Efficient Cadastral Survey Methodology In Natural Disaster region
- Case study in Korea -

[BongBae, JANG Republic of Korea]

27th of Sep. 2018
Bergen Norway

Korea Land and
Geospatial InformatiX Corporation

Contents

01 Overview

1-1 Background

1-2 Objective

1-3 Key issues

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.)

국립산림과학원 NATIONAL INSTITUTE OF FOREST SCIENCE

RDA 농촌진흥청 국립농업과학원 NATIONAL ACADEMY OF AGRICULTURAL SCIENCE, RDA

국립재난안전연구원 NATIONAL DISASTER MANAGEMENT INSTITUTE

Research institute

Lack of basic disaster information

Lack of field workforce for cause analysis

Necessity of appropriate surveying method

1-2 Objective

Objective

Identify appropriate cadastral surveying method for monitoring national disaster damage

Main topic

1 Review of disaster cadastral survey methodology

2 Case Studies

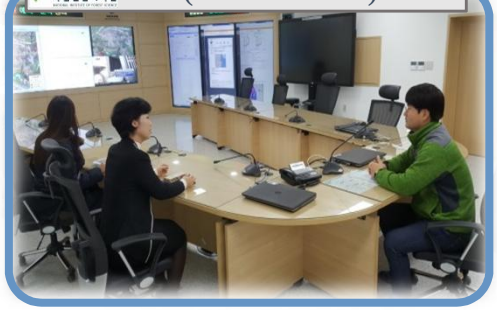
3 Identification of best solution

1-3 Key Issues

case study 1
(Landslide)

Identify optimal surveying

Discussion
(collaboration)



Time-series data collection

1 week

Person in charge
Identify requirements

3 week

visitation safety depart.

4 week

• 『Framework Act on Disaster Safety』
Reform Act

6 week

National Assembly

8 week

•(MMS/UAV)•
The latest technology

case study 2
(Earthquake)

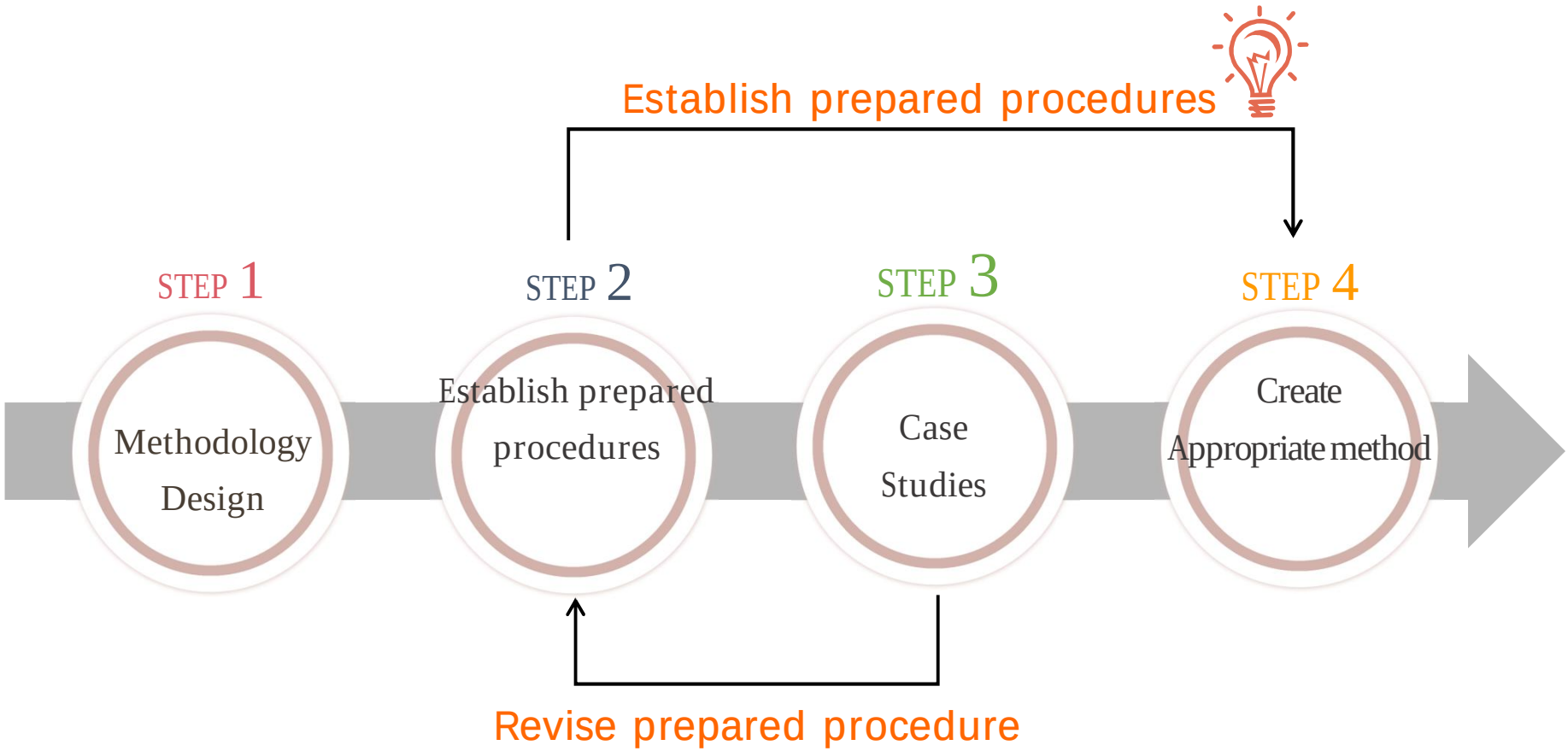
02 Establishing Disaster Investigation Methodology

2-1 Selection of Disaster Types

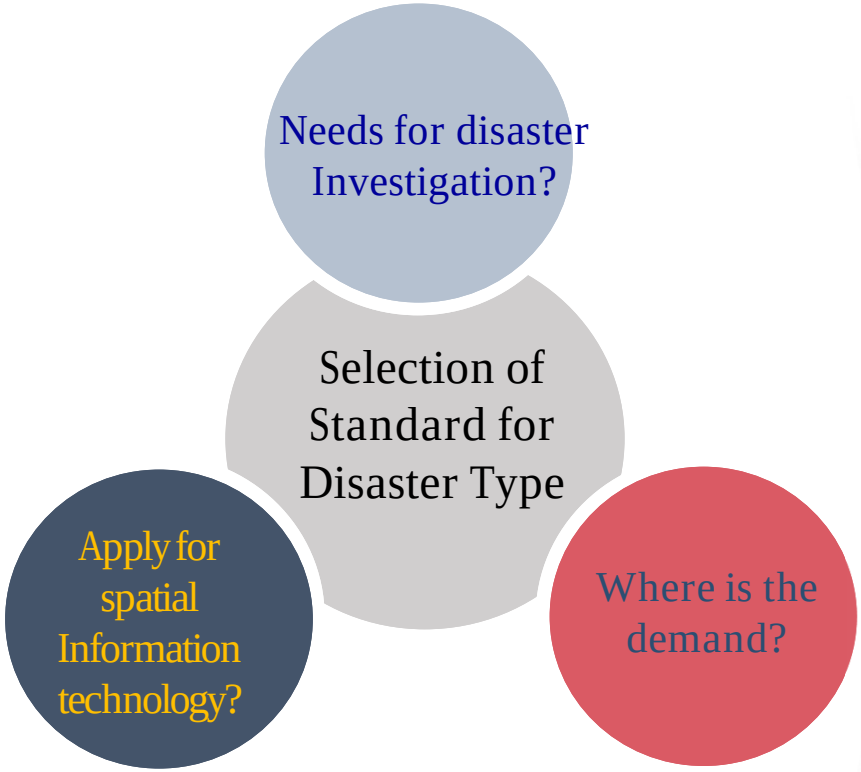
2-2 Reviewing Investigation Methods

2-3 Investigation Procedures

Flowchart


Establish prepared procedures
STEP 1
Methodology Design
STEP 2
Establish prepared procedures
STEP 3
Case Studies
STEP 4
Create Appropriate method
Revise prepared procedure

2-1 Selection of Disaster Types



Forest Fire / Hailstone
Landslide / Earthquake

2-2 Reviewing Investigation Methods

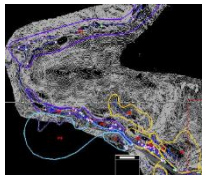
Direct Measurements

RTK

LiDAR

T/S

APP



Remote Sensing

Rotary wing

Fixed wing

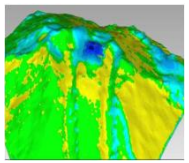
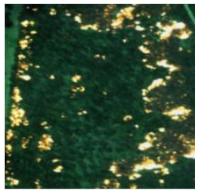


Image Analysis

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

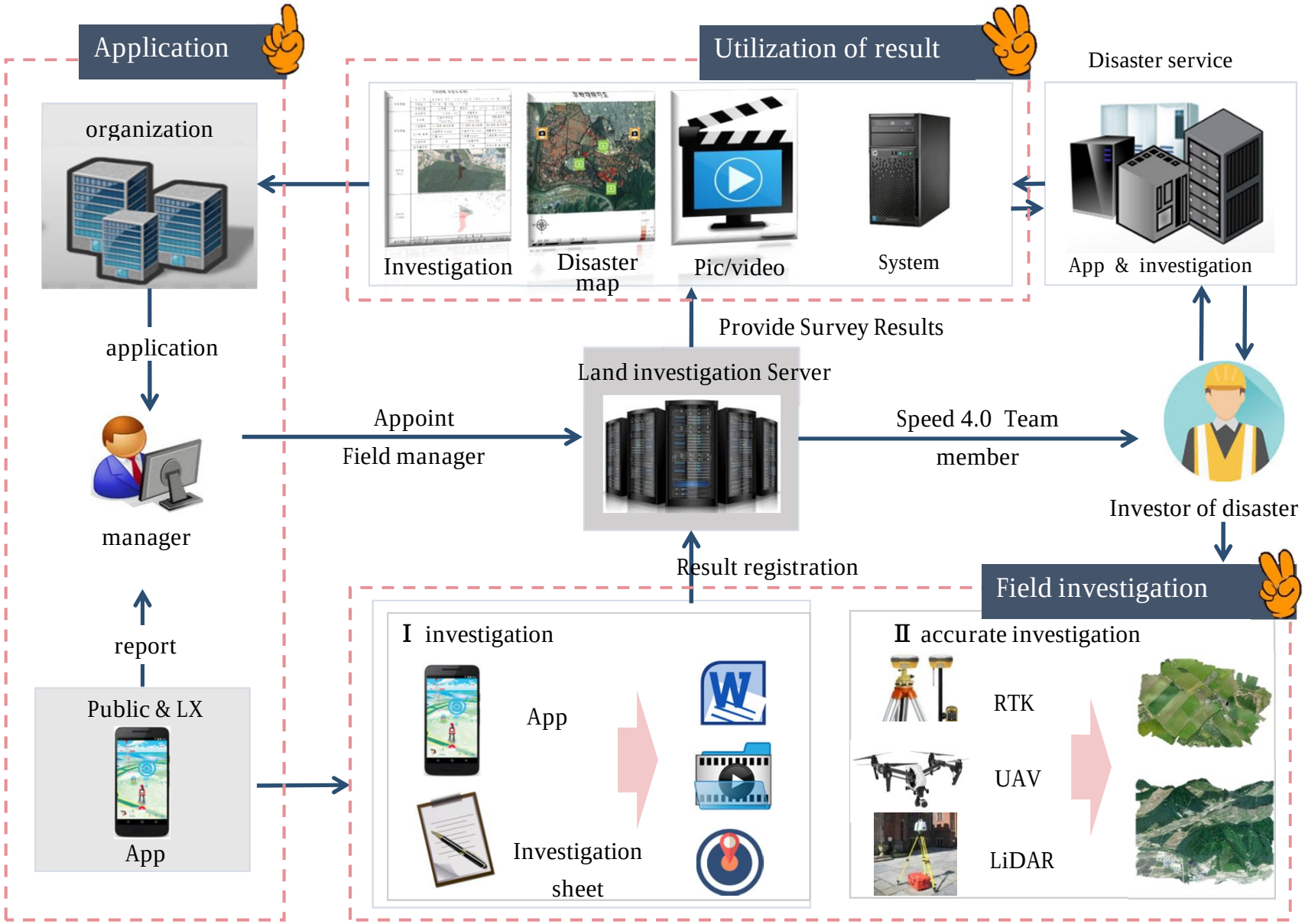
LiDAR

- 3D shape & point
- mm-level accuracy

UAV

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

2-3 Investigation Procedures



03 Case Study

3-1 Type & Scope

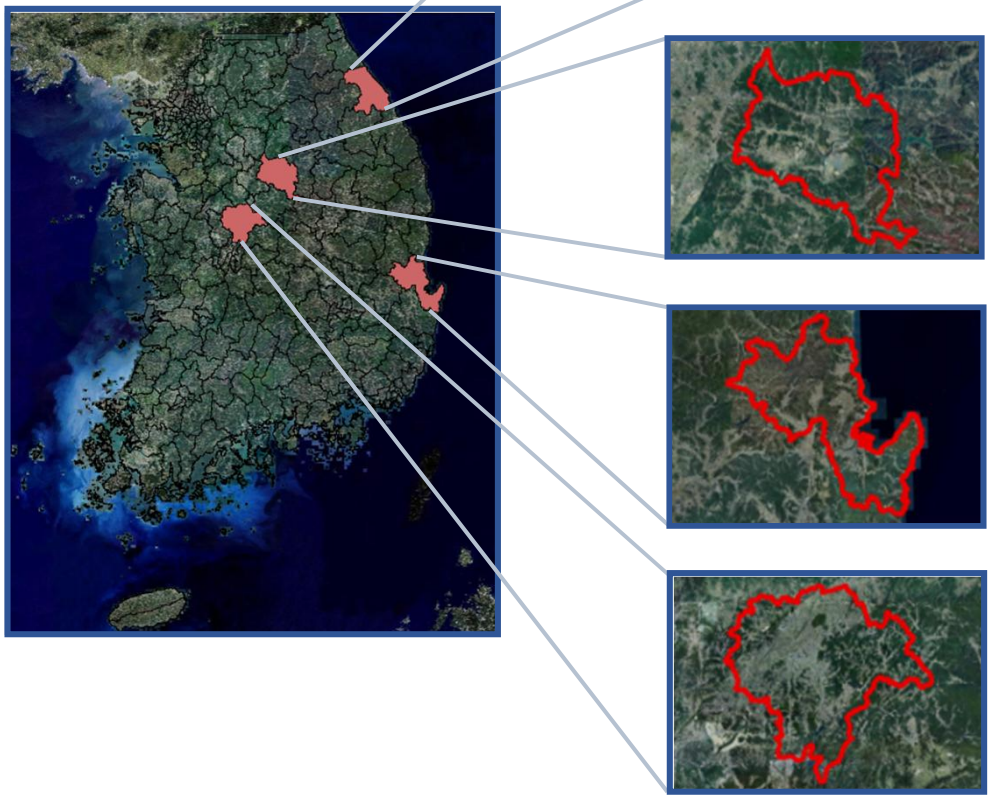
3-2 Case Studies

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

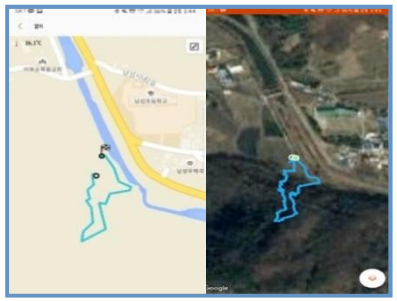
17.07.16. Choongju

3-2 Case study _ 1 Landslide

1. Precision Investigation

[Method 1] Tracking App

Utilize App -> measure destroyed area



Time	26min/ 3min
Area	3,000㎡
Difference	-339㎡
Result	Rapid info. No Equipment

[Method 2] T/S

Measure Destroyed area

Time	58min/ 7min
Area	3,339㎡
Difference	Standard
Result	Difficult measuring

[Method 3] RTK

Obtain coordinate

Time	37min/ 15min
Area	3,454㎡
Difference	115㎡
Result	Multipath

[Method 4] UAV

Acquire Ortho-photo

Time	28min /240min
Area	3,622㎡
Difference	283㎡
Result	Safe location various uses

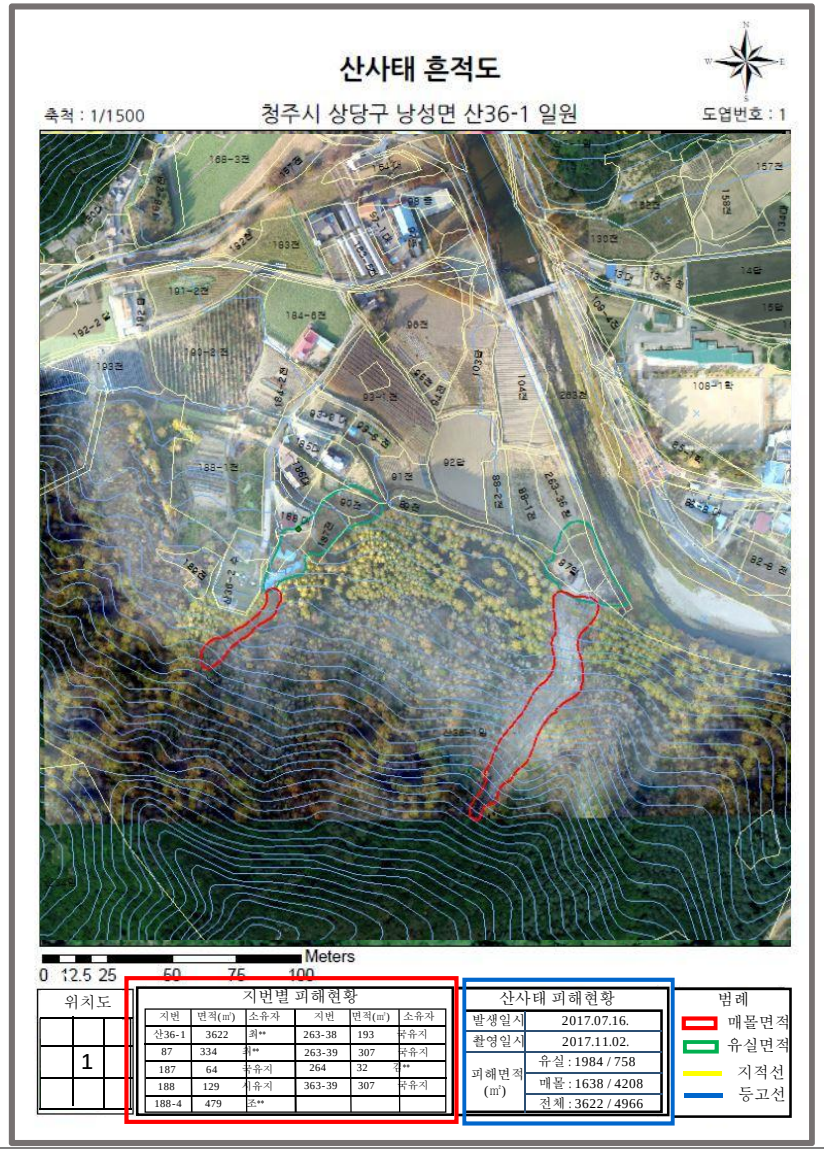
RTK is the most suitable method (Direct measurement method with rapid and good accuracy)

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

지번별 피해현황

지번	면적(㎡)	소유자	지번	면적(㎡)	소유자
산36-1	3622	최**	263-38	193	국유지
87	334	최**	263-39	307	국유지
187	64	국유지	264	32	김**
188	129	시유지	363-39	307	국유지
188-4	479	조**			

산사태 피해현황

발생일시	2017.07.16.
촬영일시	2017.11.02.
피해면적(㎡)	유실 : 1984 / 758
	매몰 : 1638 / 4208
	전체 : 3622 / 4966

<산사태 흔적도 정보>

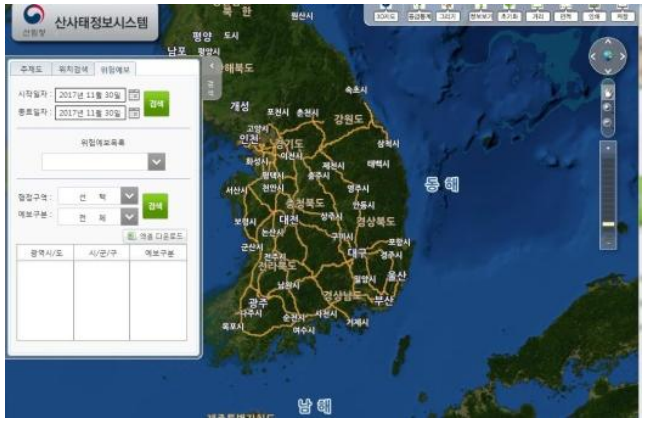
② Application

§ Report to VIP

§ Data Upload in Real-Time

§ Masterplan for Damage reduction

§ Certification for damaged level



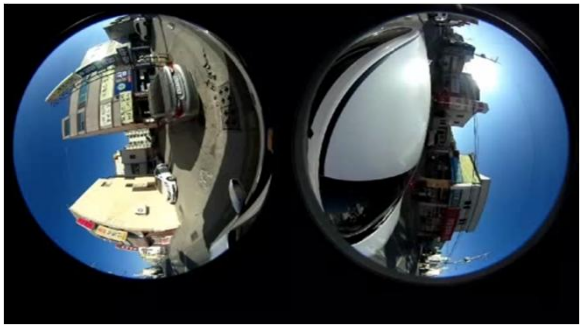
<Landslide Information System>

3-2 Case study _ 2 Earthquake

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

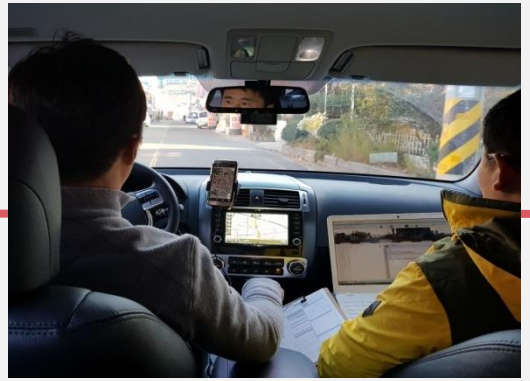
Interview

① Interview for residents

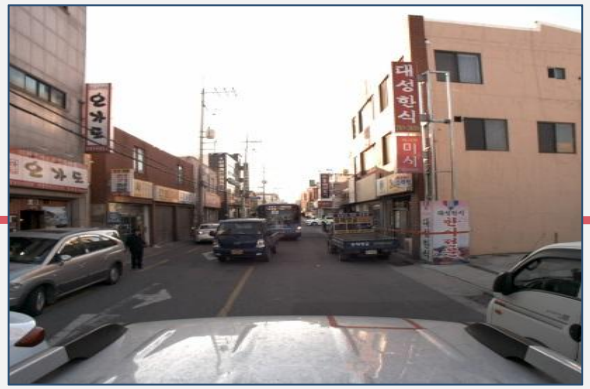
Personal Date	name	sex	age	Residence peood	Address
	이 * 구	남	60대	30년 이상	흥해읍 흥해로 88
Contents Of Interviews	Date				17.11.15.
	Location				북구 흥해읍
	Cause of Damage				지진파 증폭
	Damage Condition		인명피해		경상 2명
			시설물		집기류, 벽체 파손
			농경지		해당사항 없음
			기타		벽체 갈라짐
Opinion	피해단계 4 극심 예상				

MMS procedure

① Decide area

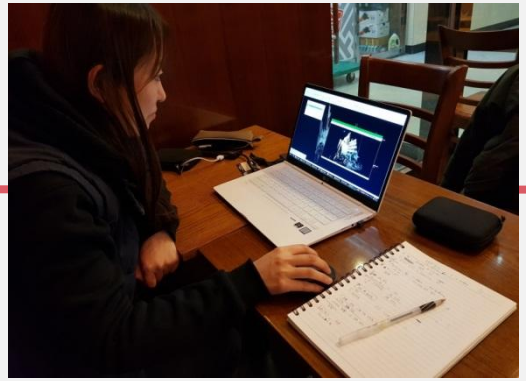


② MMS



③ Acquire image

④scanning(Point cloud)

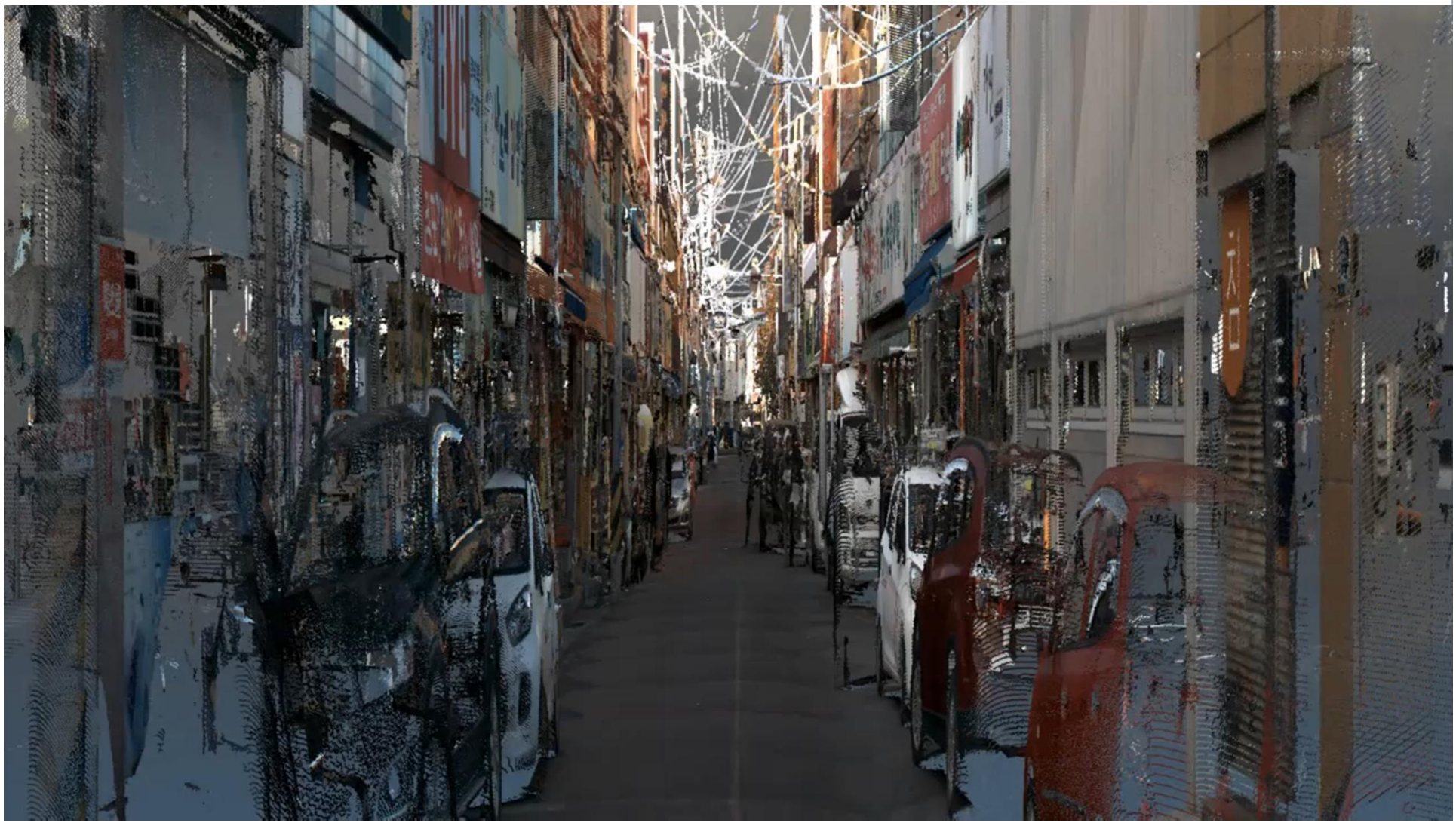


⑤ processing

⑥ results

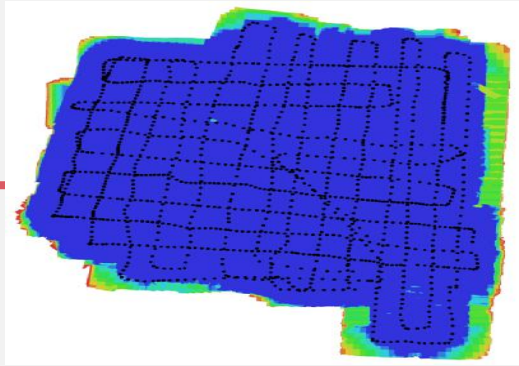
*MMS(Mobile Mapping System) : rapid data acquisition method for 3D images with Camera, Laser scanner, GPS, INS, etc.

3-2 Result of the MMS

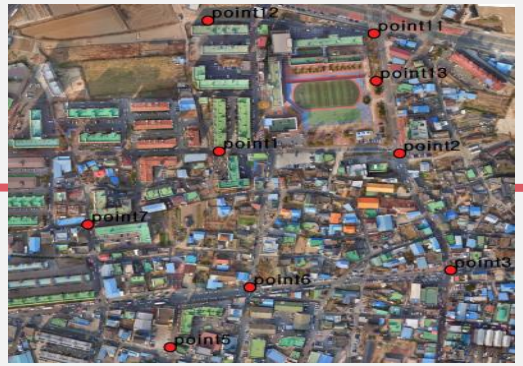


3-2 Case study-2. earthquake

UAV survey procedure

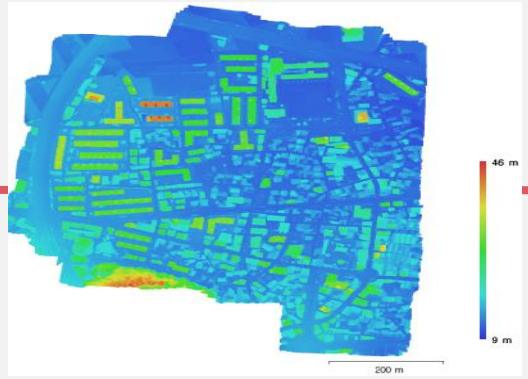


① Planning

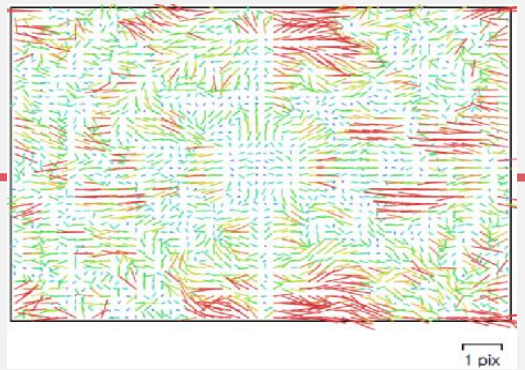


② GCP surveying

③ Data collection(flying)



④ Digital Elevation Modeling

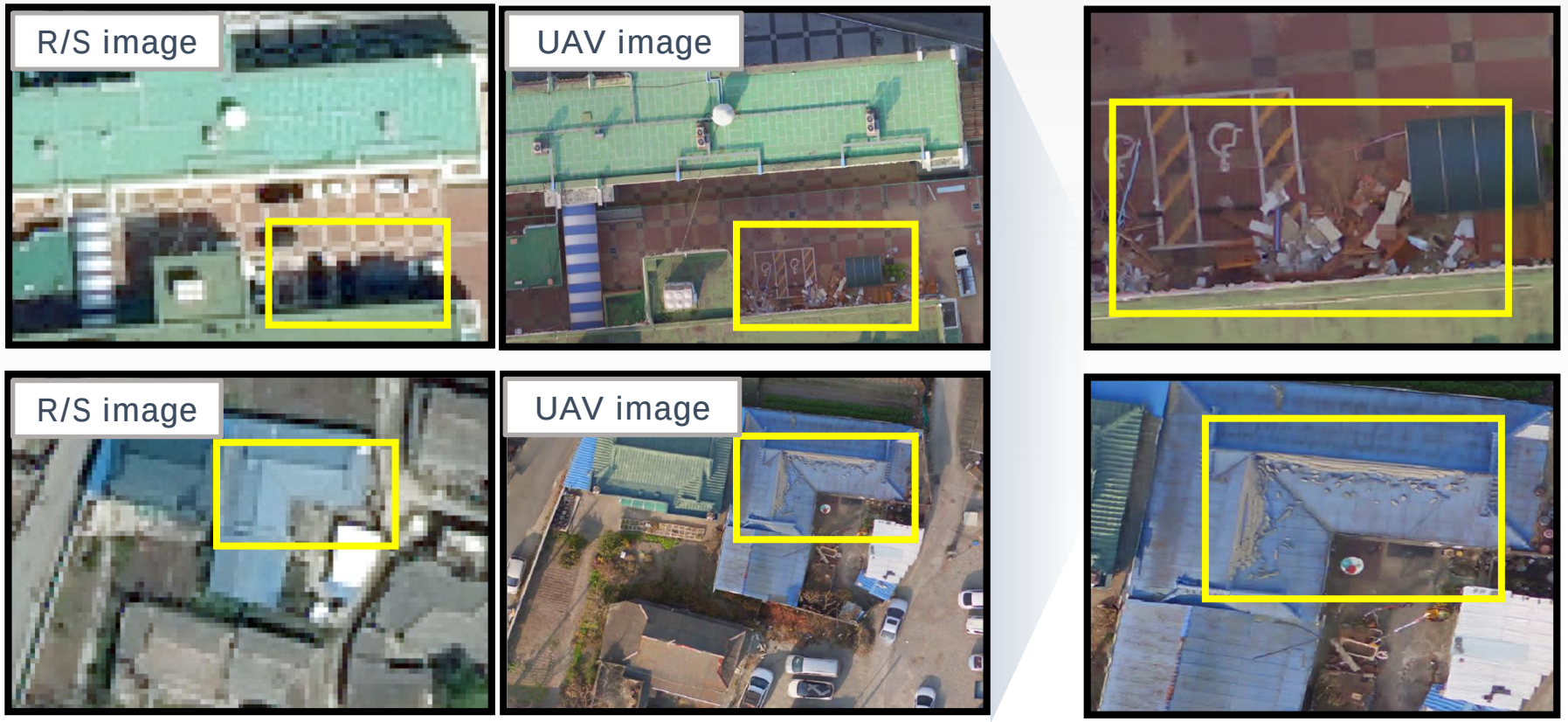


⑤ processing

⑥ results

3-2 Case study-2. earthquake

UAV mapping & decipher

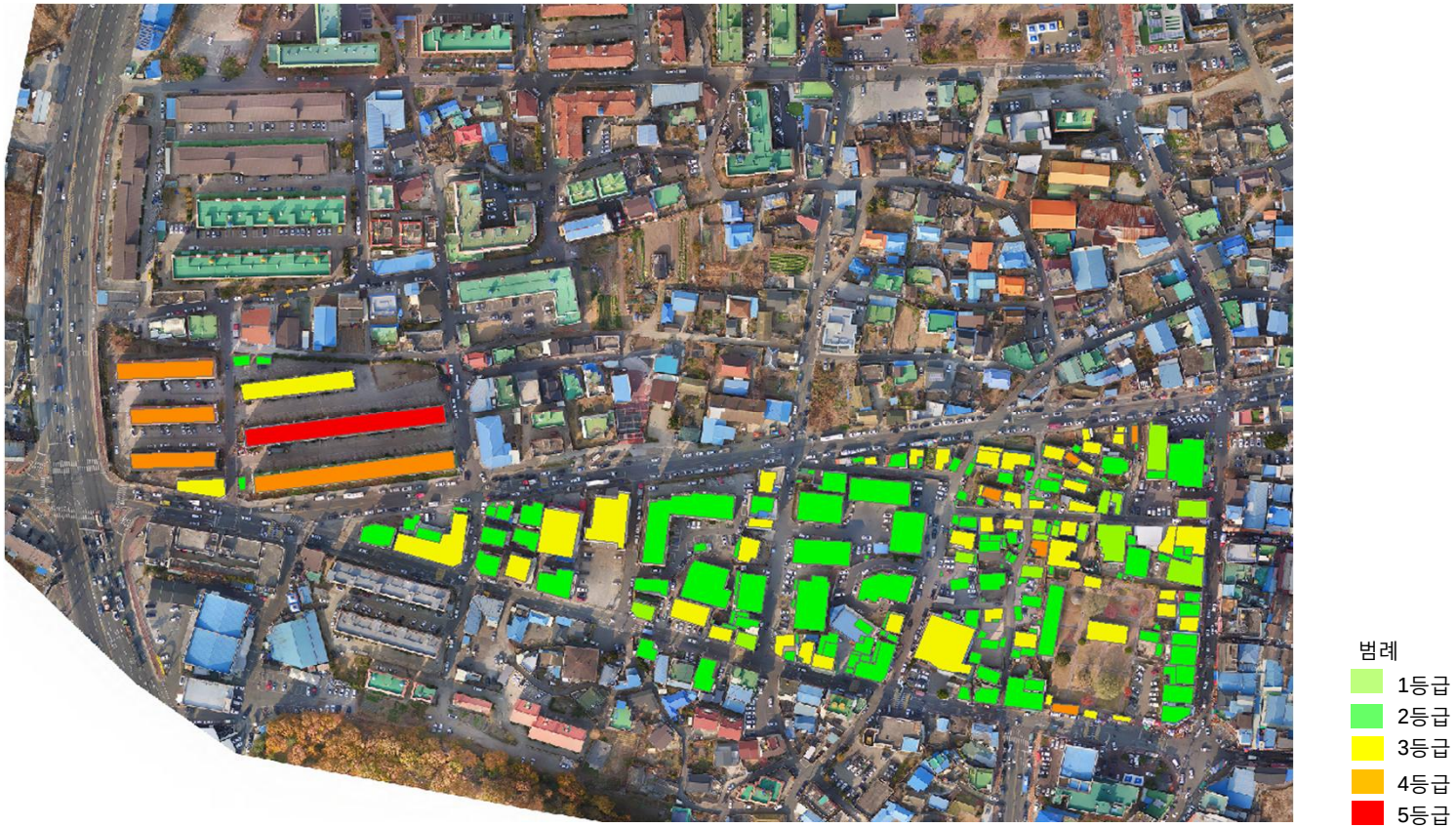


It is possible to judge the damage at location where it is impossible to survey

(narrow road, roof) → offer a few centimeter spatial resolution

3-2 Case study-2. earthquake

Building damage classification

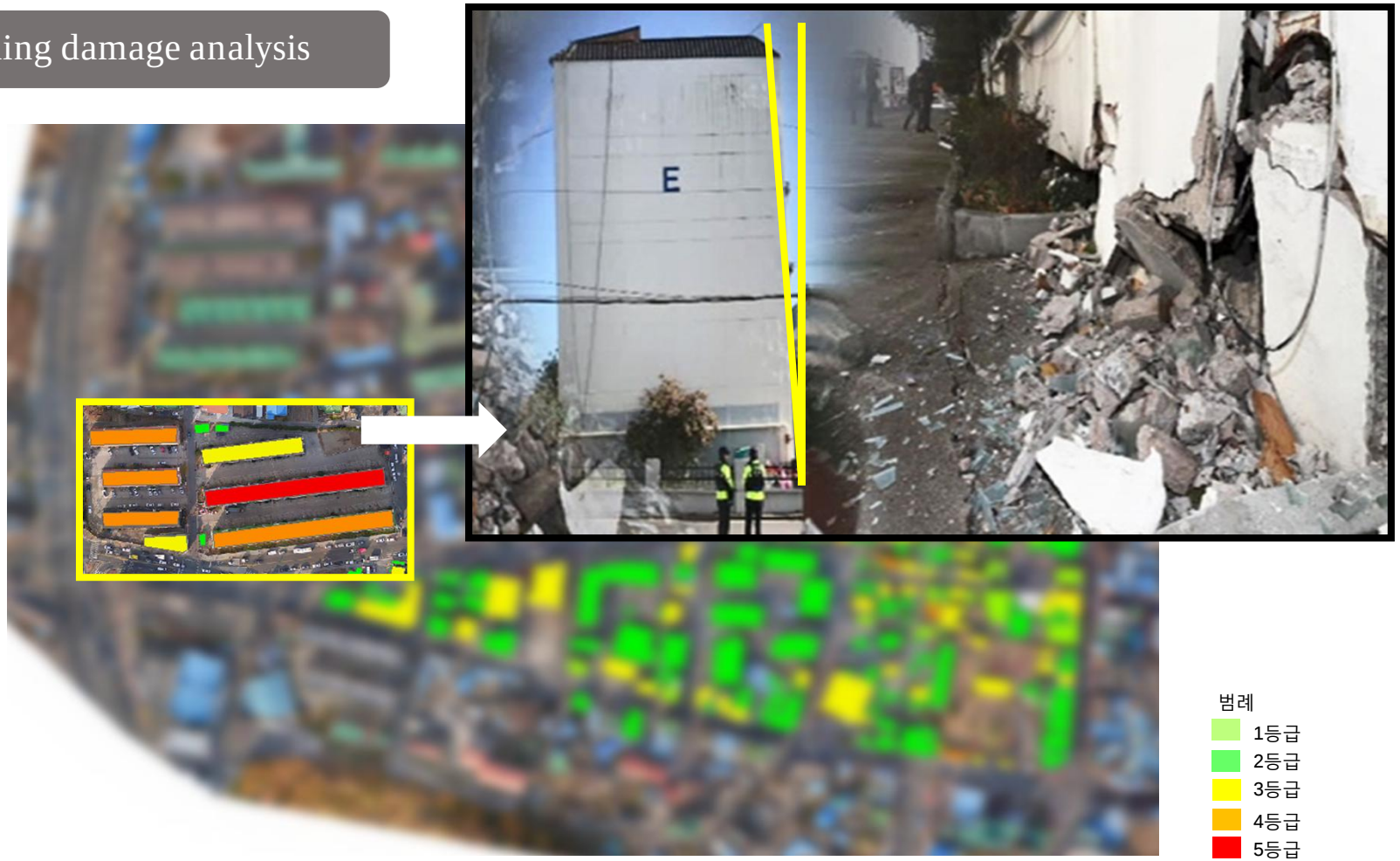


MMS(slope, well crack, damage) + UAV(well damage, roof damage)

➡ 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

3-2 Case study-2. earthquake

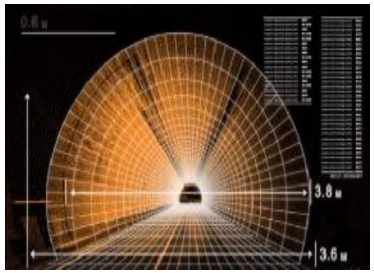
Building damage analysis

3-3 Implication

MMS

Merit	Demerit
1. Rapid Acquisition of data by using vehicle 2. Acquisition of Precise data	1. Have to employ vehicles 2. Difficulty in obtaining data of roof of building

Application

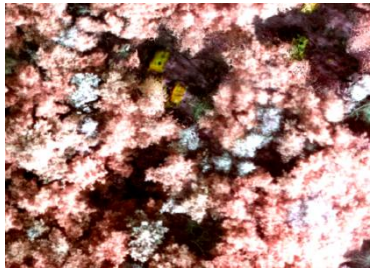


Precise maps through automatous vehicle
Safety inspector for roads and tunnels

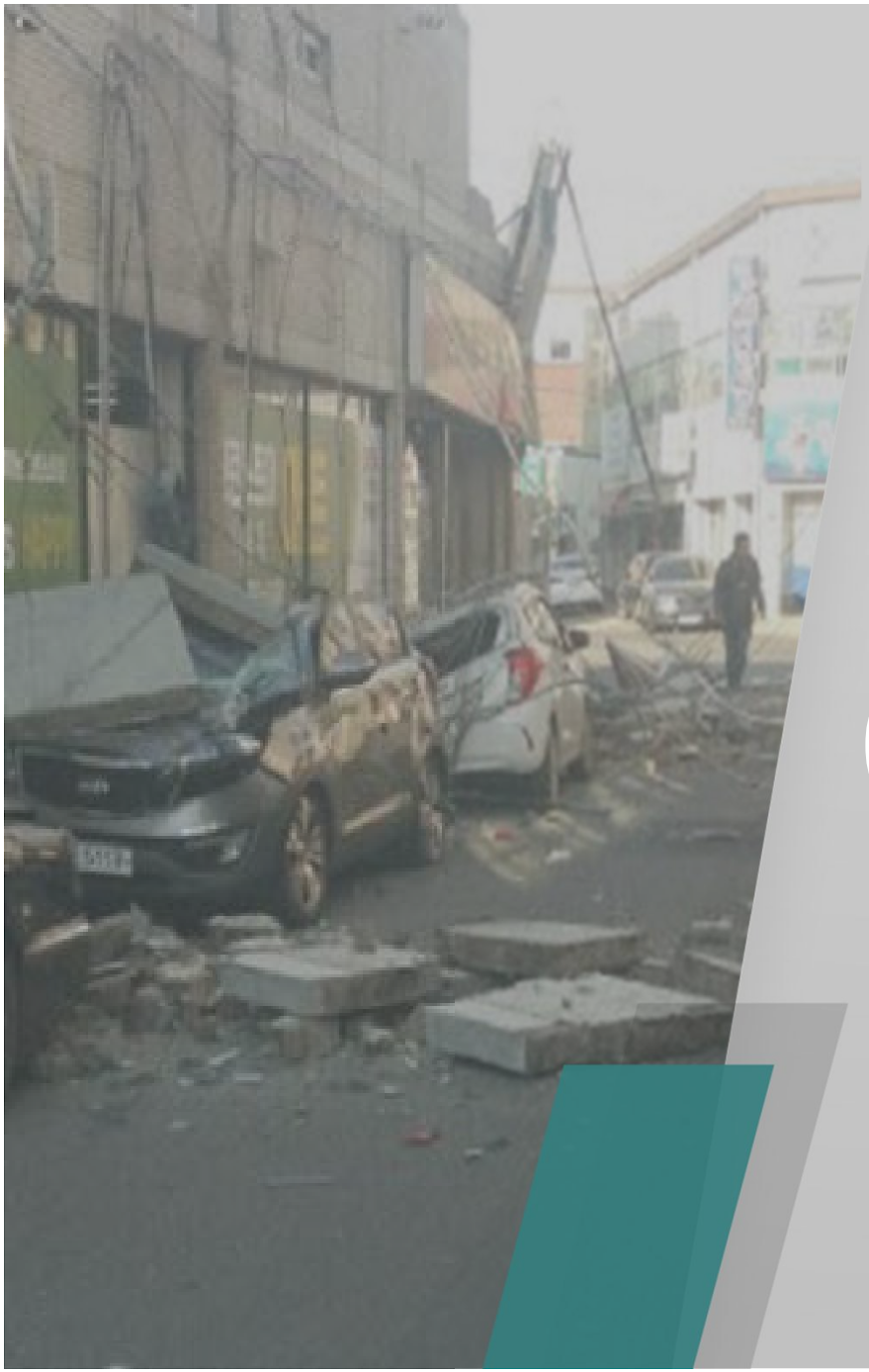
UAV

Merit	Demerit
1. Securing Safety of investors 2. Obtaining data of roof of building	1. Taking time for flight admission 2. Difficulty in getting side view

Application




Through a Variety of censors,
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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