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PROACTIVE ROAD SAFETY ANALYSIS OF A NEIGHBORHOOD USING INTERACTIVE HIGH-LEVEL SAFETY PLANNING MODEL (IHSPM): A CASE STUDY ON CAPRI LANDMARK, KELOWNA, BC, CANADA

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Abstract: Canadian cities have contributed to society and the environment immensely over the past few decades of their development. According to Statistics Canada (2016), despite the efforts of Government, most of the big cities in Canada are expanding at a faster pace on the peripheries. This growth pattern is causing cities to expand quickly in an undeveloped manner on the periphery causing urban sprawl. Studies show that there is a definite correlation between sprawl, traffic crashes, and fatalities rate due to the increase in speed limits and vehicle miles travelled associated with sprawling. SMARTer Growth Neighborhood (SG), previously known as Fused Grid Sustainable Neighborhood (FG) was introduced to minimize the effects of sprawl. This study primarily focuses on the proactive road safety analysis and retrofitting of a neighborhood: Capri Landmark, Kelowna, BC, Canada using the web-based tool Interactive High-Level Safety Planning Model (IHSPM). IHSPM was developed by the researchers of UBC Sustainable Transportation Safety Research Laboratory (STS). The study focuses on two objectives: comparing the present-future and future-future street pattern and land use scenarios for the study location and find which components are responsible for reducing the total number of accidents. For the present-future case the existing community plan of Capri Landmark is compared with the 2040 Capri Landmark concept plan developed by the City of Kelowna. For the future-future case,

the 2040 Capri Landmark concept plan is compared with the community plan developed following the SG principal.

PROJECT OVERVIEW

Transportation and land use designs are inseparable. An effective transportation system can shape the development, impact the economy, and the life of individuals living in that city. Furthermore, transportation system influences the environment, including air and water quality, climate change, and built environment and sustains quality of life. How a neighborhood is designed also impacts residents' attitude towards transit and active transportation (i.e. walking and biking).

This study primarily focuses on assessing traffic safety of the neighborhood Capri Land Mark, Kelowna, British Columbia, by applying the urban measured models, which were developed by another researcher of the STS lab of UBCO by using the online web-based tool Interactive High-Level Safety Planning Model (IHSPM) and the retrofitting of the neighborhood was done based on the principle of SG. Using IHSPM collision prediction models (CPMs) were developed for the city. The total number of collisions can be predicted based on these models. The models were developed using the past accident data collected from the City of Kelowna. The models are applied on the existing, future proposed 2040 Capri Landmark concept plan and the neighborhood retrofit plan.

STUDY LOCATION

Kelowna is located along Okanagan Lake in the Okanagan Valley, a South-central region of British Columbia, Canada. It has a land area of 211.85 square kilometers and population density of 601.3 per square kilometers. The population growth rate in Kelowna, from 2011 to 2016 was 8.6%. The census data 2016 reflects that approximately 83% people depends on private automobiles either as a driver or as a passenger. The Capri Landmark neighbourhood (area between Gordon and Spall, and Highway 97 and Springfield) is one of Kelowna's major employment hubs and attracting more people for housing, which is the main study location for this research. The proposed 2040 Capri Landmark community concept plan was developed with the help of community feedback and considering the future growth, accessibility, housing options and availability of open spaces. The main aim of the approved plan for the Capri Landmark is to increase population density and mix land use while maintaining growth. It also focuses on realigning some major streets to promote walking and biking. The current growth of the city is promoting unplanned development, which is causing urban sprawl and forcing people to live in the periphery of the city rather than living in the center. People living in the periphery drive far to reach the center, resulting in more cars on the roads. Wide highways and low-priced fossil fuel is encouraging people to have more vehicles and travel more. The increased dependency on automobiles is increasing traffic accidents, while impacting the environment (including air and water quality), climate change, and built environment.

SMARTER GROWTH GRID NEIGHBORHOOD (SG)

SG is a section of urban planning which is concerned with creating a compact walkable urban community to avoid urban sprawl. This is done by minimizing automobile use and promoting active transportation to preserve the sustainable quality of life. After investigating several historic and human scale communities which support sustainable quality of life for both residents and businesses, the SG concept was formed. In SG, the land use and transportation are integrated in such a way that the system reduces short cutting and high speed through trips directing to the perimeter, while promoting walking or biking across the neighborhood. In SG, the main design components of a neighbourhood are street networks, mixed land uses, and open spaces.

INTERACTIVE HIGH-LEVEL SAFETY PLANNING MODEL (IHSPM)

Interactive High-Level Safety Planning Model (IHSPM) is a web-based tool developed by the researchers of UBC Sustainable Transportation Safety Research Laboratory (STS). This tool was developed considering the limitations in traditional road safety planning. Based on the data uploaded and variable definition into the model development module, it asks series of questions and based on the answers it reduces and fixes the variables to develop the specific CPMs, which can be applied to analyze the area or neighborhood under analysis.

The Model development module in IHSPM requires dataset to develop the models that is acquired from the City of Kelowna. The urban measured models were developed using the data for whole city of Kelowna and then the models were applied to the existing community plan of Capri Landmark. The different variables for the models are calculated from the street networks and the socio-demographic (SD) data collected from the City of Kelowna. The data for the existing community plan for Kelowna was uploaded in IHSPM to develop the CPMs. The IHSPM developed several CPMs for Kelowna where total crash frequency was the dependent variable and based on the statistical significance (Pearson $\chi 2$) test, the best four urban measured models were chosen. There are six traffic analysis zones (TAZ) in the Capri Landmark area. The models were applied to each TAZs of the Capri Landmark area, to predict the number of total collisions for the present year.

For the approved 2040 Capri Landmark community concept plan and the community plan developed using SG principal, and variables were calculated from the proposed street network and the socio-demographic data was obtained by considering the growth of the city. The same models were used to predict the total number of collision for the present year, depending on the change in street networks and socio-demographics projected on the plans.

RESULT

The comparison between the existing community plan with the approved 2040 Capri Landmark concept plan shows , with increase in population and employment density, number of accidents increase.

Fig 1: Retrofit design of Capri Landmark concept Plan

However, change in the total lane kilometers travelled (TLKM) has no significance impact on number of accidents. It can be observed that, increasing the core size of the neighborhood and decreasing signal density decreases number of accidents in the TAZs. Comparing the community plan developed following SG principle and 2040 Capri landmark concept plan shows, increasing number of roundabouts and decreasing signal density reduces number of accidents significantly. Based on the comparison of the neighborhoods and the impact of each variables the retrofit design is made and the retrofit model shows on an average it is decreasing approximately 37% chances of a collision to happen.