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Introduction

The impact of military actions on the infrastructure of Ukrainian cities has resulted in the partial or complete destruction of buildings and structures across a large part of Ukraine. Residential buildings have suffered the most, and it is worth noting that the facts of devastation due to constant shelling are still recorded almost daily.

Description of the current situation

As of 2024, the number of destroyed or damaged buildings exceeds 250.000, including 222.000 private houses, more than 27.000 apartment buildings, and 526 dormitories. According to estimates, direct damages from the destruction of these objects amount to 58.9 billion dollars.

Resolution of the Cabinet of Ministers of Ukraine No. 1073 of September 27, 2022, approved the Procedure for Waste Management resulting from damage (destruction) of buildings and structures due to hostilities, terrorist acts, sabotage, or work to eliminate their consequences. According to the Procedure, construction waste management operations include the following operations:



There is a certain algorithm for post-war waste management, which includes information on the types of waste, possible problems and threats in their management, rules for separation and sorting, and measures to organize temporary storage facilities. It is worth distinguishing two groups of waste left behind after the destruction caused by military actions, as they differ from the usual construction waste.

1. Typical waste:

- structural materials, such as bricks, concrete, steel, wood, plasterboard, slate, roofing material, etc.;
- parts from water supply and sewage systems
- parts of electrical networks, including electrical poles, wires, electrical equipment, and transformers;
- waste, soil, fallen trees, branches, etc.;
- damaged vehicles and military equipment.

2. Specific waste:

- furniture, household appliances, household chemicals, carpets, etc., including burnt and damaged ones;
- office furniture, office equipment, including burnt and damaged furniture;
- chemicals, industrial waste, raw materials and products, production equipment;
- road surface;
- medical waste, including epidemically dangerous waste;
- chemical plant protection products and fertilizers.

According to local governments, as of the beginning of 2024, about 600 thousand tons of demolition waste have been accumulated at temporary storage sites and landfills. Waste from destruction is accounted for by authorized bodies at the place of its generation or temporary storage. However, many wastes remain in the places of their generation and thus are not included in the official statistics, as they are not accounted for at the place of generation. As a result, sorting is not carried out properly, and it is almost impossible to obtain reliable and relevant data on the volume of such waste.

Outlook and next necessary steps for improvement of war and post-war waste management

As there is currently limited information on deconstruction and demolition waste, as well as on the composition of buildings of different categories, it is difficult to assess the overall picture, especially concerning the material intensity of categories of buildings and structures that are currently underrepresented and therefore subject to further research. Within the framework of the 2-year MSC4Ukraine fellowship, a scientifically based concept of a modern and future-oriented (post-war) Ukrainian waste management system and landfill treatment will be developed. In addition, in 2023-2024, a joint Ukrainian-Austrian research project “Solid municipal waste composition research and its resource potential” is being implemented. The data obtained may become the basis for developing a waste management system in Ukraine.

Acknowledgments

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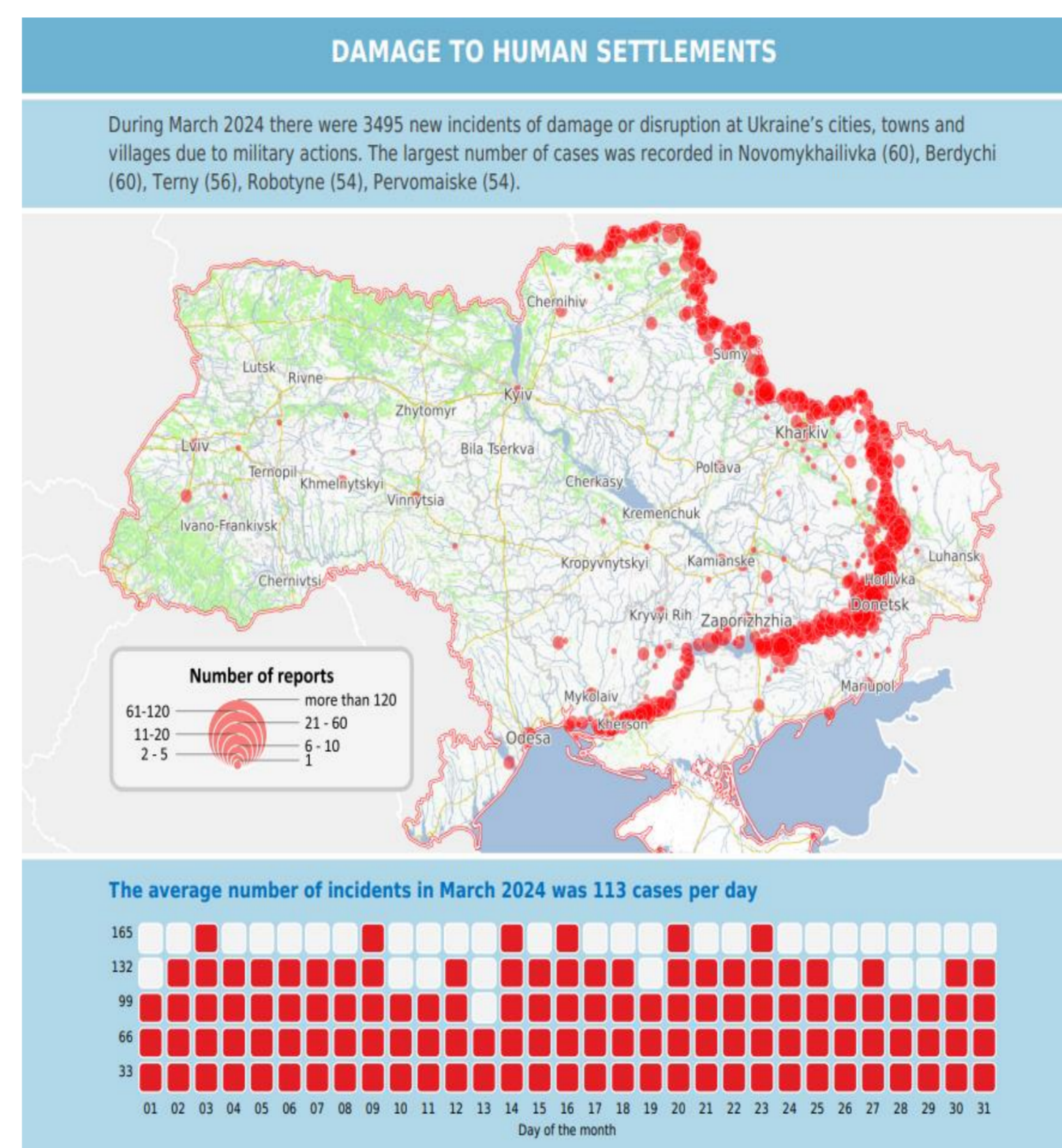


Figure 1. Damage to human settlements, March 2024

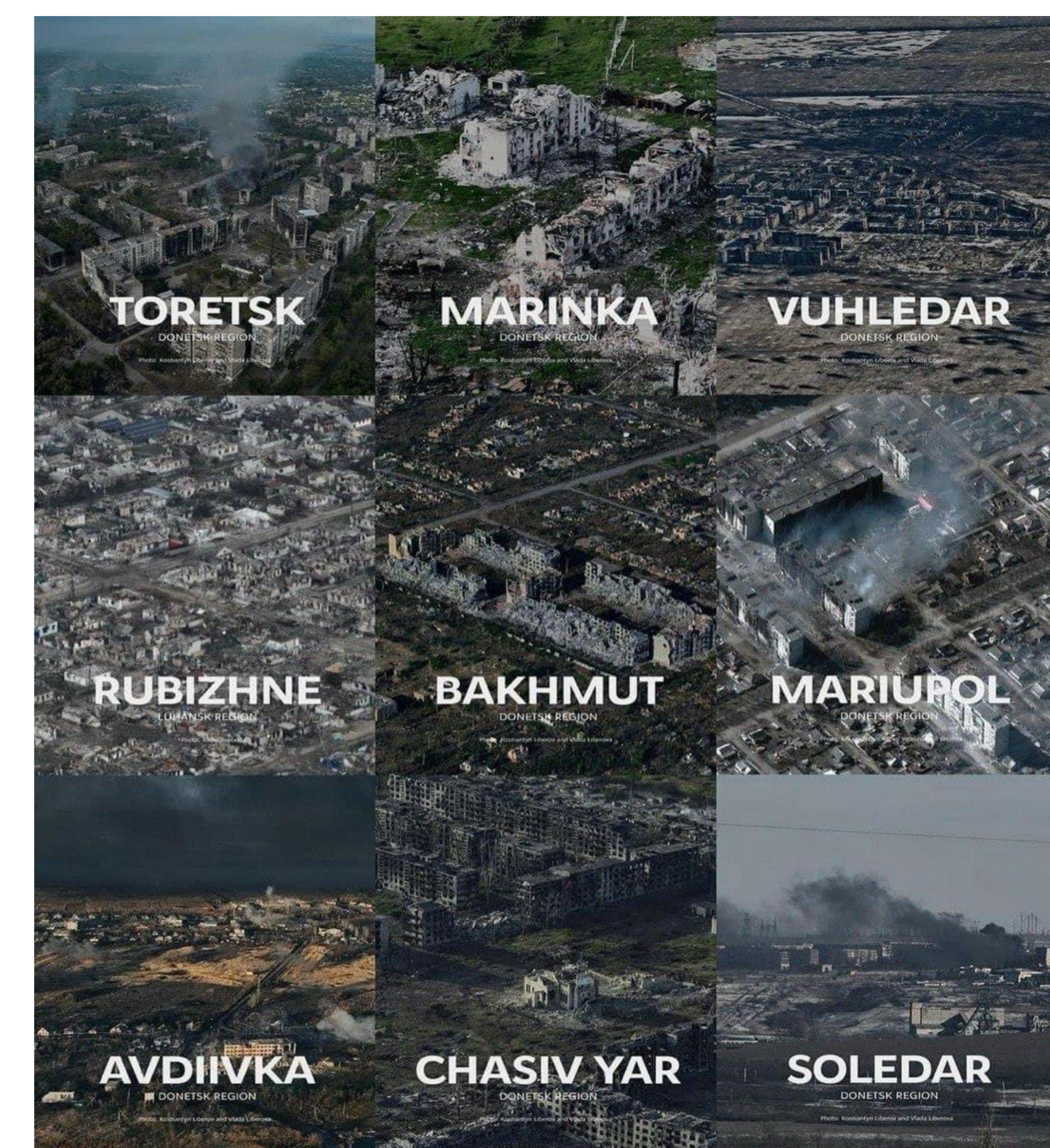


Figure 2. Photo of destroyed cities in Eastern Ukraine, September 2024