Advantages of Inner Sewer Inspection Equipment

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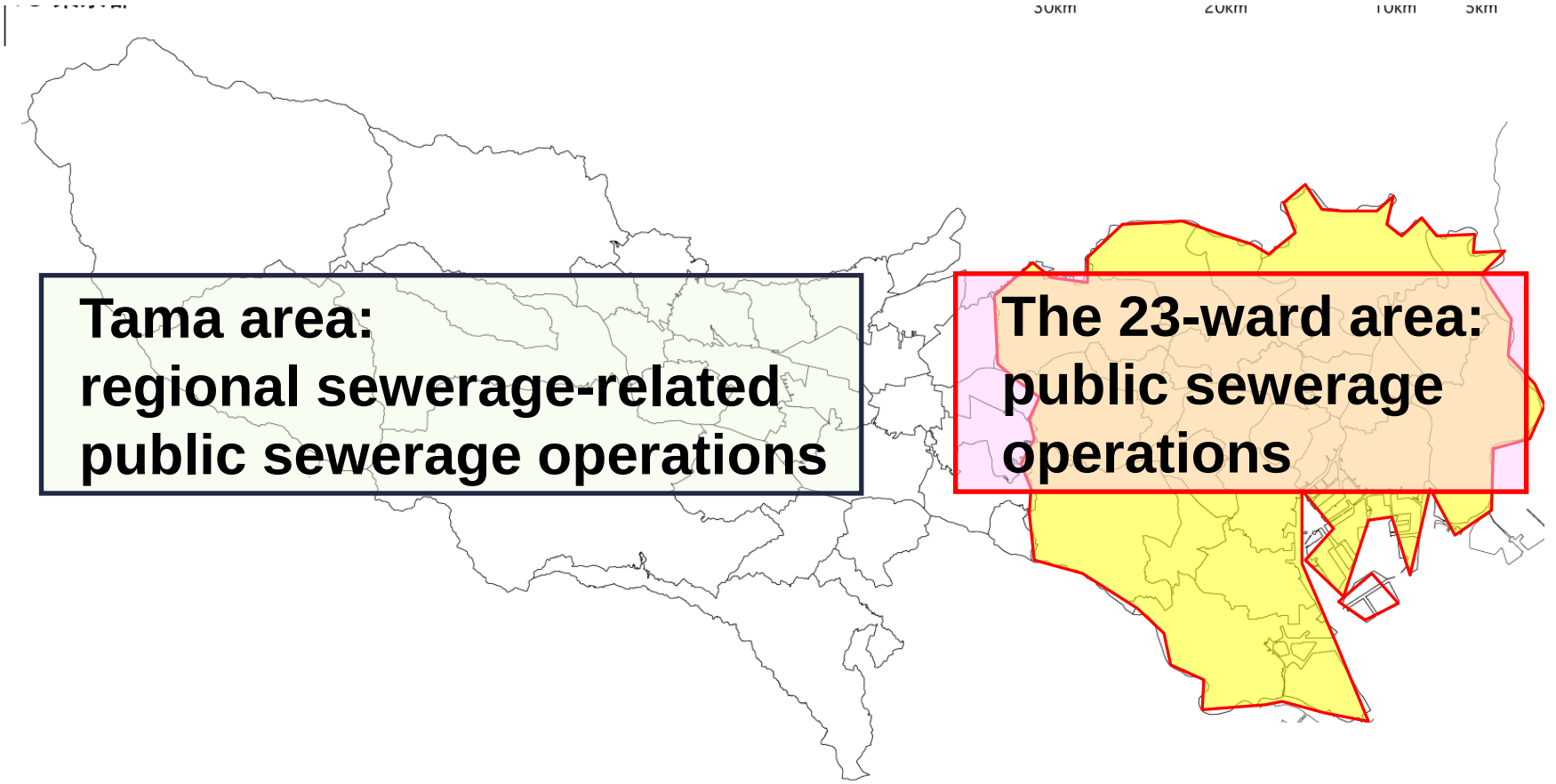
   (1) Main sewer inspection
      - Inside diameter less than 800mm
      - Inside diameter 800mm or over
   (2) House collecting sewer inspection
3. Applications of inner sewer inspection equipment

Business segments of Bureau of Sewerage

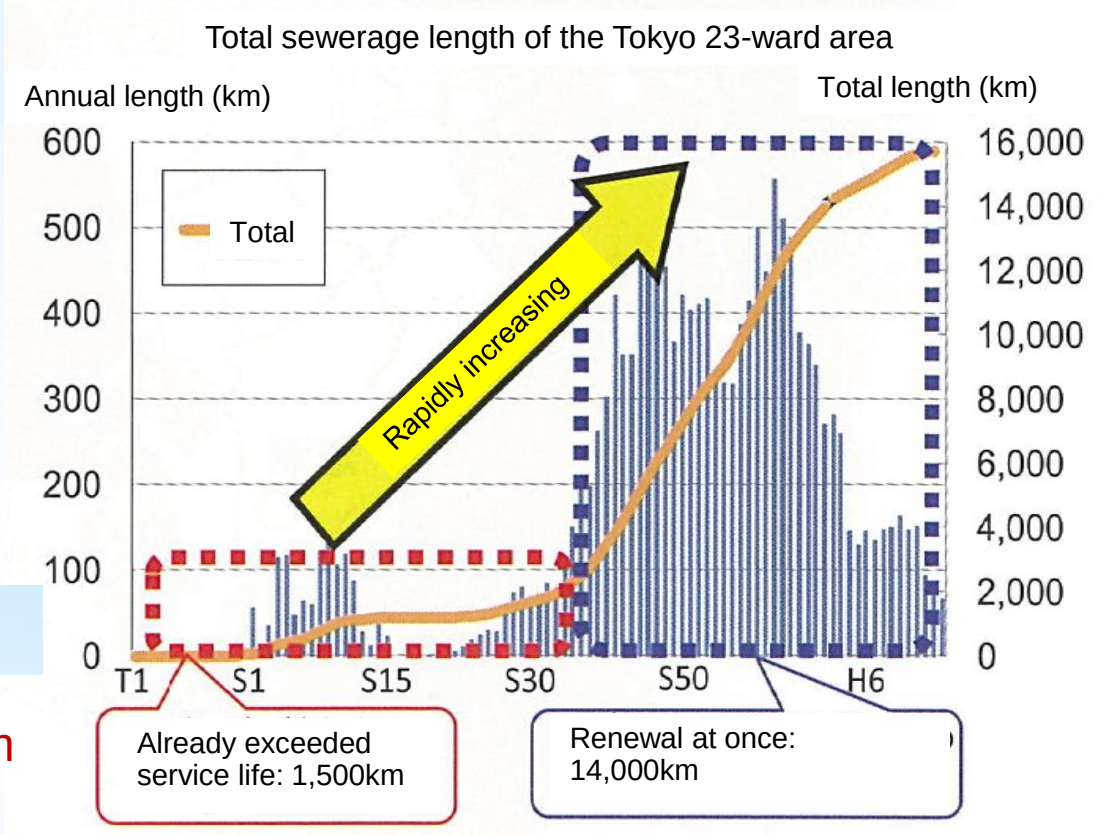


Sewerage pipeline of the Tokyo 23-ward area today

At the end of March 2012

Total sewerage length is equivalent to round trip between Tokyo and Sydney

Total conduit length:about 16,000km



Length already exceeded the legal service life of 50 years: about 1,600km

Length exceeding the legal service life within 20 years: about 6,500km

Issues the Bureau faces today
(Issues related to aging pipelines)

(1) Addressing aging sewer
Total conduit length already exceeded the legal service life of 50 years: about 1,600km
Additional length exceeding the legal service life within 20 years: about 6,500km

(2) Addressing road cave-in
Annual road cave-in accidents: about 800 cases
(Average of 5 years between FY2009 and FY2013)
*** More than 70% of the accidents are caused by fractured house collecting sewers made of ceramic.**

Inner sewer inspection equipment helps us address the above issues.

Maintenance and management of sewerage

- **Inspection and diagnosis**

  Video camerainspection
  Visual inspection

- **Construction works**

  Repair(Partial construction)
  Improvement(Scheduled construction)
  Reconstruction(Large-scale construction)

Inner sewer inspection

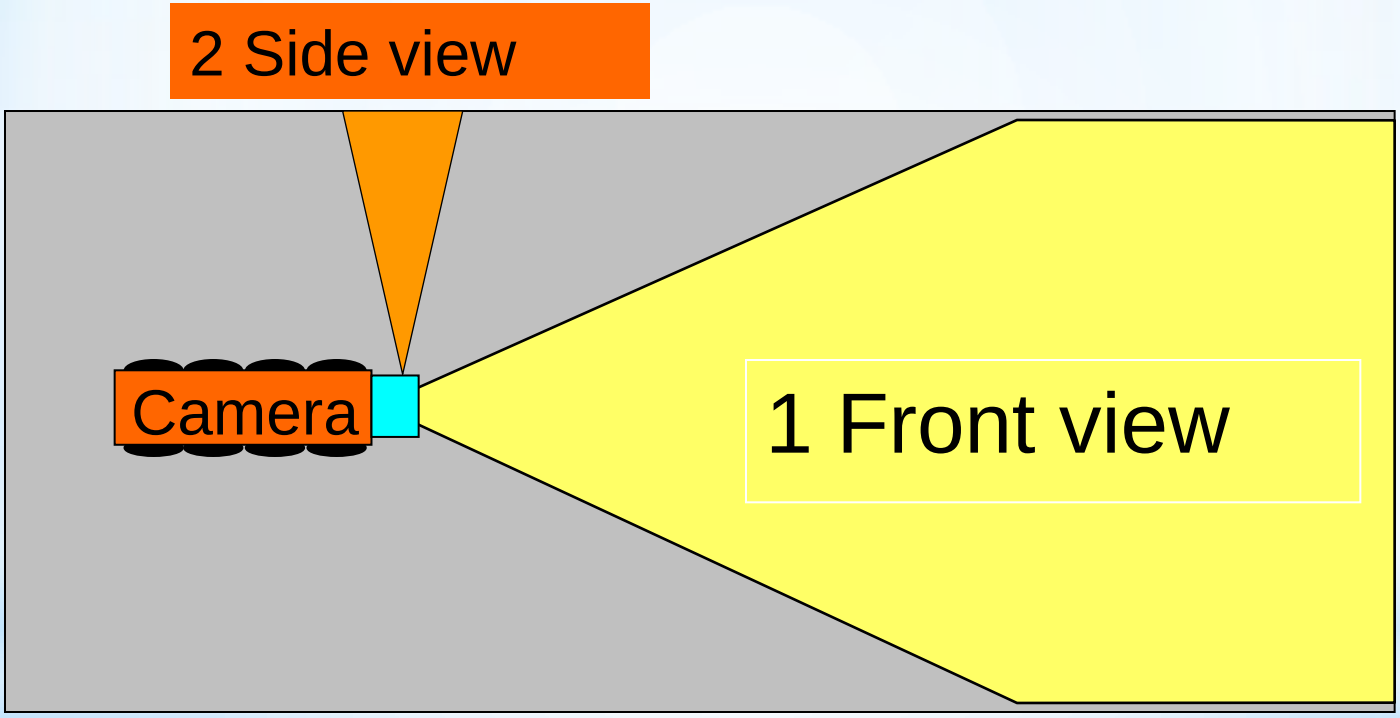
Main sewer (Inner diameter less than 800mm)

Conventional method

➡ **Analog video camera**

- No digital data stored
- One direction view

Scope of analog video camera



* No simultaneous imaging of side and front views

Judging standard in video and visual inspection (example)

		A	B	C
Damage on pipe	Reinforced concrete pipe	Gap	Crack in the direction of axis	Crack in the direction of axis
		Crack in the direction of axis		
		Width: 5mm or over	Width: 2mm or over	Width: less than 2mm
	Ceramic pipe	Gap		
		Crack in the direction of axis		
		50% or more of pipe length	Less than 50% of pipe length	

Disadvantages of analog video camera

【Inspection】

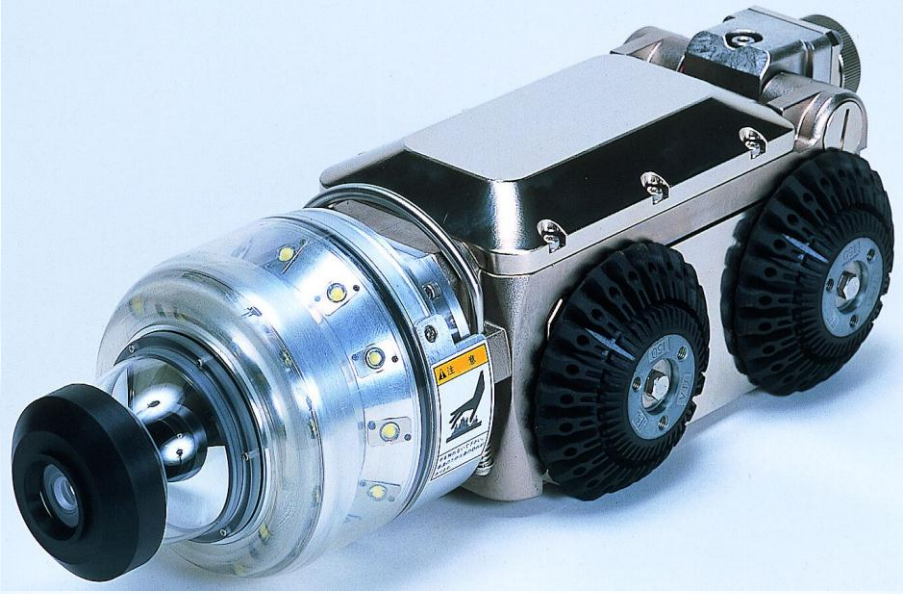
- Time-consuming on-site inspection(Switching to side view inspection takes long time.)
- Inconsistent results (Difference of individual skill may have created different inspection results.)

【Application】

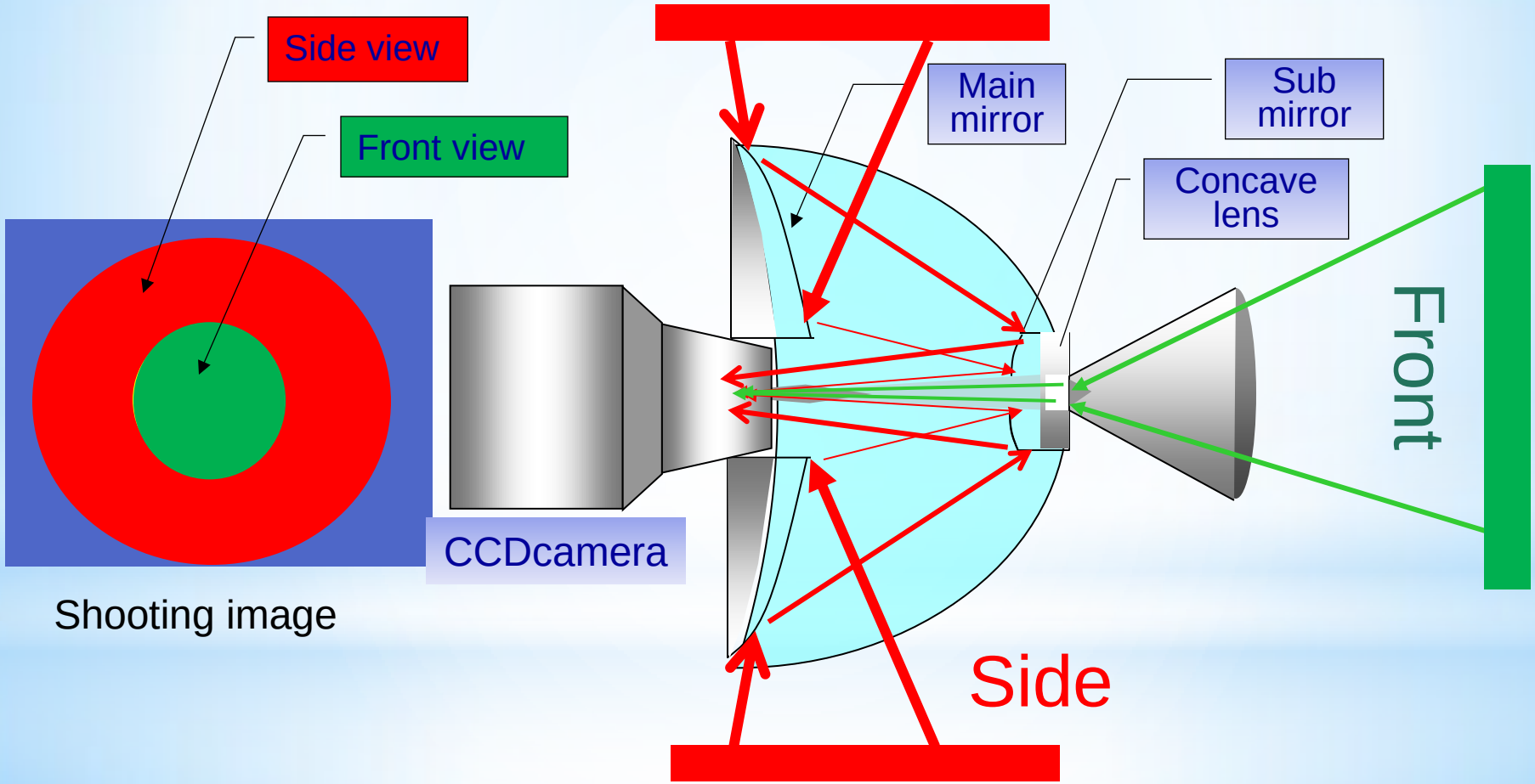
- Time-consuming analog video search
- Difficulties in understanding whole damage from moving picture

Mirror-reflection, multi-vision camera

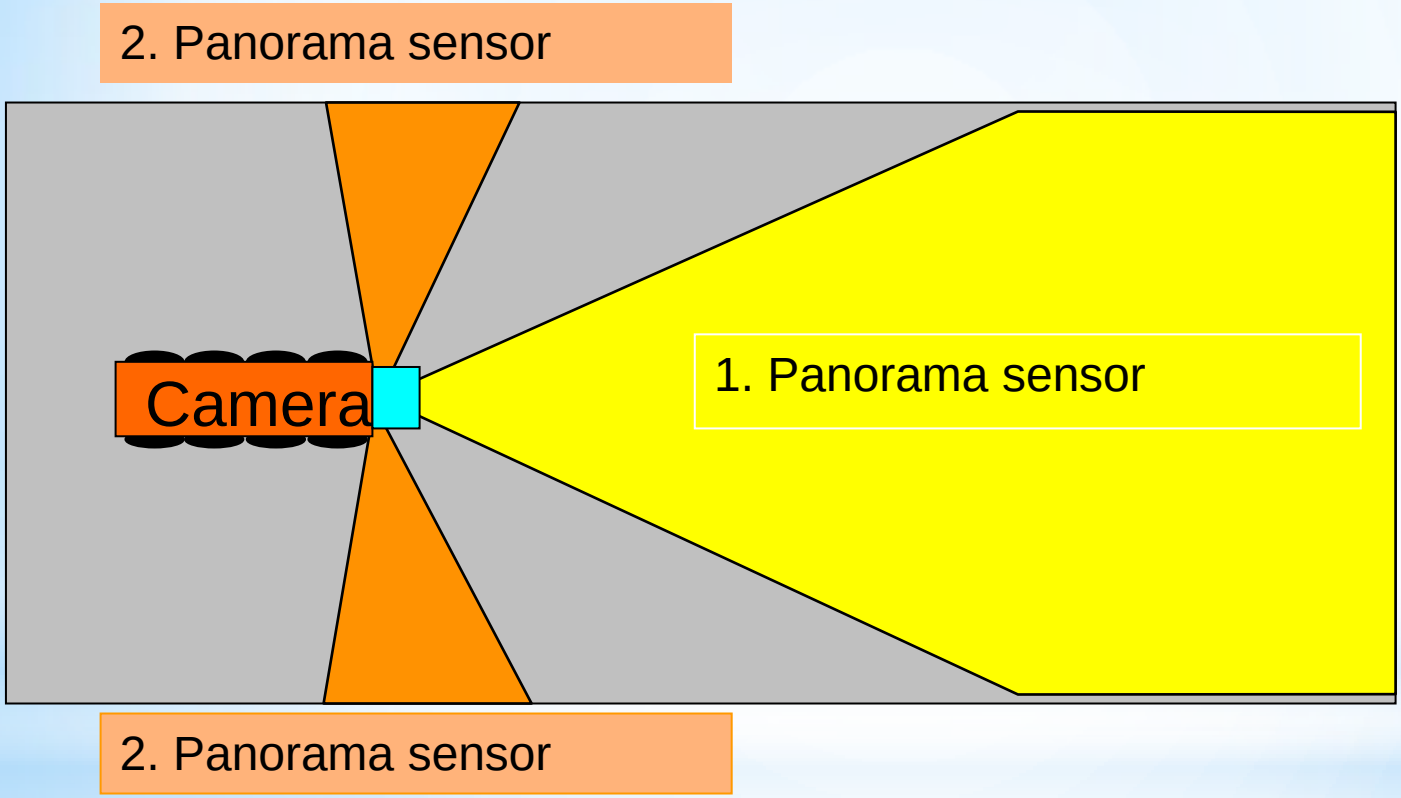
- CCD camera employing mirror-reflection system and multi-vision panorama sensor enables simultaneous imaging of side and front views, significantly reducing the on-site working time.
- Digital image is processable for automatic fault inspection, eliminating the variation by individual skill and improving inspection quality.

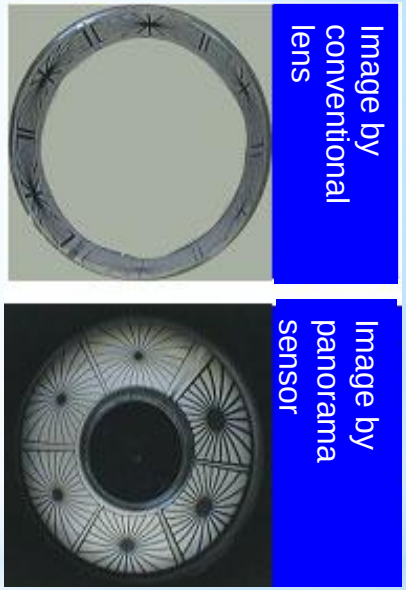


Sectional view of mirror-reflection, multi-vision camera



Shooting image of multi-vision camera



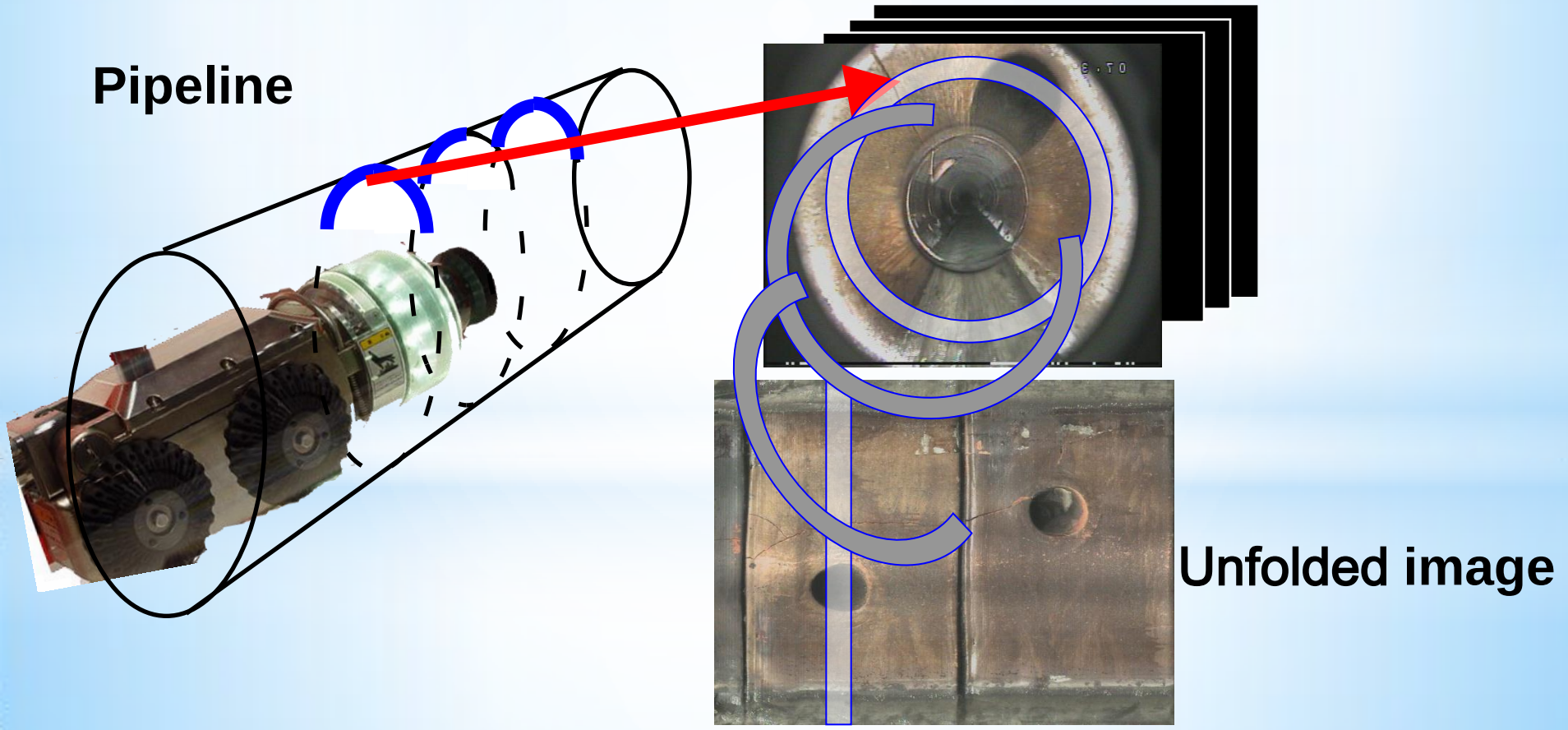


* Mirrors reflect (2) side image and camera receives both (1) front image and (2) side image simultaneously.

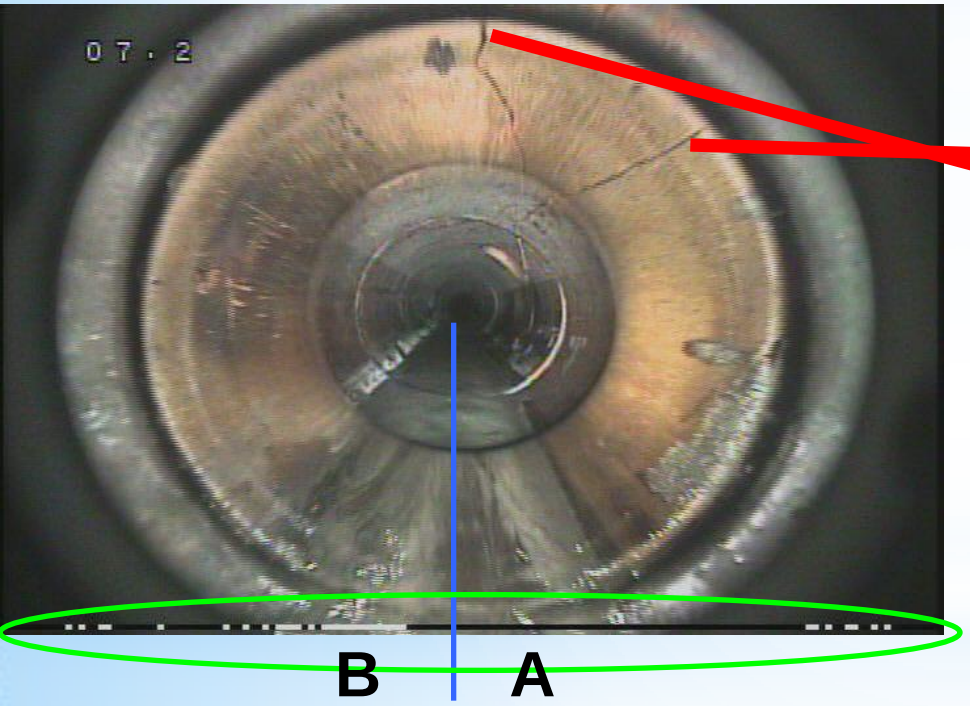
Unfolding image system for inner conduit

Outline of unfolding image of inner conduit

Coordinates of inner surface data are converted to create unfolded image.



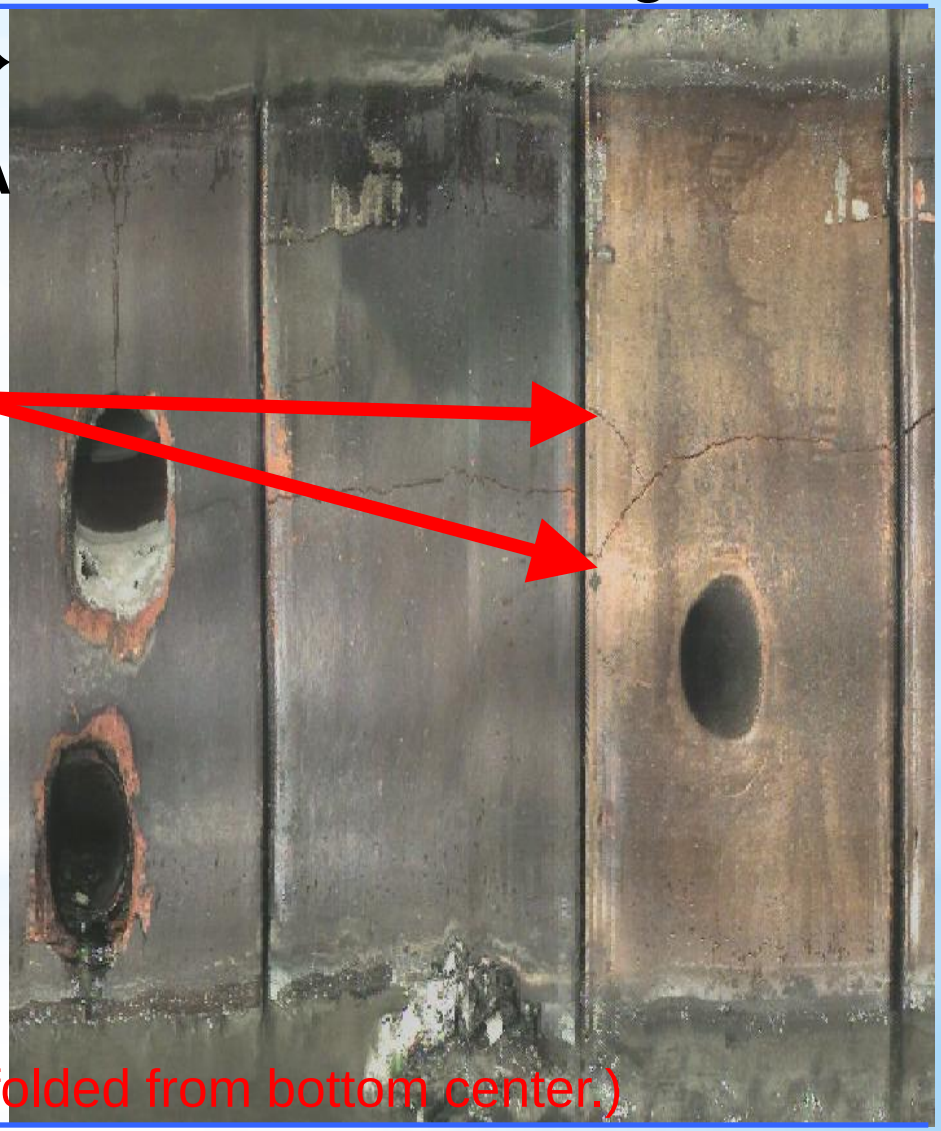
Unfolded image



Unfolded image

Bottom center →

A

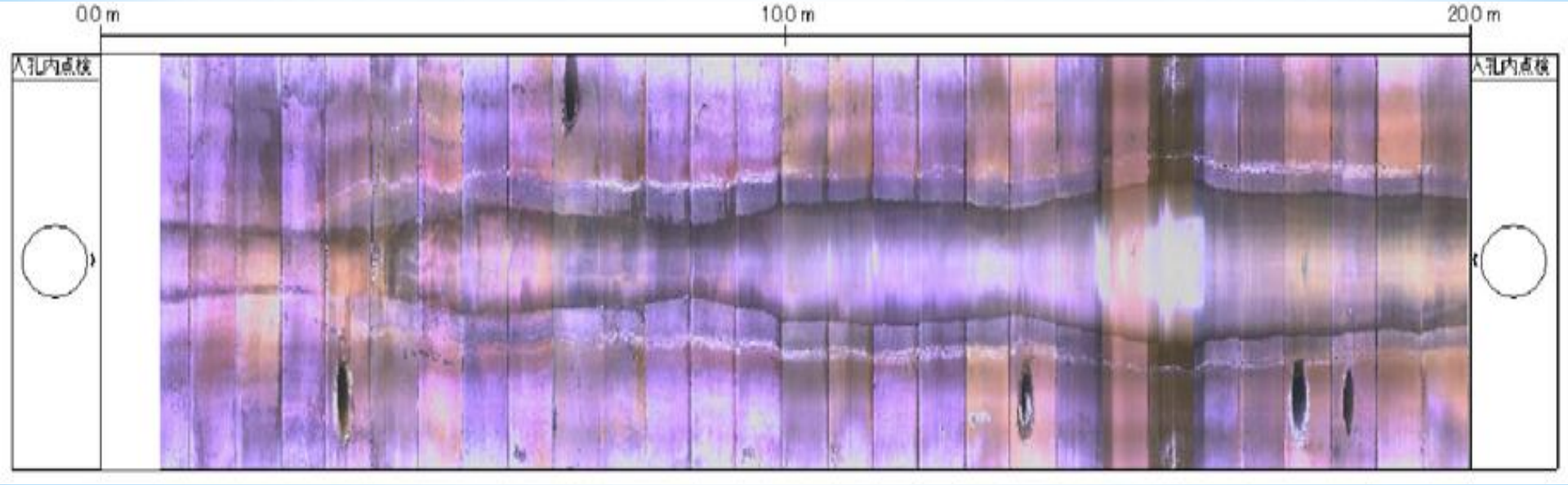


B

* Unfolding point=180°(The image is unfolded from bottom center.)
Usually the image is unfolded from top center.

Image unfolding system for inner conduit

Unfolded image



Conduit inspection diagnosis supporting system

Conduit inspection diagnosis supporting system

(1) Digital image recorded through multi-vision camera
(2) Image unfolding system for inner conduit

Both are combined.

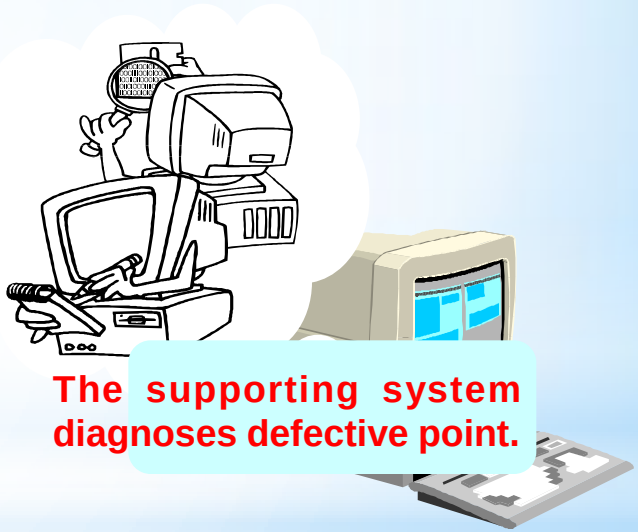
- It is a supporting system to detect damages in conduit.

【Detection】

Damage, crack, gap, trace of water, slack, protrusion of house collecting sewer, intruding water, etc.

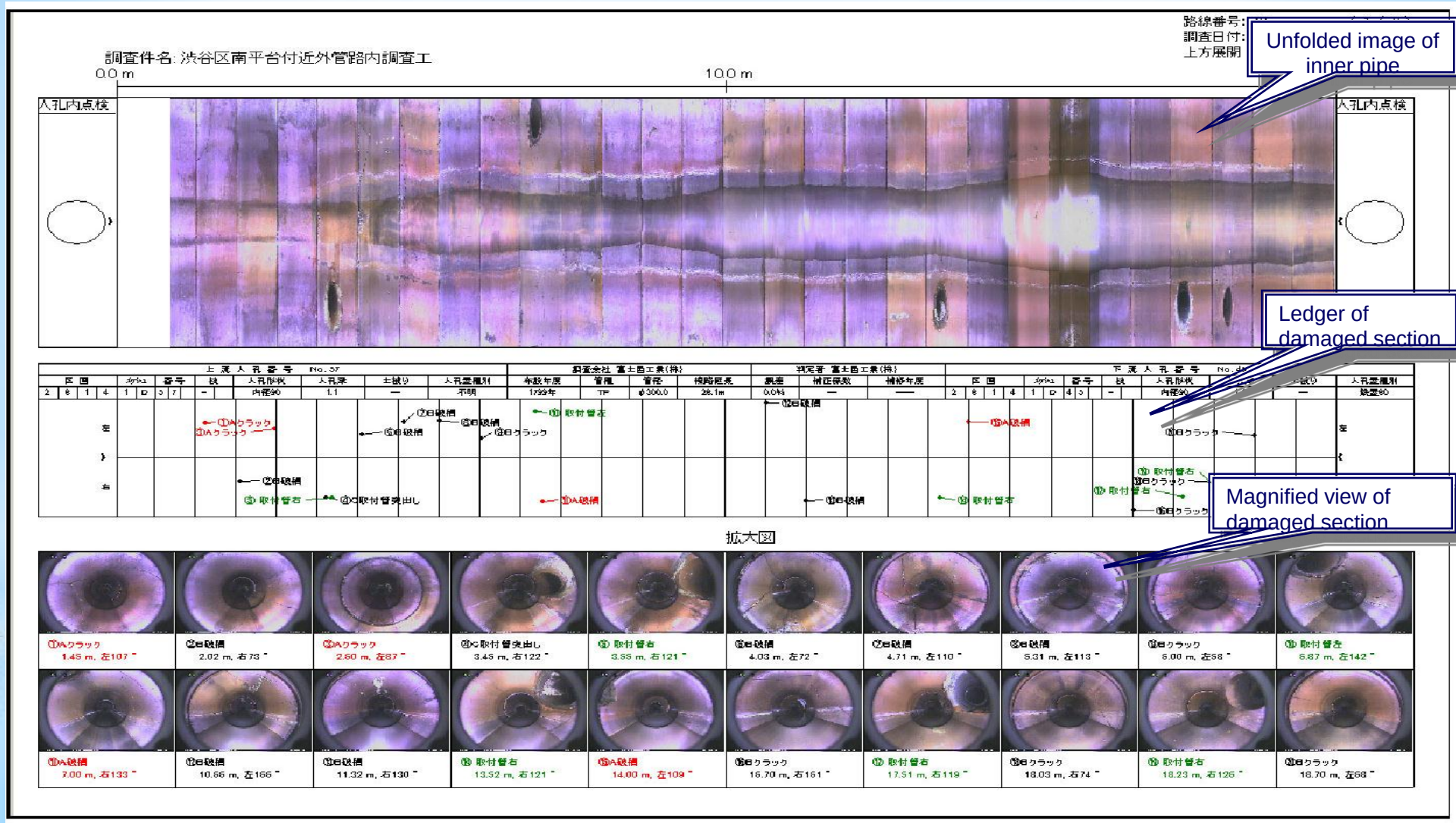
Conduit inspection diagnosis supporting system

The system replaces the on-site diagnosis by operator with the one through PC in the office.



***The system is semi-automatic, requiring final judgment by engineer.**

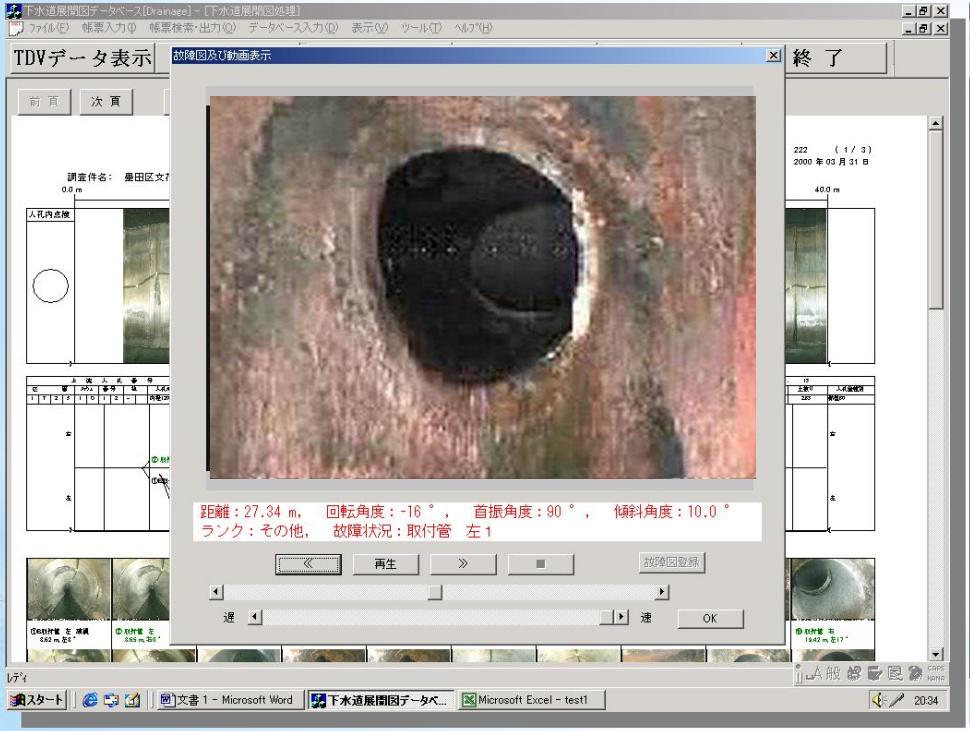
Ledger of unfolded image of inner conduit



Unfolding image system for inner conduit

Magnified view

Motion picture



Magnified view of damaged section and connecting section of house collecting sewer

Inner pipe image replayed in motion picture for maximum 1 span interval

Inner sewer inspection

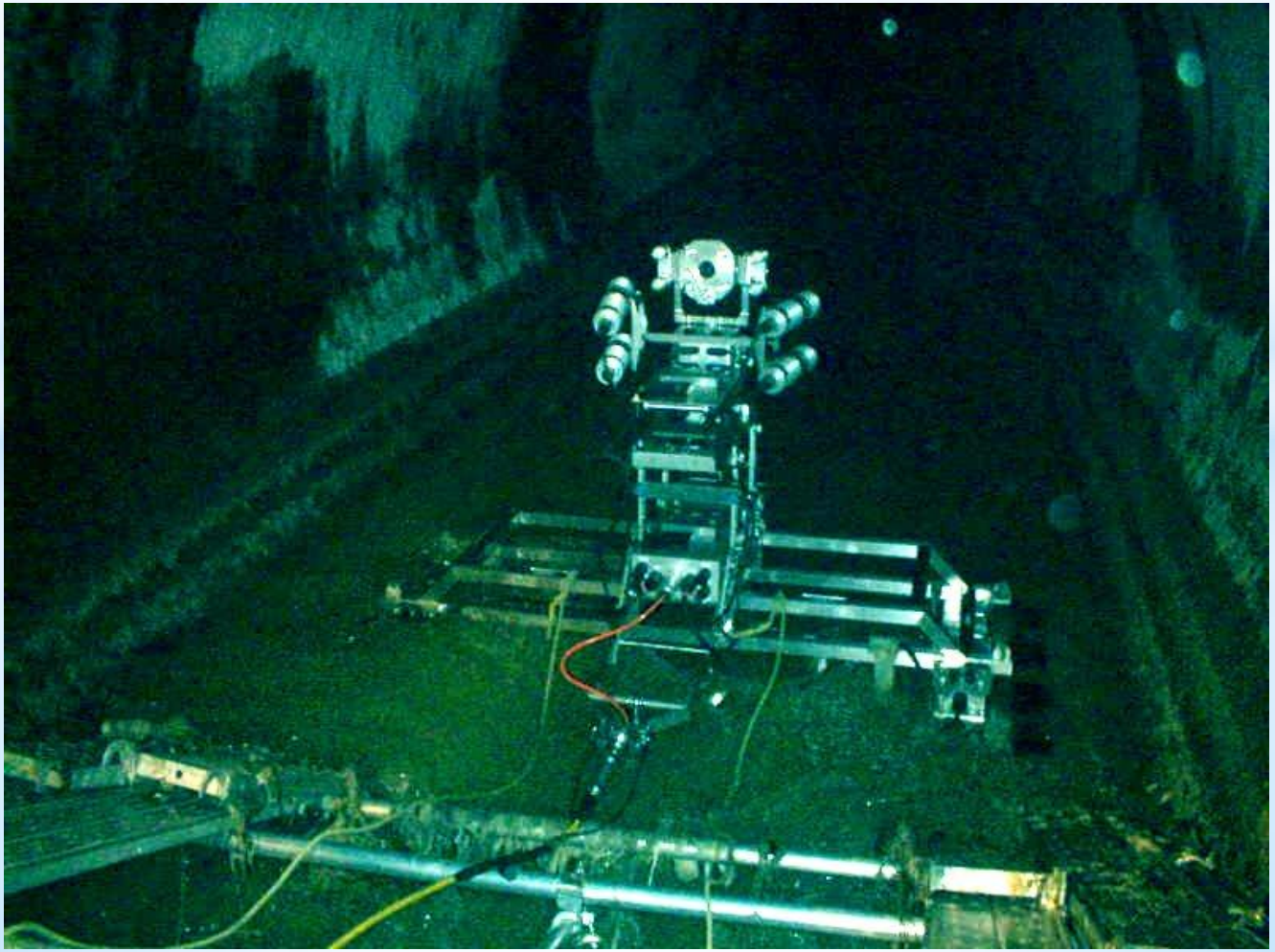
Main sewer (Inner diameter 800mm or over)

Inner sewer inspection: boat video camera inspection

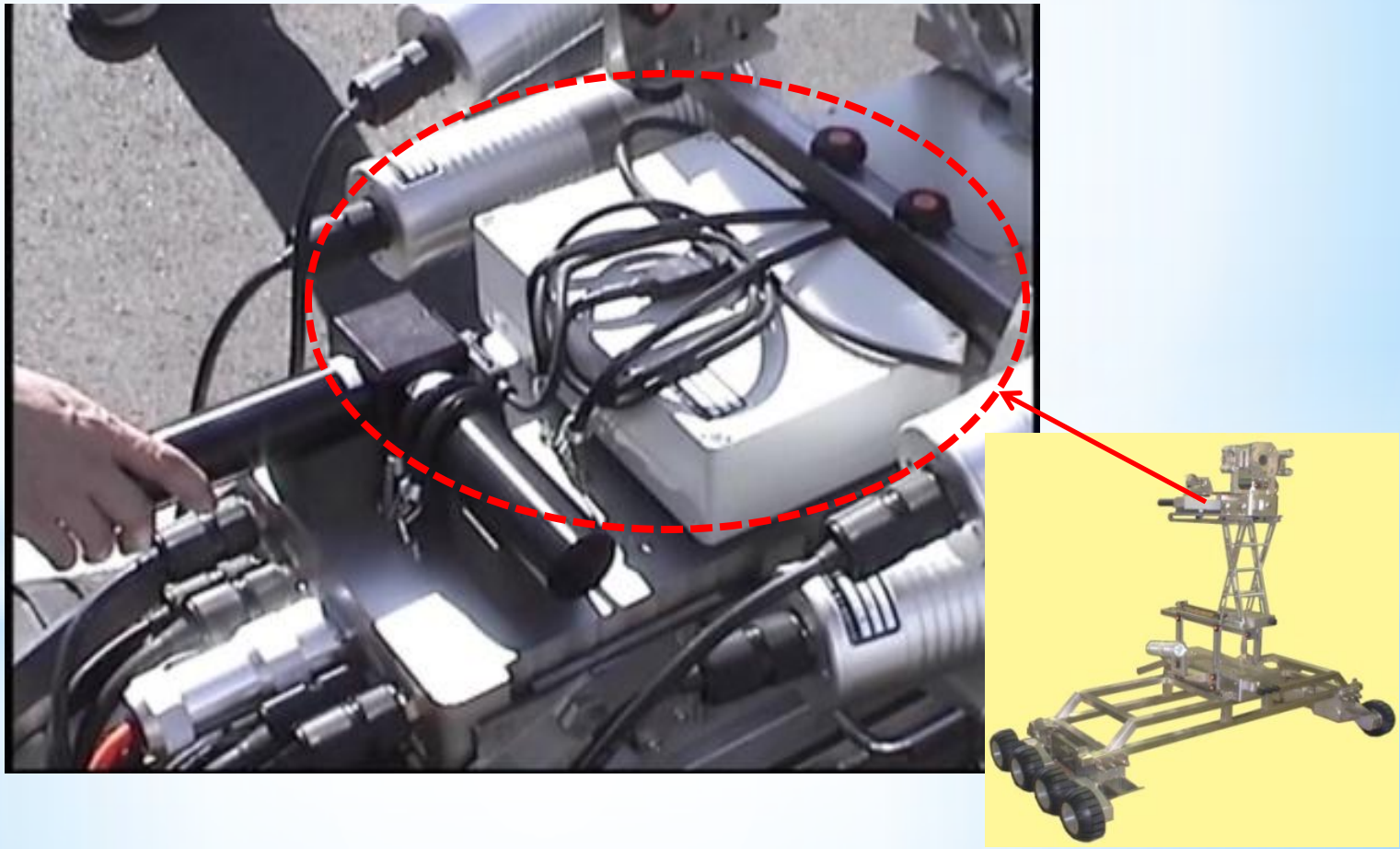
(Inspection of the inaccessible area due to water level or flow speed)

Inner sewer inspection: self-propelled video camera inspection

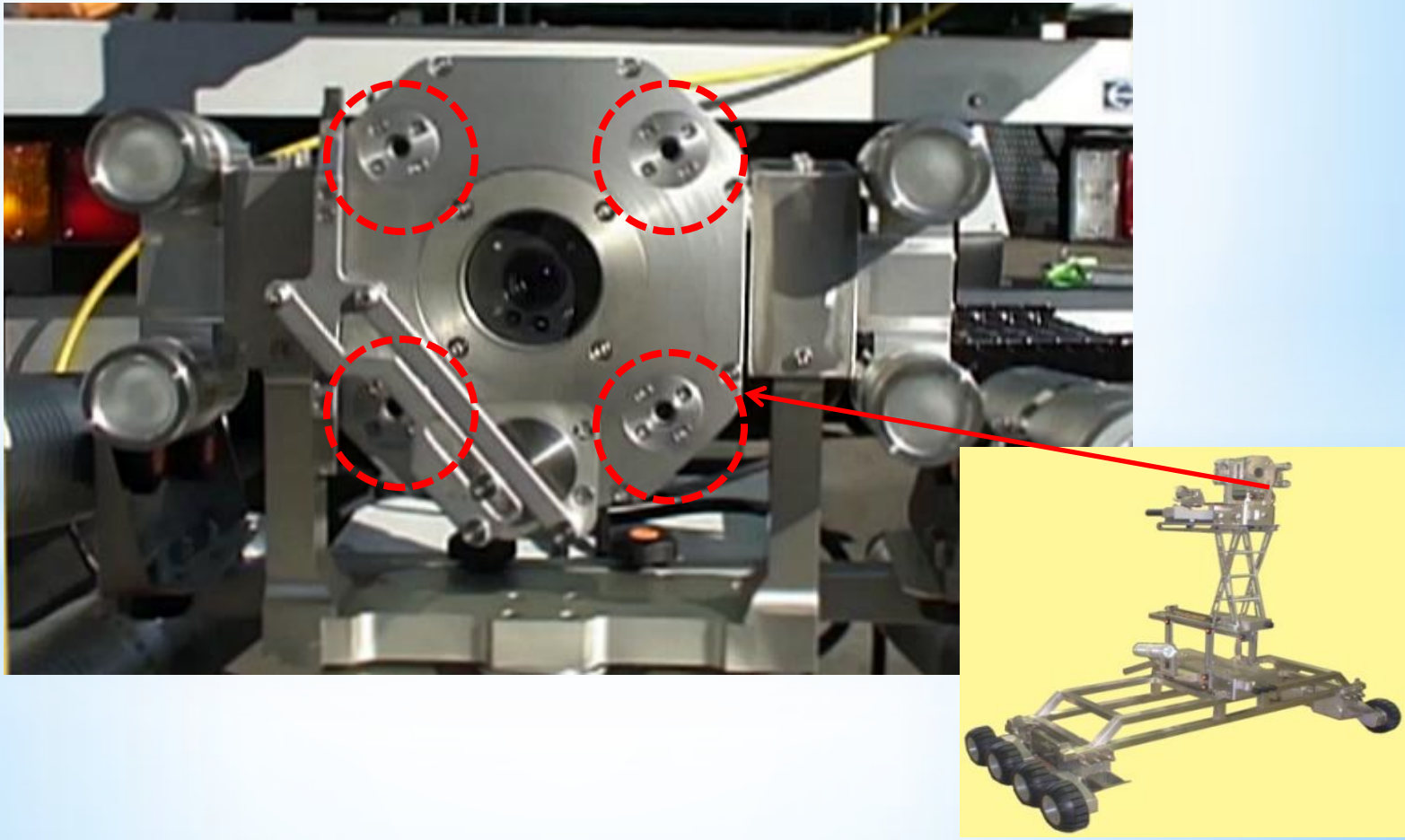
(Inspection of the hazardous area such as high H_2S density)



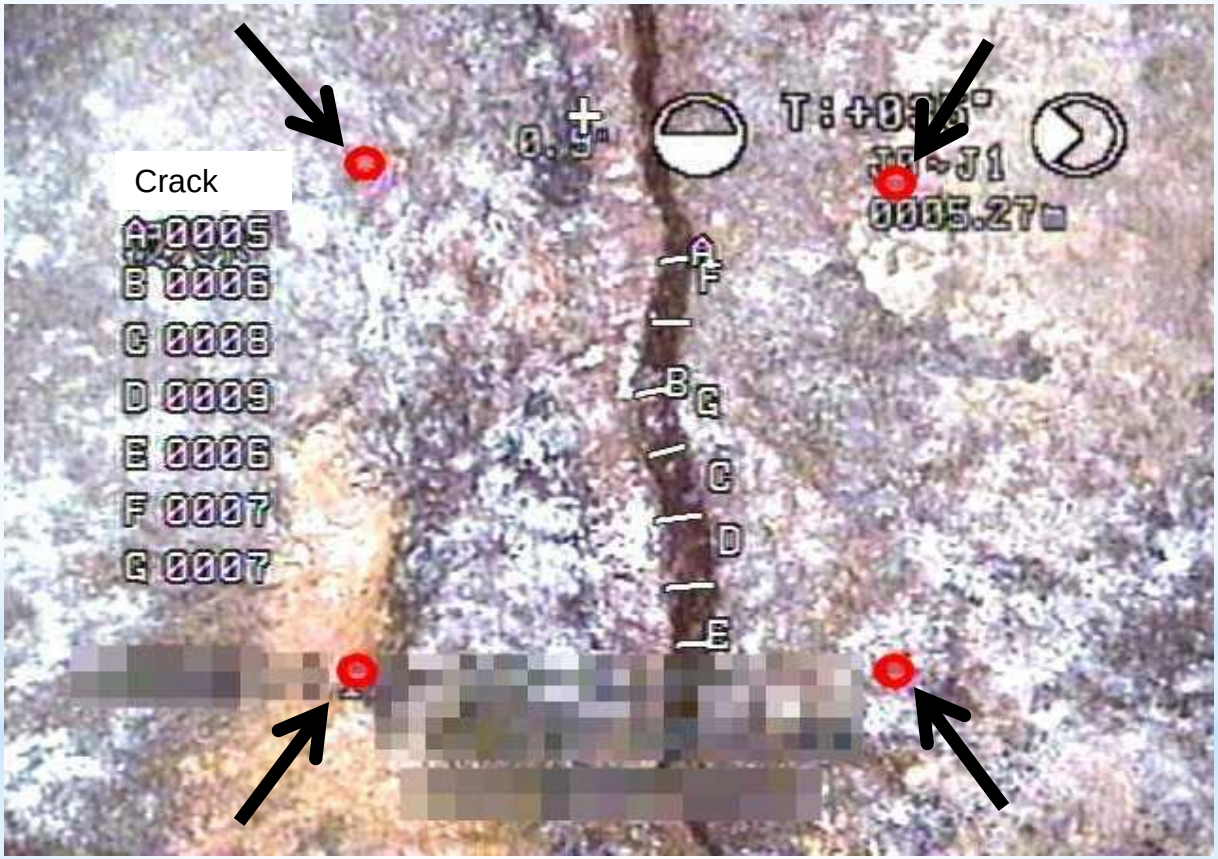
H_2S and O_2 density sensors



4-pointlaser device is mounted



Measurement by 4-pointlaser device



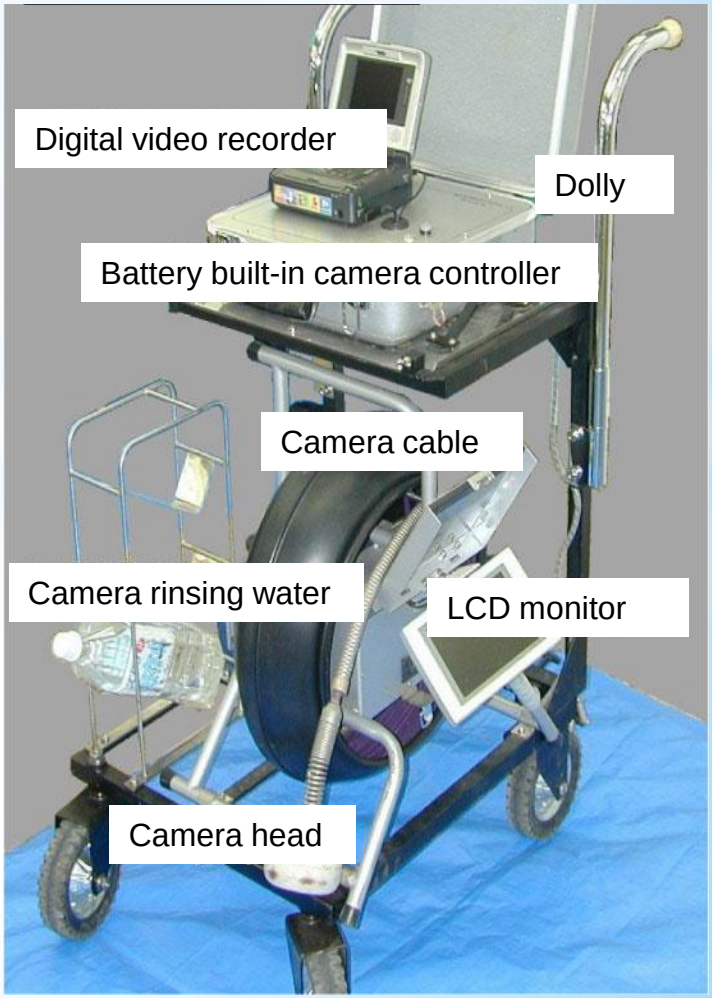
Overcoming roadblock

Inner sewer inspection

House collecting sewer

Inspection of house collecting sewer (simplified TV monitor)

Inspection by video camera (House collecting sewer with diameter between 150㎜ and200㎜) : Inspection of sewer damage and degradation is made by inserting a purpose-designed compact camera from house inlet.



Applications of Inner Sewer Inspection Equipment

【From reported samples】

(1) Application in inaccessible area such as narrow place or under ground
- Mirror-reflection, multi-vision camera

(2) Application in difficult-to-inspect and work area
- Boat video camera
- Self-propelled video camera

(3) Application in order to reduce differences by individual skill
- Conduit inspection diagnosis supporting system

Further expansion of application is expected.

End of presentation.
Thank you.