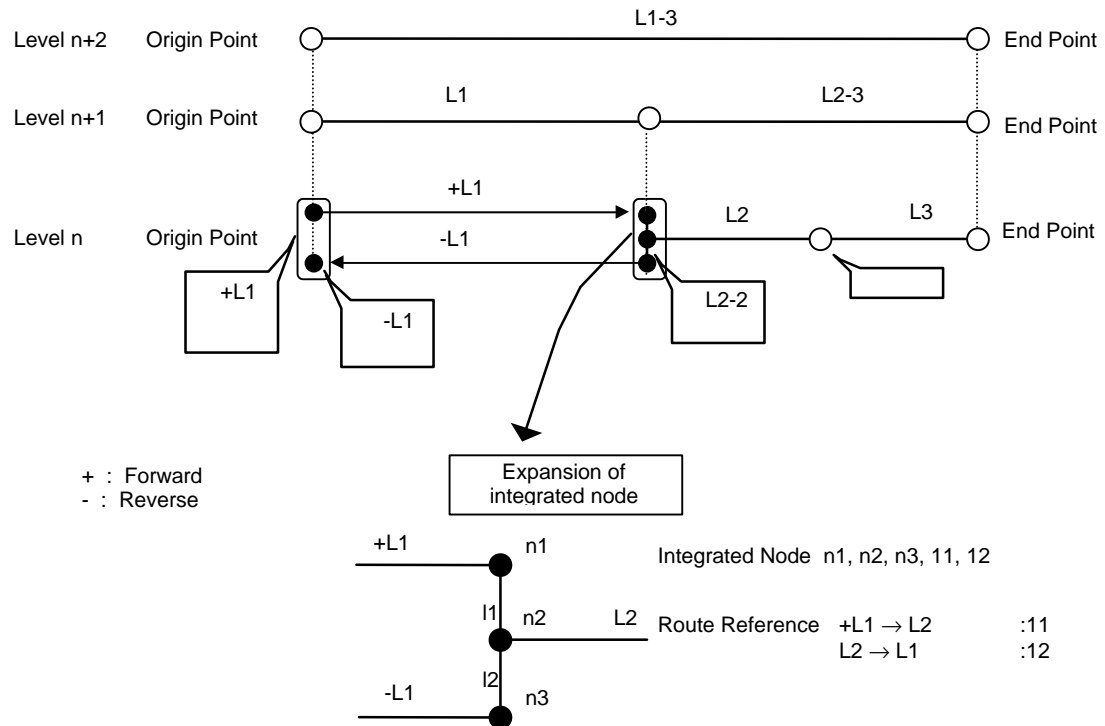
- Line number (30 bits), 0 to 1073741823: Indicates link numbers in the medium.
(0: RESERVED, 1073741823: Indicates an unfixed number.)

Example of link ID settings

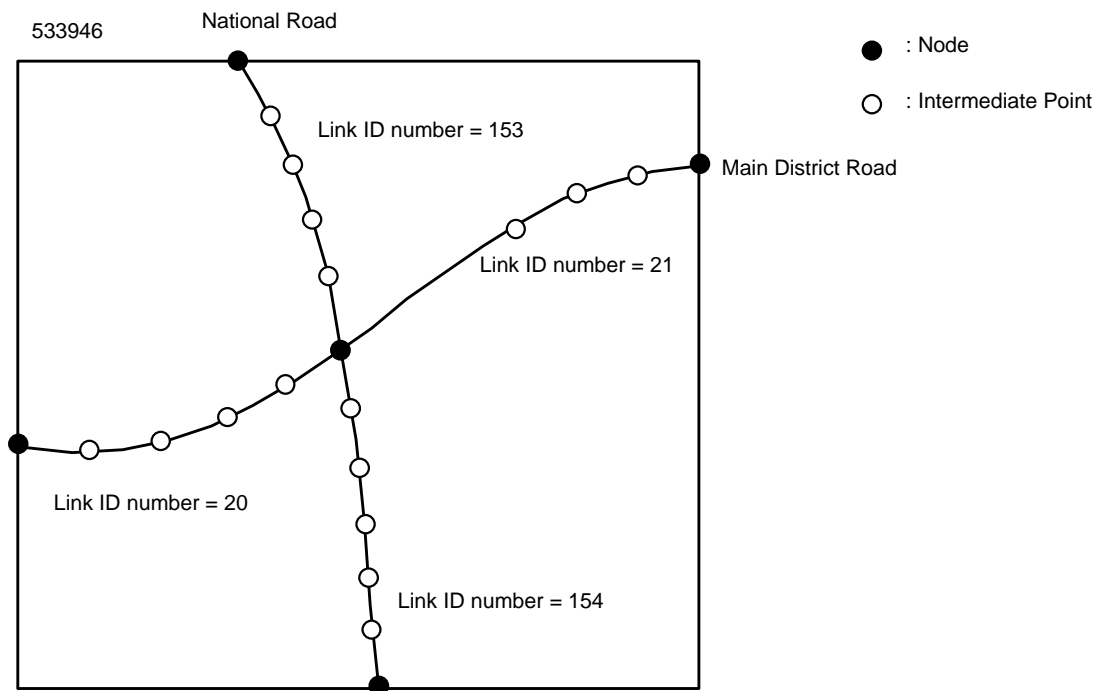
(1) When lower levels and higher levels are simple network



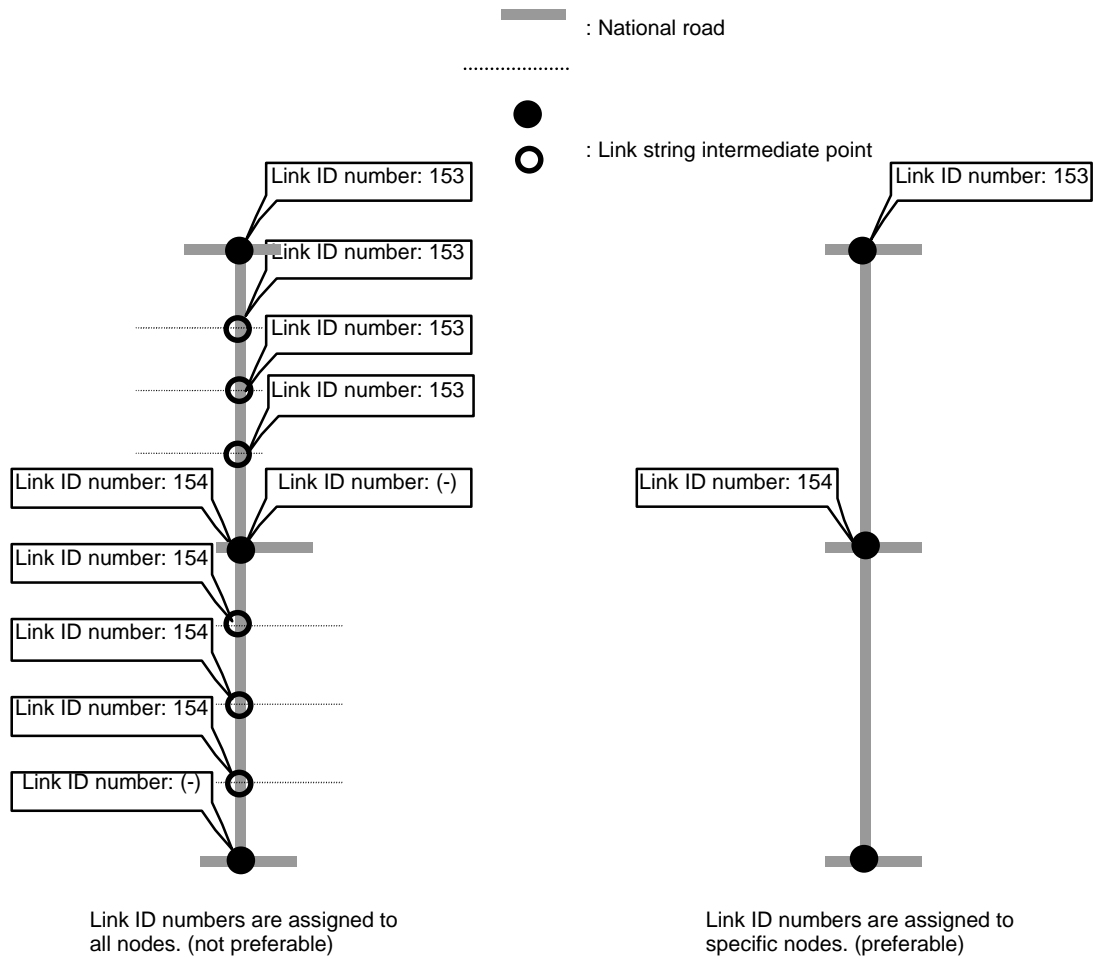
(2) When lower levels are simple network and a higher level is complex network



a) Assign unique link ID numbers in a medium at the polylining step when creating road data.

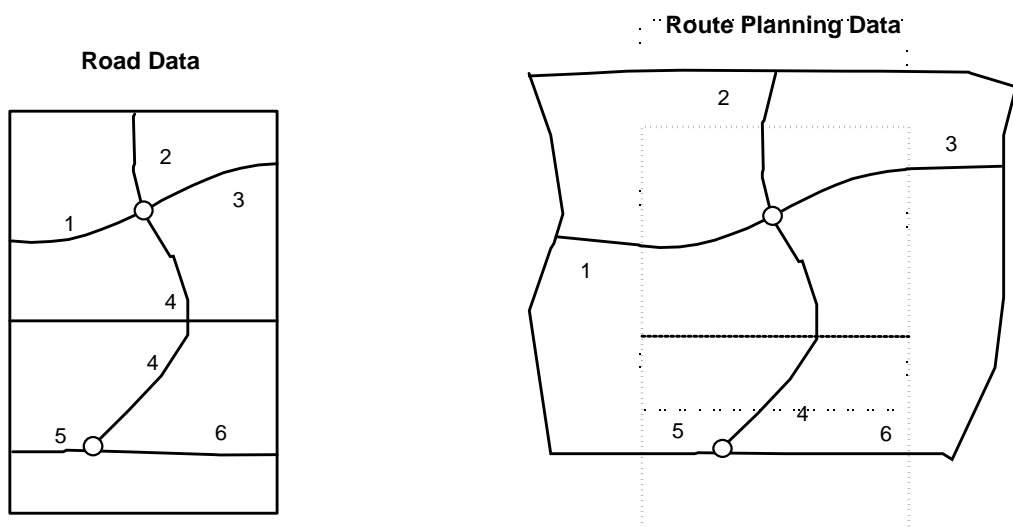


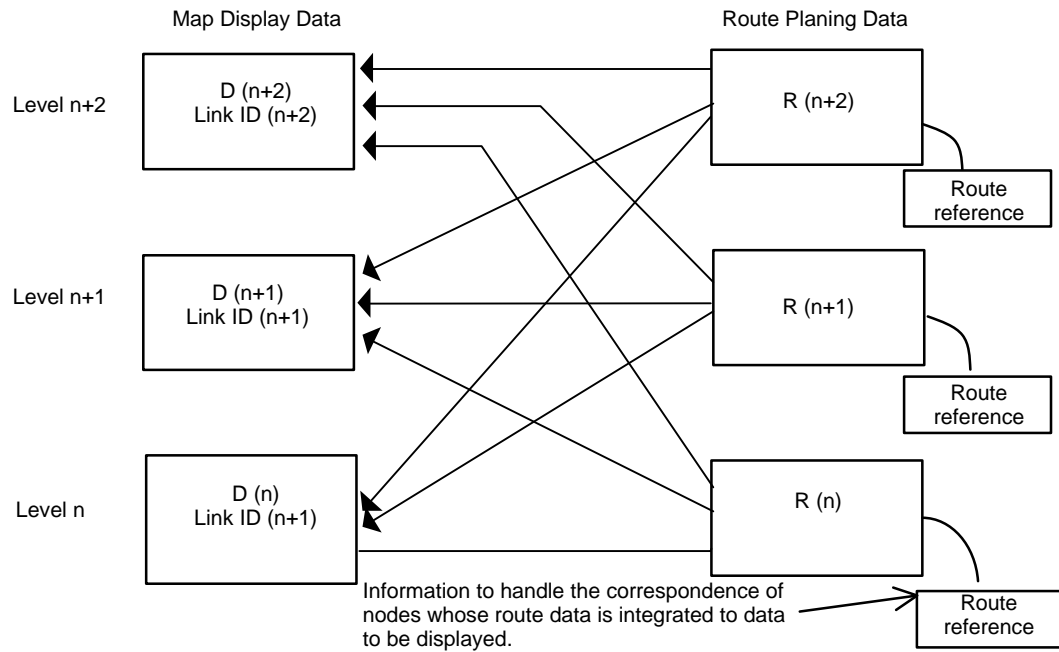
b) Assign a link ID number (differential) to a node at which a link ID number changes, in general.



d) Relationship between Road Data and Route Planning Data

7.A.8.1 Correspondence between the Link IDs of Map Display Data and Route Planning Data





Relationship at the Same Level

"Link ID number information" in each D(m)

R (n)	D (n)	} One-to-one Relationship
R (n+1)	D (n+1)	
R (n+2)	D (n+2)	

Correspondence from a lower level to a higher level

R(n)	D(n+1):	Find link ID(n+1) from link ID(n) directly.
R(n)	D(n+2):	Find link ID(n+2) from link ID(n) directly.
R(n+1)	D(n+2):	Same as above

Correspondence from a higher level to a lower level

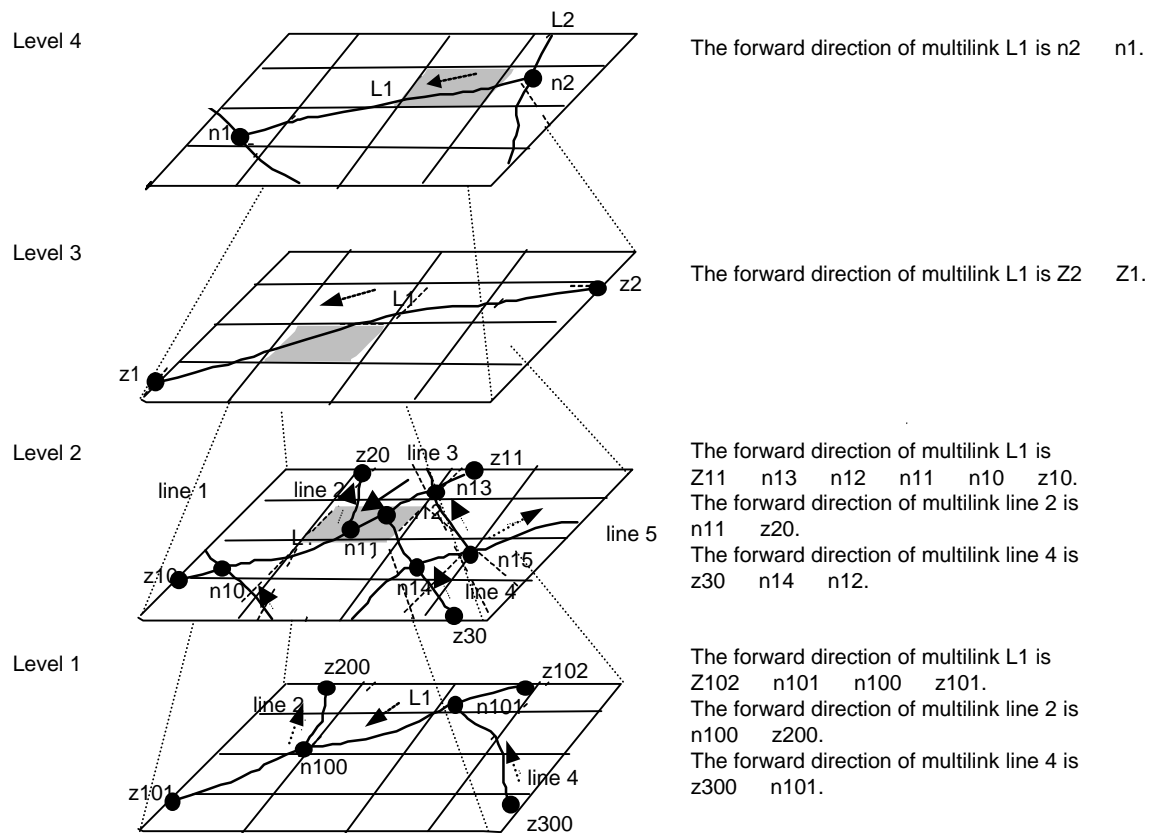
R(n+2)	D(n+1):	Find link ID(n+1) from link ID(n+2) directly.
R(n+2)	D(n):	Find link ID(n) from link ID(n+2) directly.

When R(n+2) is integrated using a single-line and D(n) is integrated using a double-line with higher levels, add the "link direction" (level n+2) to link ID(n+2), then set it in D(n), then make a direct search.

R(n+1)	D(n):	Same as above.
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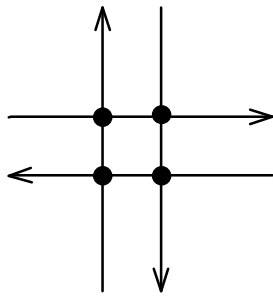
Supplement 1:

MultiLink with identical link IDs at each level (polylines) are created in the order in which nodes and intermediate points for MultiLink that are set at the highest level are displayed (forward/reverse direction).



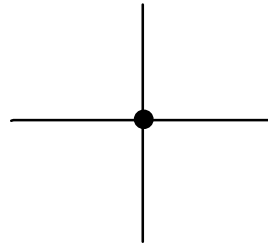
7.A.9 Supplement Explanation about Road Data and Route Planning Data

7.A.9.1 Simple Network and Complex Network



Simple

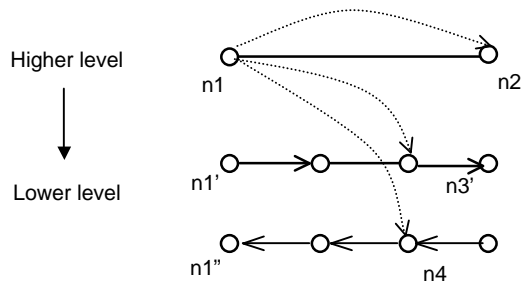
(Example of GDF level 1)
Graph (nodes and links)



Complex

(Example of GDF level 2)
Roads and an intersection

7.A.9.2 Relationship between the Levels of Route Planning Data



Neighboring node

$n1$ $n2$ (higher level)

$n1$ $n3$ (lower level)

$n1$ $n4$ (lower level)

Higher level

Lower level

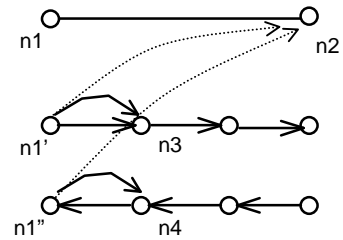
Neighboring node

$n1'$ $n3$ (lower level)

$n1''$ $n4$ (lower level)

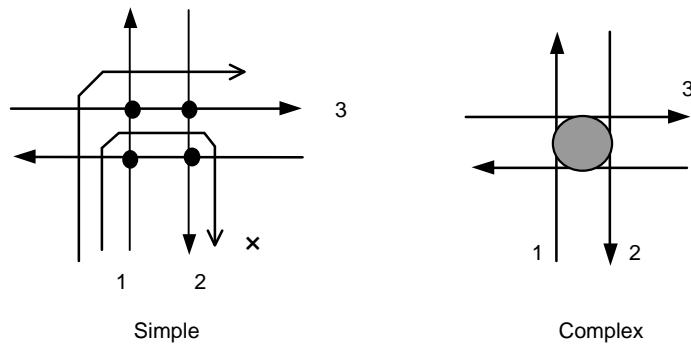
$n1'$ $n2$ (higher level)

$n1''$ $n2$ (higher level)



7.A.9.3 Integrated Route Planning Data on the Same Level

Simple Networks creates Complex Networks for some parts where passage regulations cannot be represented.



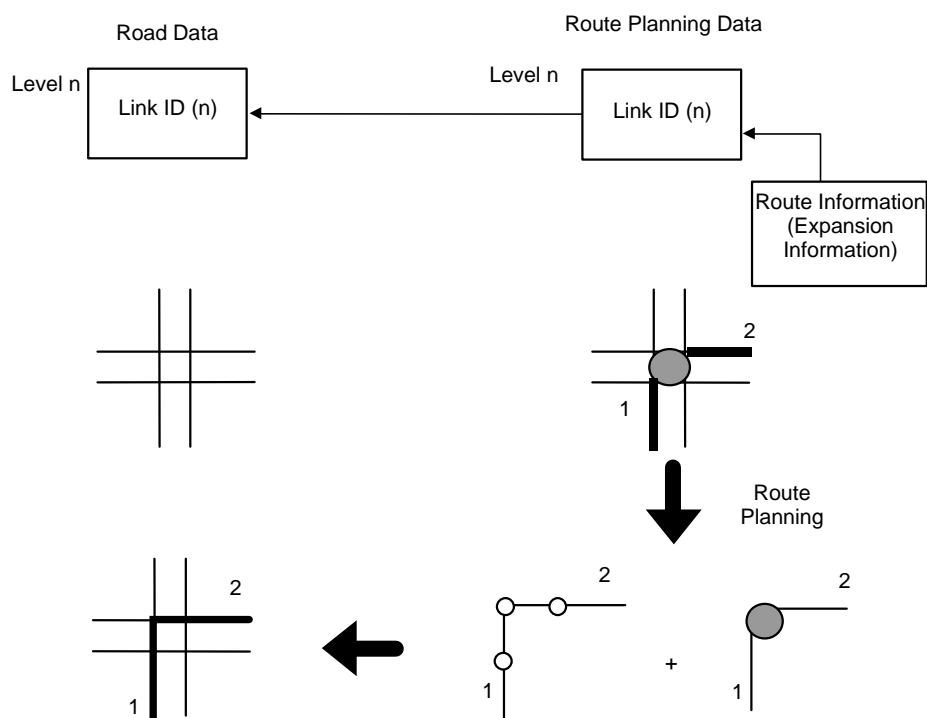
Example:

1 3: Passage allowed (right turn allowed)

1 2: Passage forbidden (U-turn forbidden)

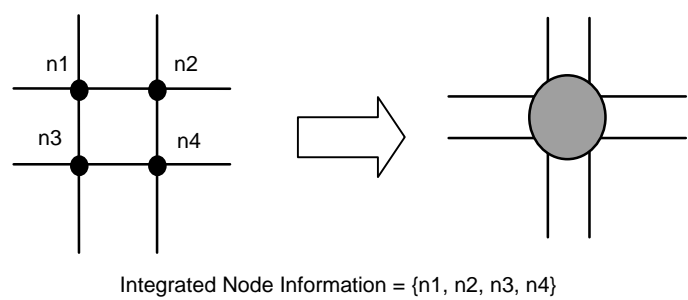
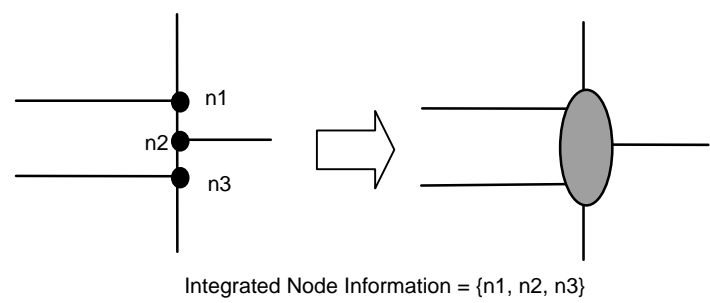
Complex representation allows passage regulations to be represented simply.

7.A.9.4 Simple Network

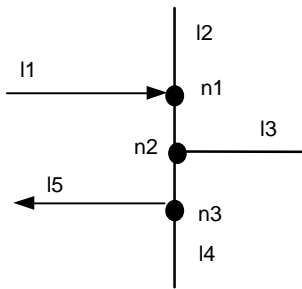


7.A.10 Road Reference

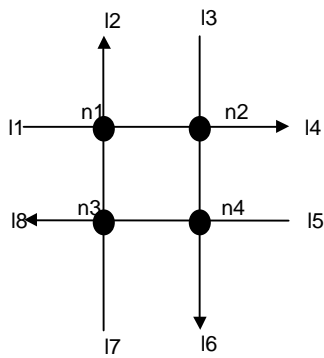
Integrated Node Information



Route Information

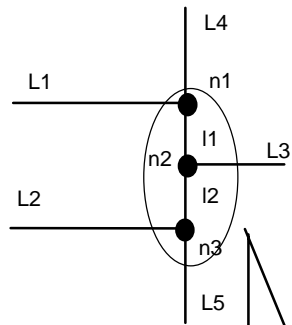


11	13	:	n1 to n2
11	14	:	n1 to n3
11	15	:	n1 to n3
12	13	:	n1 to n2
12	14	:	n1 to n3
12	15	:	n1 to n3
13	12	:	n2 to n1
13	14	:	n2 to n3
13	15	:	n2 to n3
14	12	:	n3 to n1
14	13	:	n3 to n2

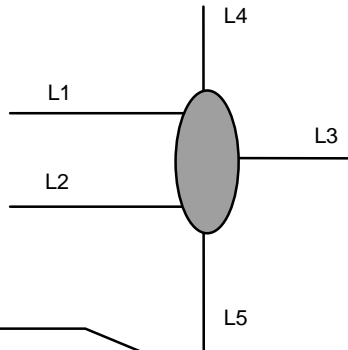


11	14	:	n1 to n2
11	16	:	n1 to n2, n2' to n4 go through different MultiLinks
11	18	:	n1 to n2, n2' to n4, n4' to n3
13	16	:	n2 to n4
13	18	:	n2 to n4, n4' to n3
13	12	:	n2 to n4, n4' to n3, n3' to n1

Map Display Data

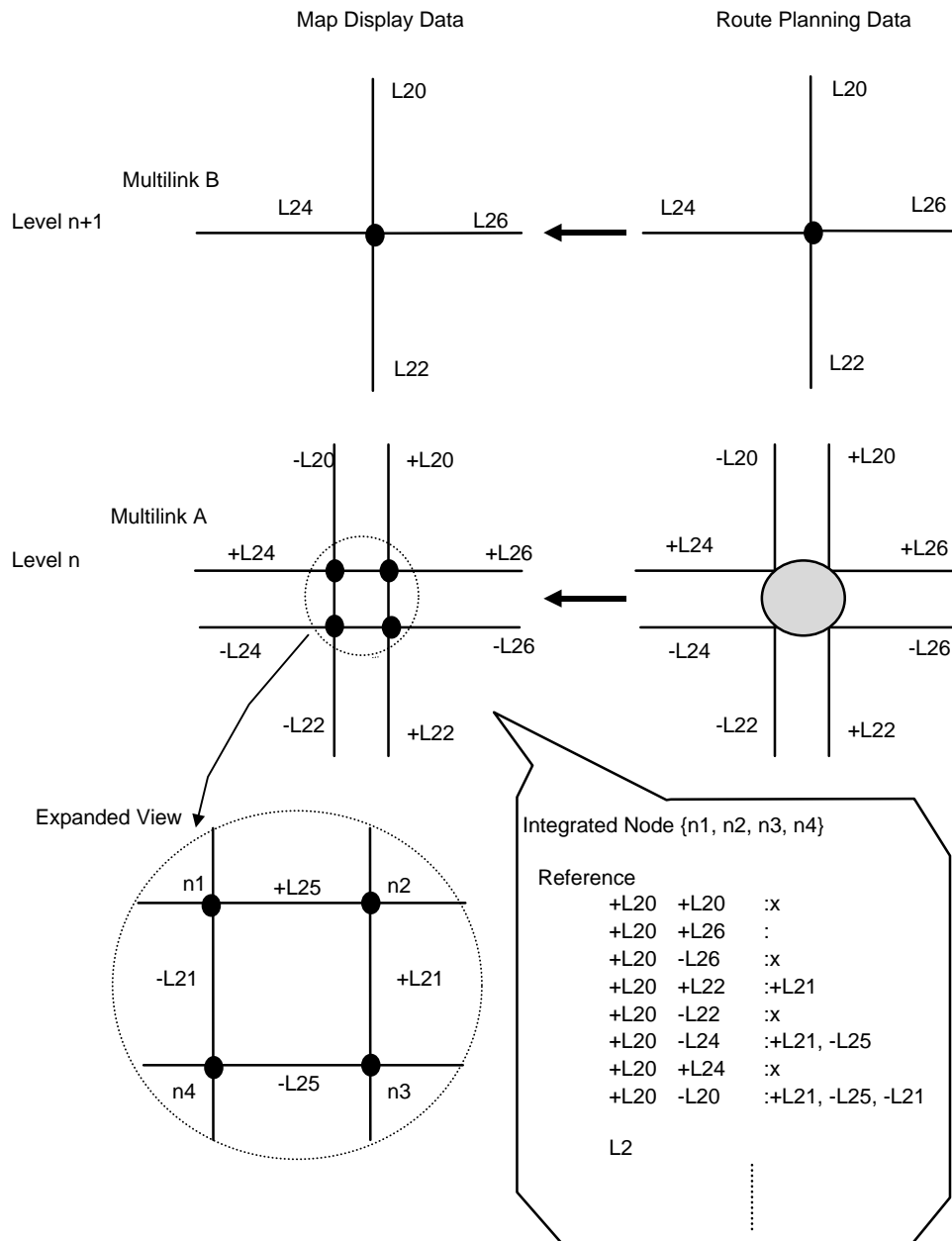


Route Planning Data

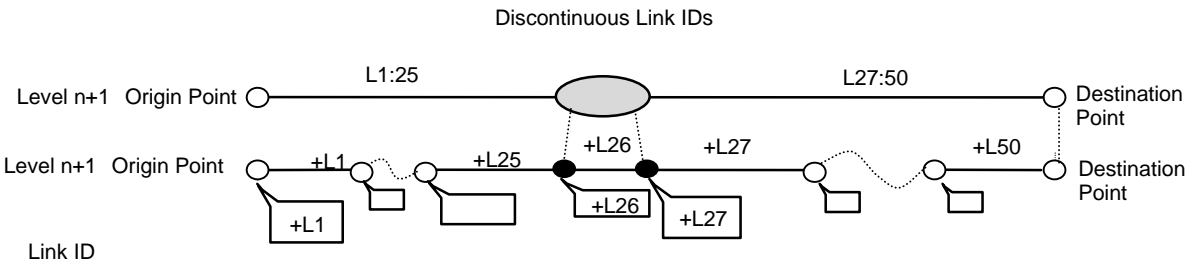


Integrated node {n1, n2, n3}

Reference	L1	L2	:11, 12
	L1	L3	:11
	L1	L4	:x
	L1	L5	:11, 12
	L2	ALL	:x
	L3	L1	:x
	L3	L2	:12
	L3	L3	:x
	L3	L4	:11
	L3	L5	:12
	L4	L1	:x
	L4	L2	:11, 12
	L4	L3	:11
	L4	L4	:x
	L4	L5	:11, 12
	L5	L1	:x
	L5	L2	:x
	L5	L3	:12
	L5	L4	:11, 12
	L5	L5	:x

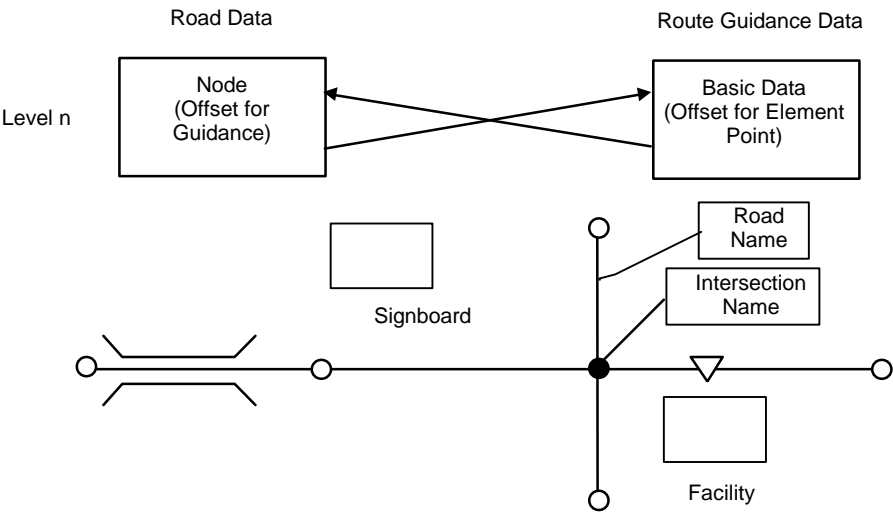


MultiLink



7.A.11 Relationship between Main Map Road Data and Route Guidance Data

Relationship at the same level and in the same parcel must be secured.



Intersection name

Road name

Route number

Destination name

Detailed figure of intersection

Road structures (bridges, tunnels, railroad crossings, pedestrian overpasses, skyways):

Distance along road, character data

Traffic signals (one-light signals, two-light signals, three-light signals, arrows, pedestrian lights):

Distance from node, character data

Signboards for advertisement (unfixed):

Offset position, character data

Traffic signs

Buildings and facilities

Facility codes, positions of facilities, positions of entrances/exits, facility shapes

