

# ESTIMATING BENEFITS TO CANADA AND THE WORLD: THE CANADIAN SPATIAL REFERENCE SYSTEM PRECISE POINT POSITIONING SERVICE

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## Introduction

One of the most fundamental questions a manager asks is whether the work being performed under his or her direction has sufficient value to justify the related expenses. In other words, cost-benefit analysis is at the heart of management.

Natural Resources Canada (NRCan) provides a service known as Canadian Spatial Reference System Precise Point Positioning (CSRS-PPP) that delivers improved positioning using Global Navigation Satellite Systems (GNSS). NRCan has processed more than 2.05 million GNSS datasets from around the globe with CSRS-PPP since it was inaugurated in late 2003, and considerable information has recently become available about the magnitude and nature of client usage of the service [Klatt and Johnson 2017]. Provision of CSRS-PPP is a costly endeavor requiring significant investment on an annual basis. The question arises whether and to what extent this is a good investment for the Canadian taxpayer. This study answers that question by establishing an approximate value to Canada from CSRS-PPP.

The study builds upon the U.S. National Geodetic Service (NGS, part of NOAA) report entitled “Socio-Economic Benefits Study: Scoping the Value of CORS and GRAV-D” [Leveson 2009].

The annual value to the Canadian economy estimated in this study is approximately C\$44 million, considering

professional engineering and surveying work (only) performed in Canada, representing an approximate cost-benefit ratio of 100 based on basic operational costs only (and not standards development and improvements). An additional C\$42 million of value is estimated as an international contribution through work performed outside Canada. Benefits in the geosciences are believed to be very substantial but no economic estimate is provided here. A number of additional benefits are identified.

## 1. Preliminaries: Economic Methodology

The methodology presented in this report (as with *Leveson's* work [2009]) is an economic impact assessment [Smart 2016] based on avoided cost.

It involves defining two scenarios: first, the (factual) reference case where clients have access to CSRS-PPP, and second, the counterfactual case where national public active reference services do not exist, which includes CSRS-PPP and the Canadian Active Control System (CACS), a network of continuously operating GNSS receivers that provide differential GSP capability. By excluding both CSRS-PPP and CACS in the counterfactual, clients are limited to commercial networks and passive reference stations.

For each positioning “transaction” (client file processed with CSRS-PPP) an avoided cost is generated for the client. Figure 1 illustrates two means by which a surveyor might obtain the information required, with the avoided cost for this transaction being the difference between X and Y. We assume that Y is equal to or greater than X in all cases, as clients will choose the most efficient method.

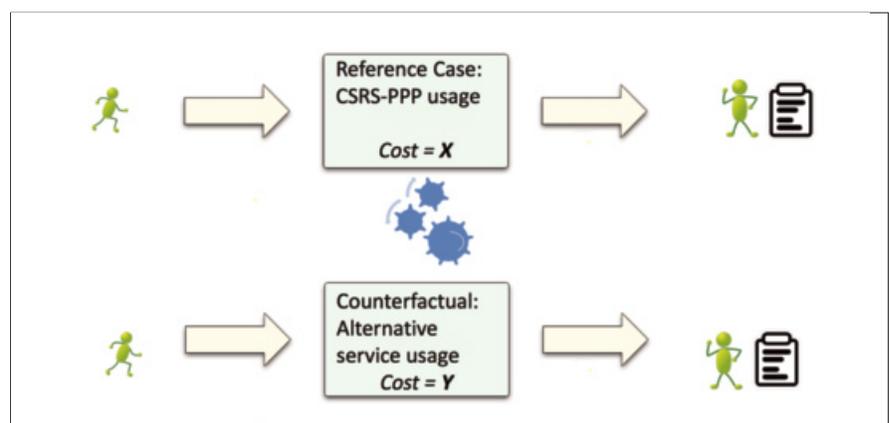


Figure 1: Reference case versus counterfactual (alternative service usage).