Pipeline Management Using GIS

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1. Background of Installation of GIS

- Major Issues on Water Utilities in Japan -

①Necessity to replace/renew the facilities

- Aging facilities
  - In the 1960s-70s, many water facilities were built to meet the increasing water demand
  - Now, those facilities are 40 years or over 40

・・・GIS will be an effective tool for preparation of system renewal plan

②Necessity to manage the facilities efficiently and document properly

- Increase of Facilities and drawings
  - ➢many water facilities = many documents(as-built drawings)

・・・GIS will provide efficiency on asset management

③Necessity to transfer experienced engineer's knowledge to younger generations

- Retirement of experienced engineers/field staff
  - ➢ After World War II, Baby boom(1947-1949)
  - ➢They worked hard to build new facilities for increasing water demand.
  - ➢They have a lot of knowledge and experience of management of water facilities
  - ➢Now, the baby boom generation are nearly 60

・・・GIS will assist inheritance of the technical knowledge

④Necessity to improve the facilities

- **Changes of consumer's needs for water supply service.**
  - ➢ To supply palatable (good quality) water
  - ➢ To serve with adequate pressure/to serve to 3rd floor-5th floor directly(without receiving tank and pumping up).
  - ➢ To reduce troubles
    - red water
    - no/little suspension even in case of emergencies such as earthquake

・・・GIS will help you to improve customer services

Major Issues on Water Utilities in Japan

① Necessity to replace/renew the facilities
② Necessity to manage the facilities efficiently /properly
③ Necessity to transfer their knowledge to younger generations
④ Necessity to improve the facilities

- Facility data is necessary to conduct above items
- Facility data is various and is huge

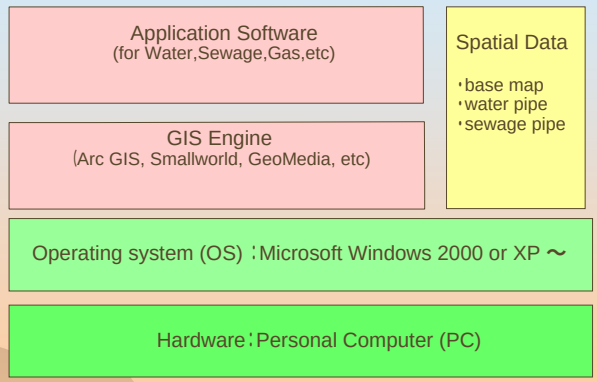
・・・GIS must be effective to process these data

2. What is GIS?
-Outline of GIS-

Definition

- Geographic Information System is a computerized database management system for spatial data that enable storage, retrieval, analysis and support of decision making .
- Spatial data means a figure that have coordinate (position) data and attribute.

Components

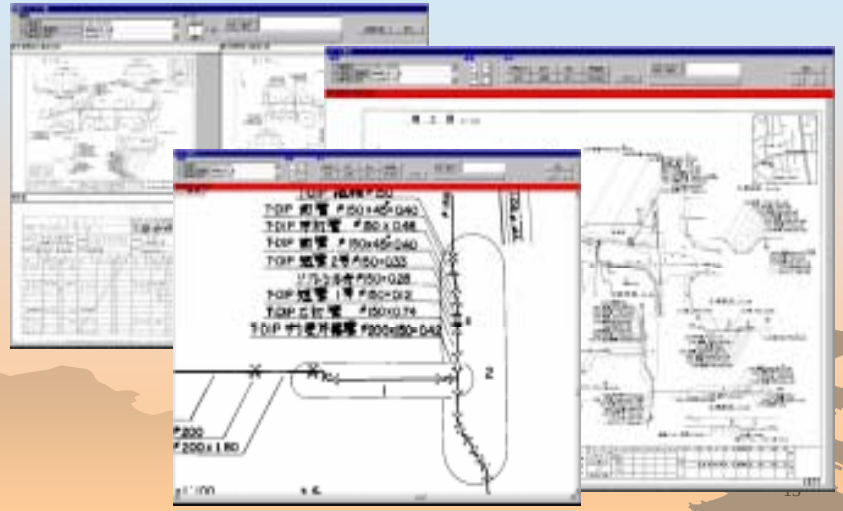


Data Feature of GIS/Image data

- Dot data / pixcel data.
- Resolution; dot per inch (dpi).
  ex: digital photos, scanned documents, etc
- File format; BMP, JPEG, Tiff
- Not usable for retrieval and analysis

Data Feature of GIS

Ex. of Image data: As-built drawings



Data Feature of GIS/Vector data

- Position/location
  X and Y coordinates/latitude and longitude
- Geometry/Shape
  point, line, polygon (rectangle, circle, etc)
- Attribute
  contents of objects
- Geographic display = Easy to grasp
- Usable for retrieval and analysis

Data Feature of GIS

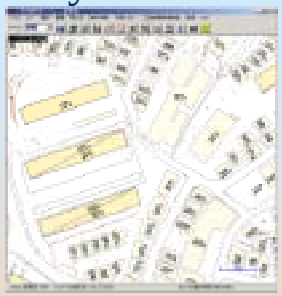
Ex. of Vector data:
Pipeline

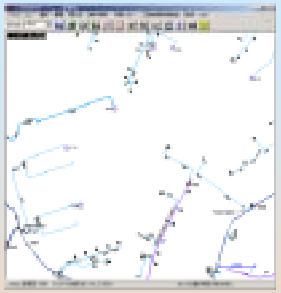
Management of Vector Data

- GIS data is managed in layers separately.
  - Base map: road layer, house layer, river layer, ・・・
  - Water data: water main, service pipe, valve, ・・・
- Data display is controlled by layers.
- You can display only necessary data.

Ex. of layer control

base map





pipe lines

base map +

pipe lines

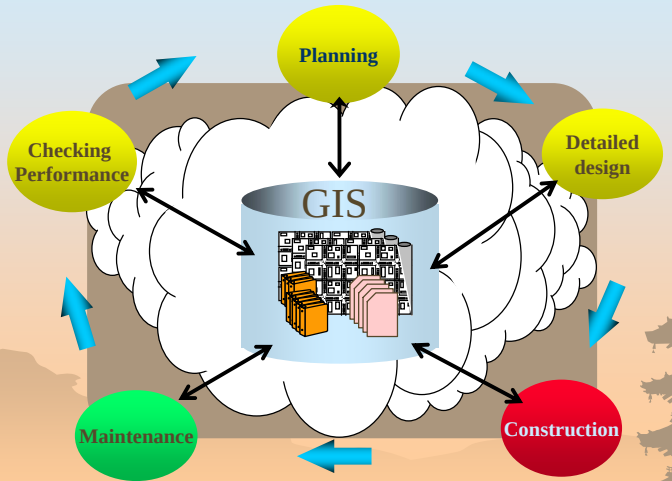
Function Features of GIS

- Display
  - Arbitrary range: scale up / down, movement
  - Display of necessary data, non-display of unnecessary data
- Retrieval
  - Attribute condition
  - Spatial condition
  - Complex condition (Spatial + Attribute)

3. Using GIS in Water Utility

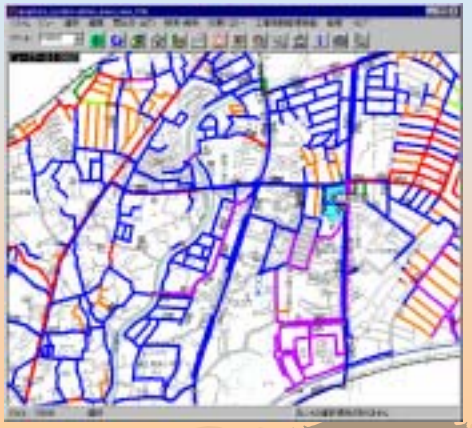
Business Activity Based on GIS

Facility data is used or updated at **Each step**



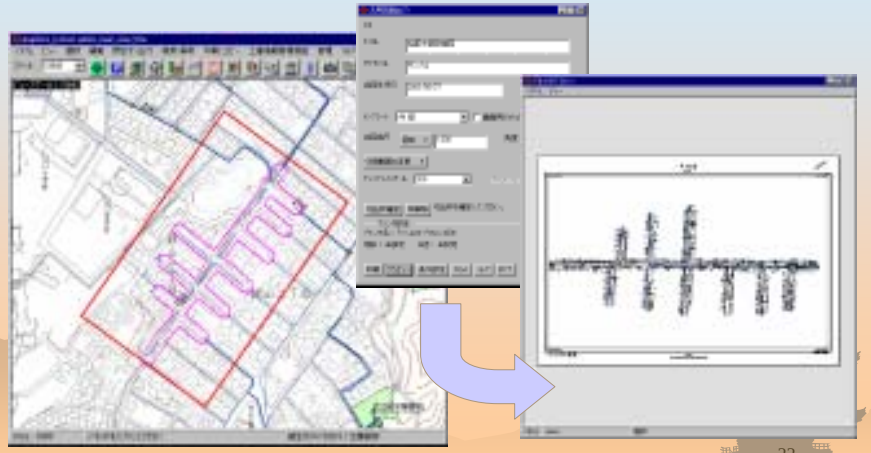
Planning support ; Pipe Replacement

- Coloring By pipe types (materials) or installation year
- Easy to find which pipe should be replaced



Design support

Export of Existing base map and pipe data to CAD system



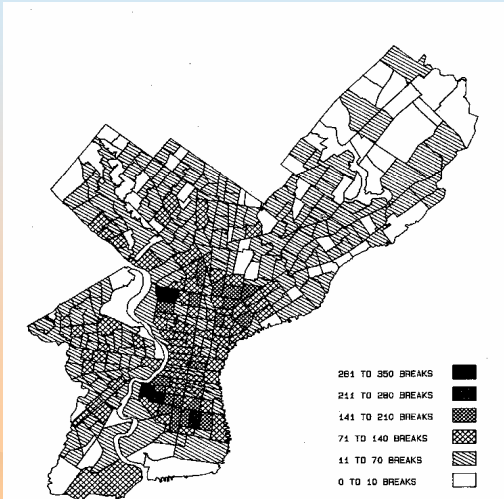
Maintenance/Pipe failure

•Indication of valves that should be closed

•Indication of suspension area

Checking performance/analysis

- Distribution of leak points
  - Frequent leak area

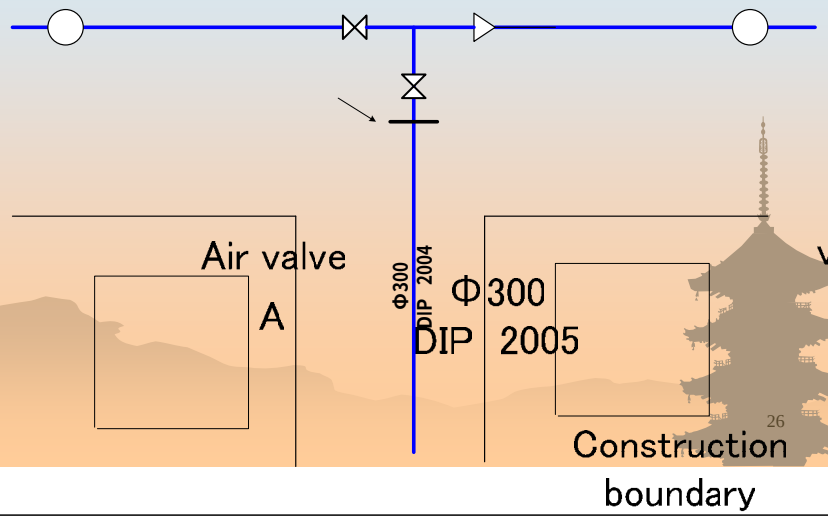


AWWA Research Foundation

"Water Main Evaluation for

4. GIS Data for NRW Reduction

Representation of distribution pipelines



GIS data : Pipeline

Attribute	Contents
Purpose	transmission, distribution, drain, etc
Material	DIP、CIP、SP、VP、etc
Diameter	75,100,150,200,・・・
Length	210.58 (m)
Lining	Mortal, Epoxy resin, Synthetic resin
Corrosion protection	Polyethylene sleeve
Construction year	1984

GIS data : Valve

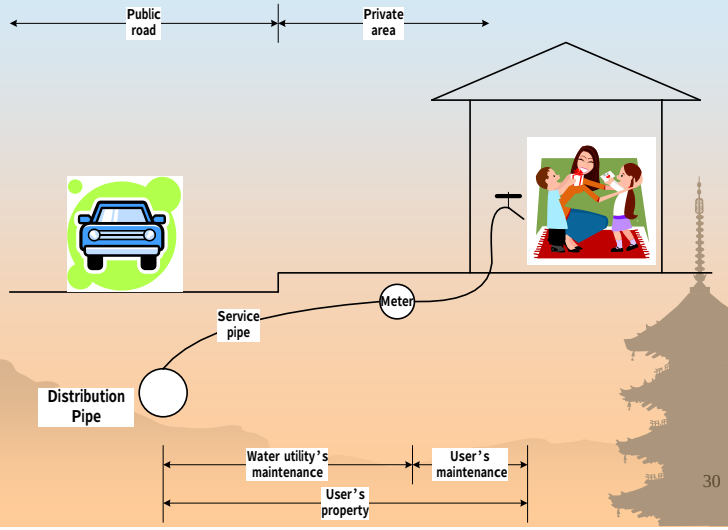
Attribute	Contents
Type	butterfly, sluice, etc
Diameter	75、100、150、200、・・・
Switch status	open, close,
Switch direction	right, left
Operability	will not open, etc
Construction year	1996

GIS data : Hydrant and Air valve

Name of Object	Attribute	Contents
Hydrant	Type	single, dual,
	Purpose	fire fighting, drain
	Diameter	75,100
	Construction year	2004
Air Valve	Type	single, dual,
	Diameter	25, 75, 100,150,
	Construction year	2005

Service installation

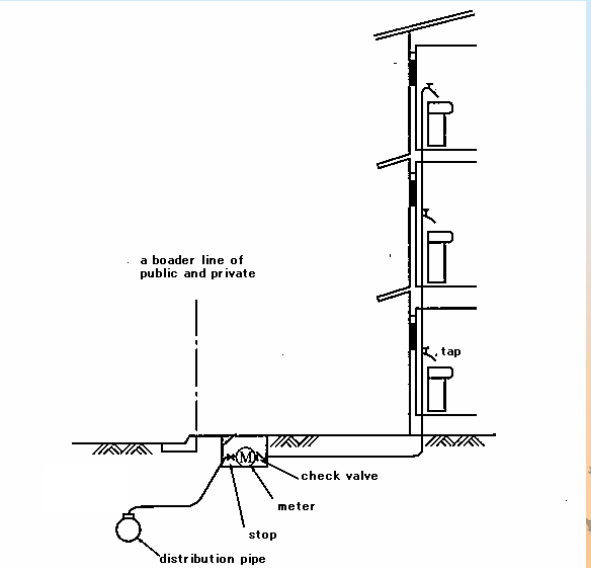
- Property and maintenance



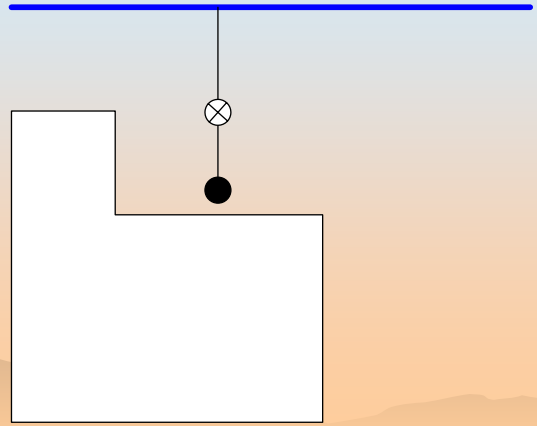
Water service system

- Three types of water service system
  - Direct connection system
  - Receiving tank system
  - Booster pump system

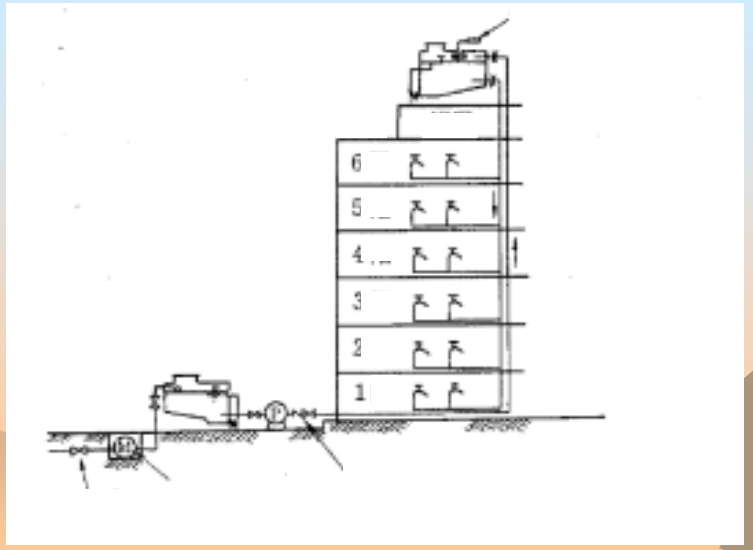
Direct connection system



Representation of direct connection



Receiving tank system



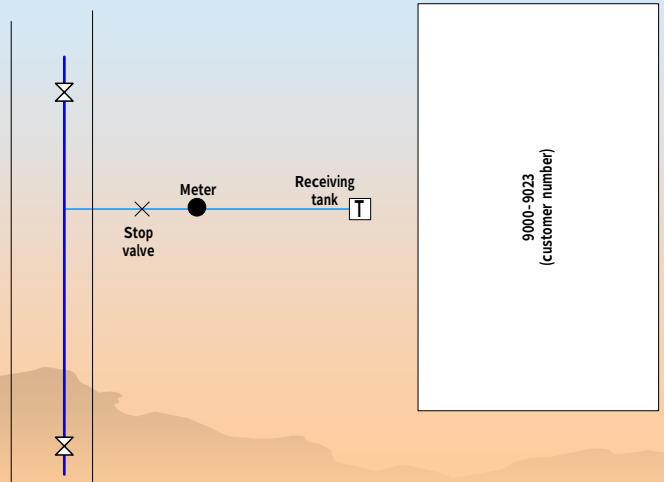
JWWA2000"Guidelines for Design of Water Facilities"

Service pipe

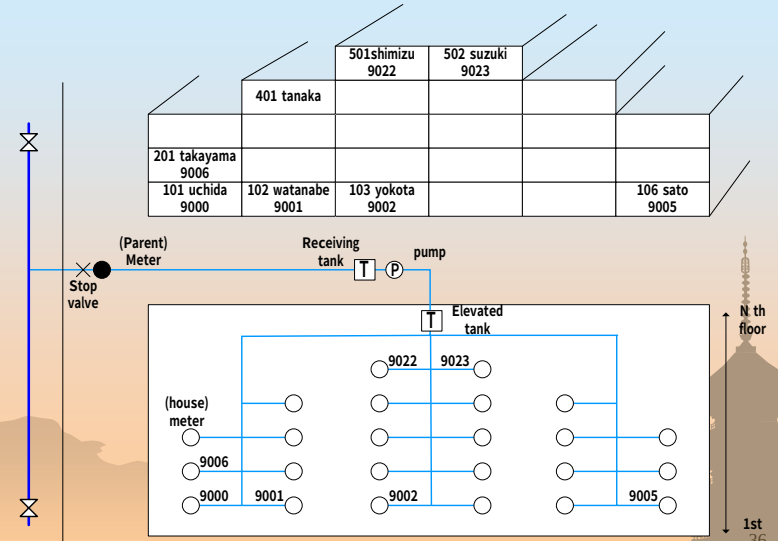
Stop valve

meter

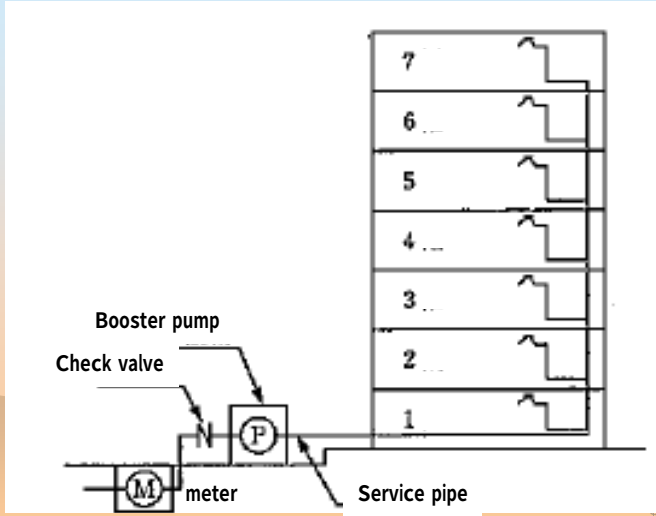
Representation of receiving tank system-1



Representation of receiving tank system-2

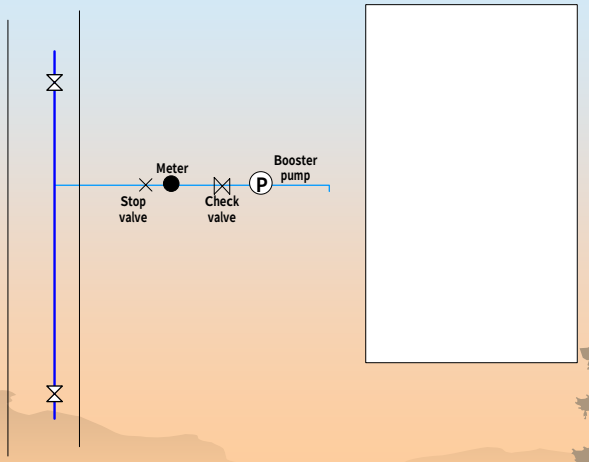


Booster pump system



JWWA2000"Guidelines for Design of Water Facilities"

Representation of booster pump system



GIS data :Service pipe and stop valve

Name of Object	Attributes	Contents
Service pipe	Customer number	12345
	Material	PEP、VP、Pb、etc
	Diameter	13,20,25,・・・
	Length	15.23m
Stop valve	Customer number	12345
	Type	butterfly, stop, etc
	Diameter	13,20,25,・・・

GIS data : Meter

Name of Object	Attributes	Contents
Meter	Customer number	12345
	Diameter	13,20,25、・・・
	Meter number	3825
	Installation data	10-Oct-06
	switch status	open, close
	Customer name	Takayama
	Customer address	Sayama city
	Customer tel. number	04-2955-×××××
	Owner name	Watanabe
	Owner address	Yokohama city
	Owner tel. number	03-5323-6220

GIS data : receiving tank and booster pump

Name of Object	Attributes	Contents
Receiving tank	Customer number	12345
	Volume	10m3
Booster pump	Customer number	12345
	pump head	30m
	capacity	0.1m3/min

GIS data : leak repair and customer complaint

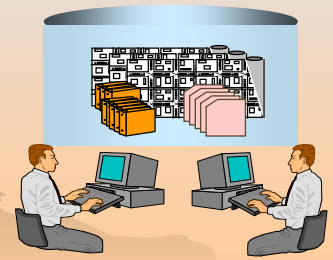
Name of Object	Attributes	Contents
Leak repair	Repair date	nov-7-06
	Address/road name	
	Pipe data	DIP 300 installed in 1975
	Damage data	pipe broken and leaks
	Repair data	replaced 2m pipe
	Remarks	
Customer complaint	Received date/time	nov-7-06 10:00am
	Customer number	
	Address	
	Customer name	
	Complaints	delay in repaving the road after pipe installation
	Action	instruction to contractors
	Remarks	

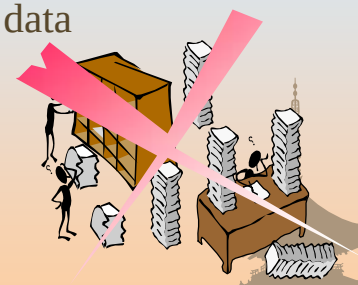
5. Conclusions
- Effect of GIS -

Effect of GIS-1

Adequate management of materials

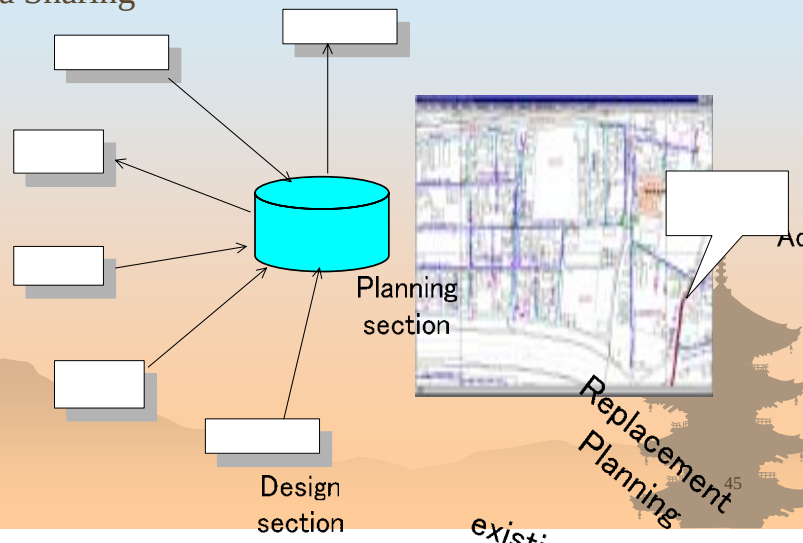
- Less papers/Less space
- No deterioration or loss of data





Effect of GIS-2

Data Sharing



Effect of GIS-3

Efficient operation

- Reduction of Retrieval Time of the Facilities data.
- Efficient Maintenance of the Facilities(pipe failure ,leak inspection, etc).

Under Construction
01/05/2004-

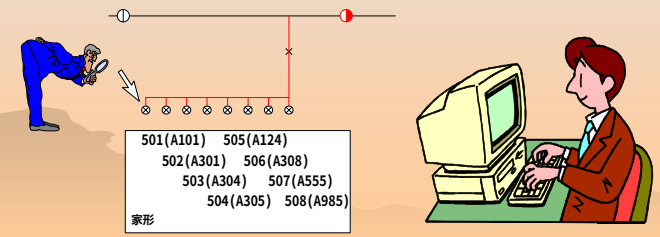
er GIS

Effect of GIS-4

Efficient operation

- Decision making support for Investment priority(pipe replacement, etc)
- Quick response to customer's inquiries/complaints

→Improvement of Water Supply Service



Thank you

(Questions)