



# Geospatial analysis of suicidal bridge jumping in the Metro Vancouver Regional District from 2006 to 2014



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## ABSTRACT

In the past decade, there have been many structural changes implemented to Vancouver's largest bridges as a means of deterring criminogenic and suicidal behaviors. Guided by an environmental criminology theoretical framework, this research examines the patterns and trends of 201 cases of successful suicide jumping in the Metro Vancouver Regional District (MVRD) of British Columbia, Canada from 2006 to 2014. To evaluate these trends and to bolster the existing literature on deterrence measures through environmental design, this research will examine the spatial relationship between preferential bridge jumping locations and the home addresses of the deceased. Network analysis of 145 bridge jumpers suggests that suicidal people are willing to travel greater distances to jump from more iconic bridges than those closest to their home. Beyond mere aesthetic or practical functions, symbolic significance may impact which bridges become suicide hotspots over other convenient locations. Dwelling types, demographic profiles, and regional prevalence in the MVRD have also been aggregated and explored in this study.

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## 1. Introduction

Metropolitan bridges are often revered for their architecture, indifferent to the changing populous that rely upon them. But beyond their mere function of enabling travellers to cross water or as postcard backdrops for tourist attractions, these structural behemoths tacitly serve as popular locations for suicidal bridge jumping. In many cases, people are willing to travel great distances to jump from larger and more iconic bridges rather than those that are closest or more accessible from their expected individualized pathways. This phenomenon is witnessed around the world, and is not unique to North America.<sup>1–6</sup> Rising over 200 feet, the Golden Gate Bridge in San Francisco is the single most popular suicide location documented in the world.<sup>7</sup> With more than 2000 recorded suicide jumps and a conservative estimation of 8000 jumps since its creation, foreign nationals have travelled from across the globe to jump from this particular bridge.<sup>7,8</sup> Seiden and Spence's (1983) study also showed that jumpers continuously preferred the more famous Golden Gate Bridge over the Oakland Bay Bridge, despite

their many physical similarities.<sup>1</sup> In some cases, suicidal people would have to cross Oakland Bay Bridge to gain access to Golden Gate Bridge, perhaps inadvertently making the decision to postpone their method of choice for a bridge with different symbolic qualities.<sup>1,7</sup> Research shows that other metropolitan bridges have also been targeted in a similar fashion. In a study of suicidal jumpers in Scotland, Wyatt et al. (2000) found that 36.5% of cases ( $n = 63$ ) took place on bridges, rather than private homes, tall buildings or cliffs.<sup>9</sup> Despite there being many bridges across the country, all 23 cases took place on one of two prominent bridges; one is described as being in the city centre, and another on a major transit hub on the outskirts of Edinburgh.<sup>9</sup>

This phenomenon appears to be unaccounted in two types of environmental conditions. Firstly, areas where there are no bridges or elevated areas understandably have little suicides by means of jumping. Glasgow's (2011) study of 3116 US cities revealed that there was a statistically higher number of jumping suicides in areas with 'landmark bridges' as compared to those without, but the overall rate of suicide was unaffected.<sup>6</sup> Secondly, the frequency of suicidal jumping appears to taper off in cities where high-rise buildings are more abundant. This suggests that availability and accessibility can be viewed as a threshold, whereby suicidal people whom are committed to jumping as a method may value

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convenience more than symbolism for site selection in areas of greater population density because there is a substantial increase of suitable target locations.<sup>10–14</sup> If the number of targets were the limiting factor then there would be a higher rate of suicide, which does not appear to be the case. A five-year study of 2964 suicide jumps in Hong Kong found that 2521 (85%) occurred at residential apartments instead of public spaces (157, 5%).<sup>10</sup> This longitudinal study suggests that physical barriers were effective means of lowering the number of suicidal jumps, although displacement still occurred.<sup>10</sup> With a population density of 6540 persons/km<sup>2</sup>, the tightly packed cityscape atop mountains and accessible high-rises may be the reason for why suicidal activity in private homes are more prevalent.<sup>10</sup> Other studies in cities like New York, Singapore, and Taipei have similar results, which suggests that the heightened convenience and accessibility of jumping from residential buildings may redirect the need or desire to travel to other suitable public venues.<sup>10–13</sup>

## 2. Methodology

### 2.1. General overview

This study is interested in how suicidal individuals navigate the physical world during site selection. More specifically, this research is concerned with the distance that suicidal people are willing to travel, based on existing road networks between their respective residences and their target location. The level of energy exertion invested in this behaviour is a means of gauging attractiveness of bridges.<sup>15–17</sup> Informed by Environmental Criminology Theories and other criminological frameworks like Crime Prevention Through Environmental Design (CPTED), it is assumed that most people will select familiar pathways that expend the least amount of energy unless their route or destinations (nodes) contain some form of significance.<sup>15–20</sup> This study has applied geospatial network analyst tools to examine the distance travelled by suicidal bridge jumpers from across British Columbia to the Greater Vancouver Regional District from 2006 to 2014. A detailed network analysis of the six most popular bridges has been conducted, as determined by the number of fatal suicide attempts involving identified persons. The distances featuring jump sites that only have a single incident will also be measured. Secondary objectives include aggregating victim demographics based on their age, sex, and the municipality of their choice of bridge. Identifying suicide hotspots and the journey taken can lead to policy implications for public health and safety through environmental design.

### 2.2. Research design

The author used IBM SPSS Statistics 22 for all statistical computing and ArcGIS 10.3 with the Network Analyst Tools plug-in for majority of the geospatial analysis. DMTI BC Road Networks provided all base maps used in this research, and all of the home addresses were manually converted to decimal degree coordinates (DDC) by the PI using Google Earth v.7.1.5.<sup>21,22</sup> Because there is limited documentation on which part of the bridge the deceased jumped from, the DDC of the bridge is taken from the midpoint of the length of each bridge. The length of the bridge is calculated based on the area which stretches over water because the amount of land surface beneath up-ramps can vary greatly between different bridges, and all cases in this data subset took place above water. To calculate the distance between residence and bridge DDC, the Network Analyst Tool relied on DMTI Road Network maps of British Columbia. On-way streets, restricted road access, and other variables that may affect the likelihood of individuals taking said path were taken into consideration when mapping the shortest

distance between nodes. Any routes that required the individual to travel by air or water are calculated by likeliest airplane or ferry route. All frequency and distributions examined define the sex of the decedent.

This data includes all fatal suicidal bridge jumping cases that have been registered by the British Columbia Coroners Service (BCCS) between the years 2006–2014. Of the 201 cases reported for the province of British Columbia, 157 of those instances took place in the Metro Vancouver Regional District (MVRD) (formerly known as the Greater Vancouver Regional District). The manner of death in all cases within this data set are ones classified as suicides by the BC Coroners Service, which excludes all accidents, homicides, or cases where the cause is undetermined. All cases involving suicide jumpers where the identity of the jumper is unknown are considered active cases, and cannot be disclosed to the public. For this reason, it is important to note that the total number of jumpers known is limited to what information has been released through a government research agreement, and only includes individuals whom have been identified.

### 2.3. Ethics and confidentiality

Ethical concerns about privacy have been considered. There is no associative information used in this research that link to the identity of a particular individual. All names and other personal information were removed by the BCCS prior their release of data. Safeguards were taken to ensure that all identifying information has been removed to maintain high standards of confidentiality. Geospatial markers for home addresses were taken in a manner as to obfuscate exacting coordinates. All nodes published in this paper are done in a manner that shows which street is directly accessible from the home but not the home itself. The only demographic information released by the BCCS is age and sex. Age has been aggregated into 10-year age groups or only displayed collectively in the form of box plots, and binary gender classification of male versus female is used.

## 3. Results

As summarized in Table 1, all cases of death by suicidal jumps can be further aggregated into five different subcategories based on the type of infrastructure that individuals jumped from: *bridges and viaducts* (n = 145), *overpasses* (n = 7), *train trestles* (n = 0), *foot and suspension bridges* (n = 3), *other* (n = 1), and *missing data* (n = 1). These subcategories were created because these types of jumping activities are fundamentally different enough that results cannot be generalized across subgroups.

This research is focused on suicidal bridge jumps that have taken place on a bridge and viaduct. They account for 92.4% (145/157) of all jumps within the MVRD, which is proportional to the same number across the province 86.0% (173/201). The one case that falls under *other* involves jumping at a Skytrain station. The one case classified as *missing data* was classified as such due to the ambiguous jump location that could not be identified with confidence.

The 145 traditional bridge/viaduct jumpers travelled to 19 locations, 13 of which have names assigned by Transport Canada. As seen in Table 2, the nameless smaller bridges were aggregated into a single group and are of infrequent use for suicidal behaviour. There is only one documented case of suicidal bridge jumping behaviour that corresponds to each of these unnamed bridges. The shortest distance travelled between residences and the smaller, unnamed bridges were all less than 7.6 km, which is dramatically shorter than the range of distances travelled for all other bridges of prominence. The six most frequented bridges were: *Lion's Gate*

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