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May 6-11, 2018 in Istanbul, Turkey

Investigation on Appropriate Surveying Method Following the National Disaster Damage Investigation System



10th of May, 2018
Istanbul Congress Center

[BongBae, JANG
JuneHwan, Koh] Republic of Korea



01 Overview

1-1 Background

1-2 Objective

1-3 Research Flow

1-1 Background



People

Earthquake: **My house is safe or not?**

People can not accept the investigation outcome. **Still Feel FEAR**

Daily newspaper 28 Nov.

2017



Local government

Lack of specialized manpower

Lack of expertise due to frequent job rotation

Overwork(recovery, response, complaint, etc.)

Research institute

Lack of basic disaster information

Lack of field workforce for cause analysis



국립산림과학원
NATIONAL INSTITUTE OF FOREST SCIENCE



국립농업과학원
NATIONAL ACADEMY OF AGRICULTURAL SCIENCES



국립재난안전연구원
NATIONAL DISASTER MANAGEMENT INSTITUTE

Necessity of appropriate surveying method

Objective

**Identify appropriate surveying method
for monitoring national disaster
damage**



Main topic

- 1** Review of disaster survey methodology
- 2** Case Studies
- 3** Identification of best solution



1-3 Research Flow



Identify optimal surveying



Time-series data collection

1 week

3 week

4 week

6 week

8 week



Person in charge
Identify requirements



『Framework Act on Disaster Safety』
Reform Act



•(MMS/UAV)•
The latest technology



02

Establishing Disaster Investigation Methodology

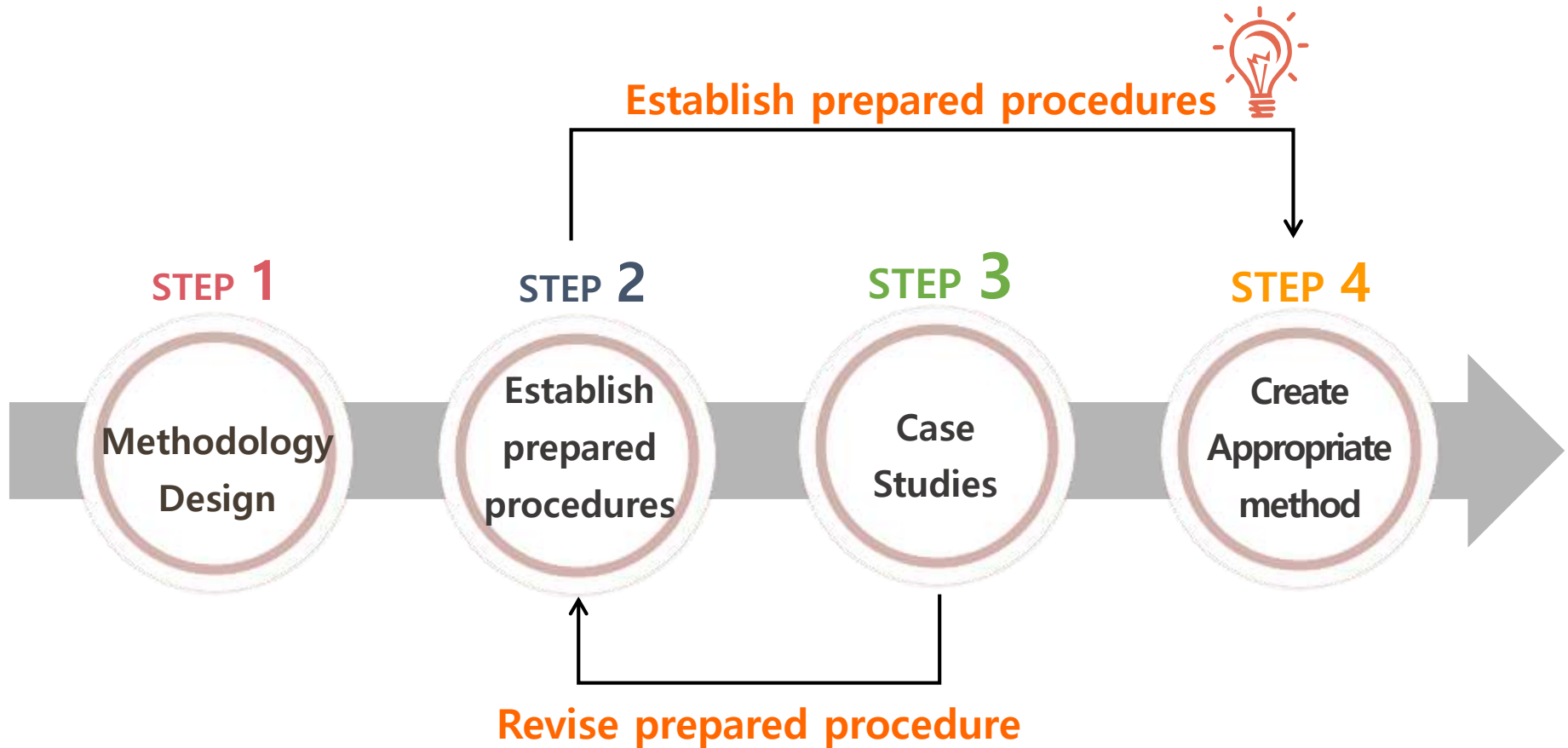
2-1 Flowchart

2-2 Reviewing Investigation

Methods

2-3 Investigation Procedures

2-1. Flowchart



2-2 Reviewing Investigation Methods

Direct Measurements



RTK



LiDAR



T/S



APP



Remote Sensing



Rotary wing



Fixed wing

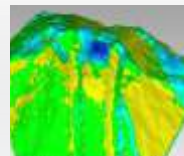
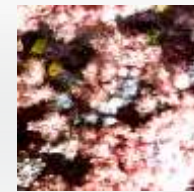


Image Analysis



Thermo-graphic
NIR Camera

GX1: NIR range



Early Investigation

Land Survey APP

- Response early inv.
- Input convenient info.
- Use for spot survey

Detailed investigation

RTK

- Real Time data collection
- Accurate measurement
- Rapid surveying

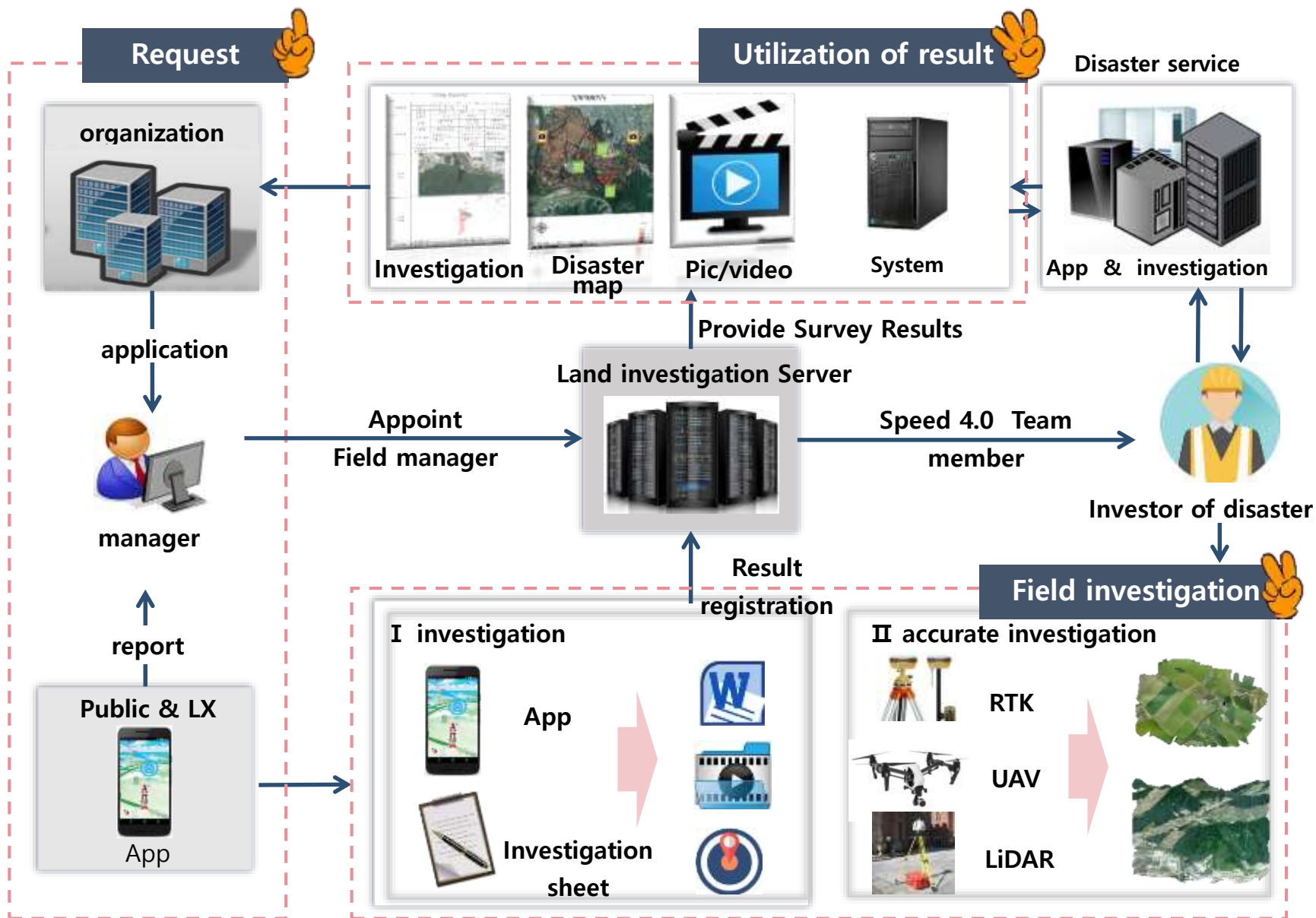
LiDAR

- 3D shape & point
- mm-level accuracy

UAV

- Ortho Photo, 3D data
- Capture in unapproachable area

2-3 Investigation Procedures



A low-angle photograph of a building under construction, showing a dense grid of steel reinforcement. In the foreground, a person's silhouette is visible, holding a surveying instrument (a theodolite or similar) up to their eye. The sun is bright, creating a lens flare effect. The sky is blue with some clouds. The image is partially obscured by a grey overlay on the right side.

03 Case Studies

3-1 Type & Scope

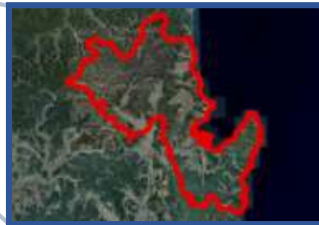
3-2 Case Studies

Case1. Landslide

Case2. Earthquake

3-1 Type & Scope of Case Studies

Type of case studies



Forest fire

17.05.06.
Gangueng

Hail

17.09.19. Choongju

Earthquake

17.11.15. Pohang

Mountain landslide

17.07.16.
Choongju

3-2 Case study _ 1 Landslide

1. Precision Investigation

**[Method I]
Tracking App**



Utilize App -> measure destroyed area



Time	26min/ 3min
Area	3,000m ²
Difference	-339m ²
Result	Rapid info. No Equipment

**[Method II]
T/S**



Measure Destroyed area



Time	58min/ 7min
Area	3,339m ²
Difference	Standard
Result	Difficult measuring

**[Method III]
RTK**



Obtain coordinate



Time	37min/ 15min
Area	3,454m ²
Difference	115m ²
Result	Multipath

**[Method IV]
UAV**



Acquire Ortho-photo



Time	28min /240min
Area	3,622m ²
Difference	283m ²
Result	Safe location various uses

RTK is the most suitable method (Direct measurement method with rapid and good accuracy)

UAV provides a highly accurate ortho-images and can be used for various disaster monitoring

UAV is one of the most effective and efficient methodologies for landslide

3-2 Case study _ 1 Landslide

2. Landslide Maps



① Attribute data

- Orthphoto, 3D Image, Video, DATA of destroyed areas

areas 지번별 피해현황					
지번	면적(m ²)	소유	지번	면적(m ²)	소유
산36-1	3622	최**	263-38	193	국유
87	334	최	263-39	307	국유
187	64	국유	264	32	김
지188	129	시유	363-39	307	국유
지88-4	479	조	지		

산사태 피해현황	
발생일시	2017.07.16.
촬영일시	2017.11.02.
피해면적 (m ²)	유실 : 1984 / 758 매물 : 1638 / 4208 전체 : 3622 / 4966

<산사태 흔적도 정보>

② Application

- Report to VIP
- Data Upload in Real-Time level
- Masterplan for Damage reduction
- Certification for damaged



<Landslide Information System>

Field Investigation

① Analysis of current and further damages



② Video and Photos for data acquisition



③ Level of risk

0 = Mini, 1 = Minor, 2 = Normal, 3 = Critical, 4 = Max

Interview

① Interview for residents

Personal	name	sex	age	Residence peood	Address
Date	이 * 구	남	60대	30년 이상	흥해읍 흥해로 88
Contents Of Interviews	Date				17.11.15.
	Location				북구 흥해읍
	Cause of Damage				지진파 증폭
	Damage Condition	인명피해			경상 2명
시설물			집기류, 벽체 파손		
농경지			해당사항 없음		
기타			벽체 갈라짐		
Opinion	피해단계 4 극심 예상				



MMS procedure



① Decide area



② MMS driving



③ Acquire image



④ scanning(Point cloud)



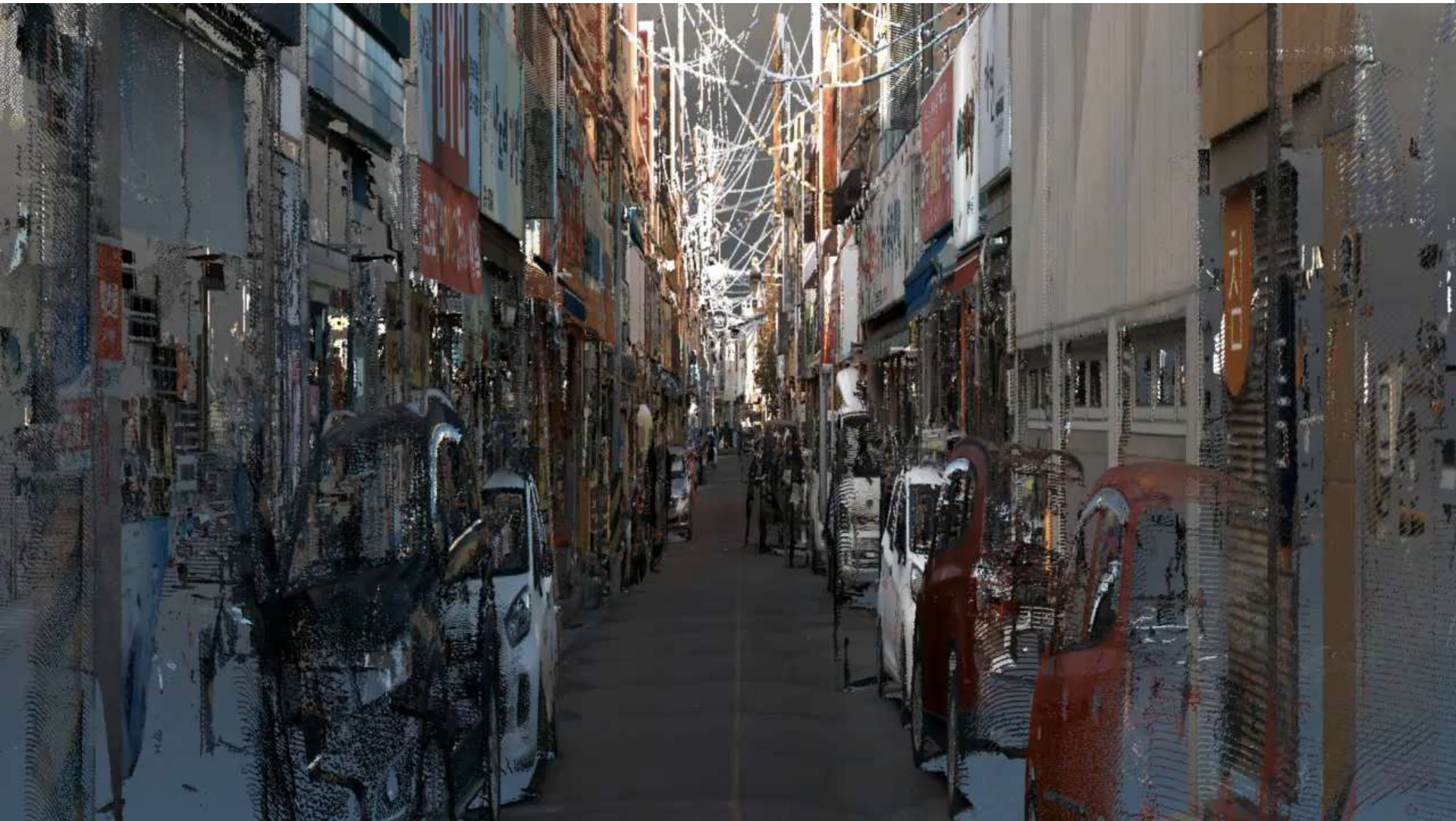
⑤ processing



⑥ results

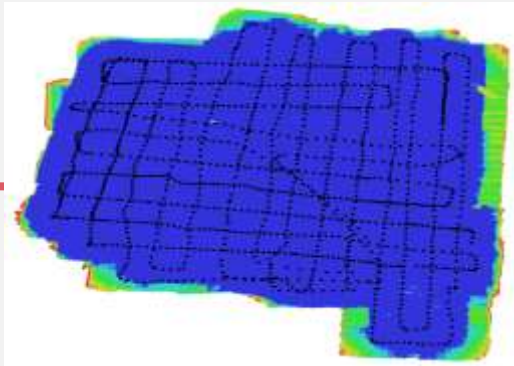
*MMS(Mobile Mapping System) : rapid data acquisition method for 3D images with Camera, Laser scanner, GPS, INS, etc.

3-2 Result of the MMS



3-2 Case study-2. earthquake

UAV survey procedure



① Planning



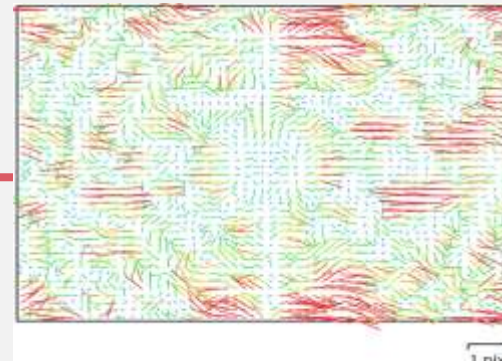
② GCP surveying



③ Data collection (flying)



④ Digital Elevation Modeling



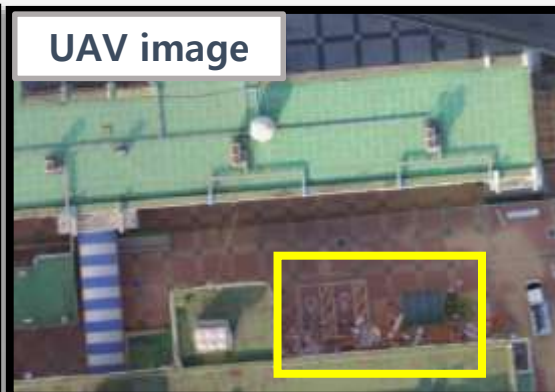
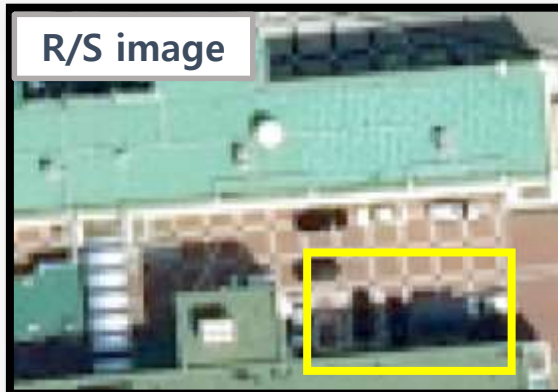
⑤ processing



⑥ results

3-2 Case study-2. earthquake

UAV mapping & decipher



It is possible to judge the damage at location where it is impossible to survey
(narrow road, roof) ➡ Offer a few centimeter spatial resolution

3-2 Case study-2. earthquake

Building damage classification

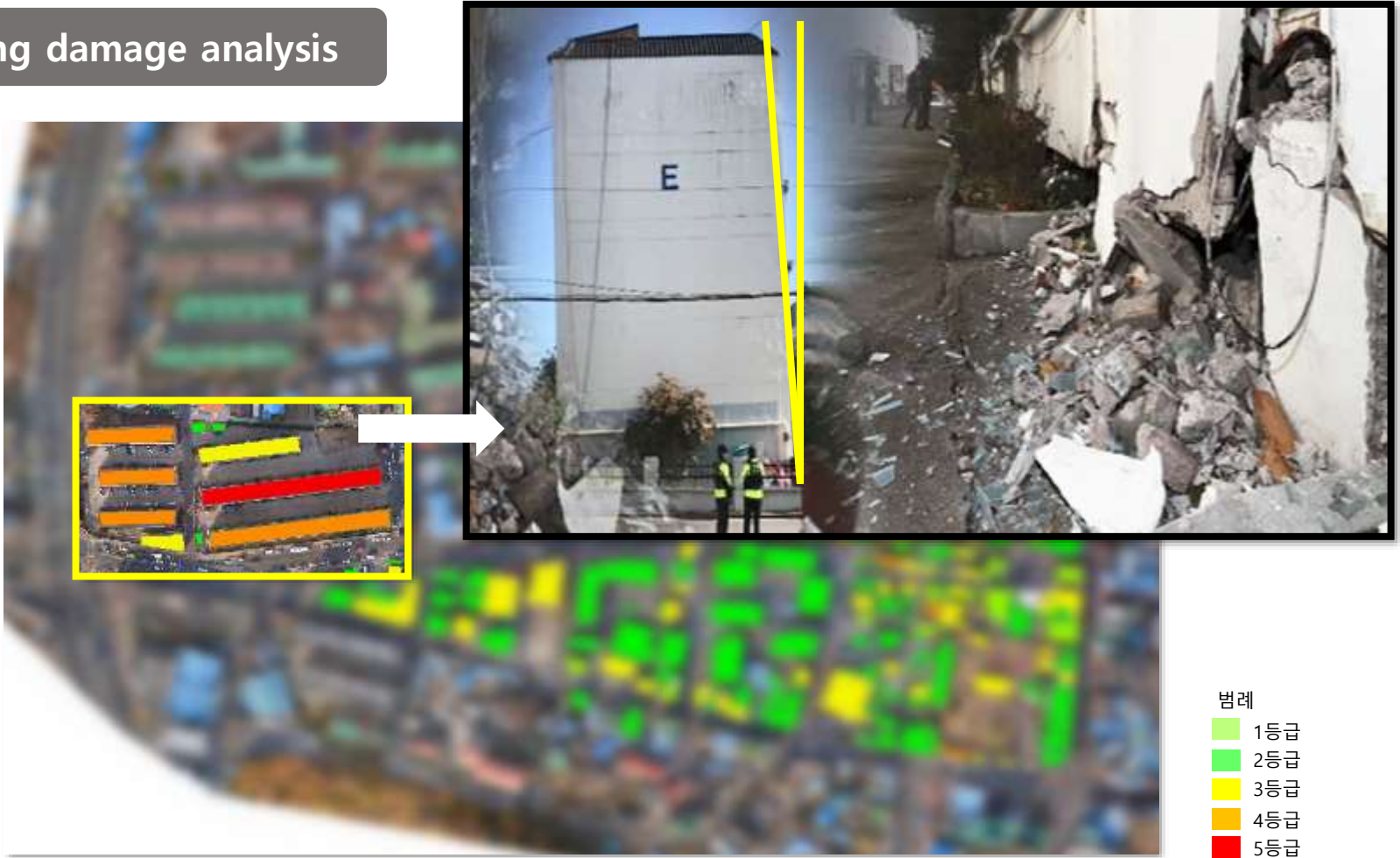


MMS(slope, well crack, damage) + UAV(well damage, roof damage)

➡ classification about building damage

3-2 Case study-2. earthquake

Building damage analysis



MMS(slope, well crack, damage) + UAV(well damage, roof damage)

➡ classification about building damage

3-3 Implication

MMS

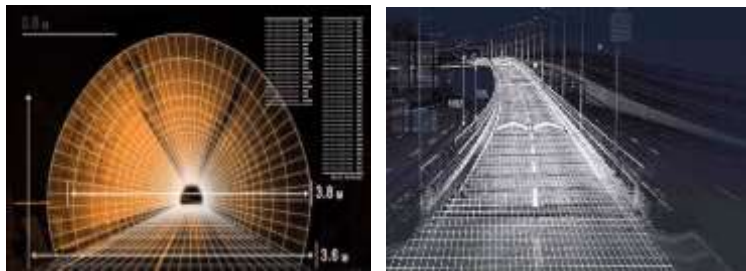
Merit

1. Rapid Acquisition of data by using vehicle
2. Acquisition of Precise data

Demerit

1. Have to employ vehicles
2. Difficulty in obtaining data of roof of building

Application



Precise maps through **automatous vehicle**
Safety inspector **for roads and tunnels**

UAV

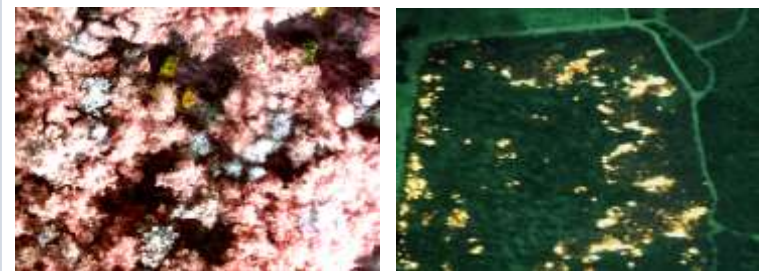
Merit

1. Securing Safety of investors
2. Obtaining data of roof of building

Demerit

1. Taking time for flight admission
2. Difficulty in getting side view

Application



Through a Variety of sensors,
people rescue and estimate for **damaged areas**



04 Conclusion

4-1 Conclusion

National disaster damage investigation system was designed.

The most appropriate surveying method was identified by two case studies.

Case Study 1

For the landslide disaster four different methods were compared and analyzed.(APP, TS, RTK, UAV)

➡ UAV is the fastest and safest method

Case Study 2

MMS and UAV methods for earthquake area investigation were compared and analyzed. As a result, a precise 3D mapping result could be produced using the MMS method, but it was not possible to obtain data in certain areas such as earthquake area, roof tops and upper section of buildings where vehicles are not able to approach. Therefore, it could be concluded that both of methods utilizing UAV and MMS should be applied in appropriate combination.

Thank You !



Q & A

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