Wicked Hot Chelsea: Mapping Urban Heat and Implementing Urban Heat Island Reduction Strategies

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Background/Objectives. The confluence of built environment characteristics (dense urbanization and industrialization), historical settlement patterns, and unbounded air pollution has compounded the urban heat island (UHI) effect in the City of Chelsea, Massachusetts. Chelsea has been designated as an environmental justice community and the increase in annual temperatures and heat waves driven by climate change combined with the UHI effect is likely to exacerbate the degradation of public health, welfare, and living conditions. To combat this, the City is dedicated to pursuing equitable UHI mitigation and climate adaptation projects that are grounded in science, rooted in community engagement, and replicable at a meaningful scale.

Approach/Activities. The UHI mitigation efforts included the development of a model to analyze UHI using sensors from the on-going heat research and land surface data. The UHI analysis identified known and emerging "hot spot" zones through the City in conjunction with community feedback. Multiple heat mitigation strategies were analyzed on a city-wide scale and in targeted areas including increased tree canopy, reduced impervious cover, lighter-colored paving materials, and increased green infrastructure and open public open space. The cooling strategies modeled also considered co-benefits, such as flood reduction, water quality improvements and carbon sequestration, which informed design prioritization. A pilot "Cool Block" project was identified to move forward with implementation of cooling strategies. Light-colored paving material research and design considerations sought to understand regional capacity around light color aggregate pavements and surface treatments that could help reduce the UHI effect in the Cool Block and beyond. The project team worked closely with a local hot mix asphalt pavement supplier to identify and analyze mix strategies that would perform in the extreme cold of New England winters and increasing extreme heat events. Three approaches to adapting hot mix asphalt pavement albedo were considered, weighing effectiveness, cost, and maintenance. To further support municipal-grade application of the light-albedo hot mix asphalt for UHI effect reductions, aggregates were compared with a graded color scale and specifications were established to use aggregates of color "equal or lighter" in gradation.

Results/Lessons Learned. The "Cool Block" serves as a proof-of-concept for modeling urban heat, identifying heat mitigation strategies that are informed by the community, and testing and implementing new strategies. As strategies are implemented in the "cool block", sensors will continue to report data to gain an understanding of progress in heat reduction.