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SAFE EARTHWORKS TRAINING WITH THE USE OF AUGMENTED REALITY

IO1

EVIDENCE BASED LEARNING OUTCOMES

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1. Introduction

About the project

According to the European Commission: “The construction industry is very important to the EU economy. The sector provides 20 million direct jobs and contributes to about 10% of the EU's GDP. It also creates new jobs, drives economic growth, and provides solutions for societal, climate and energy challenges. The goal of the European Commission is to help the sector become more competitive, resource-efficient and sustainable". Commission also lists the main challenges facing construction. Two of these challenges are:

- Training: Improving specialised training and making the sector more attractive, in particular for blue-collar workers, technical colleges and universities.

- Innovation: More active uptake of new technologies.

The project address those needs by the creation of innovative training with the use of Augmented Reality (AR) technology. Another important issue is Health & Safety. Construction works are among the most common source of serious accidents, often fatal, not only in Poland but throughout the European Union. As human life is the most important value, there is a great need for elevating the H&S level. This problem has been raised in European Directive 2001/45/EC, which obliges to take appropriate measures to improve safety and health at work.

The project address H&S issues as it stems from the need for the prevention of accidents on construction sites. These accidents are mainly caused by falling from a height to excavations or by inappropriate heavy machinery use and construction site security measures. Earthworks are one of the most dangerous among construction works. One of the main reasons is: because current training methods are insufficient. As the research shows, workers are not interested in classic training. The use of mobile devices (smartphones, tablets), modern AR technology and supporting media files makeS setAR training much more interesting and unforgettable.

setAR adheres to the ET2020 framework by developing up-to-date VET ensuring the matching of labour market with skill requirements. It also complies with the initiative of "OpeningupEducation" widening access to education through OERs. Developing skills through setAR training also support EU policies such as "Burges Communique", "Vocational education and training for better skills growth and jobs" and "Agenda for New Skills and Jobs".

The main objective of the project is to decrease the accident rates during construction works, especially during earthworks. To achieve that goal, the training system will be prepared. It will contain knowledge on earthworks, with particular emphasis on efficiency of work and health&safety regulations.

The project will also help to improve the mobility of construction personnel, due to its international content (presentation of practices from participating countries) and Multilanguage form (this will help users to learn vocabulary specific for earthworks).

The project is addressed to construction engineers, construction workers, construction trainees, construction managers, stakeholders and associations in the construction sector, SMEs and companies (construction sector), VET providers, and technical universities.

OUTPUTS OF THE PROJECT:

- O1: Evidence based learning outcomes. This output comprises learning outcomes on earthworks namely statements of what learners should know, understand and be able to do upon completion of the setAR training, in the form of definitions of specific knowledge, skills and competences.
- O2: setAR training system.
- O3: setAR manual.
- O4: setAR application (software). It is foreseen to prepare two versions of application for two most common systems for mobile devices in EU: android OS and iOS.
- O5: setAR AR markers.
- O6: setAR instructional movies.

The objective of these outputs is to develop up-to-date, tailor-suited to sectoral needs, modern earthworks training, appropriate to be integrated into existing VET offerings or to serve European community as a stand-alone training. These outputs will address modern skills needs of construction engineers, construction workers, stakeholders and associations in the construction sector, SMEs and companies (construction sector), VET providers, and technical universities, delivering a European solid, reliable and comprehensive pedagogical tool.

The partnership of the project consist of:

- The Faculty of Civil Engineering, Warsaw University of Technology (WUT)
- Technische Universität Darmstadt (TUDA)
- Polish Association of Building Managers (PABM)
- Fundación Laboral de la Construcción (FLC)
- Universitat de Valencia (UVEG)

For more information about the project, please visit its official website:
www.setar.il.pw.edu.pl

Intellectual Output 1 - Evidence based learning outcomes

This output comprises learning outcomes on earthworks namely statements of **what learners should know, understand and be able to do** upon completion of the setAR training, in the form of **definitions of specific knowledge, skills and competences**.

The objective of this output was to develop up-to-date, tailor-suited to sectorial needs, modern earthworks learning outcomes, appropriate to be integrated into existing VET offerings or to serve European community as a stand-alone training. These evidence-based learning outcomes address modern skills needs of construction engineers, construction workers, stakeholders and associations in the construction sector, SMEs and companies (construction sector), VET providers, and technical universities, delivering a European solid, reliable and comprehensive pedagogical tool.

The output consisted of 3 activities:

O1/A1: Development of instructions and tools for data collection

At this stage WUT (using advice of other partners) developed instructions and tools for data collection. Basing on the experience of the project coordinator, it was decided that partners will gather data through paper surveys (questionnaires), e-surveys (using google surveys prepared by WUT) and by the way of classic face-to-face meetings with setAR stakeholders (construction engineers, construction workers, stakeholders and associations in the construction sector, SMEs and companies (construction sector), VET providers, and technical universities).

The form and questions of the questionnaires were carefully chosen on the base of meetings with important stakeholders, potential beneficiaries opinions and partners expertise in the field of earthworks.

O1/A2: Data collection & analysis

Equipped with the instructions and tools each partner collected and analysed data received from setAR stakeholders. WUT gathered data from each partner and combined it in order to suit needs of target groups with transnational, EU approach. Both surveys and results (analysis) are included in this document.

O1/A3: Definition of setAR learning outcomes

On the base of gathered and analysed data, partnership defined setAR learning outcomes, which are the base for development of the setAR training system. Partners selected the most important topics basing on the results of the surveys, meetings with project stakeholders, and own expertise. The results of the intellectual work are presented in a form of this text.

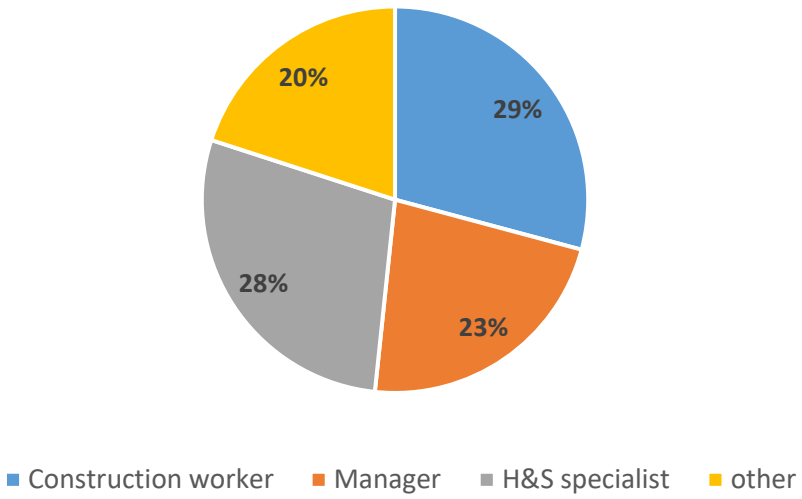
2. Questionnaires results

Due to the considerate interest of project stakeholders (construction engineers, construction workers, stakeholders and associations in the construction sector, SMEs, and companies (construction sector), VET providers, and technical universities) across Europe, the partnership was able to gather **206** answers via e-versions and paper versions of questionnaires. Unfortunately, some of the questionnaires were incomplete, probably due to the fact that respondents were working out of office for more than a year now. As a result, only **120** answers were further analysed. Also, numerous additional opinions were gathered from project potential beneficiaries during face-to-face meetings. The data collection phase of the project was hindered by the COVID-19 pandemic. However, the partnership came through and managed to collect enough evidence to create IO1.

Presented below are the results of e-versions and paper versions of questionnaires.

Who are you?

Answer	PL	DE	ESP	ENG	Total
Construction worker	33	0	0	2	**35**
Manager	19	5	0	3	**27**
H&S specialist	5	2	27	0	**34**
other	6	12	6	0	**24**
				SUM:	**120**



Other included:

- Geotechnical designer *(Projektant geotechniczny)*
- construction engineer *(inżynier budowy)*
- construction engineer working from the office *(inżynierem budowy pracującym z biura)*

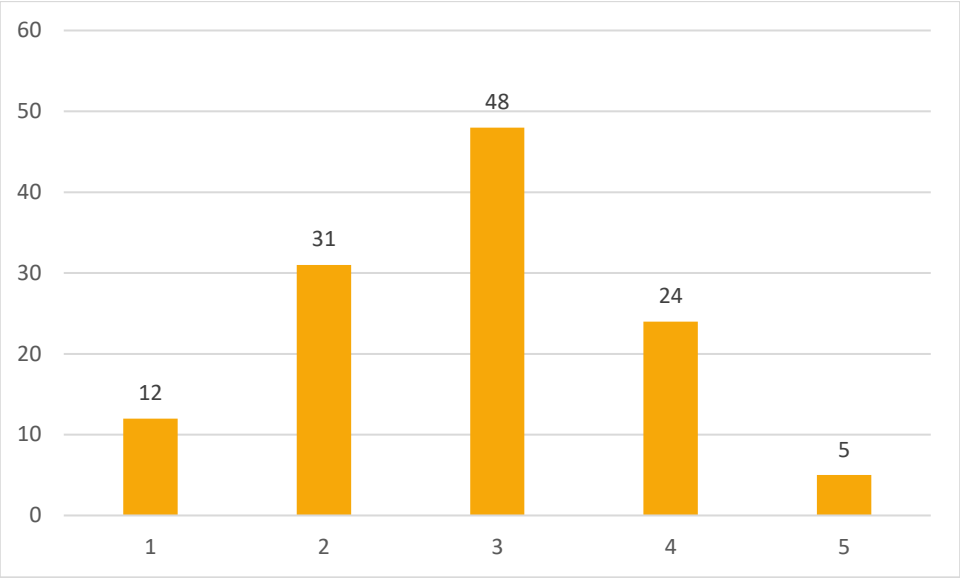
- an academic teacher *(Nauczycielem akademickim)*
- Designer *(projektant)*
- Trainer *(Formador)*
- Facultative management *(Dirección facultative*)
- Occupational risk prevention trainer *(Formadora de PRL)*
- Teacher, trainer *(Profesor, instructor)*
- Architect *(Arquitecto)*
- Site manager *(encargado de obra)*
- Project management (site management only sporadically) *(Projektleitung (Bauleitung nur sporadisch))*
- Client/Owner *(Auftraggeber*)
- BIM Management
- Project manager *(Projektleiter)*
- Client/Owner *(Auftraggeber)*
- Head of digital development *(Leiter digitale Entwicklung)*
- Official expert *(Sachverständiger)*
- University lecturer *(Hochschullehrer)*
- Professor
- Civil engineer *(Bauingenieur)*
- Owner's representative *(Bauherrenvertreter)*
- Lecturer *(Dozent)*

Preparation of earthworks

The level of hazard:

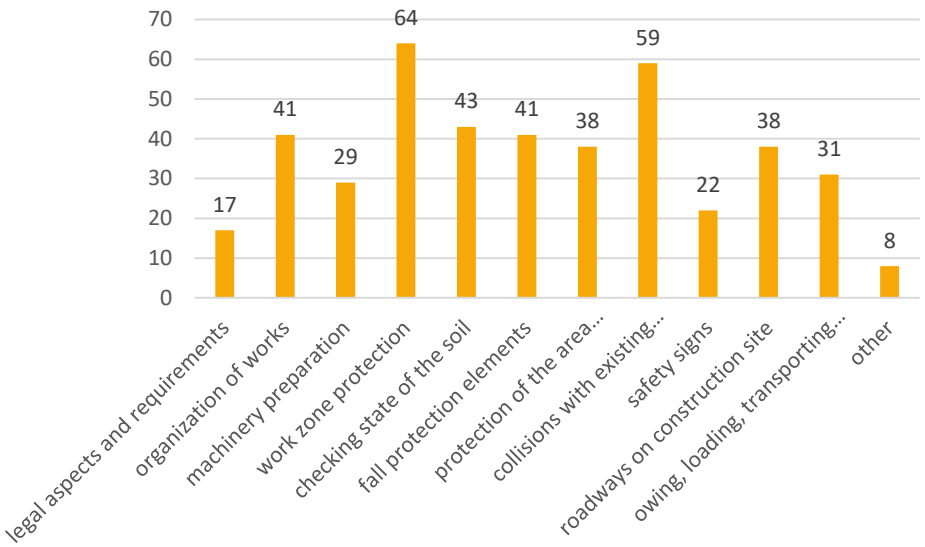
PL	DE	ESP	ENG	Total	Mark
6	4	2	0	12	1
18	4	9	0	31	2
22	7	15	4	48	3
14	3	7	0	24	4
3	1	0	1	5	5

Average: 2,83



Please mark the most dangerous tasks/elements:

Answer	PL	DE	ESP	ENG	Total
legal aspects and requirements	6	6	4	1	**17**
organization of works	17	8	13	3	**41**
machinery preparation	12	8	8	1	**29**
work zone protection	33	13	15	3	**64**
checking state of the soil	20	9	14	0	**43**
fall protection elements	22	12	6	1	**41**
protection of the area (buildings, roads, trees, etc.)	17	7	13	1	**38**
collisions with existing infrastructure	30	10	16	3	**59**
safety signs	6	5	10	1	**22**
roadways on construction site	6	9	23	0	**38**
owing, loading, transporting earth-moving machinery	6	9	16	0	**31**
other	1	2	5	0	**8**



Other included:

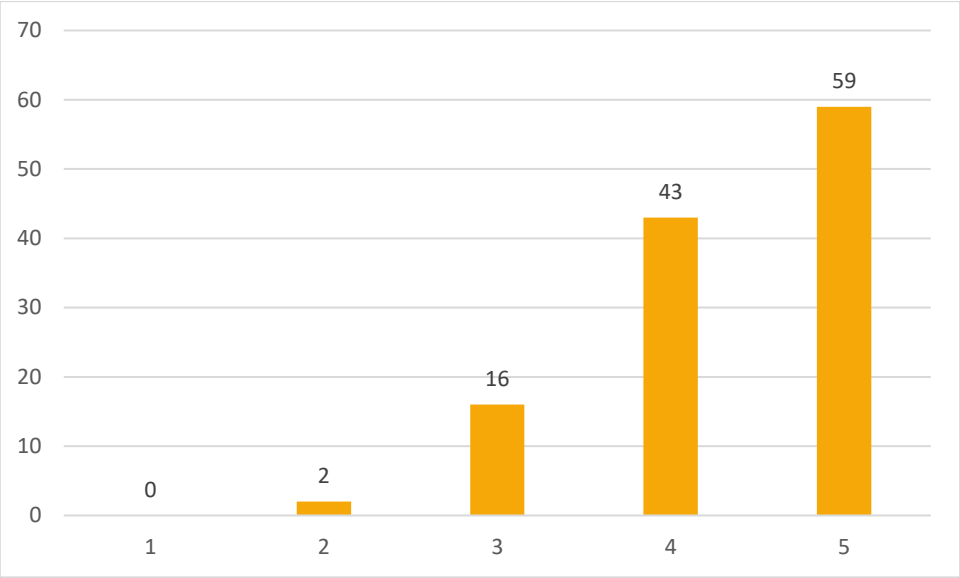
- WORK PLATFORM! FOR GEOTECHNICAL WORKS *(PLATFORMA ROBOCZA! DO ROBÓT GEOTECHNICZNYCH)*
- GEOTECHNICAL STUDY *(ESTUDIO GEOTECNICO)*
- Geotechnical study *(Estudio Geotécnico)*
- Interaction with other machinery operating at the time of excavation preparation. (e.g., clearing operations). Failure to identify possible pre-existing installations *(Interacción con otra maquinaria actuando en el momento de preparación de la excavación. (ej: operaciones de desbroce). No identificación de posibles instalaciones preexistentes)*
- Risks with affected services, GAS and ELECTRICITY *(Riesgos con servicios afectados, GAS y ELECTRICIDAD)*
- Unidentified electrical or gas installations *(Instalaciones electricas o gas no identificadas)*
- Explosive Ordinance Survey *(Kampfmittelsondierung)*
- breaking up the surfaces, if necessary *(Ggf. Aufbruch der Oberflächen)*

Excavation works

The level of hazard:

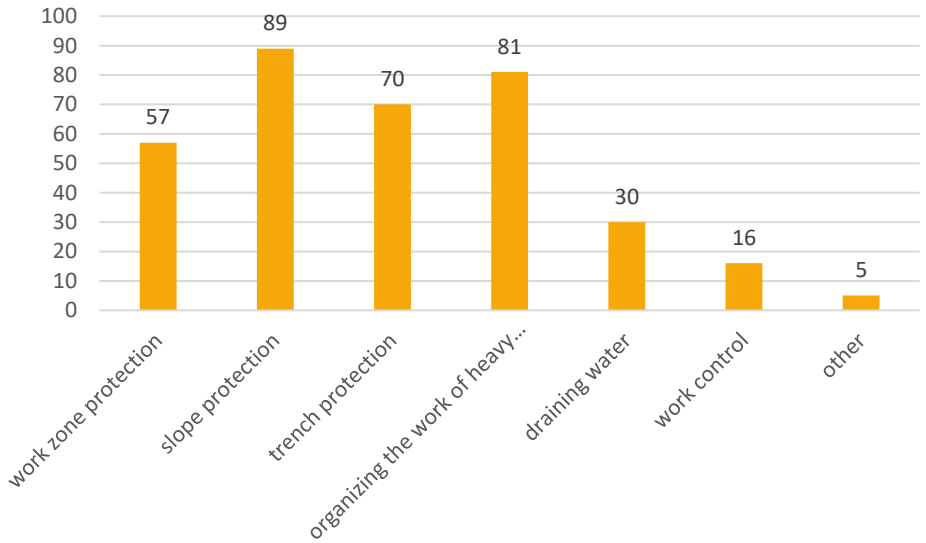
PL	DE	ESP	ENG	Total	Mark
0	0	0	0	0	1
0	2	0	0	2	2
6	3	7	0	16	3
21	7	15	0	43	4
36	7	11	5	59	5

Average: 4,33



Please mark the most dangerous tasks/elements:

Answer	PL	DE	ESP	ENG	Total
work zone protection	28	15	9	5	**57**
slope protection	40	17	28	4	**89**
trench protection	29	15	22	4	**70**
organizing the work of heavy machinery alongside workers, danger areas and visibility restrictions	39	12	27	3	**81**
draining water	13	8	8	1	**30**
work control	6	4	5	1	**16**
other	0	0	5	0	**5**



Other included:

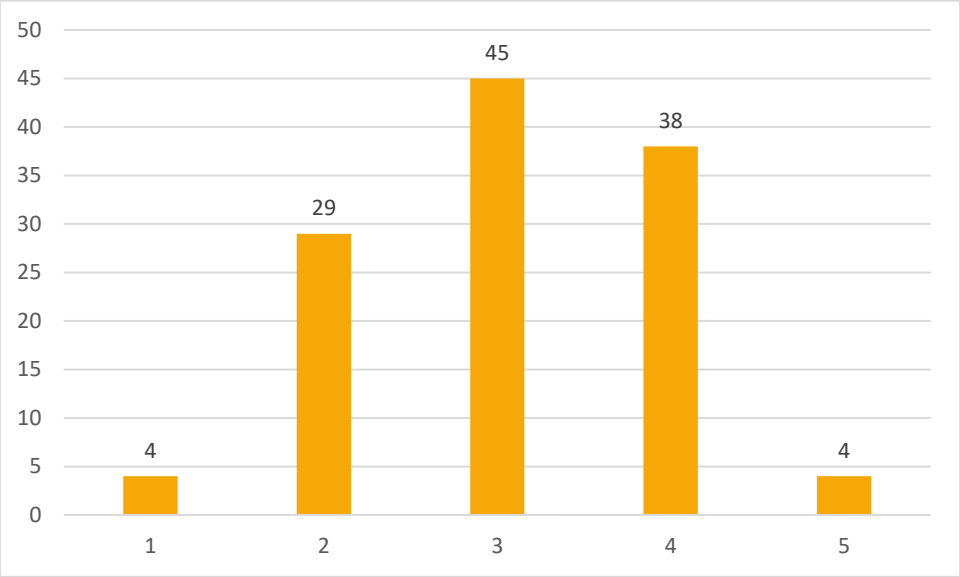
- No excavation work is being valued. The excavation activity itself is missing: emptying, manual work in the excavation, *(No se está valorando ningún trabajo de excavación. Hecho en falta la propia actividad de la excavación: vaciado, trabajos manuales en la excavación,)*
- Signposting of the excavation area *(Señalización de la zona de excavaciones)*
- Correct installation and safe assembly procedure of the shoring systems. Change in the stability conditions of the excavation due to climatic aspects, nearby vibrations, etc. *(Instalación correcta y con un procedimiento de montaje seguro de los sistemas de entibación cuajado. Cambio en las condiciones de estabilidad de la excavación por aspectos climáticos, vibraciones cercanas, etc.)*
- Risks involving affected services, GAS and ELECTRICITY *(Riesgos con servicios afectados, GAS y ELECTRICIDAD)*
- Electrical catenaries *(Catenarias electricas)*

Soil transporting

The level of hazard:

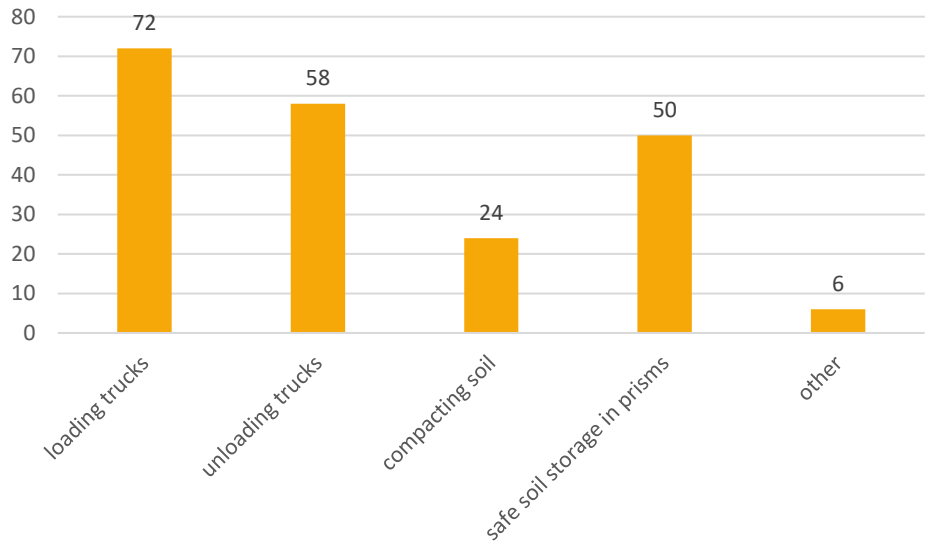
PL	DE	ESP	ENG	Total	Mark
2	2	0	0	4	1
13	9	7	0	29	2
20	7	13	5	45	3
26	1	11	0	38	4
2	0	2	0	4	5

Average: 3,08



Please mark the most dangerous tasks/elements:

Answer	PL	DE	ESP	ENG	Total
loading trucks	31	14	23	4	**72**
unloading trucks	23	13	19	3	**58**
compacting soil	9	6	9	0	**24**
safe soil storage in prisms	23	5	20	2	**50**
other	3	0	3	0	**6**



Other included:

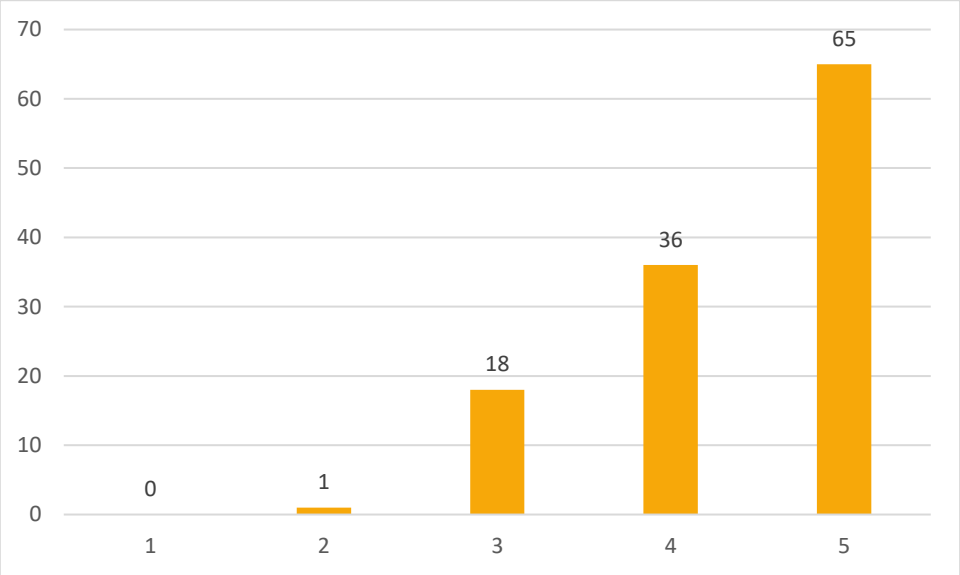
- Hitting people, equipment and vehicles during loading / unloading *(Potrącenie, uderzenie osób przez sprzęt i pojazdy podczas załadunku / rozładunku)*
- Transportation of the soil *(Transport urobku)*
- organization of joint work of machines and people *(organizacja wspólnej pracy maszyn i ludzi, praca w obszarze skażonym)*
- Truck traffic *(Circulación de camiones)*
- Risks involving affected services, GAS and ELECTRICITY. *(Riesgos con servicios afectados, GAS y ELECTRICIDAD)*
- Overturning due to exceeding the maximum load. Interaction and collision with other machinery. Lanes duly separated and signposted for the transit of trucks/trailers *(Vuelco por superación de la carga máxima. Interacción y colisión con otras máquinas. Carriles debidamente separados y señalizados para el tránsito de los camiones/extraviales.)*

Working inside the excavation

The level of hazard:

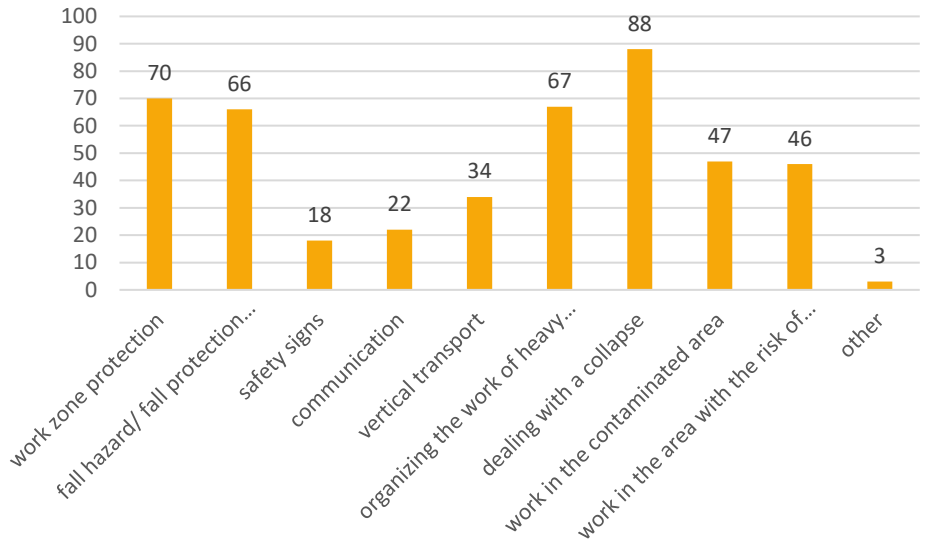
PL	DE	ESP	ENG	Total	Mark
0	0	0	0	0	1
1	0	0	0	1	2
10	3	4	1	18	3
21	7	6	2	36	4
31	9	23	2	65	5

Average: 4,38



Please mark the most dangerous tasks/elements:

Answer	PL	DE	ESP	ENG	Total
work zone protection	30	15	20	5	**70**
fall hazard/ fall protection elements	36	14	13	3	**66**
safety signs	7	3	6	2	**18**
communication	7	6	9	0	**22**
vertical transport	15	9	10	0	**34**
organizing the work of heavy machinery alongside workers	37	11	17	2	**67**
dealing with a collapse	41	16	27	4	**88**
work in the contaminated area	17	15	14	1	**47**
work in the area with the risk of unexploded ordnance or explosives remnants of war	23	14	9	0	**46**
other	0	0	3	0	**3**



Other included:

- Planning interior works and assessing risks, identifying potential hazards *(Planificar los trabajos en el interior y evaluar los riesgos, detectando posibles peligros)*
- Slope support *(Sostenimiento de taludes)*
- Safe access to the interior of the excavation/trench. Use of proper lighting and signalling inside the trench. Ensure that work inside the trench is not incompatible. Authorised personnel access only. Warning mechanisms against possible changes in trench/excavation stability conditions. *(Accesos seguros al interior de la excavación/zanja. Utilización de iluminación y señalización correcta*

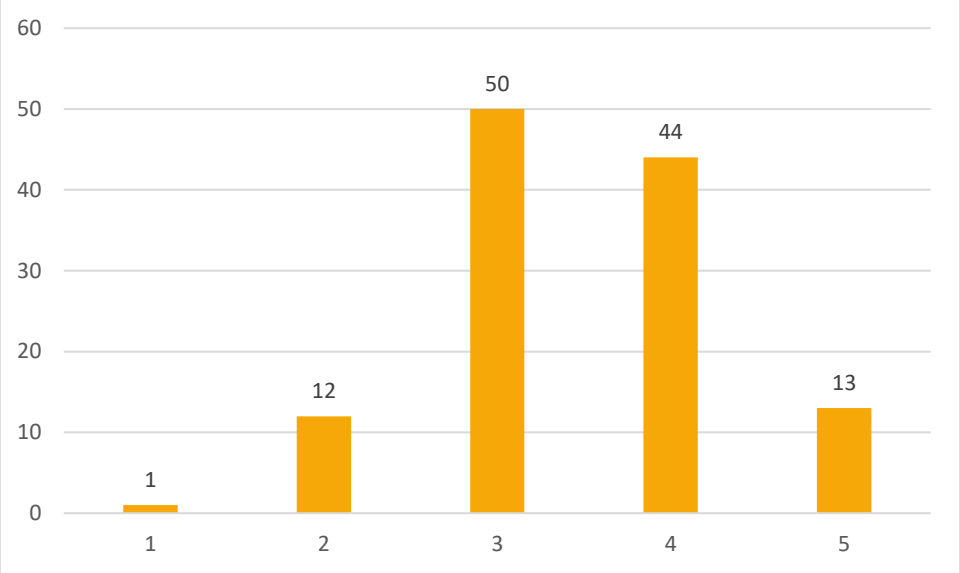
en el interior. Asegurarse de la no incompatibilidad de los trabajos realizados en el interior de la zanja. Acceso sólo por parte de personal autorizado. Mecanismos de advertencia frente a posible cambios de las condiciones de estabilidad de la zanja/excavación.)

Excavation maintenance

The level of hazard:

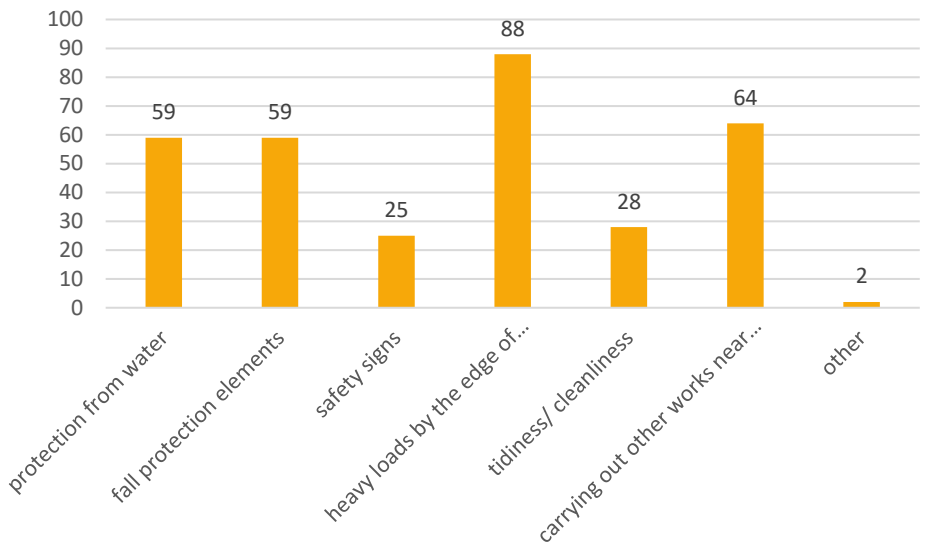
PL	DE	ESP	ENG	Total	Mark
1	0	0	0	1	1
6	4	2	0	12	2
23	11	13	3	50	3
26	3	14	1	44	4
7	1	4	1	13	5

Average: 3,47



Please mark the most dangerous tasks/elements:

Answer	PL	DE	ESP	ENG	Total
protection from water	29	9	20	1	**59**
fall protection elements	28	18	10	3	**59**
safety signs	9	4	9	3	**25**
heavy loads by the edge of excavation/trench	40	15	30	3	**88**
tidiness/ cleanliness	8	8	12	0	**28**
carrying out other works near the excavation	32	13	17	2	**64**
other	0	0	2	0	**2**



Other included:

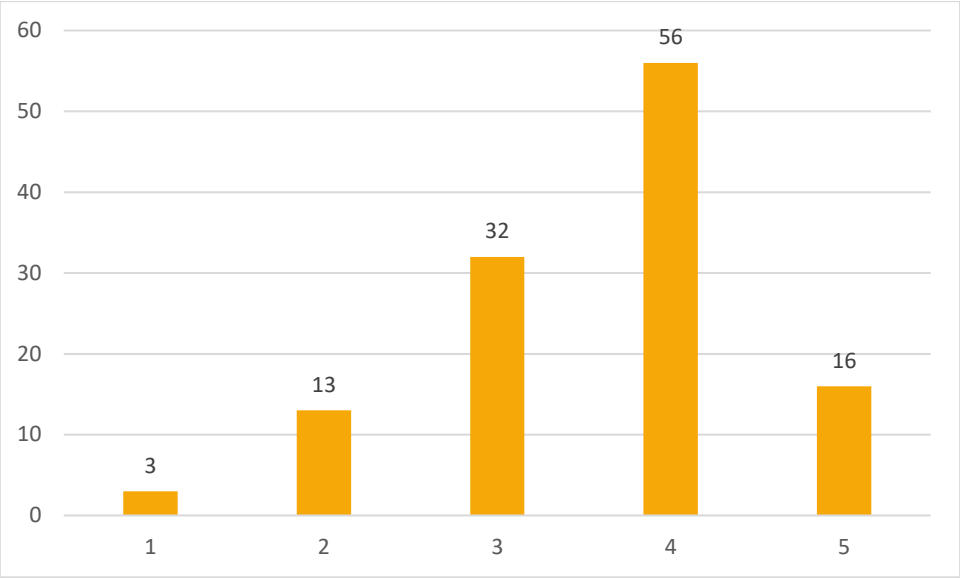
- Ground stability *(Estabilidad del terreno)*
- Slope support *(Sostenimiento de taludes)*

Backfilling the excavation

The level of hazard:

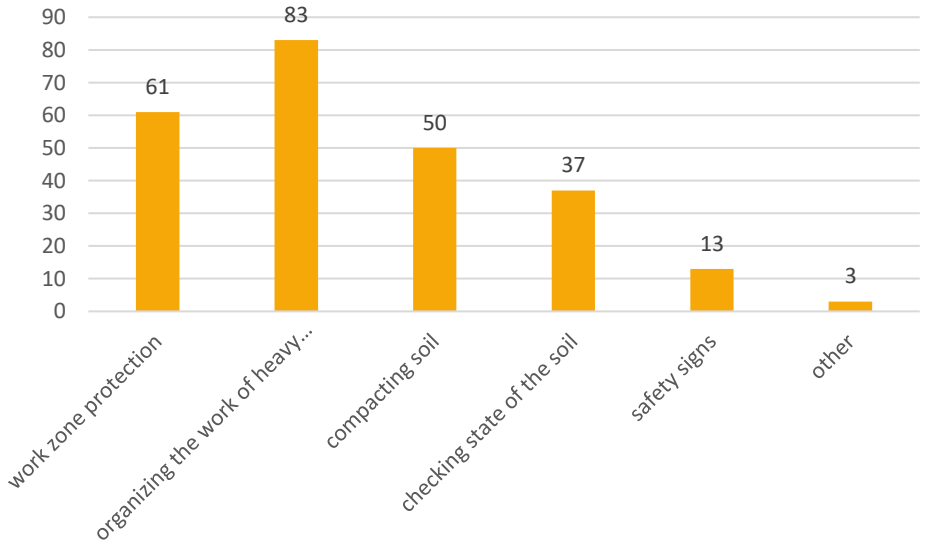
PL	DE	ESP	ENG	Total	Mark
1	1	1	0	3	1
5	6	1	1	13	2
15	4	12	1	32	3
28	7	19	2	56	4
14	1	0	1	16	5

Average: 3,58



Please mark the most dangerous tasks/elements:

Answer	PL	DE	ESP	ENG	Total
work zone protection	29	11	17	4	**61**
organizing the work of heavy machinery alongside workers	41	14	25	3	**83**
compacting soil	20	10	18	2	**50**
checking state of the soil	19	6	10	2	**37**
safety signs	5	2	6	0	**13**
other	1	1	1	0	**3**



Other included:

- Suitability of the compaction method, and its associated intrinsic safety. *(Idoneidad del método de compactación, y su seguridad intrínseca asociada.)*

- Protection of the building *(Schutz des Bauwerks)*
- heavy loads at the edges of the trench (duże obciążenia na krawędziachwykopu)

Additional answers

Other important subjects / areas of H&S issues during use of earthworks named by potential beneficiaries were:

- Individual and general safety measures *(Indywidualne i zbiorowe środki bezpieczeństwa)*
- Due to the lack of an introduction to the study, I need to draw attention to one issue. The fact that any of the parameters / factors is not the "most important / dangerous" does not mean that it will not have a significant impact on the safety of the works. The sum of the factors affecting safety should be met, not only the most important ones. I understand that as a result of the survey it will be possible, for example, to select the most important elements in which training / research will take place. By providing a direct answer to the question: the issue of transport outside the construction site on public roads is important (the driver fully answers - no influence and responsibility of the site manager / works manager). *(Ze względu na brak wprowadzenia do opracowania, potrzebuję zwrócić uwagę na jedną kwestię. Fakt, że któryś z parametrów / czynników nie należy do „najważniejszych / najbardziej niebezpiecznych" nie oznacza, że nie będzie mieć istotnego wpływu na bezpieczeństwo prowadzenia robót. Spełniona powinna być suma czynników wpływających na bezpieczeństwo, a nie wyłącznie najistotniejsze. Rozumiem, że w wyniku ankiety będzie można np. dokonać wyboru najistotniejszych elementów, w obszarze których odbędą się szkolenia / badania. Udzielając wprost odpowiedzi na pytanie: istotna jest kwestia transportu poza terenem budowy po drogach publicznych (odpowiada w pełni kierowca - brak wpływu i odpowiedzialności kierownika budowy / kierownika robót).)*
- Conducting works - ceiling excavations - proper ventilation of the areas under the ceiling, workplace and general lighting. Extraction and transport of excavated material from a deep excavation. *(Prowadzenie robót - wykopów podstropowych - prawidłowa wentylacja obszarów pod stropem, oświetlenie stanowiskowe i ogólne. Wydobywanie i transport urobku z głębokiego wykopu.)*
- inspection of the condition of the protection of the excavation walls or excavation slopes *(kontrola stanu zabezpieczenia ścian wykopu lub skarp wykopu)*
- 1. Overlapping of works // 2. Close movement of people and machinery *(1. Superposición de trabajos // 2. Circulación de personas y maquinaria en proximidad)*
- Rescue after landslide accident *(Rescate tras accidente por derrumbe)*
- Geotechnical study vs. site reality *(Estudio geotécnico vs realidad de obra)*
- Shoring. Drainage pumps in wells (phreatic level). Geotechnical studies (indicating the real slopes to be made). Protection of the edge of excavation (handrails). Presence of affected services, including overhead power lines. *(Entibaciones. Bombas de achique en pozos (nivel freático). Estudios geotécnicos*

(donde indiquen los taludes reales a realizar). Protección de borde de excavación (barandillas). Presencia de servicios afectados, incluidas líneas eléctricas aéreas.)

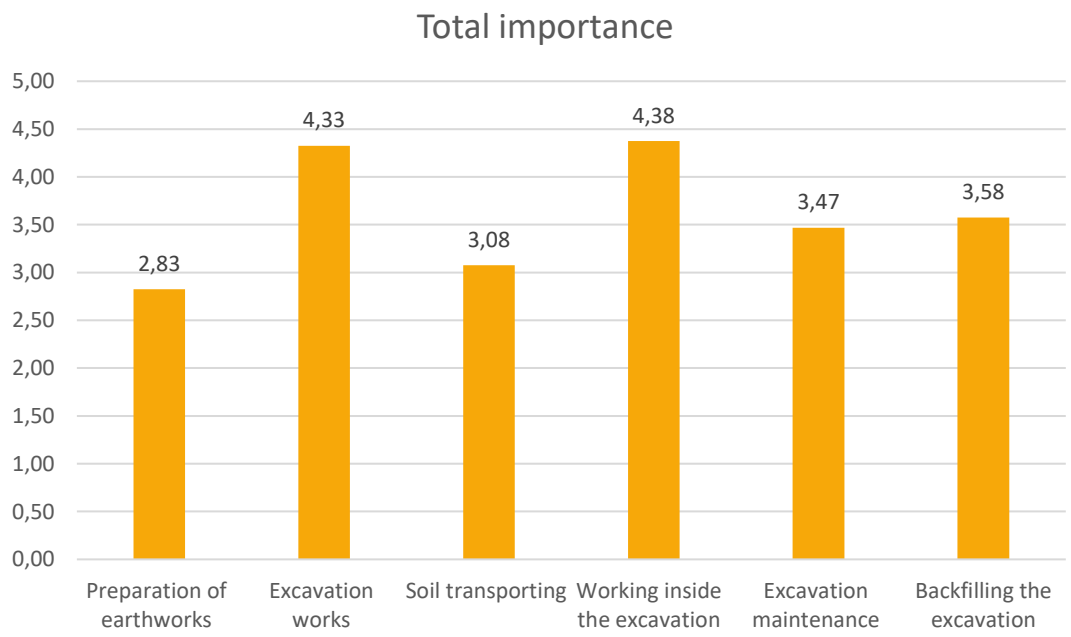
- Affected Services *(Servicios Afectados)*
- In general, sequentially, the most important points are: 1. Knowledge of the terrain (Geotechnical Study), affected services and annexed buildings.// Organise internal circulation // 3. Adequate signposting at the site exit // 4. Ensure the stability of the excavation walls/ slopes // 5. Protect possible falls into the excavations //6. If necessary, access ramps with appropriate slopes // 7. Separate vehicle traffic/movement from pedestrians *(En general, secuencialmente, los puntos más importantes, son: 1. Conocimiento del terreno (Estudio Geotécnico), servicios afectados y edificaciones anexas. // 2. Organizar circulación interna // 3. Adecuada señalización en salida de obra // 4. Asegurar la estabilidad de las paredes/taludes de la excavación // 5. Proteger posibles caídas al interior de excavaciones // 6. En su caso, rampas de acceso con pendientes adecuadas // 7. Separar circulación/movimiento de vehículos del personal de a pié)*
- Planning and safe working procedures. Knowledge and establishment of the selection criteria, use and installation of the support and/or shoring system in particularly complex and unstable excavations/trenches. *(Planificación y procedimientos de trabajo seguro. Conocimiento y establecimiento de los criterios de selección, utilización, e instalación del sistema de sustentación y/o entibación en excavaciones/zanjas de especial complejidad e inestabilidad.)*
- Use of explosives for rocky earthworks. *(Empleo de explosivos para el movimiento de tierras rocosas.)*
- MOVEMENT OF MACHINERY ON SLOPES *(MOVIMIENTO DE MAQUINARIA SOBRE TALUDES)*
- No or inadequate sanitary and restrooms available *(Keine oder mangelhafte Sanitär- und Pausenräume vorhanden)*
- Safety measures due to adjoining buildings/ Topic: Shear failure *(Sicherungsmaßnahmen aufgrund angrenzender Bebauung/ Thema: Grundbruch)*
- Coordination of trades *(''Koordination der Gewerke)*
- Suppliers *(Versorger)*
- Securing of excavation pit *(Baugrubensicherung)*
- Site access to the excavation pit *(Baustellenzugang in der Baugrube)*
- none *(keine)*

Total importance summary

Each task group was assessed as at least rather dangerous which was no surprise for the partnership, as works associated with earthworks are among one of the most hazardous in construction industry.

The answers received from e-versions and paper versions of questionnaires varied depending on the category. Stakeholders assessed that preparation of earthworks is the least dangerous category (average score 2,83). At the same time, they pointed that the most hazardous works are associated with excavation works and working inside the excavation (average score 4,33 and 4,38).

The graph below shows summary of the received answers.



3. setAR learning outcomes

The final learning outcomes were carefully selected on the base of the questionnaires results, meetings with important stakeholders and partners expertise in the field of earthworks. Due to the limited size of setAR training program the most important aspects were chosen. These aspects address H&S issues as the project aims for prevention of accidents on construction sites.

Learning outcomes include key aspects of the following:

- Introduction: What are earthworks? Differences between deep excavations and earthmoving / regular and specialized works. Why issues such as listed below will not be tackled by setAR project: Earthworks during winter; protection from water; contaminated areas; explosives; trench protection; diaphragm walls; compacting ground; remnants of war.
- Excavation works: slope protection – compare local standards, types of soil, angle of slope, + heavy loads by the edge of the excavation
- Working inside the excavation: dealing with a collapse / evacuating the excavation
- Excavation works: organizing the work of heavy machinery alongside workers, danger areas and visibility restrictions + Soil transporting: loading trucks
- Working inside the excavation: work zone protection, fall hazard/ fall protection elements
- Preparation of earthworks: collisions with existing infrastructure (gas pipes, water pipes)
- Machinery falling down – protection/ what to do in a case of the accident
- Storage of the soil
- Transporting excavation machines

The final names of procedures might be changed during the development of other IOs.

Annex: Questionnaires

In order to fully engage project stakeholders across Europe and to receive the best possible outcomes, surveys were prepared in four languages.

Presented below are print screens of e-versions of survey sent to stakeholders as links and also available at project official website. The surveys/ questionnaires were presented during numerous meetings (mostly online) with target groups.

English version

E-version

Safe Earthworks Training with the use of Augmented Reality

Cooperation for Innovation and the Exchange of Good Practices
Strategic Partnerships for Vocational Education and Training, 2020-1-PL01-KA202-081555

This project has been funded with support from the European Commission. This publication [communication] reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

*Required

IO1: Evidence based learning outcomes
QUESTIONNAIRE

Who are you? *

- ◯ Construction worker
- ◯ Manager
- ◯ H&S specialist
- ◯ Other: _____

Please assess the level of hazard for the following:

Preparation of earthworks *

	1	2	3	4	5	
LOW	◯	◯	◯	◯	◯	HIGH

Regarding Preparation of earthworks, please mark the most important / dangerous tasks/elements:

- ☐ legal aspects and requirements
- ☐ organization of works
- ☐ machinery preparation
- ☐ work zone protection
- ☐ checking state of the soil
- ☐ fall protection elements
- ☐ protection of the area (buildings, roads, trees, etc.)

- [ ] collisions with existing infrastructure
- [ ] safety signs
- [ ] roadways on construction site
- [ ] owing, loading, transporting earth-moving machinery
- [ ] Other: _____

Excavation works *

	1	2	3	4	5	
LOW	○	○	○	○	○	HIGH

Regarding Excavation works,, please mark the most important / dangerous tasks/elements:

- [ ] work zone protection
- [ ] slope protection
- [ ] trench protection
- [ ] organizing the work of heavy machinery alongside workers, danger areas and visibility restrictions
- [ ] draining water
- [ ] work control
- [ ] Other: _____

Soil transporting *

	1	2	3	4	5	
LOW	○	○	○	○	○	HIGH

Regarding Soil transporting, please mark the most important / dangerous tasks/elements:

- [ ] loading trucks
- [ ] unloading trucks
- [ ] compacting soil
- [ ] safe soil storage in prisms
- [ ] Other: _____

Working inside the excavation *

	1	2	3	4	5	
LOW	○	○	○	○	○	HIGH

Regarding Working inside the excavation, please mark the most important / dangerous tasks/elements:

- [ ] work zone protection
- [ ] fall hazard/ fall protection elements
- [ ] safety signs
- [ ] communication
- [ ] vertical transport
- [ ] organizing the work of heavy machinery alongside workers
- [ ] dealing with a collapse
- [ ] work in the contaminated area
- [ ] work in the area with the risk of unexploded ordnance or explosives remnants of war
- [ ] Other: _____

Excavation maintenance *

	1	2	3	4	5	
LOW	○	○	○	○	○	HIGH

Regarding Excavation maintenance, please mark the most important / dangerous tasks/elements:

- [ ] protection from water
- [ ] fall protection elements
- [ ] safety signs
- [ ] heavy loads by the edge of excavation/trench
- [ ] tidiness/ cleanliness
- [ ] carrying out other works near the excavation
- [ ] Other: _____

Backfilling the excavation *

	1	2	3	4	5	
LOW	○	○	○	○	○	HIGH

Regarding Backfilling the excavation, please mark the most important / dangerous tasks/elements:

- [ ] work zone protection
- [ ] organizing the work of heavy machinery alongside workers
- [ ] compacting soil
- [ ] checking state of the soil
- [ ] safety signs

☐ Other: _____

Wish you add other important subjects / areas of H&S issues during earthworks on construction site, please write it here:

Your answer

If you wish to receive further information about the project, please give us your contact details below (email address or phone number):

Your answer

Submit

German version

E-version

Augmented Reality – Sicherheitstraining Erdarbeiten

Kooperation für Innovation und den Austausch von bewährten Praktiken
Strategische Partnerschaft für die Berufsausbildung, 2020-1-PL01-KA202-081555

Dieses Projekt wurde mit der Unterstützung der Europäischen Kommission finanziert. Die Verantwortung für den Inhalt dieser Veröffentlichung (Mitteilung) trägt allein der Verfasser, die Kommission haftet nicht für die weitere Verwendung der darin enthaltenen Inhalte.

* Erforderlich

IO1: Nachgewiesene Lernerfolge

FRAGEBOGEN

Sie sind? *

- ◯ Bauarbeiter_in
- ◯ Bauleiter_in
- ◯ Fachkraft für den Arbeits- und Gesundheitsschutz
- ◯ Sonstiges: _____

Bitte beurteilen Sie die Gefährdung bei folgenden Arbeiten:

Vorbereitung der Erdarbeiten *

	1	2	3	4	5	
NIEDRIG	○	○	○	○	○	HOCH

Bitte kreuzen Sie die wichtigsten/gefährlichsten Aufgaben/Elemente bei der Vorbereitung von Erdarbeiten an:

- ☐ rechtliche Aspekte und Anforderungen
- ☐ Arbeitsorganisation
- ☐ Vorbereitung der Maschinen
- ☐ Schutz des Arbeitsbereiches
- ☐ Überprüfung der Bodenbeschaffenheit
- ☐ Absturzsicherung
- ☐ Schutz des Geländes (Gebäude, Straßen, Bäume, etc.)
- ☐ Kollisionen mit bestehender Infrastruktur
- ☐ Sicherheitszeichen
- ☐ Fahrwege auf der Baustelle
- ☐ Aufladen, Abladen und Transportieren der Erdbaumaschinen
- ☐ Sonstiges: _____

Aushubarbeiten *

	1	2	3	4	5	
NIEDRIG	○	○	○	○	○	HOCH

Bitte kreuzen Sie die wichtigsten/gefährlichsten Aufgaben/Elemente bei Aushubarbeiten an:

- [ ] Schutz des Arbeitsbereiches
- [ ] Hangsicherung
- [ ] Grabensicherung
- [ ] Arbeitsorganisation der Erdbaumaschinen in Bereichen von Arbeitern, Gefahrenbereichen und Sichteinschränkungen,
- [ ] Wasserhaltung
- [ ] Arbeitskontrolle
- [ ] Sonstiges: _____

Transport des Erdaushubs *

	1	2	3	4	5	
NIEDRIG	○	○	○	○	○	HOCH

Bitte kreuzen Sie die wichtigsten/gefährlichsten Aufgaben/Elemente beim Transport des Erdaushubs an:

- [ ] Beladen der LKWs
- [ ] Entladen der LKWs
- [ ] Bodenverdichtung
- [ ] Bodenlagerung in Mieten
- [ ] Sonstiges: _____

Arbeiten innerhalb der Baugrube *

	1	2	3	4	5	
NIEDRIG	○	○	○	○	○	HOCH

Bitte kreuzen Sie die wichtigsten/gefährlichsten Aufgaben/Elemente bei Arbeiten innerhalb der Baugrube an:

- [ ] Schutz des Arbeitsbereiches
- [ ] Absturzgefahr/Absturzsicherung
- [ ] Sicherheitszeichen
- [ ] Kommunikation
- [ ] Vertikaler Transport
- [ ] Arbeitsorganisation der Erdbaumaschinen in Bereichen von Arbeitern
- [ ] Vorgehen bei einem Einsturz der Baugrube
- [ ] Arbeiten in kontaminierten Bereichen
- [ ] Arbeiten in Gefahrenbereichen von nicht explodierten Kampfmitteln
- [ ] Sonstiges: _____

Instandhaltung der Baugrube *

	1	2	3	4	5	
NIEDRIG	○	○	○	○	○	HOCH

Bitte kreuzen Sie bezüglich dem Schalungstransport die gefährlichsten Faktoren an:

- [ ] Schutz vor Wasser
- [ ] Absturzsicherung

- [ ] Sicherheitszeichen
- [ ] schwere Lasten am Rand der Baugrube/des Grabens
- [ ] Ordnung/Sauberkeit
- [ ] Durchführung anderer Arbeiten in der Nähe der Baugrube
- [ ] Sonstiges: _____

Verfüllung der Baugrube *

	1	2	3	4	5	
NIEDRIG	○	○	○	○	○	HOCH

Bitte kreuzen Sie die wichtigsten/gefährlichsten Aufgaben/Elemente bei der Verfüllung der Baugrube an:

- [ ] Schutz des Arbeitsbereiches
- [ ] Arbeitsorganisation der Erdbaumaschinen in Bereichen von Arbeitern
- [ ] Bodenverdichtung
- [ ] Überprüfung der Bodenbeschaffenheit
- [ ] Sicherheitszeichen
- [ ] Sonstiges: _____

Hier können Sie gerne weitere wichtige Themen oder Bereiche im Kontext des Arbeits- und Gesundheitsschutzes bei Erdarbeiten auf der Baustelle formulieren:

Meine Antwort

Wenn Sie weitere Informationen über das Projekt erhalten möchten, bitten wir um Angabe Ihrer Kontaktdaten. E-Mail Adresse oder Telefonnummer:

Meine Antwort

Senden

Polish version

E-version

Szkolenie w zakresie bezpiecznego wykonywania robót ziemnych wspomagane technologią rzeczywistości rozszerzonej

Współpraca na rzecz innowacji i dobrych praktyk
Partnerstwa strategiczne i sojusze na rzecz umiejętności
Numer projektu: 2020-1-PL01-KA202-081555

Ten projekt został zrealizowany przy wsparciu finansowym Komisji Europejskiej. Projekt lub publikacja odzwierciedlają jedynie stanowisko ich autora i Komisja Europejska nie ponosi odpowiedzialności za umieszczoną w nich zawartość merytoryczną.

*Wymagane

Safe Earthworks Training with the use of Augmented Reality

IO1: Potwierdzenie wyników nauczania
ANKIETA

Jestem: *

- ◯ pracownikiem budowy / fizycznym

- ○ menedżerem / kierownikiem
- ○ specjalistą ds. BHP
- ○ Inne: _____

Proszę ocenić stopień zagrożenia dla poniższych robót:

Przygotowanie robót ziemnych *

	1	2	3	4	5	
NISKI	○	○	○	○	○	WYSOKI

Proszę zaznaczyć najważniejsze/najniebezpieczniejsze zadania/elementy w zakresie przygotowania robót ziemnych:

- ☐ wymagania i aspekty prawne
- ☐ organizacja robót
- ☐ przygotowanie maszyn
- ☐ zabezpieczenie stref pracy
- ☐ kontrola stanu gruntu
- ☐ elementy zabezpieczające przed upadkiem
- ☐ zabezpieczenie terenu (budynki, drogi, drzewa, itp.)
- ☐ kolizje z istniejącą infrastrukturą
- ☐ znaki bezpieczeństwa
- ☐ drogi na terenie budowy
- ☐ holowanie, załadunek, transport maszyn do robót ziemnych
- ☐ Inne: _____

Wykopy *

	1	2	3	4	5	
NISKI	○	○	○	○	○	WYSOKI

Odnośnie wykopu, proszę zaznaczyć najbardziej niebezpieczne etapy/ czynniki:

- [ ] zabezpieczenie stref pracy
- [ ] zabezpieczenie skarp
- [ ] zabezpieczenie wąskich wykopów
- [ ] organizacja wspólnej pracy maszyn i ludzi, strefy niebezpieczne i ograniczenia widoczności
- [ ] odprowadzenie wody
- [ ] nadzór nad robotami
- [ ] Inne: _____

Transport urobku *

	1	2	3	4	5	
NISKI	○	○	○	○	○	WYSOKI

Proszę zaznaczyć najważniejsze/najniebezpieczniejsze zadania/elementy w zakresie transportu urobku:

- [ ] załadunek pojazdów
- [ ] rozładunek pojazdów
- [ ] zagęszczanie gruntu
- [ ] bezpieczne składowanie gruntu w pryzmach
- [ ] Inne: _____

Praca wewnątrz wykopów *

	1	2	3	4	5	
NISKI	○	○	○	○	○	WYSOKI

Proszę zaznaczyć najważniejsze/najniebezpieczniejsze zadania/elementy w zakresie pracy wewnątrz wykopów:

- [ ] zabezpieczenie stref pracy
- [ ] zagrożenie upadkiem/zagrożenie upadającymi elementami
- [ ] znaki bezpieczeństwa
- [ ] komunikacja
- [ ] transport pionowy
- [ ] organizacja wspólnej pracy maszyn i ludzi
- [ ] postępowanie w razie zawalenia się ścian wykopu
- [ ] praca w obszarze skażonym
- [ ] praca w obszarze zagrożenia niewybuchami
- [ ] Inne: _____

Utrzymanie wykopów *

	1	2	3	4	5	
NISKI	○	○	○	○	○	WYSOKI

Proszę zaznaczyć najważniejsze/najniebezpieczniejsze zadania/elementy w zakresie utrzymania wykopów w odpowiednim stanie:

- [ ] zabezpieczenie przed wodą
- [ ] elementy zabezpieczające przed upadkiem

- [ ] znaki bezpieczeństwa
- [ ] duże obciążenia na krawędziach wykopu
- [ ] porządek/czystość
- [ ] prowadzenie innych prac w pobliżu wykopu
- [ ] Inne: _____

Zasypywanie wykopów *

	1	2	3	4	5	
NISKI	○	○	○	○	○	WYSOKI

Proszę zaznaczyć najważniejsze/najniebezpieczniejsze zadania/elementy w zakresie zasypywania wykopów:

- [ ] zabezpieczenie stref pracy
- [ ] organizacja wspólnej pracy maszyn i ludzi
- [ ] zagęszczanie gruntu
- [ ] kontrola stanu gruntu
- [ ] znaki bezpieczeństwa
- [ ] Inne: _____

W razie chęci uzupełnienia innych ważnych aspektów/obszarów dotyczących bezpieczeństwa i higieny pracy przy robotach ziemnych, proszę zamieścić je poniżej:

Twoja odpowiedź

Jeśli chcieliby Państwo otrzymać więcej informacji dotyczących projektu, prosimy o zapisanie swojego adresu e-mail lub numeru telefonu komórkowego:

Twoja odpowiedź

Prześlij

Spanish version

E-version

Formación en movimientos de tierras seguros con Realidad Aumentada

Cooperación para la Innovación e Intercambio de Buenas Prácticas
Asociaciones estratégicas para Educación y Formación Profesional, 2020-1-PL01-KA202-081555

Este proyecto ha sido financiado con el apoyo de la Unión Europea. Esta comunicación (información) refleja el punto de vista de su autor, y la Comisión no puede considerarse responsable del uso que pueda hacerse de la información contenida en la misma.

*Obligatorio

IO1: Evidencia basada en resultados de aprendizaje
CUESTIONARIO

¿Cuál es su puesto de trabajo? *

- ◯ Trabajador de la construcción
- ◯ Gerente
- ◯ Especialista en Seguridad y Salud
- ◯ Otro: _____

Por favor, evalúe el nivel de riesgo de las siguientes propuestas

Preparación de la excavación *

	1	2	3	4	5	
BAJO	○	○	○	○	○	ALTO

Respecto a Preparación del movimiento de tierra, por favor, señale las tareas/elementos que considere más peligrosos:

- ☐ requerimientos y aspectos legales
- ☐ organización de las actividades
- ☐ preparación de la maquinaria
- ☐ protección de la zona de trabajo
- ☐ comprobación del estado del suelo
- ☐ elementos de protección anticaída
- ☐ protección de la zona (edificios, carreteras, árboles, etc.)
- ☐ colisiones con infraestructuras existentes
- ☐ señalización de seguridad
- ☐ existencia de vías públicas afectadas por las obras de construcción
- ☐ remolcar, cargar, transportar maquinaria para la actividad
- ☐ Otro: _____

Trabajos de excavación *

	1	2	3	4	5	
BAJO	○	○	○	○	○	ALTO

Respecto a los Trabajos de excavación, por favor, indique qué tareas/elementos considera más peligrosos:

- [ ] protección de la zona de trabajo
- [ ] protección de taludes
- [ ] protección de zanjas
- [ ] organizar el trabajo de la maquinaria pesada junto a otros trabajadores, en las zonas de riesgo y con restricciones de visibilidad
- [ ] agua de drenaje
- [ ] control de las tareas
- [ ] Otro: _____

Transporte de tierras *

	1	2	3	4	5	
BAJO	○	○	○	○	○	ALTO

En relación con el Transporte de tierra, por favor, señale las tareas/elementos que considere más peligrosos:

- [ ] carga de camiones
- [ ] descarga de camiones
- [ ] compactación del suelo
- [ ] acopio y almacenamiento de las tierras de la excavación de forma segura
- [ ] Otro: _____

Trabajar dentro de la excavación *

	1	2	3	4	5	
BAJO	○	○	○	○	○	ALTO

Respecto a Trabajar dentro de la excavación, por favor, indique qué tareas/elementos considera más peligrosos:

- [ ] protección de la zona de trabajo
- [ ] elementos de protección contra caídas
- [ ] señalización de seguridad
- [ ] comunicación
- [ ] transporte vertical
- [ ] organizar el trabajo de la maquinaria pesada con otros trabajadores
- [ ] enfrentarse a un derrumbe
- [ ] trabajar en una zona contaminada
- [ ] trabajar en la zona con riesgo de munición sin explotar o restos de explosivos de guerra
- [ ] Otro: _____

Mantenimiento de la excavación *

	1	2	3	4	5	
BAJO	○	○	○	○	○	ALTO

En relación con el Mantenimiento de la excavación, por favor, señale las tareas/elementos que considere más peligrosos:

- [ ] protección contra el agua
- [ ] elementos de protección anticaídas
- [ ] señalización de seguridad
- [ ] cargas pesadas al borde de la excavación/zanja
- [ ] orden/limpieza
- [ ] llevar a cabo otras actividades cerca de la excavación
- [ ] Otro: _____

Relleno de la excavación *

	1	2	3	4	5	
BAJO	○	○	○	○	○	ALTO

Respecto al Relleno la excavación, por favor, indique las tareas/elementos que considere más peligrosos:

- [ ] protección de la zona de trabajo
- [ ] organizar el trabajo de la maquinaria pesada con otros trabajadores
- [ ] compactación de suelo
- [ ] comprobar el estado del suelo
- [ ] señalización de seguridad
- [ ] Otro: _____

Si desea añadir otros temas/áreas importantes sobre Seguridad y Salud en las actividades de movimiento de tierras en la obra, por favor indíquelo aquí.

Tu respuesta

Si quieres recibir más información sobre el proyecto, por favor danos algún dato de contacto. (dirección de correo electrónico, número de teléfono)

Tu respuesta

Enviar

Project coordinator:

The Faculty of Civil Engineering, Warsaw University of Technology (Poland)

Partners:

Fundación Laboral de la Construcción (Spain)

Polskie Stowarzyszenie Menedżerów Budownictwa (Poland)

Technische Universität Darmstadt (Germany)

Universitat de Valencia (Spain)