

## **Analyzing the relationship between urban heat islands and transit-oriented developments: A case of Edmonton, Canada**

Transit-oriented developments (TODs), as a smart growth policy, have gained popularity as an approach to combatting the adverse effects of urban sprawl. TODs provide environmental benefits by reducing GHG emissions as well as offering some economic and social benefits. However, little or no research exists regarding their impact on urban heat stress/exposure. This study aims to fill this gap in the literature by analyzing the relationship between the concept of TOD and the urban heat island effect (UHI), an environmental phenomenon that leads to extreme hot spots in urban areas. More specifically, this study strives to answer the following questions: (1) Do TODs in a winter city such as Edmonton experience the UHI effect? (2) How did the UHI effect in TODs change temporally? (3) What factors mainly contribute to the UHI effect of TODs?

We used Landsat 5 and 8 satellite images from 2010 to 2020 that were acquired during the summer to generate land surface temperatures (LST) and UHI maps. We studied the UHI changes in TOD areas (400m area around selected LRT stations) compared to surrounding non-TOD areas (that have a similar area as TOD areas) to understand the effect of TOD on UHI development. Our results show that UHIs have significantly increased in the TOD areas over the last decade. Furthermore, TOD areas experienced a higher UHI effect compared to non-TOD areas, due to the differences in land use and land cover between the two areas. Although non-TOD areas also experienced an increase in temperature over the years, the rate of increase in land surface temperature (LST) and UHI effect was higher in TODs. Our findings suggest that when developing and designing new TODs, policies and development guidelines should aim to mitigate the UHI effect by preserving or increasing the natural landscapes, particularly vegetation.

Our findings have significant implications for the field of urban planning, as they call into question TODs as a sustainable planning tool. Although TODs can generate environmental benefits by decreasing city residents' use of their personal vehicles, thereby reducing GHG emissions, our study shows that they experience a higher heat island intensity if enough vegetation cover and high albedo surfaces are provided. The outcomes of this study will help policy-makers, planners, and developers to address and mitigate UHI effects when developing new TODs.

**Keywords: Urban Heat Island; Transit-oriented Developments; Urban Sprawl; Surface Temperature**