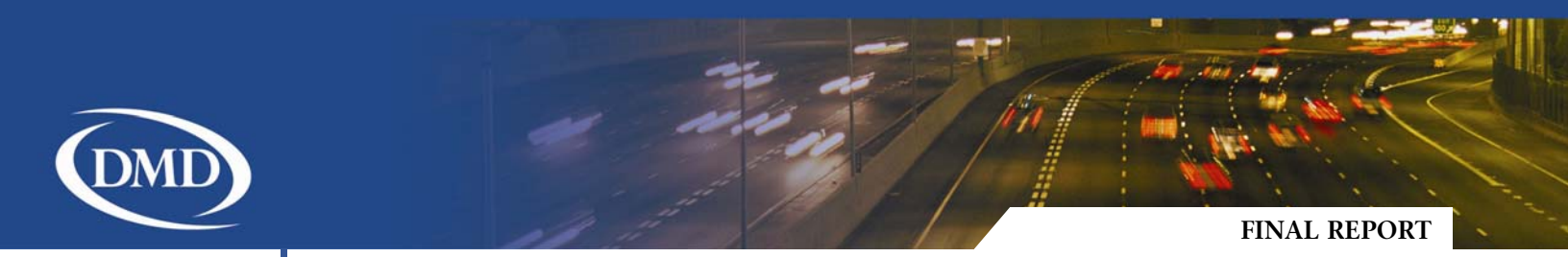

FINAL REPORT

# Highway 1 Adaptive Lighting Retrofit Project

## Executive Summary

Recent blackouts in eastern North America as well as an increasing demand for power have opened all our eyes to what we often take for granted—reliable electricity. Unfortunately we can't continue using electricity at will without considering an increase in power conservation. We must seek out new and innovative ways to reduce our power demands to ensure future generations can benefit from what we have enjoyed—uninterrupted delivery of reliable electrical power. In fact, all communities should be strongly encouraged to find innovative ways to save power.

A new wireless technology which retrofits into street lights has the potential to save 5 billion kW/h of power each year in North America through dimming street light lamps during non-peak periods. Besides dimming of the luminaries an asset management feature tied into a Global Positioning System (GPS) assigns coordinates to each street light which allows outages to be located, tracked and reported via wireless systems and the Internet. Through the system software outages are shown on a map of the corridor.

The report analyzes the retrofit of the Trans Canada Highway (TCH) freeway lighting from Port Mann Bridge to the Westview Interchange with such a wireless lighting control technology. The section of freeway is approximately 32 km in length with nearly 662 – 400W cobra head style luminaries and 216 – 1000W highmast luminaires. The existing freeway lighting uses over 2.4M kilowatts of power a year.

From the analysis undertaken in the report the freeway is over-lighted to current Ministry of Transportation roadway lighting standards. The freeway was over-lighted to provide the required ambient illumination to monitor night-time traffic via CCTV cameras. New CCTV cameras have recently been installed to replace previous cameras. These new cameras require far less ambient lighting (4 to 6 Lux) than the previous cameras (which required 13 Lux). Even with the dimming proposed the lighting levels would still meet current Ministry standards. We have been able to find no relevant data to support lighting the roadway to levels which exceed Ministry Standards will be of any real benefit.

As part of this report, a detailed safety study was undertaken by Paul de Leur of de Leur Consulting Ltd. The study indicated that the safety performance on the TCH freeway corridor is currently operating better than provincial safety thresholds, including the safety performance under darkened conditions. Road safety engineering literature suggests that safety benefits can occur when new or improved lighting is provided on a corridor and that safety dis-benefits can occur when lighting levels are reduced below standard levels. However, the safety impacts associated with reducing the lighting levels from an "above standard level" to the standard lighting levels is not clearly understood. The safety study indicated that there appear to be some opportunities for a reduction in the level of lighting that could result in minimal adverse affects on safety performance.

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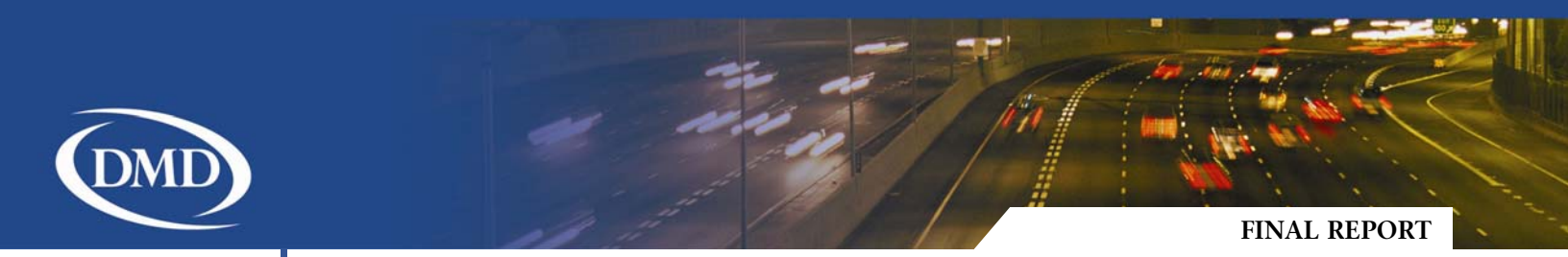



The existing interchanges are primarily lighted with high-mast lighting while roads between the interchanges use davit style lighting. The estimate total power consumed by the street lighting is 2,405,153 kilowatt hours per year. We estimate annual power savings will be in the order of 451,350 kilowatt hours for the cobra head roadway lighting and 378,660 kilowatt hours for the highmast lighting for a total of 830,010 kilowatt hours. That equals a **35%** savings. This is based on dimming to no less than a maintained average horizontal luminance of 0.4 cd/m2 (6 Lux) during low traffic volume periods (8:00PM to 6:00AM) and 0.6 cd/m2 (9 Lux) during high volume periods (dusk to 8:00PM and 6:00AM to dawn).

Estimated annual power cost savings for davit lighting would be approximately **$24,914.52** per year based and approximately **$20,902.03** for the highmast lighting per year. The estimated payback is approximately 5.5 years for the davit lighting and 2.2 years for the highmast lighting.

If the concept is accepted the majority of the costs would be funded by NR Can and BC Hydro through their Power Smart Program. The Ministry would benefit from reduced energy cost after the payback period and will benefit from being able to monitor outages via the internet.

The application of adaptive lighting discussed in this report is mainly from the standpoint of energy saving, however we see the long term potential for this technology being much broader. In the case of freeway lighting applications, we would see this technology being tied into Road Weather Information Stations (RWIS) and light levels being adjusted to suit the actual road conditions (i.e. rain, snow, fog, etc). The end result would be lighting levels tied to road conditions which would result in improved driver visibility.

The concept of adjusting light levels to suit activity levels and tasks is well proven in the interior lighting industry where great strides have been made. In the past, designer simply lighted a space to the suit the task which required the highest level. New lighting control technologies now allow lighting levels to be adjusted to suit the task being undertaken.

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