



Distressed Properties: Community Risk Reduction in the City of Surrey

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September 2021



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Executive Summary

The purpose of this research is to evaluate the effectiveness of an administrative compliance program which targets residential properties to reduce fire risk at the final stage of neighbourhood decline, abandonment. The program is administered by the City of Surrey's Community Property and Safety Team (CPST).

In 2016, a study called *Distressed Properties: Pathways of Decline and the Emergence of Public Safety Risk* conducted by Garis, et al. [1], was conducted in Surrey. Real estate speculation practices leading owners of older homes to stop investing in and maintaining these properties, set the stage for this work. The study revealed a convergence of public safety risks at and around distressed properties, with resulting demands for Police, Fire and Bylaw responses.

Police are called to distressed properties more often, as criminals use them for illegal drug production, consumption, distribution, fencing of stolen property and acts of violence. City Bylaw Officers frequently respond to public complaints of noise, unsightly premises, and unwanted transient foot traffic through residential neighbourhoods. Fire services experience increased fire incidence at distressed properties, often the result of vulnerable population using abandoned homes for shelter and often introducing ignition sources for cooking, lighting, and heating due to the absence of utility services.

The program methodology began with review of relevant legislation to understand the authority and constraints when municipalities address distressed properties. The legislative framework spans both provincial and local government jurisdictions. The BC Fire Code provides municipalities the authority to not only inspect distressed properties, but also to minimize the fire risk at them. The *Local Government Act* permits municipalities to adopt bylaws that provide for cost recovery when property owners do not comply with orders or when illegal actions occur on their property.

This legislation informed the design of Surrey's Distressed Properties program, which is carried out by the CPST. The goal of the program is to reduce the fire rate in Surrey's abandoned buildings. A trial program was initially piloted over 2017 to identify any unexpected issues requiring further process development. The program is comprised of the following phases: property identification, property inspection, issuing property owners with orders to secure their abandoned properties, securing abandoned properties while recovering costs from non-compliant owners, and monitoring for any security breaches on the properties. The security phase includes progressively increasing security measures, as required to meet the program goals.

The program utilizes a variety of data sources to determine community risk and proactively identify properties at risk of becoming distressed. A machine learning approach shows promise in predicting the presence of distressed properties based on risk factors such as building & land values, the year of construction and the property's utility consumption pattern. Over a 16-month period up to May 2021, the period machine learning was implemented, the model predicted 242 potential vacant properties with over 73% accuracy.

Each property's level of risk must also be assessed to prioritize them within the Distressed Properties program. Further analysis has determined that vacant or abandoned properties within 1,000 metres

of unauthorized homeless encampments are nine times more likely to catch fire than those beyond the 1,000-metre radius.

Notable results from the Distressed Properties program are as follows:

- Since the program began, over 6,000 inspections have been conducted by the fire department.
- Fires in abandoned structures in Surrey have declined by 94%.
- The number of abandoned house fires in Surrey in 2016 was 33.
- In 2020, there were only 2 abandoned residential house fires.
- As of September 2021, there has been only one abandoned structure fire recorded for 2021. By June 2021, 80% of abandoned properties inspected by the program had either been reinvested or demolished.

Despite the promising results, the number of properties still at risk continues to increase as additional properties begin to age out and become distressed or abandoned due to disinvestment.

Overall, the findings of this study indicate that community safety can be effectively enhanced with a targeted risk-reduction program that monitors indicators to maintain a continued focus on distressed properties. The program has demonstrated a 94% decline in abandoned structure fires since its inception. By utilizing data sources available to local government, a predictive model for identifying properties in decline or abandonment, has proven to assist with prioritizing efforts of the CPST.

Purpose of this Research

Like other cities with growing populations, the Surrey, British Columbia faces challenges related to urban renewal and a growing number of vulnerable populations living or gathering at distressed properties in neighbourhoods within the City. Residential properties with visible signs of decline – such as lack of caretaking, vandalism, overgrown yards, and broken or boarded windows – are indications of an existing or developing public safety concern.

These aging neighborhoods typically provide low-income individuals and families with housing opportunities. Of concern is that neighbourhood distress may also be a catalyst for residential fires, crime and disorder, bylaw violations, and medical emergencies, leading to heightened public safety risk.

Several studies have addressed the issue of neighbourhood distress in Surrey. The latest study, Garis et al. [1] aimed to understand the factors that trigger, and speed neighbourhood decline in the City of Surrey, and to create a framework of actions to reduce this decline. Building upon that study, this research identifies residential properties at the final stage of neighbourhood decline – abandonment – and assesses the effectiveness of actions taken by the CPST to reduce their fire risk.

Background

According to James Jennings in *Measuring neighborhood distress: A tool for place-based urban revitalization strategies* [2], neighbourhood distress is defined as a situation reflecting concentrated social and economic conditions that may point toward lower quality of life standards for residents, while also presenting public safety hazards and raising service demands on local, provincial, and federal government and community non-profit organizations. Additionally, 2013 research titled *Temporal and geographic clustering of residential structure fires: A theoretical platform for targeted fire prevention*, Wuschke et al [3], investigated fire clustering and demonstrated higher crime rates in areas with higher rates of unemployment and more single-parent families, low-income households, vacant properties, older properties, and properties in disrepair. Neighbourhood distress can take many forms, and if left unchecked, may cascade into a self-reinforcing process of decline that leads to heightened public safety risk.

The City of Surrey has implemented multiple initiatives over the years to address the causes and effects of neighbourhood distress. The City Council implemented a Crime Reduction Strategy in 2007, followed by the Surrey Criminal Justice Task Force in 2014 that was charged with examining the unique justice needs and challenges in Surrey. The Task Force assessed a variety of safety issues – such as domestic violence, mental health, and illicit substance use – as well as prolific property offenders. Since that time, the Surrey Integrated Services Network has been formed as an inter-agency provincial and municipal committee focusing on enhancing justice and public safety service delivery in the City. Additionally, the topic of neighbourhoods in transition was addressed in 2016 by members of Surrey’s Emerging Leaders Program (ELP) and was discussed at a City-sponsored Innovation Forum on Distressed Properties and Public Safety.

The Garis et al. [1] study identified the risk factors that trigger neighbourhood distress and the five stages of neighbourhood decline: 1. Incipient decline, 2. Imminent decline, 3. Clearly declining, 4. Accelerating decline, and 5. Abandonment (see Figure 1), as well as made recommendations to stem this decline. The study pointed out not only the importance of identifying when residential properties are trending toward a distressed state, but also the difficulties of pinpointing a specific trigger for residential distress and neighbourhood decline. From literature reviews, however, the study determined the indicators to be vacant and abandoned properties, unsightly properties, and areas with a high concentration of crime and disorder, higher rates of unemployment, single-parent families, and higher-than-average fire occurrences. The study also analyzed City population demographics using the Census Low-Income Measure Tax (LIM-AT) and Neighbourhood Vulnerability Index (NVI) to map areas in various decline stages.

Figure 1: Conceptual Framework of Neighbourhood Decline

		Five Stages	Indicators
Proactive	}	Incipient Decline	Low-value structures built on high-value land; property tax arrears and delinquent taxes
		Imminent Decline	More dwellings shift from owner to renter occupancy
Reactive	}	Clearly Declining	More single-parent headed families; and widespread minor deficiencies in home repair (unsightly properties)
		Accelerating Decline	Fewer residential vacancies; start of spot residential abandonment
		Abandonment	Abandoned properties, increase call-for-service

The study revealed the role of real estate speculation and development pressures on neighbourhood distress, especially on older residential properties with disproportionately greater land values than building values. This frequently leads to disinvestment – when owners defer or stop property maintenance – and finally to property abandonment.

At the same time, the Jennings study [2] mentioned most abandoned properties increase the demand for Police, Fire, and Bylaw services and are at heightened risk of fire, crime, and disorder. Surrey has experienced a convergence of public safety risk at and around distressed properties that are accessed by people who have mental health issues, substance use disorders and may conflict with the law (or a combination of all three). The lack of utilities at those properties adds to the fire risk, as occupants introduce fire ignition sources for light, cooking or heat. Additionally, fires at distressed properties tend to be larger when fire crews arrive than those at typical properties due to a lack of early reporting. This increases the risk of fire spreading to adjacent structures as well as potential casualties among occupants and firefighters. These fires also create preventable and unnecessary long-term risks to cardiovascular health and exposure to carcinogens to fire fighters.

The Garis et al. study [1] proposed the following actions to reverse neighbourhood decline:

1. Focus on identifying and treating one- and two-family at-risk dwellings located in suburban and urban neighbourhoods in Surrey before they degrade in the next 5 to 10 years.
2. Design and implement prevention strategies in areas where land development pressures and risk factors are starting to intersect. The strategies should provide residents with education on fire and crime prevention opportunities tailored to reduce risks at abandoned and nuisance properties.
3. Legally attach an order to remedy conditions (ORTC) to any private residential dwelling that has been purchased for development purposes as soon as the property is bought. The OTRC

could be made a condition of the development permit application process, thereby addressing concerns around speculative practices and disinvestment up front.

4. Develop a distressed property early warning system based on the following indicators: previous crime and disorder, history of unpaid property taxes, land value and building value ratio, demographic and population shifts, unabated bylaw violation, and building owners with a history of abandoning properties.

Program Methodology

Building upon the recommendations from the study by Garis et al. [1], the program model focuses on assessing the administrative processes and evaluating effectiveness of the fire-prevention strategy for properties at the final stage of decline.

The analysis looked at the process beginning with identifying abandoned properties using several methods, including tips from other City departments, a predictive tool Surrey developed, and other measures as permitted by legislation. Once properties of interest are identified, a survey is conducted to confirm the property is in distress and determine its stage of decline. The next steps involve inspecting the properties and ensuring properties at risk are secured to prevent fires and keep the sites safe. The outcomes are then measured based on established key indicators.

Review of Legislation

The following legislation pertains to Community Property Safety Team (CPST) inspectors' authority to prevent fires at vacant/abandoned properties and require owners to maintain them in a safer state:

- **BRITISH COLUMBIA FIRE CODE 2018 Section A.2.4.6.1.(1)** on vacant buildings [4]. The code describes the obligation for property owners to secure vacant buildings as they frequently become the target of vandalism and arson. They should be locked, and accessible windows and doors should be barricaded to prevent unauthorized entry without preventing fire department access in the event of a fire.
- **FIRE SERVICES ACT Sections 21 and 22** on inspection of fire hazards and Order to Remedy Conditions [5]. This act describes the authority of local assistants to the Fire Commissioner as Peace Officers to enter, inspect fire hazards, and issue Orders to Remedy Conditions that are subject to cost recovery.
- **COMMUNITY CHARTER Sections 16 and 18** [6]. This charter describes the purposes and authority for municipal staff to enter on or into a property and the conditions by which that can be appropriately accomplished without the consent of the owner.
- **CITY OF SURREY BYLAW 10771** on Prevention and Suppression of Fires [7]. The bylaw describes the authority of the Fire Chief and authorized members of the Fire Department to conduct inspections of premises for fire prevention inspections; the ability to order owners or

occupiers to destroy or repair the building within a set time; and that the Fire Department shall not be refused entry on reasonable grounds of fire hazards. Further, it outlines the owners' liability for City costs and expenses for securing of vacant buildings against unauthorized entry when owners do not comply with orders.

- **CITY OF SURREY BYLAW 16394** on Abandoned Properties [8]. The bylaw describes the duty of the owner to secure abandoned properties against unauthorized entry, outlines the methods that may be required, and sets out the City's authority to inspect and provide notice requiring security of the property.
- **CITY OF SURREY BYLAW 16393** on property maintenance and unsightly premises [9]. The bylaw describes the authority to inspect unsightly properties and provide notice of requirements to remedy and includes a provision to recover the cost of this work if the owner does not comply.

This set of legislation provides Surrey Fire Service the authority to inspect properties of interest for fire prevention purposes, and to remedy the fire risk of those properties by issuing Orders to Remedy Conditions (OTRC). The OTRCs order property owners or occupiers to destroy or repair the property within a set timeline and inform them that if they do not comply, the CPST will hire a private contractor to perform the work and charge back the cost to the property owner. Fire risk is reduced as owners are required to provide or pay for effective security for their vacant properties.

Business Processes

The legislation not only sets out the authority and limitations of the CSPT, but also provides direction for appropriate and effective procedures for preventing fires at abandoned properties. The Distressed Properties model lays out a phased process in line with the team's authority as a Local Assistant to the Fire Commissioner (LAFC) (see Appendix A). The phases are as follows:

- Phase 1: Property Identification

Abandoned or vacant properties are identified by referral from another department, by property security issues or bylaw infractions identified by City bylaw officers, or by other sources such as a data-driven predictive tool (see predictive tool section below). An assessment or 'deconfliction' is then performed to minimize the potential for inter-departmental conflict because of mutual activity at a property. For example, if police are actively surveilling a property due to a criminal concern, any CPST actions taken could compromise police operations or pose a serious safety risk for CPST staff. For suitable properties, an on-site survey is then conducted to validate the need for action. The survey is guided by City bylaws 16393 and 16394, which describe standards that prevent property decline as well as indicators for determining the category of decline, such as whether the property is for sale, whether the property is occupied, the presence and quality of residential fencing, evidence of break-ins, and vandalism (see Appendix B). Based on the survey result, the property will be categorized as stable, vulnerable, stressed, and/or distressed (see Appendix C).

- Phase 2: Property Inspection

The property's category is used to set priorities for inspections. Properties are prioritized according to their level of distress, and their records are reviewed across multiple City databases, such as TEMPEST (property tax), AMANDA (land development), FDM Incident (fire calls), POSSE (bylaw violations) and EFSIT (electrical inspections) for ownership information and service calls.

A land title search is also performed to obtain legal names and addresses of property owners before mailing them the notice of inspection (see Appendix D). At the same time, the property inspection information is recorded in the FDM record management system's Inspection Module. The inspection process determines how much the owner or occupants have complied with fixing the declining conditions. If the inspection results in compliance, a monthly patrol by fire crews is assigned (see Phase 5). Regardless of the inspection results, any property that is vacant during the initial inspection moves to the next phase.

- Phase 3: Issuing Order to Remedy Condition (OTRC)

Based on the B.C. *Fire Service Act* sections 21 and 22, CPST inspectors are trained and authorized as a Local Assistant to the Fire Commissioner of B.C. to conduct on-site fire risk inspections and issue an OTRC that is subject to cost recovery. In this phase, a letter is sent to the owner's legal address with an order to either secure the property against unauthorized entry, destroy it, or repair it. The letter also includes a bulletin that indicates exactly how the property should be made secure – such as boarding any points of entry, setting up security perimeter fences, or demolishing or reinvesting in the property within 10 days – and includes contact information for contractors trained in the appropriate security measures and approved by Surrey's Risk Management division.

- Phase 4: Work Completion on Behalf of Property Owners

The next phase is determined by the owner's level of compliance. If the owner fails to comply with the order to secure the property against unauthorized entry by the deadline, Surrey Fire Services will arrange for an authorized contractor to carry out the work and send the invoice to the property owner.

- Phase 5: Monitoring Breaches

Surrey fire crew members will conduct regular visual perimeter assessments for CPST-inspected properties to ensure the property owner's security measures meet the requirements and has not been compromised. The regular assessment also allows crews to become familiar with any safety hazards at the site and help them identify potential operational considerations in the event of a fire. For any properties that had unauthorized entries, fire crews log their inspection result as 'unsatisfactory' in the records management system. These monthly fire crew patrols are not subject to cost recovery. Each week, the system automatically generates a report of all properties with unsatisfactory inspection results for the CPST. The listed properties will be subject to progressively increasing security requirements until the property is secure, with consideration given to effectiveness, cost, and fairness to the property owner.

Progressive Security

Monthly crew patrols monitor the owner's security measures, looking for vandalism, graffiti, litter on the property, illegal dumping, arson or forced entry, to determine if the chosen security methods in place are effective (see Figure 2). The escalating security requirements for sites with recurring issues is outlined below.

- If unauthorized entry takes place at a property secured by boarding and fencing, security requirements are increased to include a monitored security camera system with a security guard response. Monthly fire crew inspections are discontinued to avoid triggering the camera system.
- If unauthorized entry takes place despite a monitored security camera, a live security patrol no less than once every three hours is required.
- If unauthorized entry continues, a full-time live on-site security guard service is required.
- If unauthorized entry continues, additional full-time guards are required.

In all the progressive security situations listed above, the owner is required to restore the boarding and fencing to their original, effective condition as described in the bulletin provided with the OTRC.

For non-compliant property owners, or where security measures are failing continually, the CPST may consider a Remedial Action Requirement, intended to motivate property owners to demolish structures when their property is in unsafe condition.

Figure 2: Progressive Security



Dispute Process

For every step towards increasing security, the cycle of Phase 2, Phase 3, Phase 4, and Phase 5 repeat. Property owners can dispute any invoices for security costs by submitting a request to the CPST clerk. The CPST manager then reviews the actions of the team and any associated contractors related to the property. Any concerns about a contractor's fees or services are referred to the contractor for resolution, and the actions and costs associated with the Distressed Property model are explained in detail to the property owner. If any errors are discovered, they are corrected.

Predictive Tool for Vacant Property Identification

One focus of this study was to identify vacant or abandoned properties based on predictive characteristics. Although the previous study by Garis et al. pointed out the difficulties of pinpointing a specific trigger for residential distress and neighbourhood decline, it did indicate several risk factors: property tax arrears and delinquency, building age, disproportionately greater land values

than building values (leading to disinvestment), increased diversity of land use, a high number of households with low incomes, a shift from owner to renter occupancy, unsightly properties, and vacant or abandoned properties.

Surrey was seeking to identify a set of risk factors specifically for abandoned and vacant residential properties to develop a machine learning model for identifying these properties. An analysis was conducted to determine if the same risk factors related to residential distress and neighbourhood decline could be used, but not all the risk factors had enough associated data available to generate a valid and accurate predictive model for this purpose.

Narrowing the focus, the team considered the following risk predictors for vacant and abandoned buildings: building and land values, the year of construction, the property zone description, the incident type occurring on a property, the type of ownership, and the property's utility usage.

An analysis of 425 vacant or abandoned residential properties identified in mid-2019 showed:

- 90% had a building value of less than 10% of total value;
- 85% were identified as single-family residential zones;
- over 85% were built before 1980;
- over 50% had buildings of up to 2,000 square feet;
- 99% were privately owned; and
- nearly all had either zero or reduced consumption of utilities.

These risk predictors were then used to generate the machine learning model.

Model Building

The machine learning model was based on risk predictors. Datasets for both training (for building the model) and testing (for validating the model) were needed so that the machine was able to not only identify different patterns for risk predictors but also separate strong and weak risk predictors. The datasets needed to consist of both abandoned and non-abandoned properties. For that purpose, the training dataset was obtained from on-site surveys that already identified 15 abandoned and 11 non-abandoned properties. To expand this small training dataset, Surrey used a resampling method called bootstrapping to generate additional populations for both abandoned and non-abandoned properties. A machine learning model was then developed to determine a risk score of every property in the expanded training dataset.

Preliminary results showed the highest predictors to be utility consumption, the proportion of building value to total property value, and the year of construction. Using these predictors, the model was accurate 85% of the time in predicting abandoned homes. The next step in validating the model involved an on-site survey using a separate test dataset of properties. While this survey resulted in lower accuracy of 70%, the result shows the model performance is good and supports its use in the property identification phase of the Distressed Properties program.

When prioritizing properties for inspection, it is important to note that not all vacant properties have the same fire risk. Those with additional risk factors such as lack of maintenance or working utilities should be prioritized for on-site inspections that look for such conditions.

The CPST also considers proximity to unauthorized encampments when prioritizing properties for inspection. This is based on analysis of encampments in the City from 2016 to 2019 which determined that vacant or abandoned properties located within 1,000 metres of reported encampments were nine times more likely to have fires than those beyond 1,000 metres.

Model Implementation

In the 16 months ending in May 2021, the CPST used the model to predict 242 potential vacant properties. Nearly 90%, or 215 properties, were surveyed in person and their property assessment data reviewed for validation. The result was that 157 properties (73%) were vacant, 11 properties had an unknown status (5%), and 47 properties were occupied (22%). This demonstrates the model's consistent and reliable performance in predicting vacant properties, greatly improving the CPST's efficiency and effectiveness in addressing properties of concern.

Outcomes

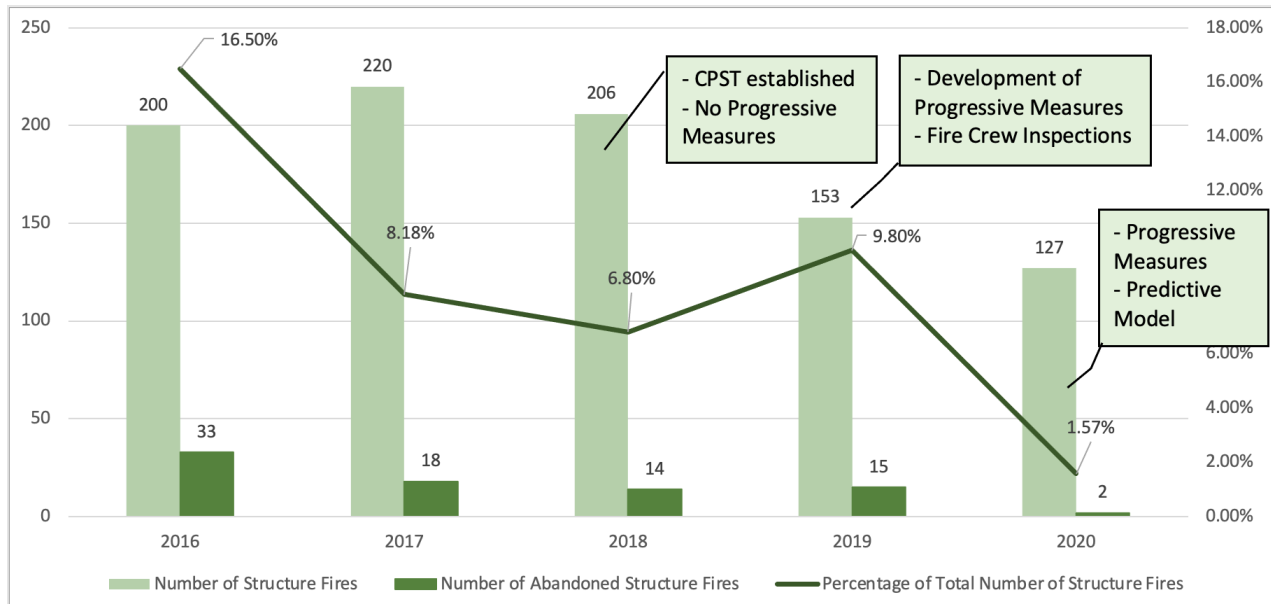
Fires at Abandoned Structures

The success of the CPST program is demonstrated by comparing fire rates at abandoned properties before and after the program was implemented. The BC Office of Fire Commissioner Fire Reporting Manual defines abandoned properties as: Buildings under demolition (code: 8320); vacant property, property without contents (code: 8350); unoccupied property, property left unoccupied over 30 days other than seasonal residences (code: 8360); and under construction or demolition, vacant, unclassified (code: 8390).

Based on these categories, Surrey experienced 33 structure fires at abandoned properties in 2016 (over 16% of total structure fires that year) and 18 in 2017 (over 8% of total structure fires, 14 fires (6.8% of the total) in 2018, 15 (9.8% of the total) in 2019 and two (1.6% of the total) in 2020). In comparison, this represents a declining trend of abandoned structure fires after the program was implemented (see Graph 1). Appendix E provides a map of abandoned structure fires. As of September 2021, there has been two abandoned structure fires reported in Surrey for 2021.

The upward trend between 2018 (14 fires and 6.8% of the total) and 2019 (15 fires and 9.8% of the total) took place while the CPST explored and developed new progressive security measures to deal with repeated unauthorized access at secured vacant properties. However, the combination of the new progressive security measures, the predictive model to identify vacant properties, and the automation in 2020 of the reporting of unauthorized property breaches led to the significant decline of abandoned structure fires in 2020.

Graph 1: Abandoned Structure Fires



Number of Inspections

The results of the inspections carried out during the various program phases are described below.

1. First OTRC On-Site Inspection

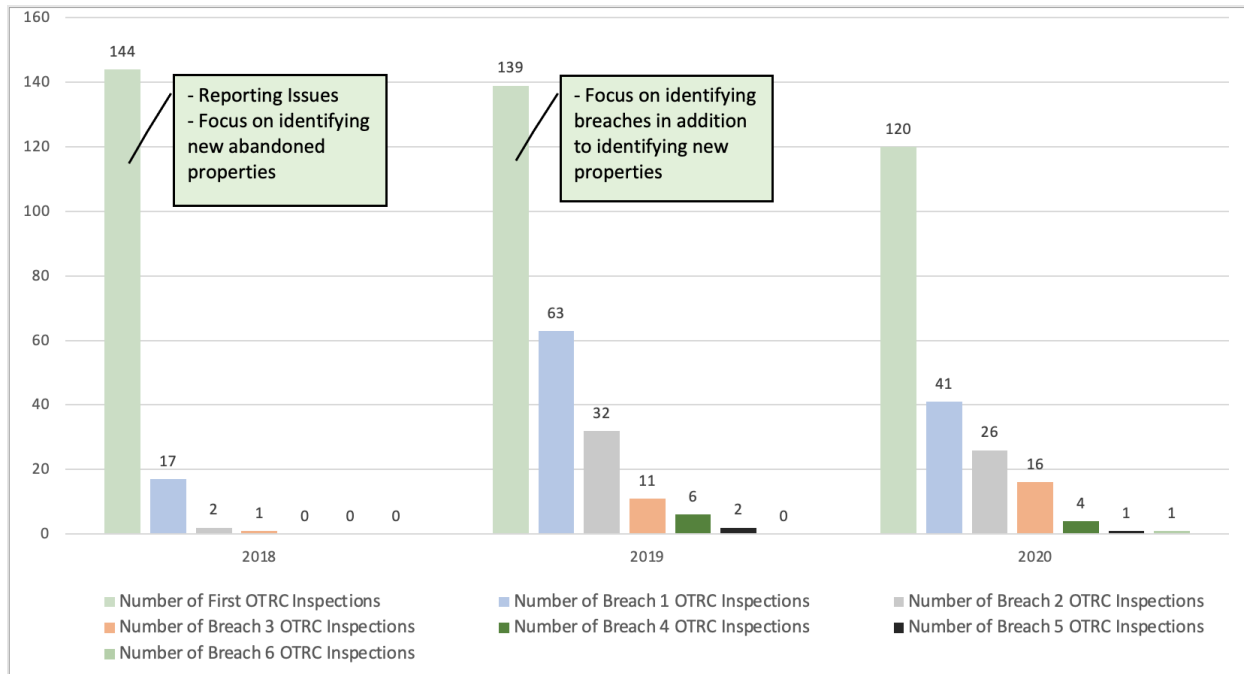
Initially, the first OTRC inspections were followed up by, on average, three inspections per property every year by the CPST (see Graph 2).

2. OTRC On-Site Inspections After One to Six Breaches

Following the first OTRC inspections, there was a declining pattern of breaches. While 30% (121) of properties experienced a first breach, only 15% (60) experienced a second, 7% (28) a third, 2.5% (10) a fourth, <1% (three) a fifth, and <1% (one) a sixth (see Graph 2 for details).

The breach OTRC inspections resulted in 410 follow-up inspections by the CPST. Graph 2 shows the year 2018 with the least number of breaches, caused by data-reporting issues and the CPST’s focus on identifying new abandoned properties instead of monitoring breaches. In 2019, the focus shifted to not only identifying new abandoned properties, but also to monitoring breaches. This led to 2019 becoming the year with the most property breaches, followed by 2020. Nevertheless, Graph 2 also shows that fewer and fewer abandoned properties experienced additional breaches because of implementing progressive security measures.

Graph 2: First OTRC Inspection and Subsequent Breach Inspections



3. Fire Crew Inspections

In addition to follow-up inspections by the CPST members, fire crews were also tasked with regularly checking for breaches at CPST properties that had been boarded and fenced. From 2018 to 2020, there were over 4,000 crew inspections.

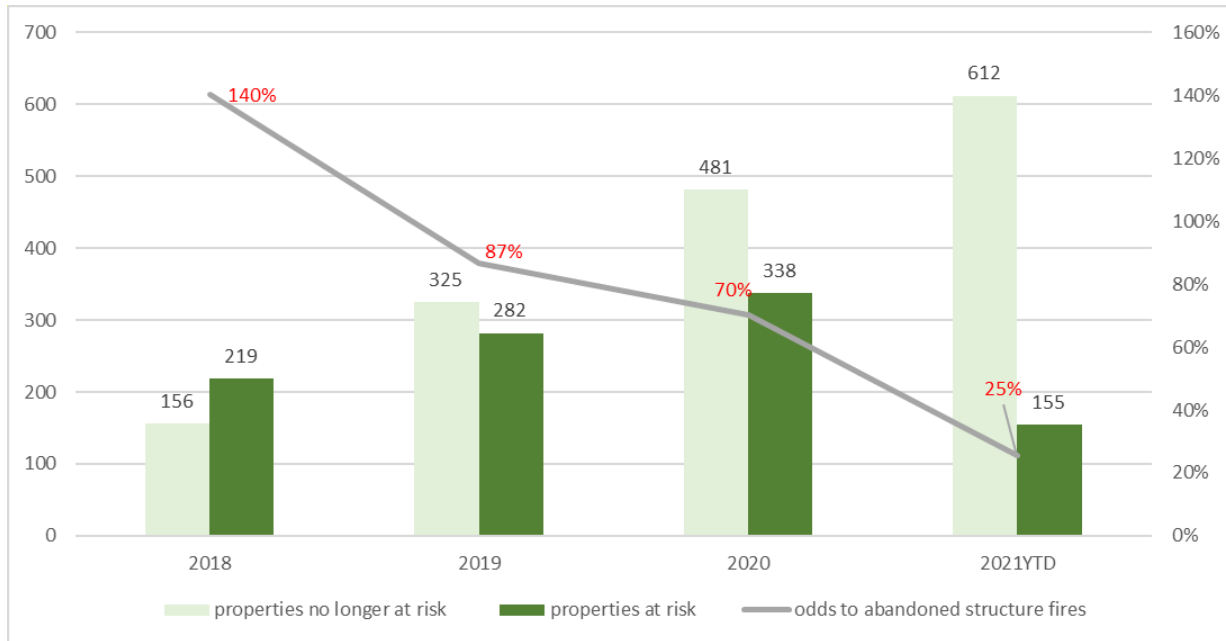
Over these three years, the CPST conducted over 600 OTRC inspections (including the first and subsequent breach), for 5,600 combined inspections.

Properties at Risk

Another method of measuring outcomes is the number of properties in the program that still pose a fire risk as a ratio of cumulative properties in the program. This ratio would be expected to be high at the beginning of the program, as more abandoned properties are identified and undergo inspections. However, this ratio would also be expected to decrease over time, as fewer properties remain unsecured and are either demolished or become reinvested (occupied and/or maintained); see Graph 3.

Overall, the number of Surrey properties that no longer pose any risk due to demolition or reinvestment has been consistent with an average of 158 properties per year. This totals 612 properties that no longer pose risk as of June 2021 (see Graph 3).

Graph 3: Cumulative Number of Properties at Risk vs. No Longer at Risk

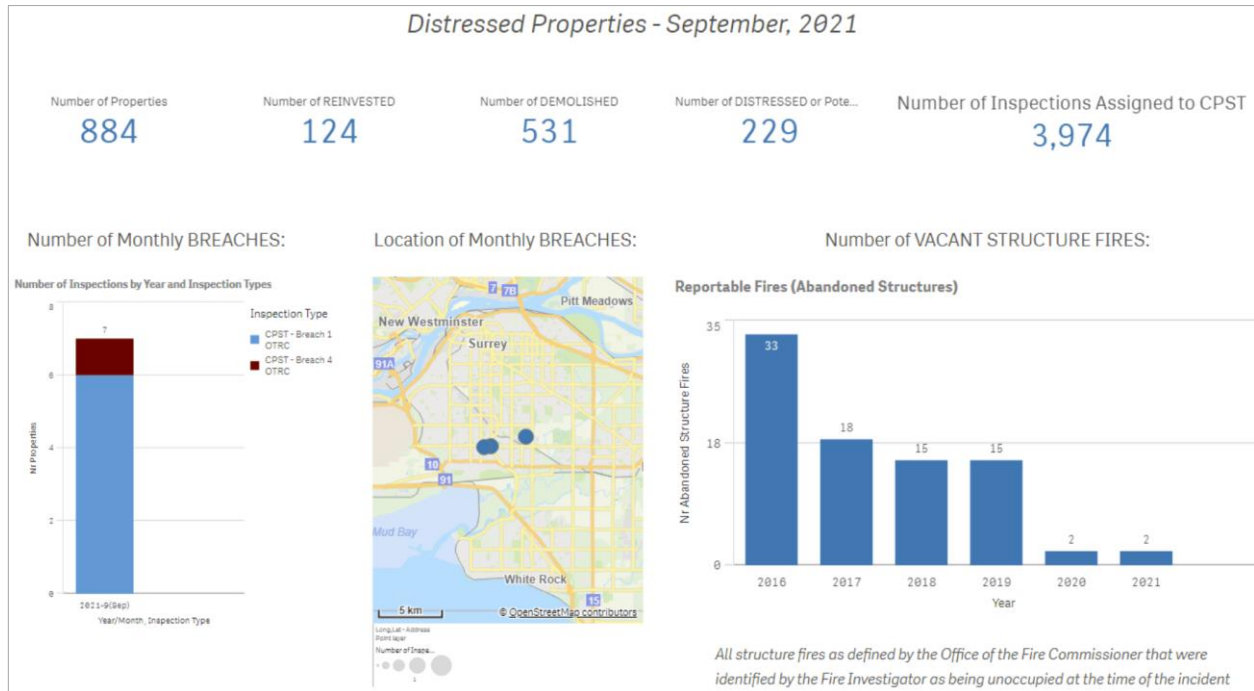


As shown in the graph above, the program’s success at identifying new properties in 2020 and 2021 through use of predictive modeling has increased the inventory of properties at risk. However, the success of the progressive security measures, targeted inspections, and reporting by fire crews about unauthorized entries has reduced the odds (ratio) of structure fires taking place in these buildings. This has resulted in fewer abandoned structure fires in 2020 and 2021, as shown earlier in this report.

Monitoring Outcomes

The program outcomes are monitored from a business intelligence dashboard application that is updated daily with data from a record management system (see Figure 3). The dashboard application combines operation measures, such as number of inspections over time, with outcome measures, such as number of breaches, number of fires at abandoned structures, and number of properties with demolition and reinvestment statuses. The application is also equipped with a map to locate properties with fires and properties at risk.

Figure 3: Business Intelligence Dashboard Application to Monitor Program Outcomes



Conclusion

Overall, the findings of this study indicate that community safety can be effectively enhanced with a targeted risk-reduction program that monitors indicators to maintain a continued focus on distressed properties. The program has demonstrated a 94% decline in abandoned structure fires since its inception. By utilizing data sources available to local government, a predictive model for identifying properties in decline or abandonment, has proven to enhance efficiency with prioritizing efforts of the CPST.

Distressed properties create costly safety and enforcement problems in communities across the country. Building upon previous research, this study focused on the work of Surrey's CPST, to identify vacant or abandoned properties and reduce their fire risk through a targeted risk reduction program.

To address this widespread issue, Surrey Fire Services identified supporting legislation that provides the authority to not only inspect vacant or abandoned properties, but also to order owners to adopt security measures to prevent unauthorized entries and to restore them to a much safer state. The legislation also gives Surrey the ability to recover the costs of implementing these measures if property owners do not comply. On this authority, the City established the CPST to implement a targeted Distressed Properties model that has proven to be effective in preventing fires at abandoned or vacant properties – demonstrated by a 94% reduction of abandoned structure fires.

The program's success can be credited to the effective predictive model developed to identify vacant properties. While the model helped identify more abandoned properties, the fire risk associated with

these properties has declined. The program's progressive security measures, targeted inspections, and ongoing monitoring by fire crews, Surrey experienced a significant decrease in the number of abandoned structure fires. Further evidence of the program's success is the absence of abandoned structure fires for the first half of 2021.

Despite these successes, a continuing dedicated effort is still needed to anticipate and reduce the number of properties at risk, as these properties carry a higher probability of structure fire risk regardless of the progressive security measures in place.

Given the ever-present development pressures in Metro Vancouver and ongoing growth in Surrey, the Fire Service will need to remain diligent in monitoring and responding to this ongoing issue through its Distressed Properties program.

References

- [1] Garis, L., Thomas, L., Tyakoff, A. Distressed Properties: Pathways of Decline and the Emergence of Public Safety Risk. May 2016. University of the Fraser Valley.
- [2] Jennings, James. Measuring neighborhood distress: A tool for place-based urban revitalization strategies. 2012. *Community Development* 43(4): 464-475.
- [3] Wuschke, K., Clare, J., and Garis, L. Temporal and geographic clustering of residential structure fires: A theoretical platform for targeted fire prevention. 2013. *Fire Safety Journal* 62: 3-12.
- [4] The Province of British Columbia. BC Fire Code 2018. 2018. <https://www.bccodes.ca/fire-code.html>
- [5] The Province of British Columbia. Fire Services Act. 2021. https://www.bclaws.gov.bc.ca/civix/document/id/complete/statreg/96144_01
- [6] The Province of British Columbia. Community Charter. 2021 https://www.bclaws.gov.bc.ca/civix/document/id/complete/statreg/03026_00
- [7] The City of Surrey. Fire Prevention Bylaw No. 10771. 2020. https://www.surrey.ca/sites/default/files/bylaws/BYL_reg_10771_0.pdf
- [8] The City of Surrey. Abandoned Properties Bylaw 16394. 2007. https://www.surrey.ca/sites/default/files/bylaws/BYL_reg_16394.pdf
- [9] The City of Surrey. Property Maintenance and Unsightly Premises Bylaw 16393. 2007. https://www.surrey.ca/sites/default/files/bylaws/BYL_reg_16393.pdf

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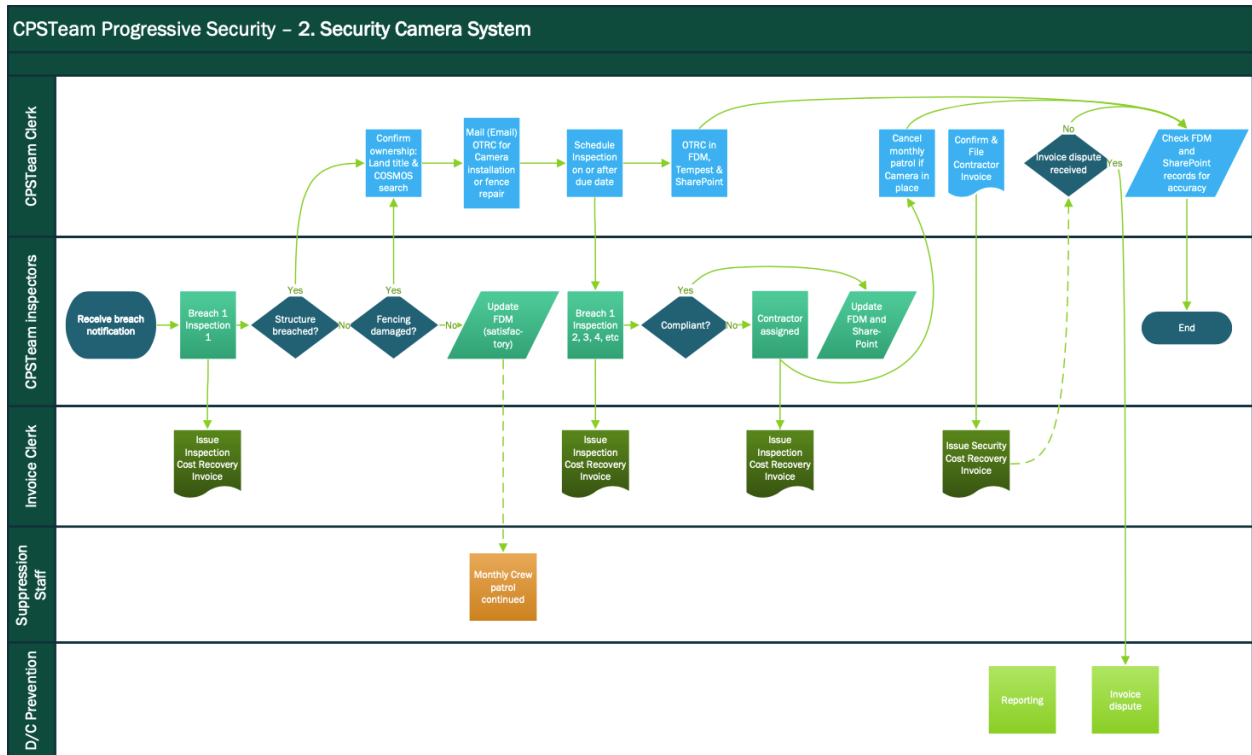
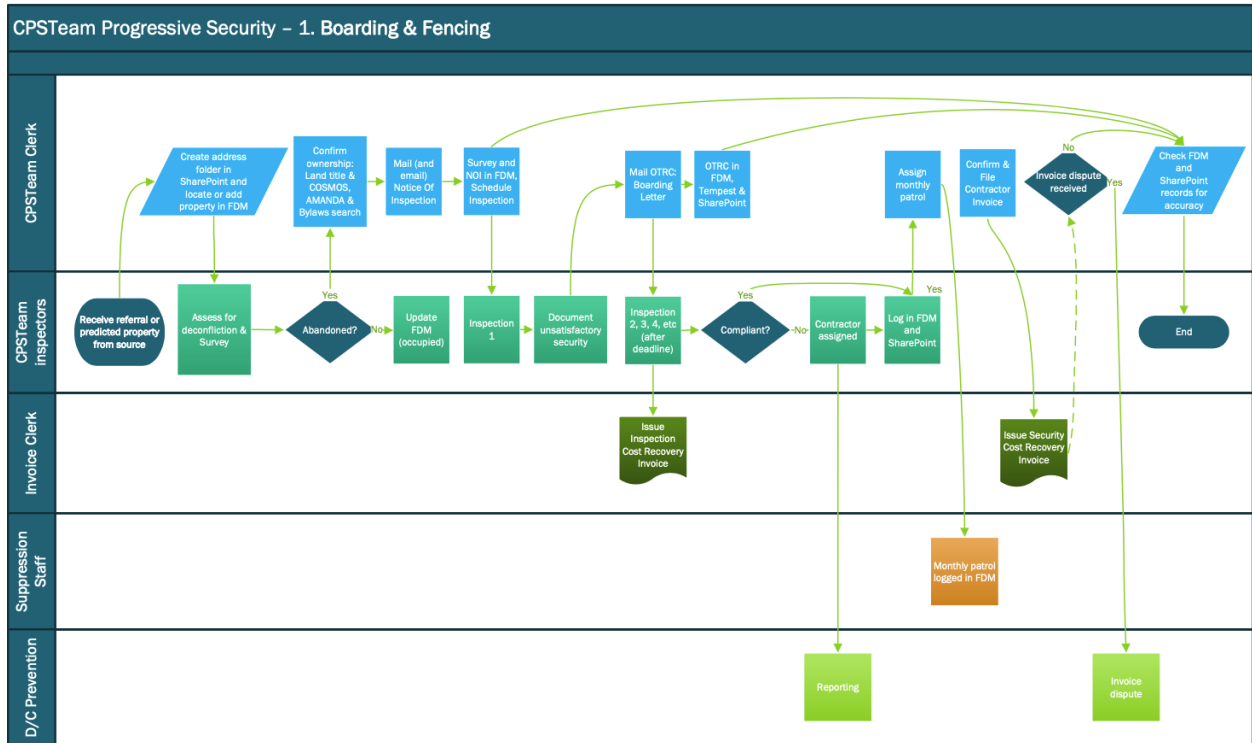
Acknowledgements

Special thanks to Len Garis, Adjunct Professor-University of the Fraser Valley and Associate Scientist Emeritus - BC Injury Research and Prevention Unit, Dr. Joe Clare, Director Criminology, Senior Lecturer in Criminology, UWA Law School, and James Bond for their valuable contributions, their initial research and program design is critical to its success. Without their efforts this work would not have been possible.

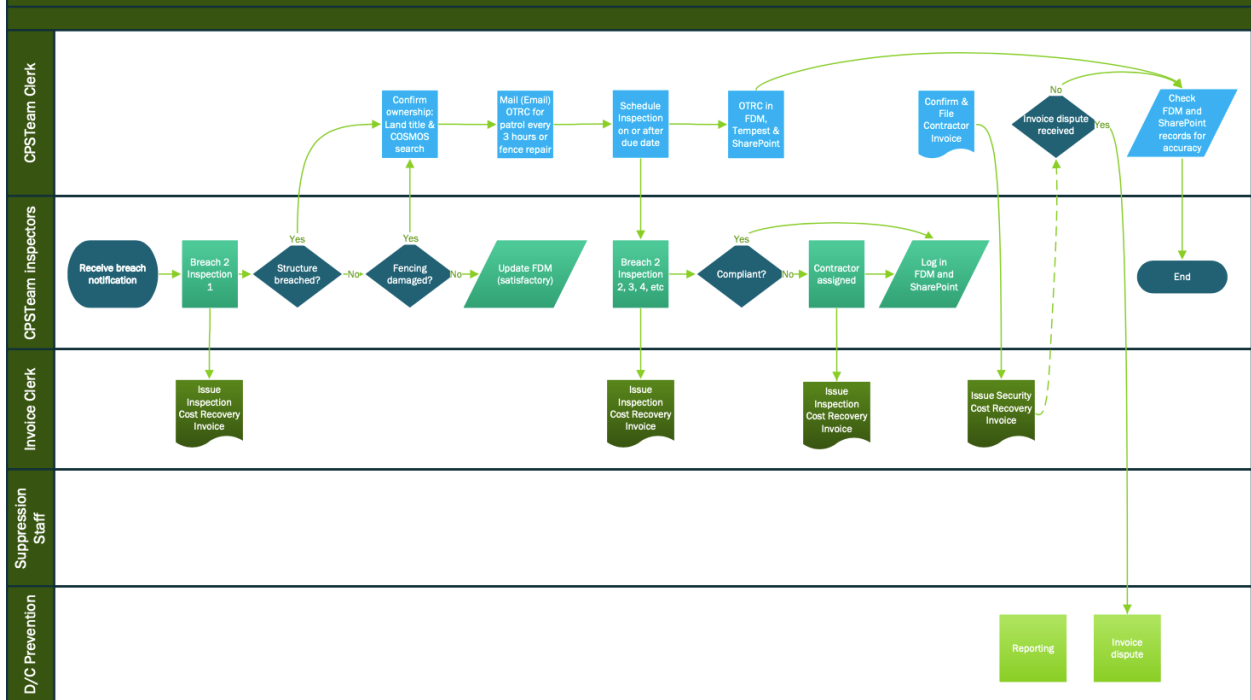
The authors wish to thank all the Community Property Safety Team members for their dedication in keeping the community safe.

Appendix A

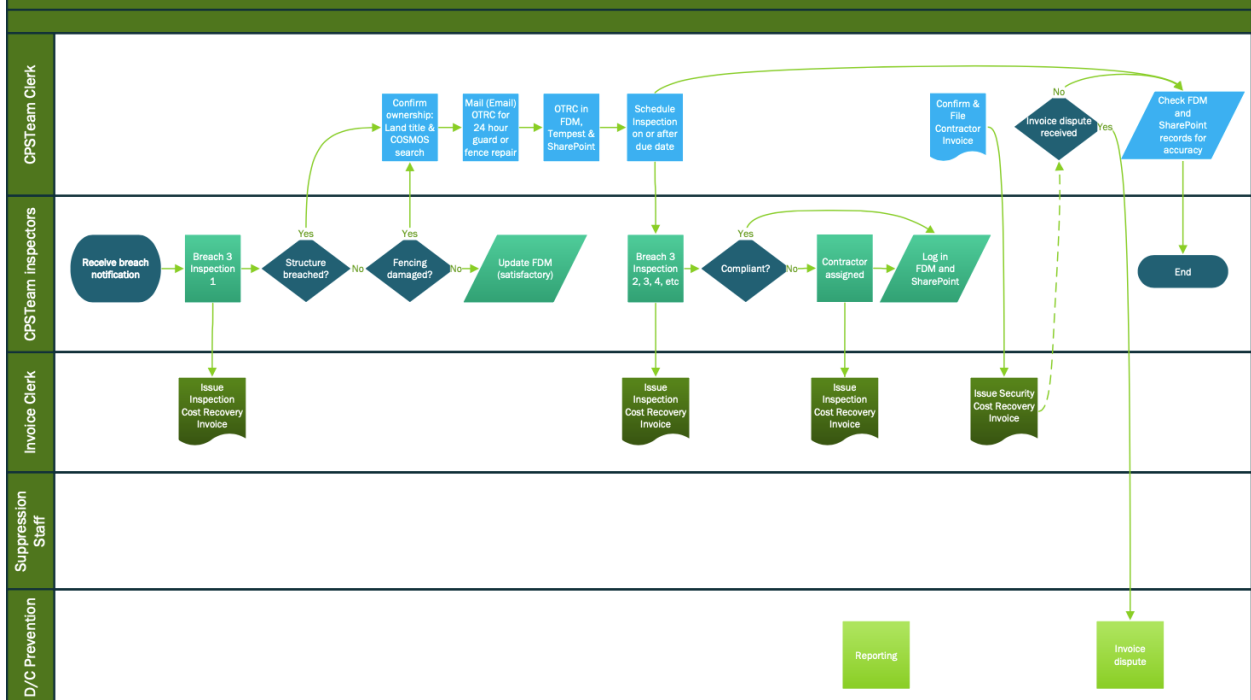
FIGURE 1: CPST PROGRESSIVE SECURITY FLOW



CPSTeam Progressive Security – 3. Patrol Every 3 Hours



CPSTeam Progressive Security – 4. Continuous Patrol



Appendix B


FIGURE 2: ON-SITE SURVEY SAMPLE

Property Assessment

Description content for the survey

Address
E.g. 8767 132 St

Pinpoint Location
Adjust map to pinpoint property on map
49°11'N 122°51'W ± 658 m



Date of Assessment
Date

Is there a For Sale Sign?
 Yes No

Is the Property Occupied?
 Yes No

Is there a green development sign on property?
 Yes No

Indicate the location of RESIDENTIAL fencing
Not security fencing
 Front Yard
 Side (Left) at the property line

Property Assessment

Indicate the quality of RESIDENTIAL fencing
Property Maintenance and Unsightly Premises By-law No. 16393
 Maintained
 Fences characterized by holes, breaks, missing boards, rot, crumbling, structural instability or not plumb

Has a Security Fence Been Installed?
 Yes No

List Security Fence Issues Requiring Attention

- Fence is not erect
- Access is possible from a neighbouring property
- Fencing sections are missing or incomplete
- Inadequate coverage at property corners
- Moved or manipulated for entry
- Open or not secure at usual point of entry
- Damaged or cut to create opening
- There is no barrier or sufficient size or strength on the driveway
- No security fencing has been installed
- Other

Have Structural Barriers Been Affixed to the Windows and Doors
Present
 Yes No

Evidence of Vandalism, Intentional Damage, Graffiti
Location
 At the Property Line
 On the Property Itself

Is There Evidence of Unauthorized Entry to the Property?
 Yes No

Property Assessment

Property Maintenance and Unsightly Premises By-law No. 16393
Choose any and all that apply

- Biomedical Hazardous Materials (condoms, needles, feces/urine, drug paraphernalia). (CHECKLIST A)
- Exterior walls, supporting columns are not plumb, or stairways are compromised and not structurally sound and this situation is exacerbated by poor security measures. Structural condition presents a safety hazard to anyone entering. (CHECKLIST A)
- Graffiti on structure. (CHECKLIST B)
- Graffiti on fence or at the property line (but not on the property itself), visual evidence of vandalism to the fence or missing/damaged fence boards or sections. (CHECKLIST C)
- Litter (light, randomly distributed) but not on the property itself. (CHECKLIST C)
- Accumulation (pile) of discarded material at the property line. (CHECKLIST C)
- The property is abandoned, there is no barrier of sufficient size or strength on the roadway to prevent dumping of debris or refuse on the property. (CHECKLIST C)
- Litter (light, randomly distributed). (CHECKLIST D)
- Accumulation (pile) of discarded material at the property line. (CHECKLIST D)
- Appliances. (CHECKLIST D)
- Furniture. (CHECKLIST D)
- Bedding/Mattress material. (CHECKLIST D)
- Construction material (not neatly piled, dumped). (CHECKLIST D)
- Vegetation (dumped). (CHECKLIST D)
- Miscellaneous refuse (dumped). (CHECKLIST D)
- Bottles, cans, broken glass. (CHECKLIST D)
- Worn pathway across the property (with an abandoned structure on the property and no fencing) indicating repeated unauthorized entries onto the property. (CHECKLIST D)
- Discarded wrecked car/trailer/boat parts, abandoned equipment, scrap metal (not used for a commercial purpose on the property). (CHECKLIST D)

Property Assessment

Abandoned Property By-law No. 16394
Choose any and all that apply

- The structure is unlawfully occupied. (CHECKLIST A)
- Exterior security measures to the structure have been breached (a door or window has been forced, a barrier to a door or window has been removed) indicating unauthorized entry to the structure (CHECKLIST C)
- The property is abandoned, there is no barrier of sufficient size or strength on the roadway to prevent dumping of debris or refuse on the property. (CHECKLIST C)

Fire Prevention By-law No. 10771
Choose any and all that apply

- Accumulations of old newspapers, cardboard, or debris inhibiting ingress or egress or creating a combustible condition that endangers life and/or property. (CHECKLIST A)
- Fire pit, evidence of illegal outdoor burning. (CHECKLIST D)

Prohibition of Nuisances By-law No. 12883
Choose any and all that apply

- Fire damage, a fire set in or against a structure (arson or suspicious fire). (CHECKLIST A)
- Miscellaneous breakage or vandalism on the property. (CHECKLIST B)
- There is no property lighting (electricity is disconnected) and there are no patrol or signage or there is no CCTV signage. (CHECKLIST D)

Checklist A - Any 1
0

Checklist A - Any 4
0

Checklist B - Any 1
0

Appendix C

DISTRESSED PROPERTY:

Any one (1) of the following conditions (as listed in the “Property of Interest: Description and Assessment” section #40) have been discovered by way of an on-site inspection:

- (a) Biomedical Hazardous Materials (condoms, needles, faeces/urine, drug paraphernalia) (Bylaw 16393 S. 3.2 Health Hazard)
- (b) Fire damaged structure as a result of fire in or against a structure
- (c) Accumulations of old newspapers, cardboard, mattresses, or debris inhibiting ingress or egress or creating a combustible condition that endangers life and/or property (Bylaw 10771, S. 11, B.C. Fire Code)
- (d) Exterior walls, supporting columns are not plumb, or stairways are compromised and not structurally sound and this situation is exacerbated by poor security measures. There may be evidence of structural collapse. The structural condition presents a safety hazard to anyone entering. (Bylaw 16393 Exterior Walls, Columns and Beams Part 3 S. 3.19)
- (e) The structure is unlawfully occupied
- (f) Exterior security measures to the structure have been breached (A door or window has been forced, A barrier to a door or window has been removed) indicating unauthorized entry to the structure (Distressed Property Bylaw 16394 S. 3 Duty of the Owner 3.1 (a))

OR

Any three of the following conditions (as listed in the “Property of Interest: Description and Assessment” section #40) have been discovered by way of an on-site inspection:

- (g) Litter distributed on the property
- (h) Discarded appliances on the property
- (i) Discarded Furniture on the property
- (j) Bedding/Mattress material on the property
- (k) Construction material (Not neatly piled, dumped) on the property
- (l) Vegetation (Dumped) on the property
- (m) Miscellaneous Refuse (Dumped Pile) on the property

- (n) Bottles, cans, broken glass on the property
- (o) Fire pit, evidence of illegal outdoor burning on the property
- (p) Discarded wrecked car/trailer/boat parts, abandoned equipment, scrap metal (not used for a commercial purpose on the property)

STRESSED PROPERTY:

Any one (1) of the following conditions (as listed in the “Property of Interest: Description and Assessment” section #40) have been discovered by way of an on-site inspection:

- (q) Graffiti on a structure
- (r) Miscellaneous breakage or vandalism on the property OR

Any two of the following conditions (as listed in the “Property of Interest: Description and Assessment” section #40) have been discovered by way of an on-site inspection:

- (g) Litter distributed on the property
- (h) Discarded appliances on the property
- (i) Discarded Furniture on the property
- (j) Bedding/Mattress material on the property
- (k) Construction material (Not neatly piled, dumped) on the property
- (l) Vegetation (Dumped) on the property
- (m) Miscellaneous Refuse (Dumped Pile) on the property
- (n) Bottles, cans, broken glass on the property
- (o) Fire pit, evidence of illegal outdoor burning on the property
- (p) Discarded wrecked car/trailer/boat parts, abandoned equipment, scrap metal (not used for a commercial purpose on the property)

VULNERABLE PROPERTY

Any one (1) of the following conditions as listed in the “Property of Interest: Description and Assessment” section #40) have been discovered by way of an on-site inspection:

- (s) Graffiti on a fence or at the property line (but not on the property itself), visual evidence of vandalism to the fence or missing/damaged fence boards or sections
- (t) Litter (light, randomly distributed) but not on the property itself
- (u) Accumulation (Pile) of discarded material at the property line OR

Any two (2) of the following conditions (as listed in the “Property of Interest: Description and Assessment” section #40) have been discovered by way of an on-site inspection:

- (v) The property is abandoned, there is no barrier of sufficient size of strength on the roadway to prevent dumping of debris or refuse on the property
- (w) Worn pathway across the property (with an abandoned structure on the property and no fencing) indicating repeated unauthorized entries onto the property
- (x) The property is situated next to a park or green space or commercial property that provides for limited property supervision
- (y) There is no evidence that the property is being patrolled or is under CCTV surveillance
- (z) There is no property lighting or security lighting (Electricity is disconnected)

STABLE PROPERTY:

None or up to one issue below has been identified during an inspection while using the “Property of Interest: Description and Assessment” section #40).

- (v) The property is abandoned, there is no barrier of sufficient size of strength on the roadway to prevent dumping of debris or refuse on the property
- (w) Worn pathway across the property (with an abandoned structure on the property and no fencing) indicating repeated unauthorized entries onto the property
- (x) The property is situated next to a park or green space or commercial property that provides for limited property supervision
- (y) There is no evidence that the property is being patrolled or is under CCTV surveillance
- (z) There is no property lighting or security lighting (Electricity is disconnected)

ATTENTION OWNER(S): NOTICE OF INSPECTION BY CPS Team

Date:

BY REGISTERED MAIL

[Owner address]

[Owner address]

Address: _____

Dear Sir/Madam:

Re: Inspection of _____ (the "Property")

We are advising you of our intention to conduct an inspection of the Property to determine if the Property is in compliance with City of Surrey Bylaws.

We will be conducting an inspection of the Property on _____ at _____ AM/PM. Your attendance is not required. If you wish to be present and it is not convenient, please call our office at **604-591-4770** to arrange another date and time.

Entry into any vacant structure on the property will not be required.

Please be advised that Inspectors are authorized to conduct inspections under the Community Charter and City of Surrey Bylaws and it is unlawful to prevent or obstruct the entry of inspectors.

Sincerely yours,

Community Property Safety Team
CPSTeam@surrey.ca

Appendix E Abandoned Structure Fires 2016 - 2020

