Crime Density and Hotspot Analysis: Seattle's Little Saigon

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ABSTRACT

This project examines the spatial distribution and clustering of crime incidents in Seattle's Little Saigon neighborhood using one year of Seattle Police Department call data (December 2024 – December 2025). Crime incidents were categorized into three offense groups, violent crimes, property crimes, and all other crime types (Sex offenders, Trespassing, Narcotics), to account for differences in spatial behavior across offense types. Point-based spatial analyses were conducted in ArcGIS Pro, including Average Nearest Neighbor, Global Moran's I, Getis-ord-Gi*, to evaluate whether incident patterns were clustered or random. Results from both statistical tests indicate statistically significant clustering across all offense categories, confirming that crime incidents are not evenly distributed within the neighborhood. Kernel Density Estimation was used to visualize the intensity and location of crime concentrations, revealing distinct hotspot patterns along key commercial corridors and transit-adjacent areas within Little Saigon. To support clear interpretation, density outputs were clipped to the official Friends of Little Saigon boundary. Together, these findings demonstrate that crime in Little Saigon is highly localized rather than neighborhood-wide. The results provide an evidence-based foundation for Crime Prevention Through Environmental Design (CPTED) strategies that support Friends of Little Saigon's community-centered safety and neighborhood revitalization efforts.

METHODOLOGY

This project uses Seattle Police Department (SPD) Call Data obtained from the City of Seattle Open Data Portal. The dataset contains geocoded call-for-service records, including offense category, date/time, and spatial location. To ensure relevance and consistency with course guidance, only the most recent full year of data (December 2024 – December 2025) was used in the analysis, along with contextual layers such as King County light rail stations, Seattle business license points, transit corridors, major streets, and the official Little Saigon boundary. These additional datasets made it possible to link crime patterns with business activity, pedestrian flow, and transportation infrastructure.

Crime incidents were filtered to the **Friends of Little Saigon study area**, using an official boundary polygon provided by Friends of Little Saigon and verified against neighborhood reference maps. Neighborhood Map Atlas Districts | Seattle GeoData

The data were categorized into three offense groups:

- Violent Crimes(9.37%) – Aggravated assaults, robbery
- Property Crimes (22.07%)– Arson, Buglary, MotorVehicle Theft, Larceny theft
- All Other Crime Types(68.56%) – Narcotic, Trespassing, Sex offenders, Fraud, Animal Cruelty, Weapon law violation.

Each category was analyzed separately to avoid masking distinct spatial patterns and These represent the major safety concerns in the area, especially around businesses and transit corridors.

After data collection, we cleaned and standardized all fields, removed duplicates, and kept only incidents inside or adjacent to Little Saigon. All layers were projected to NAD83 HARN State Plane Washington North for consistency. From the SPD dataset, we filtered crime incidents specifically within the Little Saigon boundary, to ensure accurate distance-based calculations.

Records falling outside the Little Saigon boundary were removed prior to analysis. Each offense category was saved as an independent point feature class for subsequent spatial analyses.

Spatial mapping in ArcGIS Pro included individual crime categories, business locations, transit stops, neighborhood zones, and key built-environment features. This allowed for block-level visualization of patterns and repeated hotspot locations.

Two spatial statistics were used to measure clustering. The Average Nearest Neighbor test, Average Nearest Neighbor analysis was conducted for each offense category to evaluate whether crime incidents exhibited clustered, random, or dispersed spatial patterns. ANN results provided an initial statistical assessment of spatial structure and informed the appropriateness of further hotspot analysis.

Global Moran's I was used to assess whether crime incidents within each offense category demonstrated overall spatial clustering across the study area, An inverse distance conceptualization with row standardization was applied. A fixed distance threshold of 1,000 feet was selected to reflect neighborhood-scale spatial interaction and to ensure consistent neighbor relationships across features. Global Moran's I results were used to determine whether statistically significant clustering existed at the global level before applying local hotspot methods.

Hot Spot Analysis (Getis-Ord Gi*) - Getis-Ord Gi* hotspot analysis was performed separately for each offense category to identify statistically significant hot and cold spots of crime intensity. A fixed distance band consistent with the Global Moran's I threshold was used. Results were classified by confidence levels (90%, 95%, and 99%). These results identify localized areas where crime incidents cluster at levels significantly higher or lower than expected by random chance.

Kernel Density Estimation (KDE) - Kernel Density Estimation was used as a supporting visualization tool to illustrate the general spatial intensity of crime incidents. KDE outputs were clipped to the Little Saigon boundary, and only contour representations were used in the final map to avoid visual overgeneralization. KDE was not used as a statistical test but to aid interpretation of hotspot patterns identified by Getis-Ord Gi*.

INTERPRETATION OF RESULTS

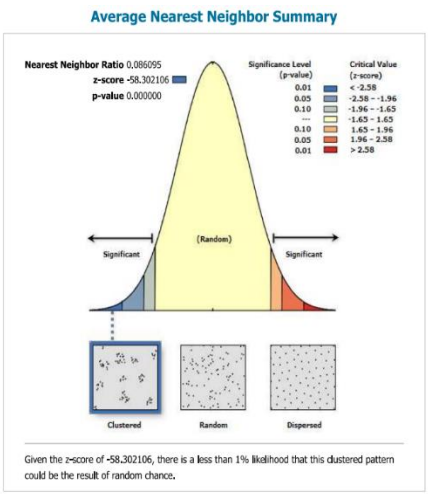
Analysis For Transit Corridors And Business Locations:

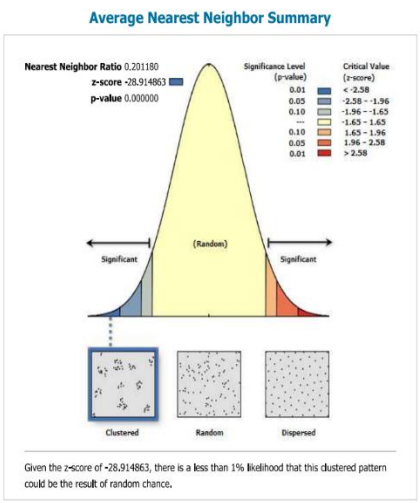
Between December 2024 and December 2025, analysis of SPD calls indicated that high call volumes primarily came from busy areas like S Jackson St., 12th Ave S, and Rainier Ave S, reinforcing the link between population density and crime opportunities. Notably, Little Saigon experienced a high number of crimes near King county stops and the around the area of transist corridors particularly these Offences categories, Although this area had fewer incidents, it still experienced clusters of harassment and threats, pointing to clear local hotspots despite a lack of significant overall crime trends.

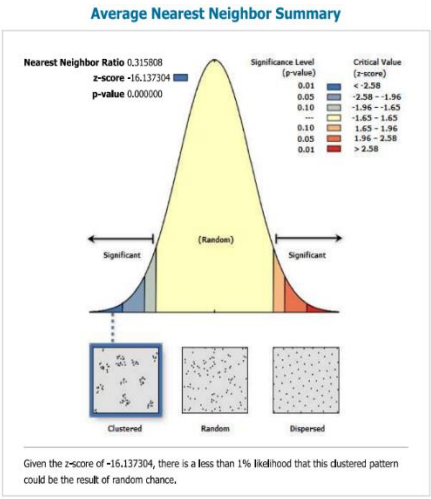
Average Nearest Neighbor (Ann) And Global Moran's I:

Average Nearest Neighbor analysis was used to assess whether crime incidents were spatially clustered, random, or dispersed for each offense category. The analysis compares observed mean nearest-neighbor distances to expected distances under complete spatial randomness using

Euclidean distance. Average Nearest Neighbor results indicate statistically significant clustering for all three offense categories. All Other Crime Types show the strongest clustering (NNR ≈ 0.09, $z \approx -58.3$, $p < 0.001$), followed by Property Crimes (NNR ≈ 0.20, $z \approx -28.9$, $p < 0.001$) and Violent Crimes (NNR ≈ 0.32, $z \approx -16.1$, $p < 0.001$). These results confirm that incidents are not randomly distributed within Little Saigon.

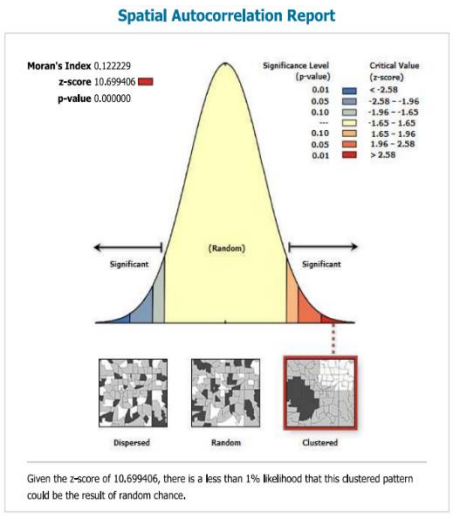


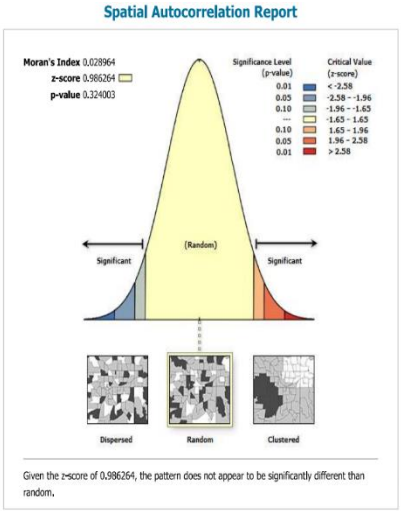


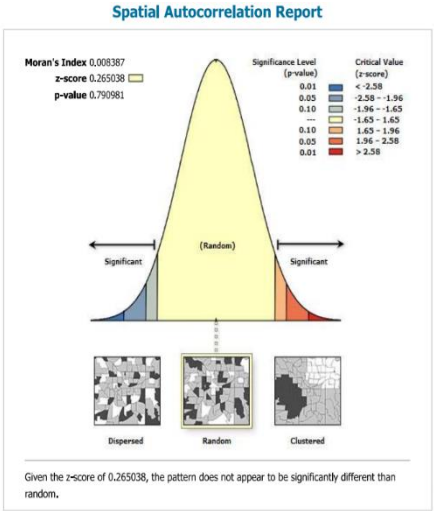


All others Crime Category	Property Crime Category	Violent crime Category

Global Moran's I was used to assess whether crime incidents exhibited significant spatial autocorrelation at the neighborhood scale using a 1,000-foot distance threshold. Results indicate statistically significant positive spatial autocorrelations for All Other Crime Types (Moran's I = 0.12, z = 10.70, $p < 0.001$), suggesting a consistent clustering pattern across Little Saigon. In contrast, Property Crimes (Moran's I = 0.03, z = 0.99, p = 0.32) and Violent Crimes (Moran's I = 0.01, z = 0.27, p = 0.79) did not demonstrate statistically significant global spatial autocorrelation. These findings suggest that while property and violent crime incidents may form localized clusters, their spatial patterns are not consistent across the neighborhood at the global scale.





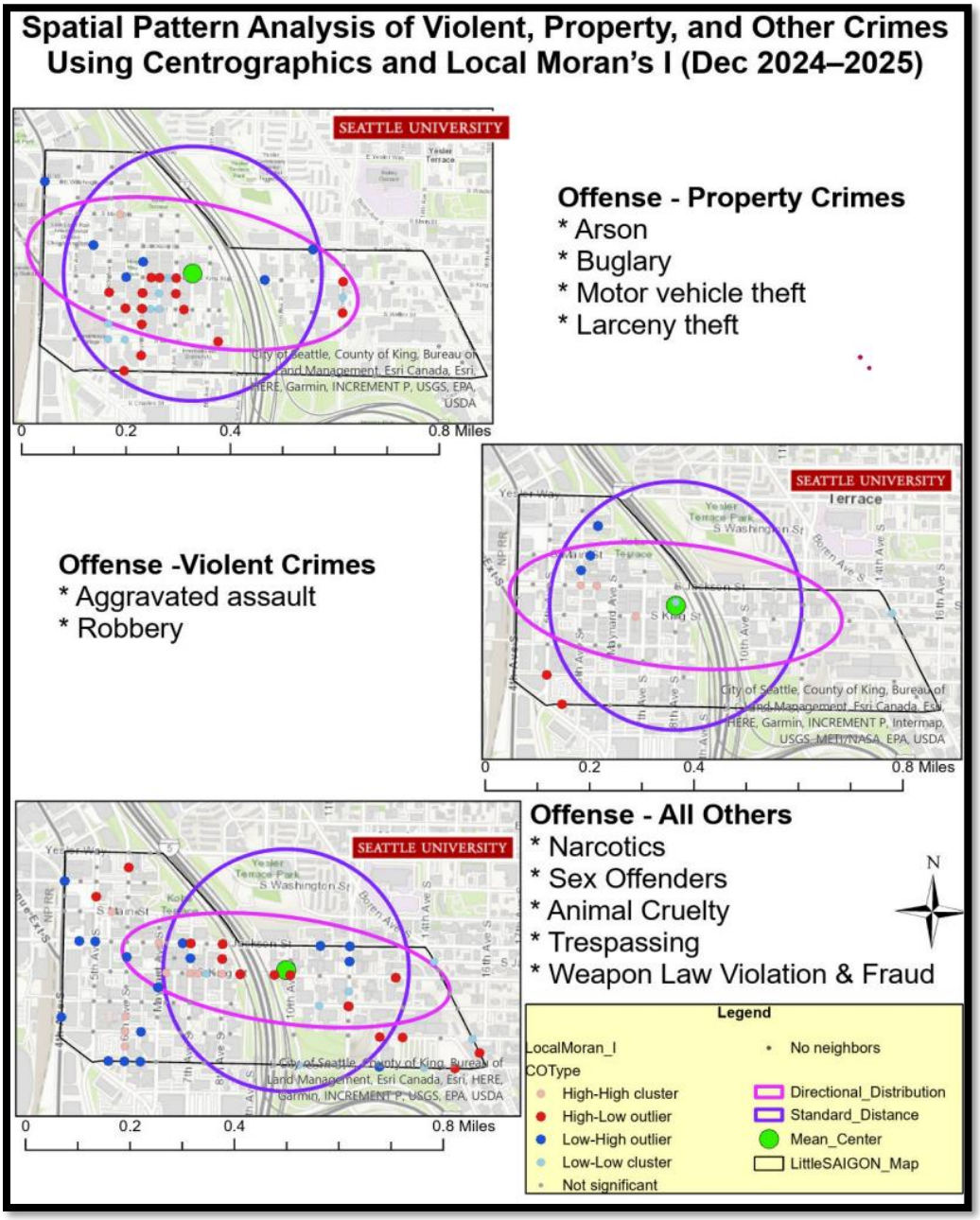


All others Crime Category	Property Crime Category	Violent crime Category

Centrographic Analysis:

Centrographic analysis reveals that violent, property, and other crime incidents are concentrated within the central Little Saigon corridor, with standard deviational ellipses oriented primarily east–west, reflecting alignment with major transportation and commercial routes.

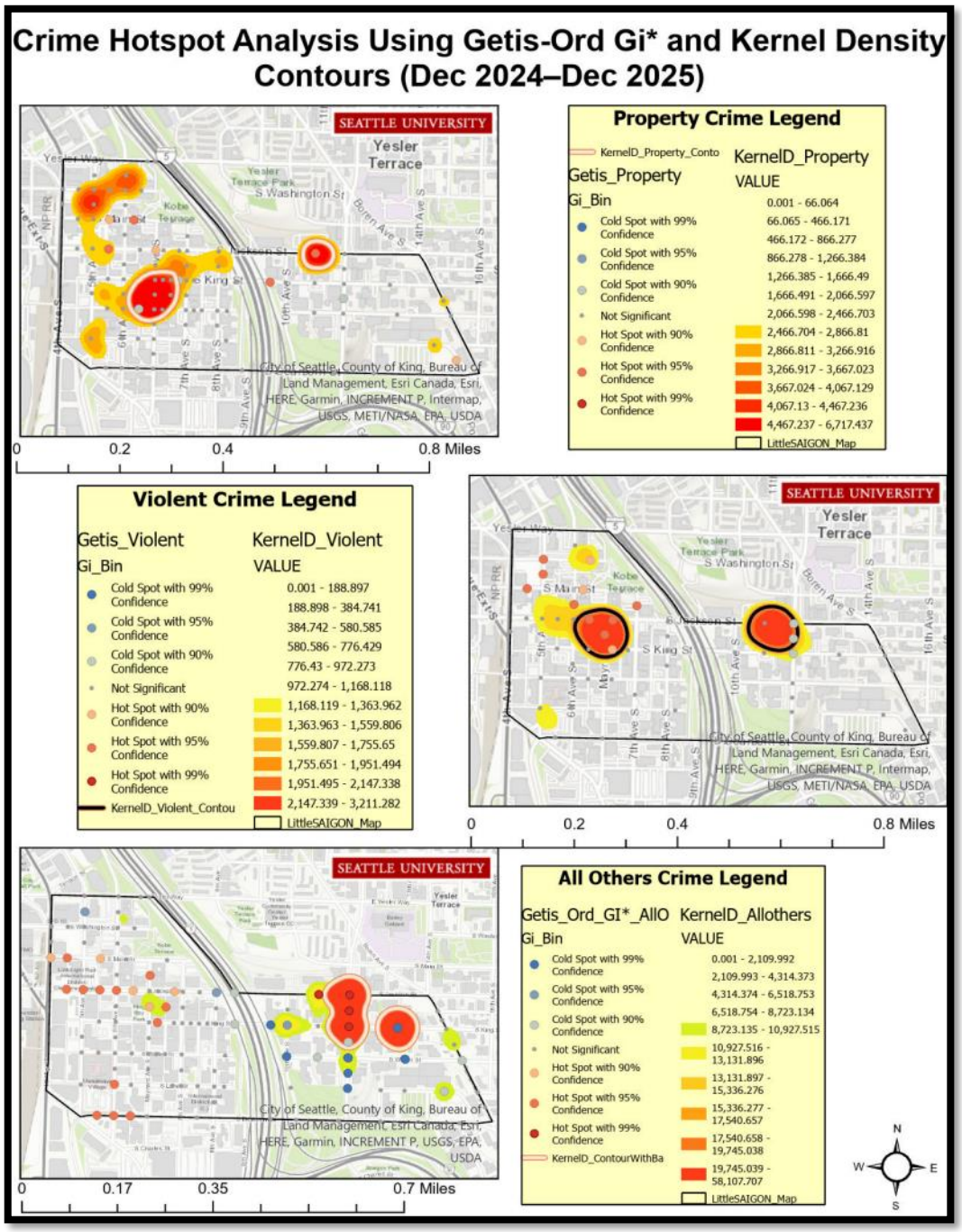
The mean centers for the crime categories are as follows: Property crimes near South King Street, violent crimes between South Jackson Street and South King Street, and "All Other Crimes" at S



Jackson Street. This suggests spatial anchoring rather than outward dispersion. The standard deviational ellipse (in purple) indicates the overall directional trend and degree of clustering, elongated in the east-west direction, which aligns with key road and transit corridors and suggests that crime patterns are influenced by urban infrastructure rather than random distribution. Local

Moran's I analysis aimed to identify localized clusters but found limited statistically significant clustering at the local level, reinforcing findings from Global Moran's I that most offense categories exhibit localized clustering instead of neighborhood-wide patterns. While some localized clustering occurs in specific blocks, the analysis indicates that crime patterns for violent and property offenses are not spatially consistent throughout the neighborhood. These findings support the conclusion that crime in Little Saigon is highly localized and would benefit from targeted Crime Prevention Through Environmental Design (CPTED) interventions.

Hotspot analysis (Getis-ord-Gi*) and KDE Hotspot contours



Getis-Ord Gi* analysis was used to identify statistically significant local hotspots which is common for all three-offence crime categories, i.e, S Jackson Street 12th avenue, while Kernel Density Estimation was used to visualize the intensity of crime incidents.

For "All Other Crimes," Gi* results revealed high-confidence hotspots that align with KDE peaks, indicating strong clustering near S Jackson and Rainier Avenue. In contrast, violent crimes showed limited hotspots with lower confidence levels, primarily along 12th Avenue Jackson Street and west of the Chinatown International District.

Property crimes exhibited broader elevated density areas south of Chinatown but showed fewer significant hotspots, highlighting spatial variability, especially around 6th Avenue and Maynard Avenue South. Overall, crime clustering in Little Saigon varies by offense type, with the most pronounced clustering seen in "All Other Crimes".

CPTED-Based Recommendations for Little Saigon

(Crime Density and Hot Spot Analysis: December 2024 – November 2025)

Crime Prevention Through Environmental Design (CPTED) emphasizes reducing crime opportunities by shaping the built environment to increase natural surveillance, territorial reinforcement, access control, and maintenance. Based on statistically significant hotspots identified through Getis-Ord Gi* analysis, Kernel Density Estimation, and centrographic analysis, the following recommendations target **specific locations within Little Saigon** where crime clusters were consistently observed.

1. **Natural Surveillance Enhancements:** The key locations identified are - S Jackson St between 6th Ave S and 10th Ave S(eastern edge of Little Saigon), Maynard Ave S near S King St(Chinatown International district). Violent and property crime hotspots are concentrated along high-activity commercial corridors and transit-adjacent blocks. KDE and Gi* results show repeated clustering in areas with high pedestrian traffic but limited nighttime visibility and obstructed sightlines. The CPTED Recommendations would be to install pedestrian-scale lighting along S Jackson St (especially mid-block segments between intersections) and Maynard Ave S near S King St. Also, encourage businesses along these corridors to increase storefront transparency (clear windows, reduced window clutter) and also maintain interior lighting after business hours. Lastly, trim or remove vegetation and street furniture that obstructs views near alley entrances off Maynard Ave S and bus stops along S Jackson St. This applies CPTED Principle, Natural Surveillance, increased visibility increases informal guardianship and reduces opportunities for violent and opportunistic crimes.
2. **Territorial Reinforcement and Community Identity:** The key locations identified are- northwestern Little Saigon commercial core (near 5th Ave S and S Main St) and blocks surrounding S King St and Maynard Ave S. Centro graphic analysis shows the mean center of crime activity lies within the commercial core of Little Saigon. Areas with unclear ownership and weak identity cues are more vulnerable to crime. The CPTED Recommendations would be to expand culturally specific visual cues such as, banners, murals, and wayfinding signage along S King St and S Jackson St. Support Friends of Little Saigon initiatives to, activate storefronts with community art and temporary displays, use

pavement markings or public art to visually define community space. encourage businesses to clearly mark store boundaries and entryways and customer-only spaces. The CPTED Principle is applied to Territorial Reinforcement, clear signals of ownership discourage offending and strengthen community cohesion.

3. **Access Control and Alleyway Improvements** at alleys between 6th Ave S and 8th Ave S, parking and service areas south of S King St, blocks near S Dearborn St (southern boundary). Property crime hotspots and cold spot transitions frequently occur near alleyways and poorly defined access points. These areas provide concealment and easy escape routes. The CPTED Recommendations will be to improve access control by, installing lighting at alley entrances and adding fencing or gates where appropriate (without restricting legitimate access). Use pavement texture changes or signage to differentiate public vs. private alley spaces. Also, encourage businesses to coordinate shared maintenance of rear entrances, trash and service areas. The CPTED Principle applied for is Access Control; reduced anonymity and increased perceived risk for offenders in transitional spaces.
4. **Transit-Oriented Safety Improvements** at bus stops along S Jackson St and 10th Ave S corridor near freeway and rail infrastructure. Hotspot analysis indicates repeated clustering near transit-adjacent locations. These areas experience high foot traffic but limited territorial control. The CPTED Recommendations would be to improve transit stop design by ensuring clear sightlines from surrounding streets and also by adding lighting and seating positioned for visibility. Collaborate with transit agencies to reduce hidden corners near stops and improve signage and wayfinding. Encourage pop-up vendors or community presence near high-use stops during peak hours. The expected outcome will be, legitimate activity increases informal monitoring and reduces crime opportunities.
5. **Maintenance and Management (Image and Order)** at western edge near 4th Ave S and southern boundary near S Dearborn St. Several areas with emerging hotspots overlap with locations showing signs of neglect (poor lighting, debris, underused spaces). The CPTED Recommendations will be to prioritize regular maintenance of lighting fixtures and sidewalks and alleyways, also, remove graffiti promptly and repair damaged infrastructure. Coordinate clean-up efforts with community events to reinforce collective ownership. The expected outcome will be well-maintained spaces signal active management and reduce crime-supportive conditions.

By focusing on specific blocks and corridors, rather than the entire neighborhood, these recommendations allow Friends of Little Saigon to target resources efficiently, advocate for infrastructure improvements with evidence, and support safety without relying on increased enforcement. The findings emphasize that crime in Little Saigon is micro-spatial and opportunity-driven, making CPTED-based environmental interventions particularly effective.

The CPTED recommendations presented in this report are grounded in established environmental criminology and crime prevention literature. Prior research demonstrates that crime is highly concentrated at micro places such as street segments and activity nodes, making place-based interventions particularly effective (Weisburd, 2015; Brantingham & Brantingham, 1998). CPTED strategies including enhanced natural surveillance, territorial reinforcement, access control, and maintenance have been shown to reduce crime opportunities when applied to high-risk locations (Cozens, 2008; Armitage, 2016). These principles guided the development of targeted recommendations for specific streets and blocks within Little Saigon.

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