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Optimizing infrastructure material recycling through adaptive reuse for affordable housing

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Annually, in the United States (US), 1 billion square feet (about the area of Manhattan) of existing buildings are demolished and replaced with new construction. This replacement generates material waste which ends up in a landfill. Furthermore, the US is facing an affordable housing crisis impacting Americans across the income spectrum—the National Low Income Housing Coalition found in 2021 that a renter working 40 hours a week at minimum wage cannot afford a two-bedroom apartment in any county nationwide. Investigating existing infrastructure as a potential solution for the housing crisis, the larger research objectives will leverage a multidisciplinary approach in design computing that includes generative assessment, material reuse optimization, design automation, and participatory design.

The proposed site is in the Homewood community in Pittsburgh, Pennsylvania. The community consists of predominantly African American residents (92.84%) with a median household income of its \$19,642 - less than half of the median household income in the rest of Pittsburgh (\$40,715). The plan is to redevelop the rowhouses with a mix of affordable, workforce, and market-rate units.

The objective of the larger work is to work with the community to assess the existing structures, explore reconfigurations, and develop conceptual design schemes. These schemes will provide basic data, such as unit types and sizes, that can be used to inform developers of opportunities for investment at the site. In support of the larger work, the objective of this seed grant is to document the material stock of the existing rowhouses and identify the characteristics of building elements that can guide future reuse planning, such as the geometry of elements and their state of conservation.