József Ambrusz,[1] László Teknős[2]

A Study of Recording and Processing Post-Disaster Damage Assessments

DOI 10.17047/Hadtud.2022.31.E.1

Based on the lessons learnt from post-disaster damage assessments, the survey of damages scattered in a large area can be performed in different ways. One typical reason for this is that the time interval of the damage assessments may be different in many cases. In Hungary, special IT subsystems were used in an unusual way during the previous damage claims and assessments, which would have addressed the immediate assessment of buildings and the data of the damage reports in a uniform manner. The basic framework of the data recording and data processing IT subsystems for the assessment of large-scale damages can provide a faster, a more accurate and a more uniform application, which may increase efficiency. In this study, the authors attempted to map a conceptual framework for data recording and data processing software for assessing damages in careful consideration of the relevant legislation.
KEYWORDS: rehabilitation, damage assessment, special IT subsystem, data recording and data processing

A katasztrófákat követő kárfelmérés adatrögzítésének és feldolgozásának vizsgálata

A katasztrófákat követő kárfelmérések tapasztalataiból kiindulva, a nagy területen keletkezett szórt károk felmérései differenciált módon valósulhatnak meg. Ennek egyik jellemző oka, hogy a kárfelmérés időintervalluma több esetben eltérő lehet. Magyarországon az eddigi kárbejelentések és kárfelmérések során nem jellemző módon került felhasználásra olyan speciális informatikai alrendszer, amely kifejezetten az épületek azonnali felmérését és a kárbejelentések adatait egységesen kezelte volna, ezen adatok többszöri feldolgozáson estek át, amely ezáltal több hibalehetőséget hordozott magában. A nagytömegű károk felmérésére irányuló adatrögzítő és adatfeldolgozó informatikai alrendszer elvi kereteivel gyorsabb, pontosabb és egységesebb alkalmazás biztosítható, amellyel a hatékonyság növelhető. A szerzők az alábbi tanulmányban kísérletet tesznek annak feltérképezésére, hogy kidolgozzák a károk felmérésére irányuló adatrögzítő és adatfeldolgozó szoftver elvi kereteit a vonatkozó jogi szabályozók figyelembevétele mellett.

[1] University of Public Service, Faculty of Law Enforcement, Institute of Disaster management - *Nemzeti Közszolgálati Egyetem, Rendészettudományi Kar, Katasztrófavédelmi Intézet*; e-mail: ambrusz.jozsef@uni-nke.hu; https://orcid.org/: 0000-0001-8062-091X.
[2] University of Public Service, Faculty of Law Enforcement, Institute of Disaster management - *Nemzeti Közszolgálati Egyetem, Rendészettudományi Kar, Katasztrófavédelmi Intézet*; e-mail: teknos.laszlo@uni-nke.hu; https://orcid.org/: 0000-0003-0759-5871.

KULCSSZAVAK: helyreállítás, kárfelmérés, speciális informatikai alrendszer, adatrögzítés és adatfeldolgozás

The study of the claim reporting process

The exclusive / comprehensible damage assessment can start after a government decision on the deadline of reporting.[34] Based on the decision of the government, the deadline for filing a claim will be set. The assessment of damages is preceded by a claim submitted by the damaged party. The mayor of the settlement is responsible for organizing the claim submissions, announcing the method and deadline in the usual manner on the site. The claimant states on the data sheet created for this purpose that they consent to the processing of their data and the transfer thereof to a third party that may be related to the compensation.

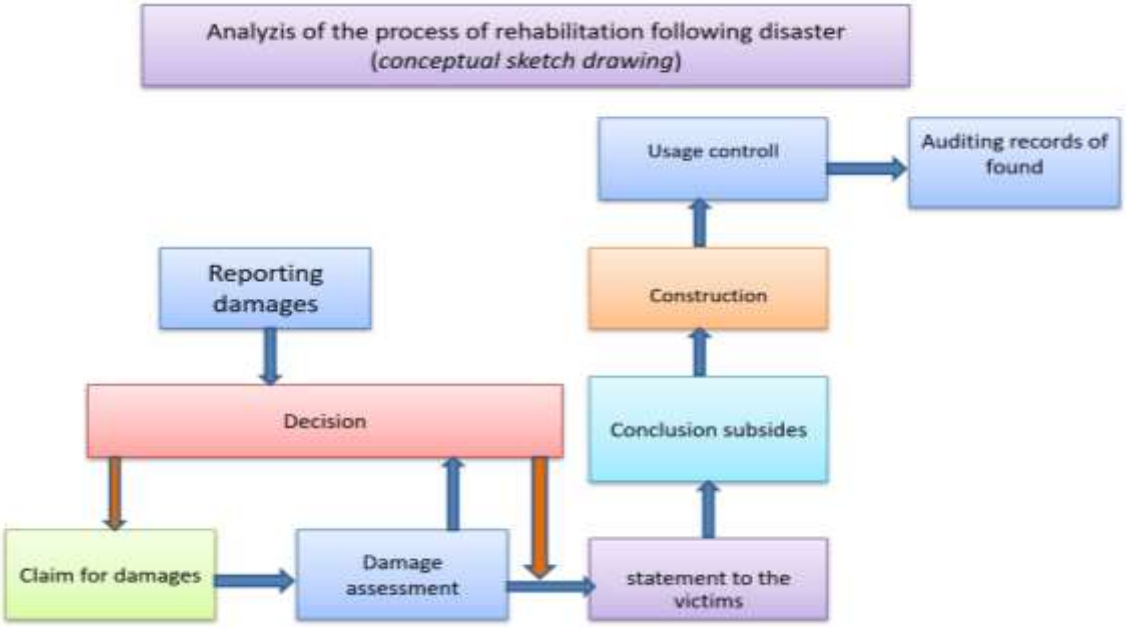

Figure 1.
A conceptual scheme of the rehabilitation process of private properties
(made by the authors)

The notary is to keep a record/registry of the reported damages, which is to be summarized after the deadline of filing the damages. This settlement summary shall be submitted to the competent county disaster management directorate along with the damage report forms. The notary may initiate an appointment of the Local Reconstruction Commissioner to the Chair of the Protection Committee in order to coordinate the damage assessment working group(s) and perform additional rehabilitation and reconstruction tasks.

The analysis of the damage assessment process, the study of the organizational system of damage assessment

The damage assessment is carried out by a damage assessment working group in accordance with the legislation on the detailed rules for the use of force majeure aid. The damage

[3] Ambrusz – Endrődi – Pellérdi 2016, 66–67.
[4] Smith – Wenger 2007, 237.

assessment working groups carry out their work in line with the same professional aspects. Given that the regulation goes beyond the rules on the use of force majeure aid, as a result of our study, it can be stated that after a natural disaster damage assessment is requested by the territorially competent capital or county government office, the competent disaster management directorate in the case of flood or inland water, the territorially competent Directorate of Environment and Water Management, in the case of damage to roads, ferries and bridges the representative of the Transport Development Coordination Center, and in the case of cellar or riverbank collapse or landslide, it is performed by a representative of a Committee of Experts on Cellar and Riverbank Hazard Prevention.

In order to perform the optimal organization of the structured onsite damage assessment process for large-scale damages, time calculation was based on the damage assessment time of residential properties of the same size and characteristics measured during the preliminary test measurements. From the time thus calculated, as well as the number of damaged residential properties and the detection data of the damage area, deduction was possible on the amount of working groups that the damage assessment could be carried out with. Following a specific situation assessment, it becomes a fact how the number of available groups can change, due to the road conditions in the damage area and the victims' accessibility.

In order to carry out damage assessment, it is necessary to calculate travel times by determining the distance between the settlements in advance. By marking the affected settlements on a map, it is expedient to determine the main directions by focusing on their location. The amount and locations of the reported damages can be integrated into a system by settlement and displayed in a table, reflecting the number of available days. To this the daily schedule of the pre-numbered damage assessment groups shall be assigned. With the number of data sheets received on already assessed properties, the total number of undamaged properties in a given settlement can be deducted in order to plan the following day's assessment.[5]

LPC	Damaged settlement	Building damage submitted until deadline X	Assessed	Assessed	Assessed	Assessed	Remaining	Assess-ment team	Work-time register
Settlement	Settlement 1	3					3	I	+4
	Settlement 2	9					9	II	+3
	Settlement 3	15					15	III	...
	Settlement 4	17					17	IV	
	Settlement 5	3					3	V	
	Settlement 6	15					15	VI	
	Settlement 7	322	214				108	VII	
	Settlement 8	5					5	VIII	
	Settlement 9	254					254	II	

Table 1.
A conceptual scheme of the damage assessment coordination
(made by the authors)

[5] Kiss – Ambrusz 2016, 846.

During the organization and daily work distribution, the location of the settlement, the address of the damaged person(s), the primary damage data (the number of collapsed or damaged buildings), hereinafter the road network (accessibility, capacity data, side roads), the problems on the ground surface, other factors), available vehicles (type, number of units), communication equipment and information, as well as communication network coverage.

If the damages in a settlement (or part of a settlement) significantly affect a minority community, which has a minority self-government in the settlement, the minority self-government must be requested to participate in the work of the damage assessment working groups.[6]

Before starting the damage assessment, the chair of the county/capital protection committee organizes training for the members of the working group(s) on the guidelines and methods of the damage assessment, the most important construction standards and local peculiarities with the assistance of the regional body of professional disaster management. Members participating in the damage assessment shall be provided with a power of attorney signed by the chair of the county/capital protection committee. A damage assessment form shall be completed in triplicate for the damage assessment. During the damage assessment, it is necessary to record the damages in photographs. The content of the damage assessment form can also be supported by other documents (title deed, contract, floor plan, previous evaluations, experts, witnesses, minutes, photos, videos, statements of insurance, etc.). A copy of the damage assessment form remains with the mayor's office of the municipality and, in the case of municipalities operating a district notary, it remains at the district notary's office, while the mayor sends an additional copy to the disaster management directorate and a copy is provided to the damaged party.

Depending on the nature of the damages, additional tasks arising from the damages have to be ascertained (soil mechanical analyses, range of secondary and ancillary damages, static tests).[7] The basis of the evaluation is the amount calculated based on the price per square meter provided by the territorially competent tax office. Remedies in connection with the damage assessment are available once, within 15 days of receipt of the damage assessment form. The chair of the county, capital city protection committee shall assess the appeal within 5 days. The assessment of damages may be supervised and controlled by the central body of professional disaster management.

The county disaster management directorate compiles the data of damages, rehabilitation, reconstruction and purchase cost estimates received from the settlements of the county and submits them to the minister responsible for disaster management through the central body of professional disaster management. It is expedient for the central body to prepare the national aggregated data thereof, in case of damage incidents affecting several counties, based on the county data, which is to be received from several settlements. With this in mind, the Government decides on the method and the extent of compensation and also provides for the possibility of reimbursing the costs of the damage assessment. The Minister of the Interior determines the amount of support for each settlement based on the decision of the Government and the damage assessment data. It is important to emphasize that the Government may also decide on different methods of mitigation.

[6] Muhoray – Papp 2013a, 30–32.
[7] Davidson et. al. 2007, 101–104.

Regarding the function of the National Spatial Development and Spatial Planning Information System (hereinafter: TeIR), it provides opportunities for central, regional and local public administration bodies, or other legal entities, as well as unincorporated business units, as well as natural persons. To learn the condition of their landscape and natural environment, as well as their territorial characteristics and economy, monitor their changes, compare them with the one of the European Union. It provides information through its database by displaying the indicators and analyses obtained during the processing of these data, by presenting the settlement development and regional development concepts, regional development plans and programs, integrated strategies and settlement planning tools in text and map. It assists in the work of governmental, regional, county, district, municipal planning and development activities and also in the preparation and control of their decisions including the analysis of their effects.

The use of IT solutions in the light of damage assessments and mitigation

During the flood incidents of 2010 and the aftermath of the 2010 red sludge disaster, there was a clear need for a monitoring system that addresses the specific aspects of the situation - the extent of property damage, the registry of state aid claimants, the appraisal process, evaluation, the reconstruction process, etc. - makes the process traceable in space and time and it contributes to analyze the current situation.[8]
Within the TeIR system, the data series of residential buildings containing real processes and their map display were published in a stand-alone application, which enabled the continuous monitoring of the damage mitigation.

Figure 2.
Damage mitigation checklist,
(source: Ministry of Interior, Hungary)

[8] Muhoray – Papp 2013b, 70–72.; Muhoray 2011, 8–10.

During the flood damage assessment and mitigation activities at that time, in parallel with the data acquisition, the employees of VÁTI started to collect the user needs that are relevant for the development of the IT system. In accordance with the functional expectations formulated by the personnel of the Ministry of the Interior, the related software was rapidly developed. The needs can be summarized as follows:

- web accessibility, allowing for onsite data upload and correction;
- possibility to search and display on the map based on topography number;
- printing option;
- displaying the damaged properties with a different signal key, depending on the extent of the damage and the method of rehabilitation;
- the possibility of exporting the tables to other systems;
- ensuring that data are filtered for complex aspects;
- traceability of milestones and timing of rehabilitation;
- the possibility to upload photos to the data sheets of the damaged properties. VÁTI helped the rapid practical implementation of the needs during the development of TeIR, which gained significant experience in the development of web GIS systems, thanks to which the necessary technological infrastructure became available.[9]

A possible design of data recording and data processing application frameworks

At present, no IT subsystems have been developed for the assessment of damaged private residential properties. The most important conclusion of the processes analyzed above is that the basic data of the onsite damage assessment are recorded on paper. In the course of my study, I assumed that a digital subsystem for data recording/registry and data processing could be developed as a theoretical solution for damage assessment, which supports the recovery process as a unified integrated database.

Defining a conceptual framework for a data recording and processing application, known as the "Single Reporting and Marking System" (EBJ), as a possible TeIR sub-program, would explicitly fill the gap in assessing damages in the case of a major disaster with mass damages, when based on an individual decision of the government, it will provide ad hoc support for the private residential property of the damaged party, it would speed up and facilitate the processes related to reporting damage assessment. Integrated into a single system, it would display the enforcement of rights in addition to the current state of compensation for victims, which will result in a more efficient procedure.

Processing the information, which is part of the government decision-making process, should be based on uniform principles, with the same technical content and a tight schedule - as this information is relevant when it comes to determining the total amount of expenditures required to mitigate the damages to private residential properties. With the development of EBJ, more time may be available for the exact determination of the technical content of a specific damage assessment in order to accurately determine the damage to the property.

Damage assessment is an extremely time consuming and complicated process to get into the properties involved; review and estimate the damages caused; consider the expected additional secondary damages.[10] Comparing the data recorded during the administration in the claim report and the damage assessment is also time consuming. As a result, in order to extract the necessary information, it is first necessary to record it in digital form - such as

[9] Szaló et. al. 2011, 140–142.
[10] Denhart 2010, 198-200; Quarantelli 1995, 47–48.

entering data into a table - or database manager, and then to further apply data processing methods that perform the necessary calculations and summaries on the table or database.

Considering the practical experience, it can be stated that a damage assessor (group) can assess *z* number of damaged residential properties in one day, then *y* number assessor(s) (group/s) can assess all *x* residential properties in *q* days.

The time factor *q* can be reduced if we manage to increase the variable *z* (daily performance) by increasing the efficiency of the damage assessment. This can be achieved by a data logging/registry and processing program designed to support the claims assessment, thus reducing administrative time and allowing claimants and members of the claims teams to immediately record the necessary data in a central database. The data will be immediately processed and evaluated, the participants in the damage assessment process will receive the most relevant information, depending on the organizational level and the activity performed, therefore, the survey will be uniform.
The most important aspects of the program development:

- display in a uniform format on different PCs and mobile phones;
- national accessibility;
- continuous, 24/7 availability;
- secure handling and storage of personal data;
- defining the group of persons entitled to access;
- associate program operations with different access rights.

The uniform assessment of damages functions to determine the damages' value, but also as a scientific starting point for the precise determination of the impacts of damage incidents, subsequent processing in a unified system, reassessment of data, construction of subsequent structures and is responsible for their safe operation. Győző Szeidovitz[11] and Dr. Péter Varga point out this connection.[12]

Access right levels

EBJ users operate as members of different organizations at various levels, therefore they should be treated differently and given different powers. Some users would only have access to the application, while others could record or modify data or delete them from the database if necessary. A distinction should be made not only between users of the application in terms of different authorities but also in terms of communicating the relevant information provided to them. Information of a different nature and content is important for a user operating in a national or county competent organization than for a user affected at the municipal level.
Possible users of the digital marking system (without HÚTB and MHUB):

- Ministry of the Interior (MoI);
- National Directorate General for Disaster Management, MoI (NDGDM)
- capital and county disaster management directorates;
- capital, county and local protection committees;
- notaries of the municipalities affected by a disaster;
- the persons entrusted with the administration of claims;
- local reconstruction commissioner;
- heads of damage assessment working groups.

[11] Szeidovitz 1990, 4.
[12] Varga 2011, 850–851.

User privileges and information provided by the application may be assigned according to the above breakdown.

Analysis of the scope of tasks related to the damage incidents in the light of EBJ

The name of the disaster should be recorded in the EBJ system in order to be able to fill in the claim and damage assessment forms for a claim. Once the government decides on compensation, the administrator records a damage incident for the damage assessment and then sends the associated automatically generated temporary usernames and passwords electronically to the participants of the rehabilitation and the damage assessors. Once users have registered, the administrator will revoke the temporary access for security reasons.

Analysis of the scope of tasks related to damage claims in the light of EBJ

The administrator sets the claim period in the program, allowing administrators to access claim forms for this period. The notary shall organize the handling of claims, taking account of the claim period. To this end, depending on the number of damaged properties in the settlement and the equipment of the office, it develops the appropriate number of personal computers and requests at least one printer unit to have the damage report forms printed. Administrators can log in to the program by using their individual usernames and passwords, where they record the necessary information during the claim process. At the end of the data recording, the printed claim form is signed by the administrator. Due to the disqualification period set by the administrator, it is no longer possible to record additional claim forms.

Analysis of the scope of tasks related to damage assessment in the light of EBJ

At the end of the damage reporting period, the damage assessment of the properties reported begins. During the preliminary preparation, the damage assessment working groups:

- register with the program using their temporary usernames and passwords, thus accessing the data of the target properties and the damage assessment data sheets;
- receive a portable computer with built-in GPS, maps and internet connection, as well as a wireless printer.

Workgroups access the program using their individual usernames and passwords. They select the target property and then use the map application to gain the site of the damage assessment. They record the necessary data and the findings of the damage assessment in the damage assessment data sheet and then use their laptops to take high-resolution photographs, which are attached to the electronic form. After the damage assessment period set by the administrator, it is no longer possible to record additional damage assessment sheets.
Under the “Summary” menu item of the Unified Reporting and Marking System, the current status of claims and damage assessments can be tracked in real time, at the national, county, district and settlement levels.

Analysis of access rights

General access rights

General access rights, usernames and passwords that allow logging in to the program without prior registration. As I have already mentioned above, each user has different rights, thus they

can access the different functions and subpages of the program according to their organizational level and the activity performed.
The following persons have general access rights:
- Minister of the Interior,
- Director General, NDGDM,
- Administrator.

The administrator has the right to assign a temporary username and password using which the notary is authorized to file a claim or the members of the damage assessment working groups can register that on the site, thus accessing the data sheets and program parts necessary for their work.
The Minister of the Interior and the Director General, NDGDM will receive full information on the current state of the damage assessment process, both in terms of national, county, district and local relations. This information is available broken down into main groups for claim reporting and damage assessment, for example under View Summary Data.

Holders of temporary access rights

Those who use a temporary username and password will be directed to a registration interface where they can create their own access to the program by entering an individual username and password in accordance with their office role or work.

Such access shall be granted to the data subject:
- the director of the county disaster management directorate and the members appointed by them;
- the head of the county protection committee and the members appointed by them;
- the head of the local protection committee and the members appointed by them;
- mayor, notary;
- local reconstruction commissioner;
- heads of damage assessment teams.

Analysis of accesses and the access rights relationships

County disaster management directorates may view data related to claim reporting and damage assessment that are relevant to them in their area of competence. Examples are the number of claims reported in a given county, the number of severely or irreparably damaged properties.

The district offices can view the data related to the claim notification and damage assessment, which belong to the area of competence of the given district, broken down by settlement.

The mayor and the notary may view data related to claims and damage assessments in their settlement, broken down to persons and buildings. The mayor and the notary can also view the claims and damage assessment sheets, which contain data on the damaged property, the identity of the claimant or proprietor and the result of the damage assessment.
During the claim period, the clerks can record, modify and print the claim data by logging in to the program using their individual usernames and passwords after filling in the claim form.
Damage assessment teams can access the program using their individual usernames and passwords. By selecting the target property, the members of the working groups can record,

modify and print the data related to the damage assessment in the damage assessment data sheet during the onsite inspection.
The actions that can be performed by an administrator include recording and modifying the data. For security reasons, only the administrator has the right to delete recorded data.
It is the responsibility of the administrator to record an incident.

Registry of damage claims

To record a claim, log in to the program as an administrator and click on "Claim submission" in the main menu. The fields of the claim form were arranged on the electronic form as follows:

Address of the damaged structure:	Post code, settlement name, public space name (road, street, square, etc.), house number, lot number
Purpose according to the permit:	... building
Useful floor space:	m^2
Comfort level:	Without comfort / With semi-comfort / With full comfort
Year of construction:	year
The damage incident:	Flood, inland water, earthquake, etc.
Date of damage:	Date
Nature of the damage:	Twist or collapse of (a) wall(s), etc.
Intended use of the structure at the time of the damage:	Residence building, outbuilding, etc.
The structure was suitable for the intended use before the damage occurred	Yes-no
The building is suitable for the intended use as per permit:	Yes-no
Name and contact details of the claimant:	(address telephone number)
Capacity of the claimant:	(proprietor, member of family, etc.)
Estimated value of damage:	HUF
The property has insurance:	Yes-no
If there is insurance, the amount of damage expected to be recovered from the insurance:	HUF
Insurance deductibles:	%
Other:	
Data statement:	By signing this form, I consent to the processing and transmission of my personal data and data related to the above property by the competent local government, the county/capital protection committee, the National Directorate General for Disaster Management and its subordinate bodies, as well as other bodies involved in damage assessment and mitigation. In order to assess the damage caused by .....

Table 2.
The content elements of submitting a claim
(made by the authors)[13]

To avoid possible misuse, such as subsequent modification of the data, modifications can only be made once, immediately after the data sheet has been recorded, when the recorded data is loaded back into the data entry fields for verification and printing.

[13] Ambrusz 2019, 133–134.

New claim submission

In addition to the “Modify” and “Print” icons at the bottom of the claim form, a field labeled “New Claim” will appear, which is to open a blank claim form.

Damage assessment operations

Accessing the program by entering the individual username and password, the damage assessment teams can perform actions related to the damage assessment data sheets after the damage notification period. Only they have the right to record or modify the damage assessment data sheets.
When accessing the program with a damage assessor right, the “Target Properties” icon in the main menu contains the address list of the properties that were recorded during the damage claims. To make it easier to select the target property, you can narrow down the list of properties to the properties that belong to your work area using the filter criteria line at the top of the page. At the very beginning of the list, the largest, while towards the end, the less damaged properties may appear. This ensures that members of the damage assessment working groups can reach those most in need as soon as possible. The list of target properties displays the claimant’s name, phone number, property address, and the extent of the damage.

Registry of the damage assessment sheet

An icon with a form symbol next to the address of the damaged property opens the form in which the following information is required:

Address of the damaged structure	Post code, settlement name, public space name (road, street, square, etc.), house number, lot number	
The name of the proprietor	XY	
Date of damage	Date	
The property has valid insurance	Yes	No
Amount of damages recoverable from insurance	HUF	
Insurance deductibles	HUF	
Intended use of the damaged structure	Home, garage, etc.	
The structure was damaged	HUF	
The structure was damaged, destroyed (collapsed)	Severely	Slightly
Brief technical description of the structure and the damages		
Number of floors/storeys of the structure	Ground floor, one-storey, two-storey, multi-storey	
Has the structure a basement	Yes	No
Major structures in the building	foundation material: no foundation, brick, concrete, other the nature of the damage: subsidence, crack, twist, other	foundation material: no foundation, brick, concrete, other the nature of the damage: subsidence, crack, twist, other
Masonry/wall material	Adobe/pise bricks, beaten or rammed walls, bricks, other	the nature of damage: cracking, falling, collapsing, soaking, other
Slab/ceiling material	wooden beam, reinforced concrete beam, lining steel beam, monolith, reinforced concrete, other	the nature of damage: cracks, plaster break-off, structural degradation, other
Roof structure material	Wood, other	the nature of damage: complete support structure,

		beam, deckage, roof shell,
The material of the roofage/shell	reed, tiles, concrete tiles, slate, other	the nature of damage: rupture, other
The structure can be restored based on the preliminary condition assessment	Yes	No
Does the structure have a building (survival) permit?	Yes	No
Does the municipality (district) have an approved development/zoning plan	Yes	No
If the municipality (district) has an approved development/zoning plan, has the structure been built accordingly?	Yes	No
The comfort level of the building	Without comfort/With semi-comfort/With full comfort	
Useful floor space	m^2	
Number of permanent residents	Person(s)	
Technical condition of the building before the damage incident	Maintained	Neglected
In the case of other residential building, does the damaged party and/or the person living with them have ownership or a permanent right of use?	Yes	No
Estimated cost of rehabilitation/reconstruction	HUF	
A separate statement by the damaged party regarding confidentiality of their personal data	By signing this form, I consent to the processing and transmission of my personal data and data related to the above property by the competent local government, the county/capital protection committee, the National Directorate General for Disaster Management and its subordinate bodies, as well as other bodies involved in damage assessment and mitigation. In order to assess the damage caused by	
Uploaded image(s)	EA	

Table 3.
The content elements of damage assessment
(made by the authors)

After filling in, the software confirms the recording in a message. In order to avoid possible abuses, such as subsequent changes to the data, changes can only be made once, immediately after the data sheet has been recorded. The recorded data is reloaded into the data entry fields for verification and printing. The damage report form is signed by the damaged party after printing. In addition to the checkboxes (icons) labeled “Modify” and “Print” at the bottom of the damage assessment form, an icon labeled “New Damage Assessment” will appear and just click on it to display a blank damage assessment form.

Viewing summary data

To view the summary data related to the damage incident, click on the "Summary" menu item in the main menu. After that, depending on the user's territorial competence (national, county, district, municipal), the following data will be displayed:

- number of claims (EA);
- slightly damaged (EA);
- severely damaged (EA)
- severely damaged or collapsed (EA);
- number of assessed properties (EA);
- restorable (EA);
- unrestorable (EA);
- total amount of assessed damage (HUF).

Storage scaling

I do not regard it as justifiable to upload a video. Considering 5,000 residential buildings, it is advisable to calculate the following data for each property:
– 10 EA 2048×1536 resolution, better quality JPG file format photos up to 5 megabytes each;
– 10-page PDF document size up to 0.5 megabytes $5000\times((10\times5) + (10\times0.5)) = 27{,}500$.
Depending on the above data, a maximum of 27,500 megabytes or 27 gigabytes of storage capacity is required.

Conclusions

1. Based on the lessons learnt from previous damage assessments, the assessment of scattered damages in a large area were carried out in different ways. One characteristic reason for this is that the time interval of the damage assessment was also different in several cases. In order to ensure a more uniform application of the law, in line with my proposed solution for a more efficient coordination of the organizational tasks, I have developed the framework of a solution that is already used in practice.
2. To date, no IT subsystems have been used for claims and damage assessments that would have handled the immediate assessment of buildings and claims data in a uniform manner, and these data have undergone multiple processing, which led to a higher potential for error. The basic framework of the data recording/registry and data processing IT subsystems for the assessment of mass damage incidents can ensure a faster, more accurate and uniform use, which can increase efficiency.
3. As a decision support subsystem of EBJ, the IT solutions of damage assessment can contribute in a unique way to the GIS solutions already used for the accurate mapping of the consequences of disasters and the rehabilitation period.

BIBLIOGRAPHY

Ambrusz, J. 2019. Katasztrófák következményeinek felszámolása, valamint a helyreállítás, újjáépítés vezetés-irányítási, műszaki feladatainak lehetséges megoldásai, PhD dissertation, 171.

Ambrusz, J. – Endrődi, I. & Pellérdi R. 2016. A katasztrófák következményei felszámolásának vezetés-irányítási rendszere. *Hadmérnök* 2016/XI no. 1., 64–78.

Davidson, C. H. – Johnson, C. – Lizarralde, G. – Dikmen, N. & Sliwinski, A. 2007. Truths and myths about community participation in post-disaster housing projects. *Habitat International*. Elsevier, 2007/31 no. 1., 100–115. DOI: https://doi.org/10.1016/j.habitatint.2006.08.003

Denhart, H. 2010. Deconstructing disaster: Economic and environmental impacts of deconstruction in post-Katrina New Orleans. *Resources, Conservation and Recycling*. 2010/54. no. 3., 194–204. DOi https://doi.org/10.1016/j.resconrec.2009.07.016

Kiss, A. & Ambrusz, J. 2016. A vörösiszap katasztrófa következményeinek felszámolása, a keletkezett károk helyreállítása. In: Takácsné, Gy. K. (Edited by): *Challenges and prospects for innovation between 2014–2020: 15th International Scientific Days*: publications, Gyöngyös, Hungary, 845–853.

Smith, G. P. & Wenger, D. 2007. Sustainable Disaster Recover Operationalizing an Existing Agenda. In: Rodríguez, H. – Quarantelli, E.L Quarantelli & Dynes, R.R (Edited by): *Handbook of disaster research,* Springer Science+Business Media LLC, 611. DOI https://doi.org/10.1007/978-0-387-32353-4

Muhoray, Á. & Papp A. 2013. A vörösiszap-katasztrófa elleni védekezés, a helyreállítás, újjáépítés tapasztalatai I. *Belügyi Szemle* 2013/61 no. 2., 27–46.

Muhoray, Á. & Papp, A. 2013. A vörösiszap-katasztrófa elleni védekezés, a helyreállítás, újjáépítés tapasztalatai II. *Belügyi Szemle* 2013/61 no. 3., 63–86.

Muhoray, Á. 2011. Az Újjáépítési Kormányzati Koordinációs Központ tevékenysége a vörösiszap-tragédia után. *Éptésügyi Szemle* 52011/3., 8–10.

Quarantelli, E. L. 1995. Patterns of shelter and housing in US disasters. *Disaster Prevention and Management*. 1995/4. no 3., 43–53.

Szaló P. – Bálint, K. – Barkóczi, Zs. – Bedő, K. – Gerzánics, A. – Halász, L. – Horváth, B. – Juhász, G. 2011. Építésügyi feladatok a 2010. évi katasztrófák után Borsod-Abaúj-Zemplén megyében és Devecser térségében. *Területi Statisztika*, 2011/14 no. 3., 121–147.

Szeidovitz, Gy. 1990. Komárom és Mór környezetében keletkezett történelmi rengések epicentrális intenzitásának és fészekmélységének meghatározása, candidate dissertation, 137.

Varga P. 2011. Földrengések előrejelzése. *Magyar Tudomány* 2011/7., 843–860.