we accelerate Ukraine's critical infrastructure recovery

bridgeUkraine.org is a non-profit alliance of more than 47 practitioners, consultants, academics, institutions, and international bodies that are tasked to accelerate Ukraine's critical infrastructure recovery

www.bridgeUkraine.org

NEWSLETTER

YEAR 2
Published: 29 March 2024

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mob: +447936842605

bridgeUkraine for a Sustainable and Resilient Future

Dear Reader,

It is a pleasure to send you our second newsletter on behalf of the bridgeUkraine Alliance. Many of our aims have been delivered during the past year, and several achievements in support of Ukraine's reconstruction and capacity building have been accomplished. We had very positive feedback and bridgeUkraine currently counts more than 47 members from all over the world with significant contribution of Ukrainians and strong participation of women. bridgeUkraine continues its collaboration based on the Memorandum of Understanding (MoU) with the Derzhdor NDI SE of the Ukrainian State Road Research Institute of the Ministry of Restoration of Ukraine.

bridgeUkraine has raised a total of £1.67m ($2.11m) to support Ukrainian academics and consultants to develop frameworks for the efficient reconstruction of Ukraine's critical infrastructure. Of this funding, 96% is directly allocated to Ukrainians. Of this funding, £1.05m is to support four Ukrainian academics, who work on the reconstruction prioritisation of Ukraine's critical infrastructure using resilience and sustainability metrics, digital data and technologies and leveraging AI where possible. bridgeUkraine also secured a large grant to deliver a 3-year capacity building programme. This programme will educate and provide certifications to thousands of Ukrainian engineers on Eurocodes and other international design guidelines, to facilitate peacebuilding for a more beautiful, sustainable and resilient Ukraine, where people are included and feel safe.

We initiated a very rewarding Twinning between the Ivan Franko National University of Lviv and the University of Birmingham on conflict resilience and organised a 1-day workshop that took place in Warsaw that was attained by more than 30 academics, consultants, politicians and policy makers of Ukraine. With targeted seminars, CPD and capacity building meetings we have educated >900 Ukrainian scientists and engineers.

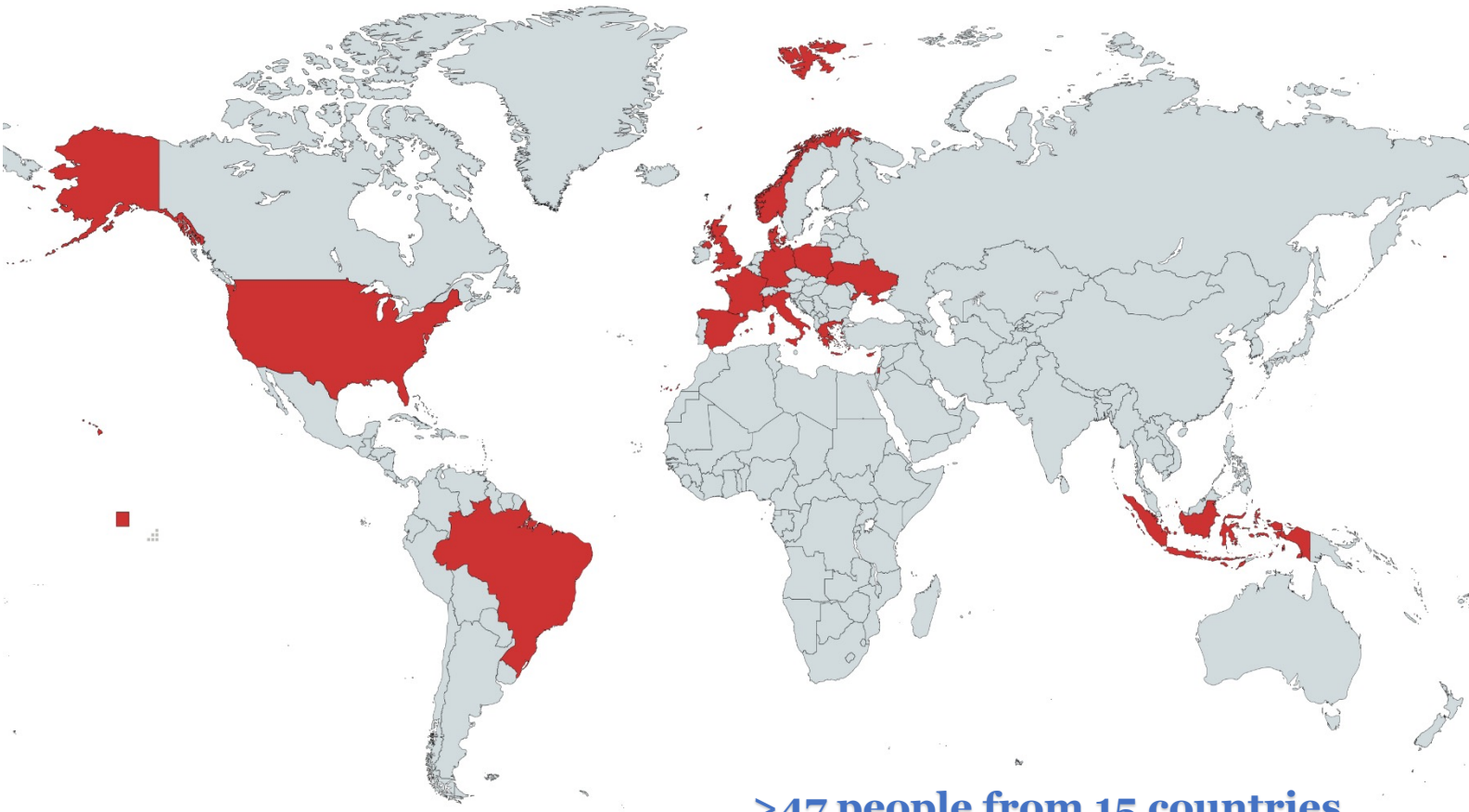
bridgeUkraine published an open access paper titled 'Conflict-resilience framework for critical infrastructure peacebuilding' in the journal of Sustainable Cities & Societies and an UNDP CDRI report on 'Financing for disaster and climate resilient infrastructure for a net-zero economic transition with a case study on Ukraine's infrastructure', which has been presented in the G20 summit.

Please share your thoughts with us and fill in this form to join the Alliance!

Sincerely,

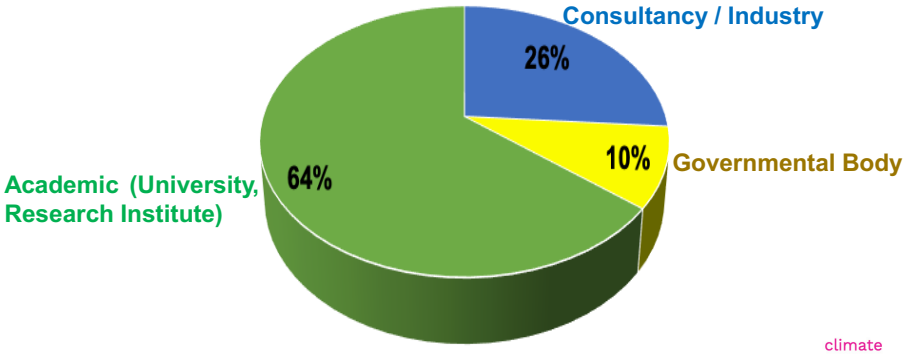
The bridgeUkraine Alliance

Geographical Distribution

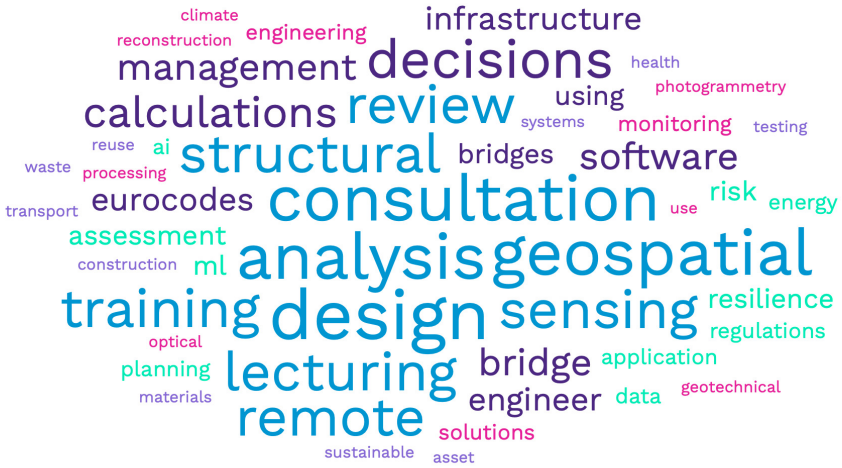


>47 people from 15 countries

the Expertise of bridgeUkraine for Reconstruction



Liaison with the Ministry of Restoration of Ukraine



47 people:

50% women, 50% men

30% from Ukraine

Objectives

We accelerate peacebuilding prioritisation and optimisation for critical infrastructure to support Ukraine's people and economy:

- Establish a Community of Practice based on an **alliance** of engineers, academics, economists and governmental bodies to build capacities and train Ukrainians for rebuilding infrastructures. *Read more >>*
- Develop and apply **resilience** frameworks using open digital data and crowdsourcing for **optimal infrastructure reconstruction** to incentivise the green transition in Ukraine for optimal resource allocation in infrastructure recovery. *Read more >>*
- Capacity-building programme "Empower Ukraine" to **educate Ukrainian engineers** on Eurocode-based infrastructure design and construction through comprehensive Continuing Professional Development sessions. *Read more >>*

bridgeUkraine contributes to UN SDSs and Targets

The British Academy

Researchers at Risk Fellowships

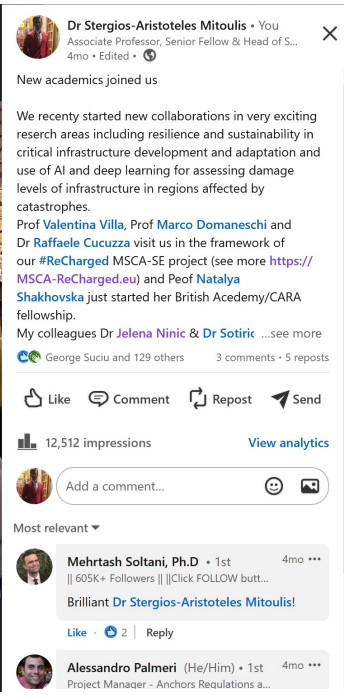
Total Funding: £1.67m

Four fellowships were supported by the British Academy/CARA for top Ukrainian academics of Lviv Polytechnic University:

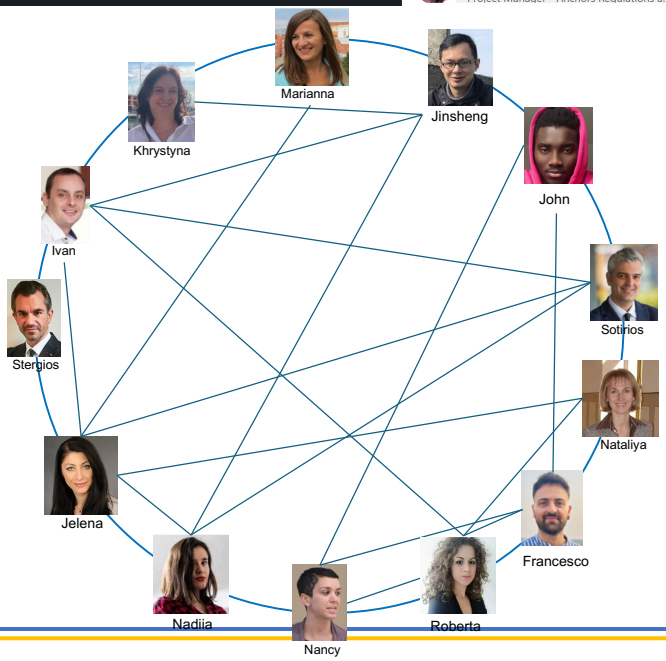
- **AI4SURE** - AI-empowered data-mining techniques for SUstainable and climate-REsilient peacebuilding
- **bridgeAdapt** - Sustainable adaptation measures for deteriorated bridges to climate-induced damage
- **WINDTUNE** - Turbulence on surface pressures on residential buildings situated in industrial zones
- **ReconAI** - Data-driven infrastructure resilience assessment toward climate adaptation and conflict-resilience

BridgeUkraine Capacity Building Programme

bridgeUkraine secured a large grant to deliver a 3-year capacity building programme. This programme will educate and provide certifications to thousands of Ukrainian engineers on Eurocodes and other international design guidelines, to facilitate peacebuilding for a more beautiful, sustainable and resilient Ukraine, where people are included and feel safe.



Ukrainian academics joined UK Universities



metaInfrastructure.org

Integration of Ukrainian researchers in the research group: metaInfrastructure.org

Achievements in Research - Highlights

Published papers

Sustainable Cities and Society 91 (2023) 104405

Contents lists available at ScienceDirect

Sustainable Cities and Society

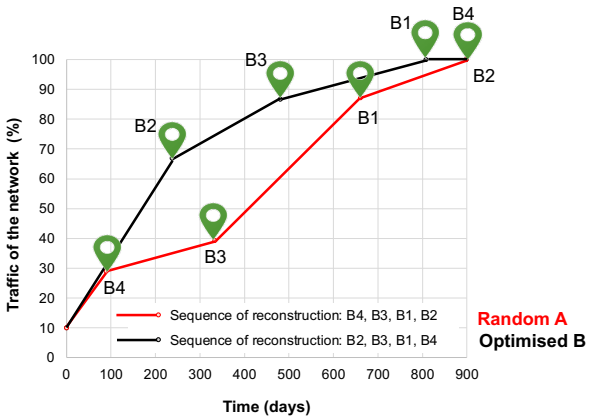
journal homepage: www.elsevier.com/locate/scs

Conflict-resilience framework for critical infrastructure peacebuilding

Stergios-Aristoteles Mitoulis [a,b,c,*], Sotirios Argyroudis [b,c,d,*], Mathaios Panteli [b,e], Clemente Fuggini [b,f], Sotirios Valkaniotis [b,g], William Hynes [h], Igor Linkov [i,j]

[a] Department of Civil Engineering, School of Engineering, University of Birmingham, UK
[b] bridgeUkraine (www.bridgeUkraine.org), London, UK
[c] Infrastructuresilience (www.infrastructuResilience.com), London, UK
[d] Department of Civil and Environmental Engineering, Brunel University London, UK
[e] Department of Electrical and Computer Engineering, University of Cyprus, Cyprus
[f] Infrastructures Business Unit, Rina Consulting S.P.A., Italy
[g] Department of Civil Engineering, Democritus University of Thrace, Greece
[h] OECD (Organisation for Economic Co-operation and Development), France
[i] US Army Engineer Research and Development Center, USA
[j] University of Florida, Gainesville, USA

doi.org/10.1016/j.scs.2023.104405



- 15-20% better traffic performance for the same investment ($) if reconstruction strategy **B** is adopted instead of **A**
- for limited investment ($) this framework can save 30% of cost and increase 30-35% the network traffic performance
- prioritisation reduces the cost due to traffic detours by 60%

Computer Science > Computer Vision and Pattern Recognition

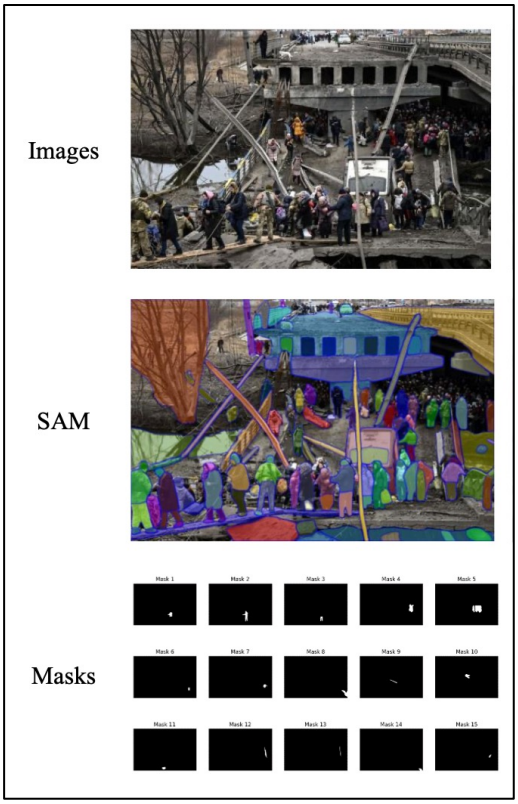
[Submitted on 31 Jan 2024 (v1), last revised 1 Feb 2024 (this version, v2)]

Tiered approach for rapid damage characterisation of infrastructure enabled by remote sensing and deep learning technologies

Nadiia Kopiika, Andreas Karavias, Pavlos Krassakis, Zehao Ye, Jelena Ninic, Nataliya Shakhovska, Nikolaos Koukouzas, Sotirios Argyroudis, Stergios-Aristoteles Mitoulis

Critical infrastructure such as bridges are systematically targeted during wars and conflicts. This is because critical infrastructure is vital for enabling connectivity and transportation of people and goods, and hence, underpinning the national and international defence planning and economic growth. Mass destruction of bridges, along with minimal or no accessibility to these assets during natural and anthropogenic disasters, prevents us from delivering rapid recovery. As a result, systemic resilience is drastically reduced. A solution to this challenge is to use technology for stand-off observations. Yet, no method exists to characterise damage at different scales, i.e. regional, asset, and structural (component), and more so there is little or no systematic correlation between assessments at scale. We propose an integrated three-level tiered approach to fill this capability gap, and we demonstrate the methods for damage characterisation enabled by fit-for-purpose digital technologies. Next, this method is applied and validated to a case study in Ukraine that includes 17 bridges. From macro to micro, we deploy technology at scale, from Sentinel-1 SAR images, crowdsourced information, and high-resolution images to deep learning for damaged infrastructure. For the first time, the interferometric coherence difference and semantic segmentation of images were deployed to improve the reliability of damage characterisations from regional to infrastructure component level, when enhanced assessment accuracy is required. This integrated method improves the speed of decision-making, and thus, enhances resilience. Keywords: critical infrastructure, damage characterisation, targeted attacks, restoration

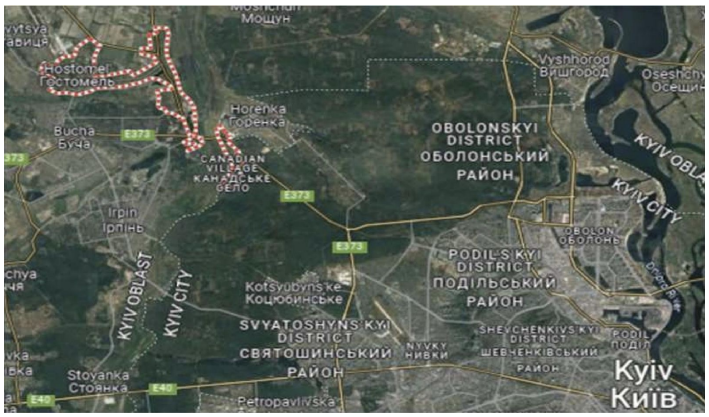
Comments: Main text (34 pages,18 figures); Supplementary materials (13 pages)
Subjects: **Computer Vision and Pattern Recognition (cs.CV)**; Image and Video Processing (eess.IV)
Cite as: arXiv:2401.17759 **[cs.CV]**
(or arXiv:2401.17759v2 **[cs.CV]** for this version)
https://doi.org/10.48550/arXiv.2401.17759



https://arxiv.org/abs/2401.17759

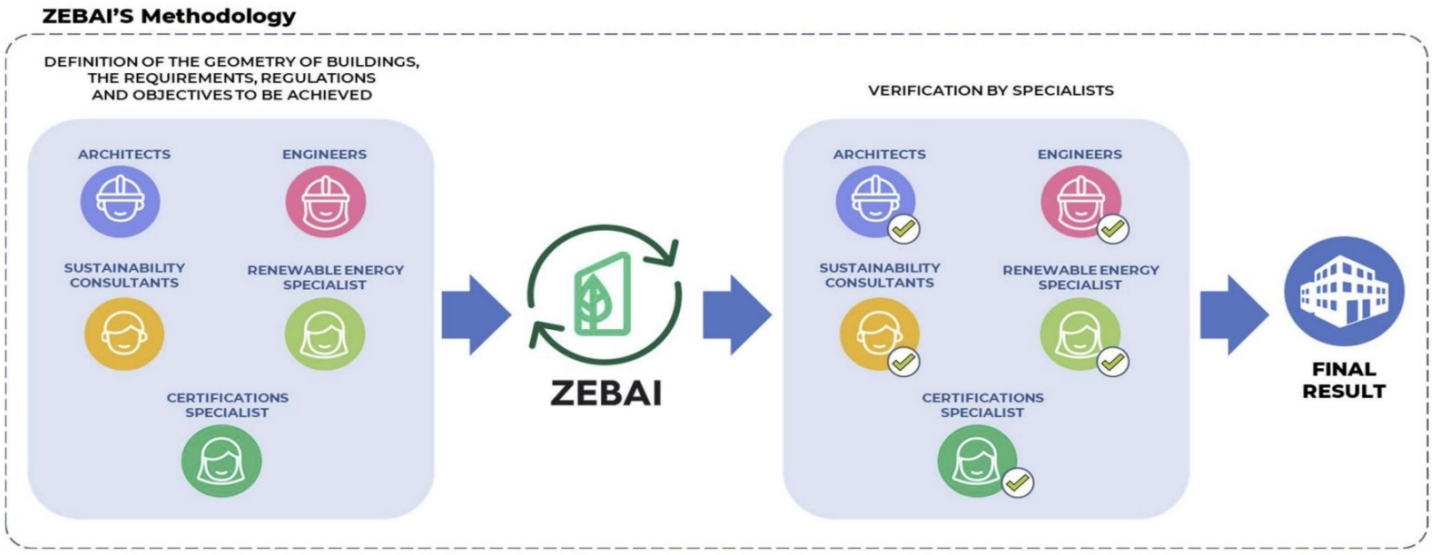
ZEBAI: Innovative methodologies for the design of Zero-Emission and cost-effective Buildings enhanced by Artificial Intelligence
Budget: €5m

https://cordis.europa.eu/project/id/101138678



Reconstructing Hostomel, Ukraine using the ZEBAI methodology.
This demonstrator comprises residential buildings in Hostomel, with a total building area of approximately 3300 m2. The primary objectives of this demonstrator are to reconstruct the building using construction waste generated during the war, thus adhering to the principles of the circular economy, and achieving a zero-emission solution.

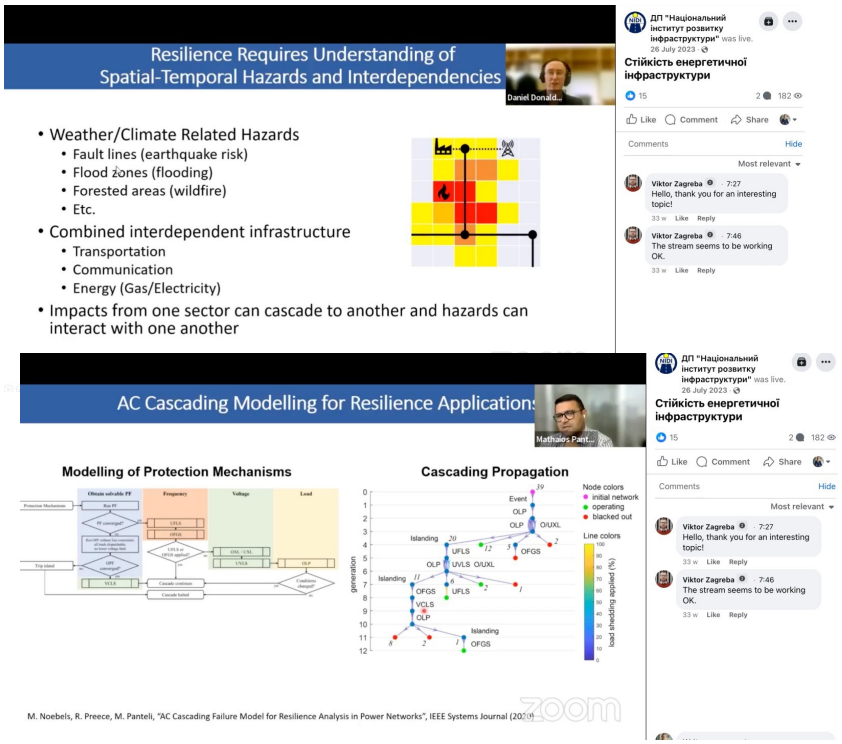
Location and description.
The project is located in Hostomel, a city in northwest of the capital city of Kyiv. The town is mainly known for Hostomel Airport. This airport and the biggest cargo airplane in the world, was destroyed by Russians in a battle which lasted from 25th February to 31st of March 2022.



Our goals during the project are to complete the reconstruction project of the war damaged town of Hostomel and create modern urban neighbourhoods using the principles of the circular economy, environmentally, economically, and innovatively. The war has resulted in over 800 million tons of construction waste in Ukraine including concrete, brick, and other debris.

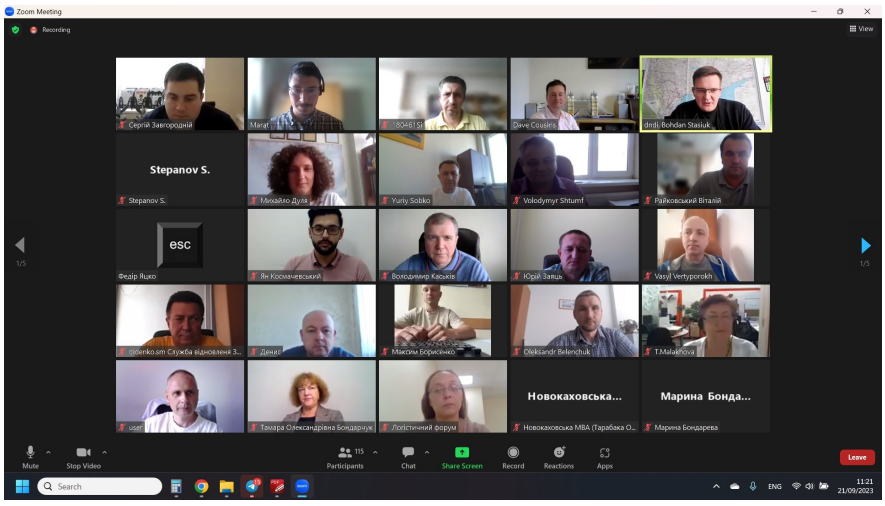
Achievements in Capacity Building

25 September 2023
the following seminar was delivered on 21.09.2023 to more than 130 Ukrainian engineers "**An overview of structural health monitoring and load testing for asset management of bridges and civil infrastructure**". Available here. Speaker: Dave Cousins



26 July 2023
a seminar was delivered on 26.08.2023 to more than 55 Ukrainian Engineers, titled "**Energy Infrastructure Resilience**", Available here. Speakers: Dr Mathaios Panteli, Dr Daniel Donaldson

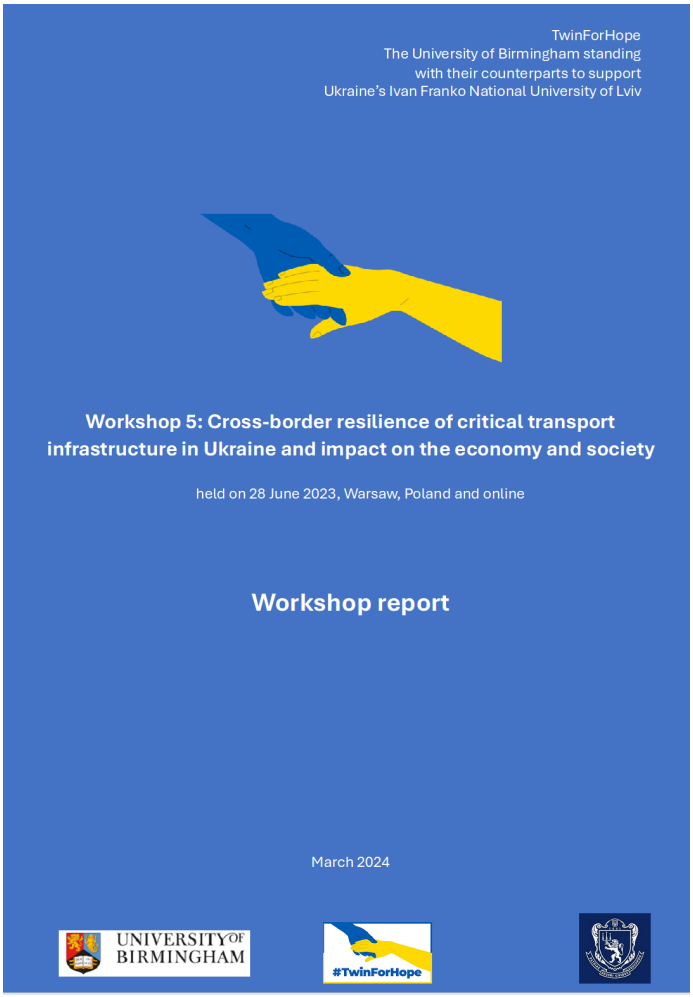
28 March 2023
a seminar was delivered on "**Eurocode 7 – Geotechnical design for foundations**". Speaker: Prof Sebastiano Foti



Organised with Stanislav Gvozdikov, Deputy Director of Eurointegration Processes – M.P. Shulgin State Road Research Institute State Enterprise – Derzhdor NDI SE for the Ukrainian State Road Research Institute.

University of Birmingham and bridgeUkraine.org formalised its collaboration with the Department of Economic and Social Geography of the Ivan Franko National University of Lviv. This is part of the University of Birmingham-Ivan Franko National University of Lviv **TwinForHope scheme** – The UK universities standing with their counterparts to support Ukraine.

A **workshop** is organised between the parties on 21 July 2023 in Warsaw, Poland. (title: *Cross-border resilience of critical transport infrastructure in Ukraine and impact on the economy and society*).



Contribution in Ukraine's recovery events

15 April 2023

bridgeUkraine.org was invited by the Royal Society to attend the "**Ukraine's Recovery: Rebuilding with Research**" conference. The Royal Society and the Universities Policy Engagement Network (UPEN), together with the Fund of the President of Ukraine for Education, Science and Sports and the Embassy of Ukraine, are delivering this conference to support Ukraine's reconstruction and recovery.

23 June 2023

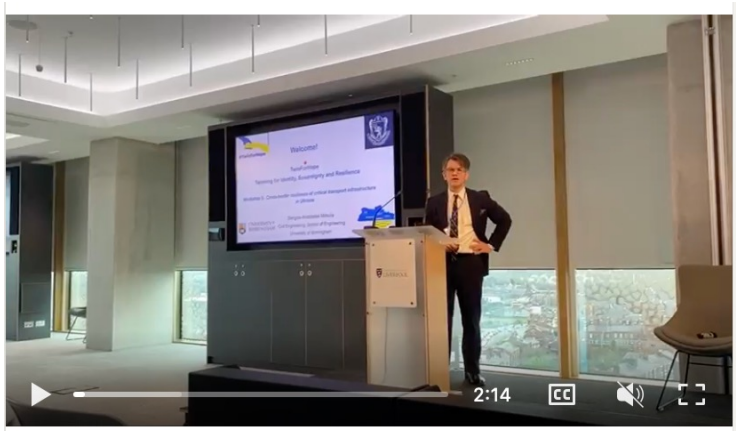
bridgeUkraine participated in the international **Ukraine Recovery Conference (URC 2023)** in London on 21-22 June 2023, which aimed at mobilising international support for Ukraine's economic and social stabilisation and recovery

26-27 March 2024

we presented bridgeUkraine and its achievements, including the twinning of the University of Birmingham with Ivan Franko National University of Lviv, at the UK-Ukraine Research Twinning Showcase & Networking Event, organised by the University of Liverpool

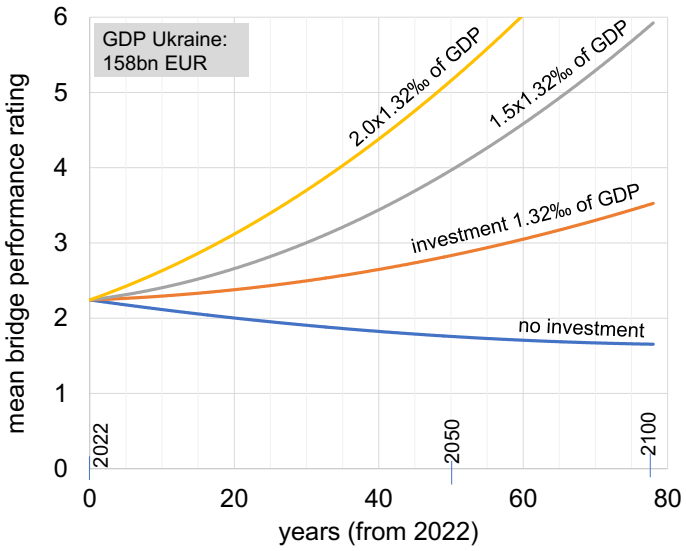
https://www.linkedin.com/feed/update/urn:li:activity:7178717113967067136/

UK-Ukraine Research Twinning Showcase and Networking, 26-27 March 2024

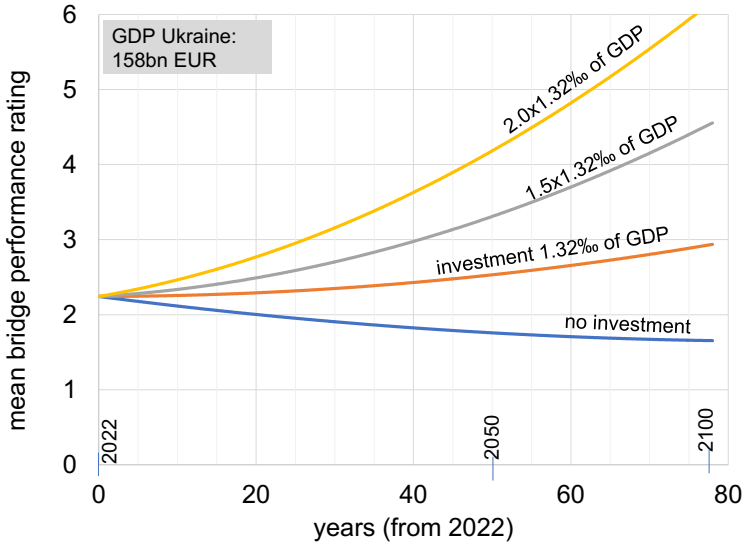


United Nations
Development Programme (UNDP)
Coalition for Disaster Resilient Infrastructure (CDRI)
Biennial Report on Global Infrastructure Resilience -CDRI Biennial Report on Global Infrastructure Resilience

Title of bridgeUkraine contribution:
Financing for disaster and climate resilient infrastructure for a net zero economic transition. Case study for Ukraine's transport infrastructure
Presented at G20 summit 2023, India



Adaptation with conventional materials and methods of reconstruction



Adaptation with sustainable strategies

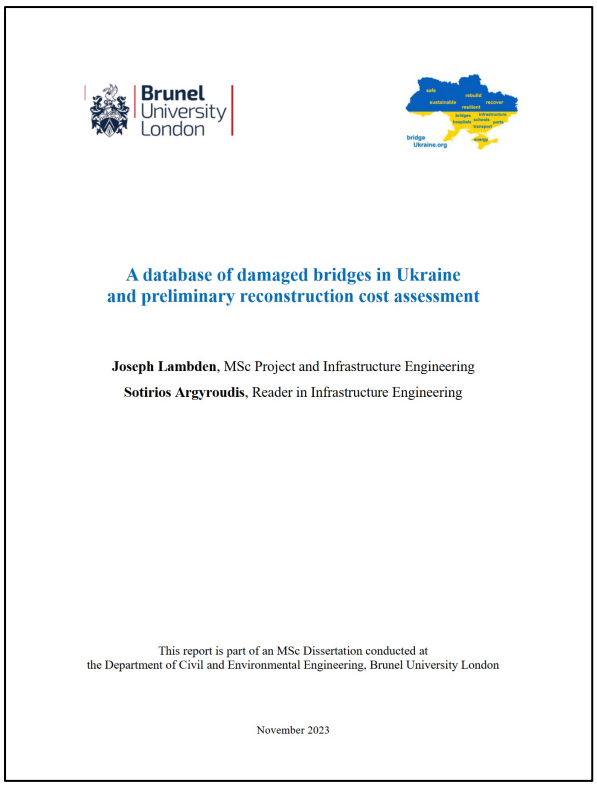
Measurable Planned Impact (3 Years: 2023-2026)

Action	KPIs	Quantifiable targets / magnitude	Size of target group
Science (SC)			
Publications-high-quality open access knowledge	Peer-reviewed open access publications, Citations, Citation index	> 25 publications, > 1000 citations after 5 years, > 3500 downloads and reads	> 1000 peers and researchers
Skills to strengthen human capital in Research and Innovation	Careers, number of upskilled staff	> 70 MSc, >20 researchers, > 5 administration staff	> 200 candidates
Share and foster knowledge and open science	Shared outputs, new collaborations	1 open web-GIS based platform, 1 Massive Open Online Course (MOOC), 1 website, > 35 new collaborations, workshops	> 30 academic and non-academic organisations
Economy/technology (EC)			
Supported employment	Number/quality of jobs	> 50 new jobs	> 3 SMEs, 10 Research Institute
Private and public investment	Amount of investment	> €10m funding/leverage investment towards 3% GDP target	5 case studies in Ukraine with critical infrastructure
Contribution to policy	Number of white papers and consultation documents	> 3 consultation/policy papers	>8 committees/review bodies, >10 Working Groups
Increase the efficiency of donors' investments toward peacebuilding	Efficiency	> 40-70% increase of efficiency, improve >30% of ROI	> 10 infrastructure operators, >5 regions, >1,000 assets
New products and services	Number of products Number of new services	1 web-GIS based open platform, 1 novel holistic reconstruction framework	> 5 software companies > 30 academic institutions, consultancies and SMEs
Society (SO)			
Outputs aimed at addressing specific policy priorities and SDGs **Improving decision-making**	Frameworks Software and tools Case studies SDGs	3 holistic reconstruction frameworks, > 10 metrics for data-driven condition assessment, 1 platform, > 3 case studies, > 10 SDG targets	> 5,000,000 citizens > 12,000,000 indirectly influenced end-users
Co-creation engagement of citizens to strengthen the uptake of innovation in society	Number of engagements with citizens and end-users	5 participatory decisions in workshops (WS), > 50,000 engagements in social media (e.g. reactions, comments, reads) > 1,000 engagements in open discussion group (e.g. comments, interactions)	> 30 decision makers per Workshop > 100 pupils and students > 5,000 citizens
CO2 emissions and whole-life carbon footprint	% reduction in CO2 emissions	> 50% reduction	> 10 municipalities
Mortality due to human induced and natural disasters	Number of casualties, affected population	> 50% less casualties / citizens affected depending on hazard and infrastructure	> 50,000 citizens depending on the case study areas

bridgeUkraine for a Sustainable and Resilient Future

Published report:

Open database of damaged bridges in Ukraine is available. Find it here>>



Brunel University London

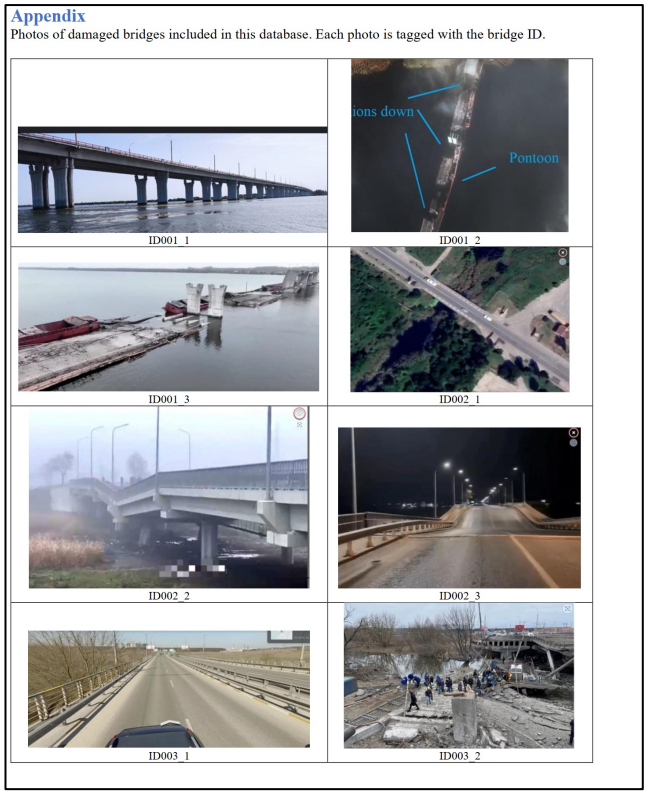
A database of damaged bridges in Ukraine and preliminary reconstruction cost assessment

Joseph Lambden, MSc Project and Infrastructure Engineering

Sotirios Argyroudis, Reader in Infrastructure Engineering

This report is part of an MSc Dissertation conducted at the Department of Civil and Environmental Engineering, Brunel University London

November 2023



Appendix

Photos of damaged bridges included in this database. Each photo is tagged with the bridge ID.

ID001_1

ID001_2

ID001_3

ID002_1

ID002_2

ID002_3

ID003_1

ID003_2

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bridge Ukraine

Contact us >>

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we accelerate Ukraine's critical infrastructure recovery

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