Artículos Técnicos

Título: **Cost benefit analysis of ITS deployments – Case study: Implementation of an adaptive traffic control system for the City of Cartagena de Indias, Colombia (Project phase 1)**

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Cost benefit analysis of ITS deployments – Case study: Implementation of an adaptive traffic control system for the City of Cartagena de Indias, Colombia (Project phase 1)

by

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Introduction

In the past public infrastructure projects were mostly analyzed by their cost of implementation. The recent decades and lack of public budget have forced public administrations to develop mechanisms looking deeper into projects future benefits. One of the mayor inconveniences is that these benefits are calculated in a theoretical manner, as real measurable benefits are only available after the project is implemented and operational.

The present article shows the two cost benefit analysis for the City of Cartagena de Indias Traffic Management System. The first was developed during project design and prior to the implementation and based on projections and microscopic models for the feasibility study. The second was recently done for an internal audit, after project implementation several months of project operation.

System description

Cartagena de Indias

Cartagena de Indias is located on the north coast of Colombia in the Caribbean. The city has one million inhabitants and its historic centre is a UNESCO world heritage site.

The city recently implemented a new adaptive traffic control system in 52 intersections with an investment of 4.500.000 USD.

System architecture

The Cartagena de Indias traffic control system is one of the most complete ITS deployments in the region including a PC SCOOT adaptive traffic control center and SCOOT traffic controllers, ITERIS Vantage video sensors, DALLMEIER digital video recorders, CCTV PTZ dome cameras and a high speed optical communications network, all operated from a single workplace.

It is the first system of its kind in Colombia, allowing the programming and manipulation of 100% of its components from the control room without the need of field visits.

(Figure - System architecture)

(Figure – Remote programming of ITERIS Vantage detection zones)

(Figure – DALMEIER video split showing ITERIS Vantage & PTZ cameras)

(Figure – ITERIS Vantage SCOOT detectors on Calle El Espinal)

Feasibility study

The feasibility study for the Cartagena traffic project was made in summer 2006. The cities 20 most critical intersections were simulated using PTV VISSIM and traffic data based on surveys done by *Universidad Nacional de Colombia* in 2004 and 2006. One of the main challenges was the simulation of an adaptive control system, without using some provider's algorithm. Therefore a specially designed two stage adaptive algorithm had to be designed.

Using a linear growth rate of Cartagena's traffic, the simulation showed an overall decrease of travel time between 2 minutes and 5 minutes, depending on the time of day, intersection arm and saturation degree of the intersections during peak hours. Previous traffic impact studies suggested that a mean 3 minute travel time savings was necessary to justify the investment for the first project phase in a 4 to 5 year term.

The real savings obtained by a 4 stage adaptive control were most likely higher than the rather conservative simulation results, so the project was a go.

Project operation study

Today, after 8 months of operation, the system operator decided to realize a first audit to determine the system performance, measuring travel times in the main corridors connecting the outer parts of the city with the downtown area.

- Downtown – Crespo (Cartagena International Airport)
- Downtown – Sur (South and access to inner Colombia)
- Downtown – Manga (Cartagena Seaport and residential areas)
- Downtown – Boca Grande (Residential and tourist area)

(Figure – Cartagena traffic corridors)

Though the coverage of the system is not yet complete travel time savings, achieved by the system have been considerable allowing an overall savings on fuel of around 1.342.000,- USD per year.

(Figure – Travel time and gas savings)

Operational savings

Traffic planning

After the implementation of the system traffic planning is only required for new intersections. The annual savings in manpower and equipment use are around 55.000,- USD.

Current saving

The new LED traffic lights save close to 85% of electricity compared to the incandescent light bulbs used before. The annual saving on electricity is around 12.000,- USD.

Maintenance savings

Incandescent light bulbs had to be changed frequently while the LED lights life cycle is estimated above 5 years. The annual savings in light bulbs, man power, and equipment are around 11.000,- USD.

Data acquisition

Traffic counts in signalized intersections are being made automatically by the ITERIS Vantage system. The annual saving in man power and equipment use is around 54.000,- USD.

Total savings

The total yearly savings of 1.474.000 USD mean a return on ITS investment in around three years, not taking into account other savings as environmental impact, traffic light down time, traffic accident rates and others. It is also important to take into account that the increasing fuel prices in Colombia have shortened the feasibility term considerably.

(Figure – Total savings)

Conclusions

ITS is worth its money

Surveys, studies but more importantly the daily traffic situation in the streets of Cartagena show, that the ITS investment has been justified. The positive experience is urging the city to accelerate its next phase of implementation.

ITS planning required

The successful implementation of the highly integrated system and different provider interoperation was only possible due to highly specialized planning being done by SIT Ltda, the Colombian branch a regional consulting group SIT.

Statement of the operator

Robert Miranda, Head of the Traffic Management and Control System of Cartagena de Indias

"Since the implementation of the new traffic management and control system the overall traffic situation in our city has improved considerably. After only 8 months of operation the system now runs smoothly and seamlessly and reports traffic data for strategic and operational planning purposes, but out of the operators point of view, the most important part of the system is CCTV and detection video, allowing us to see what is happening in our streets and verifying the accuracy or traffic detection online from the control room. Our investment in ITS planning and infrastructure was definitely worth every penny, and not only for us, but for the City of Cartagena."

Images

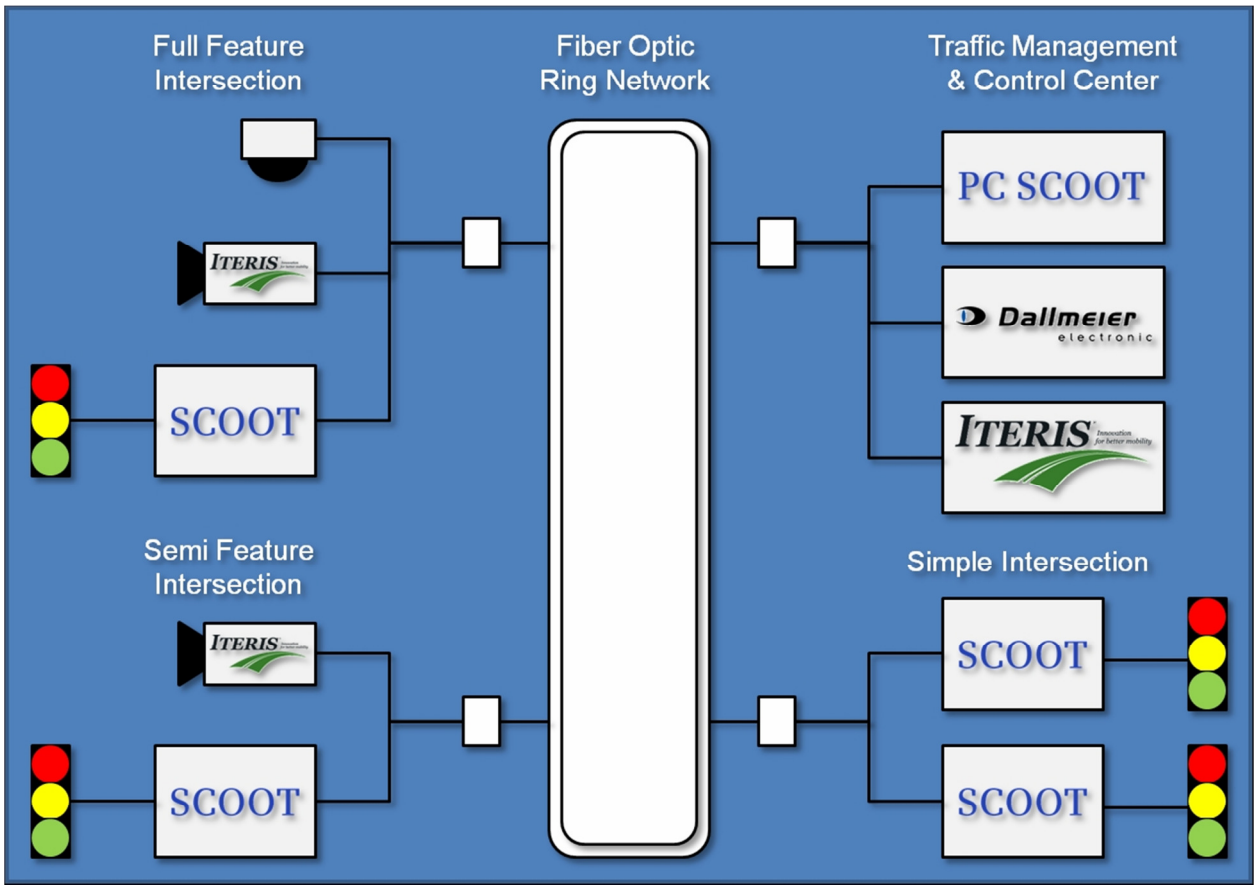

Figure - System Architecture

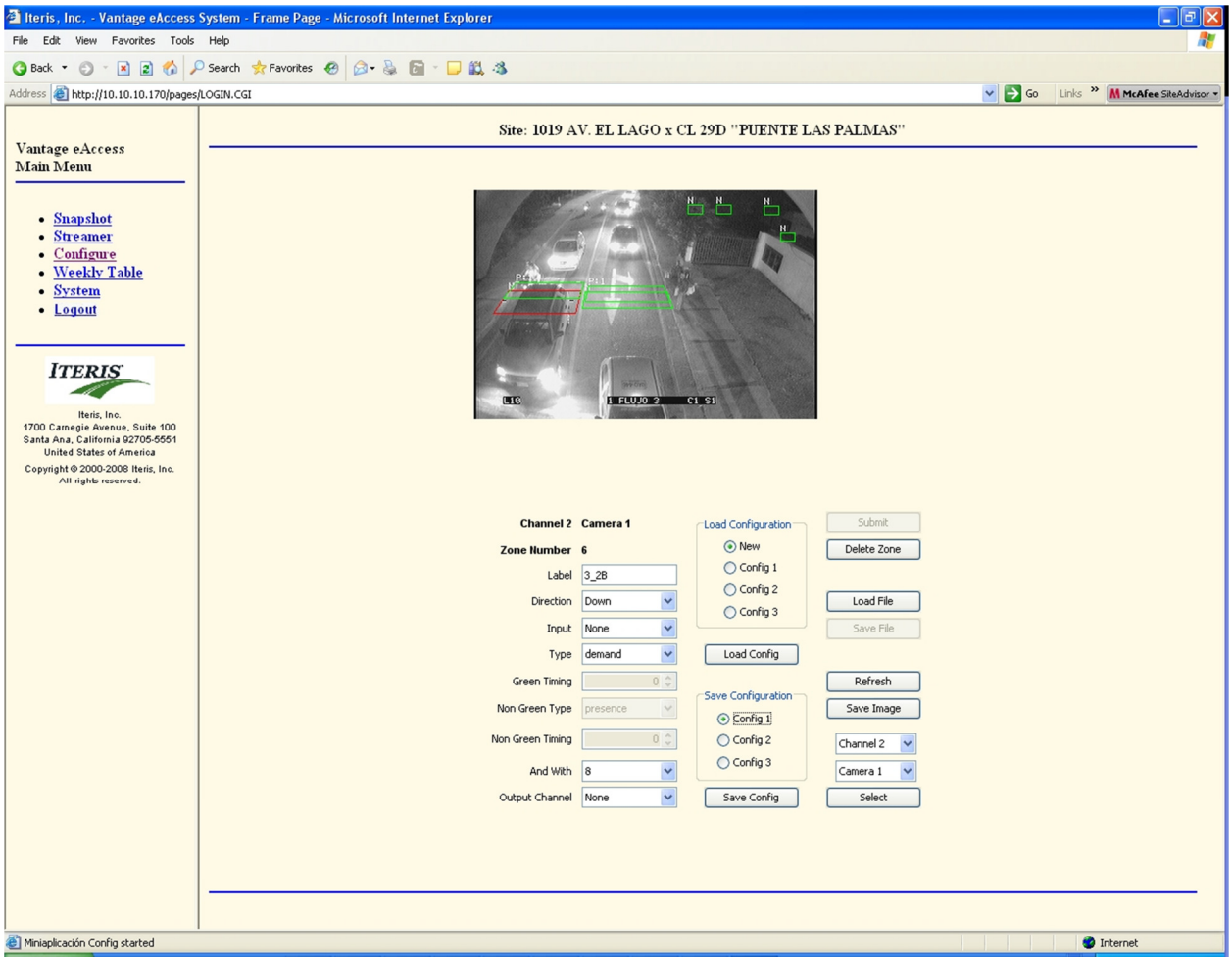

Figure – Remote programming of ITERIS Vantage detection zones

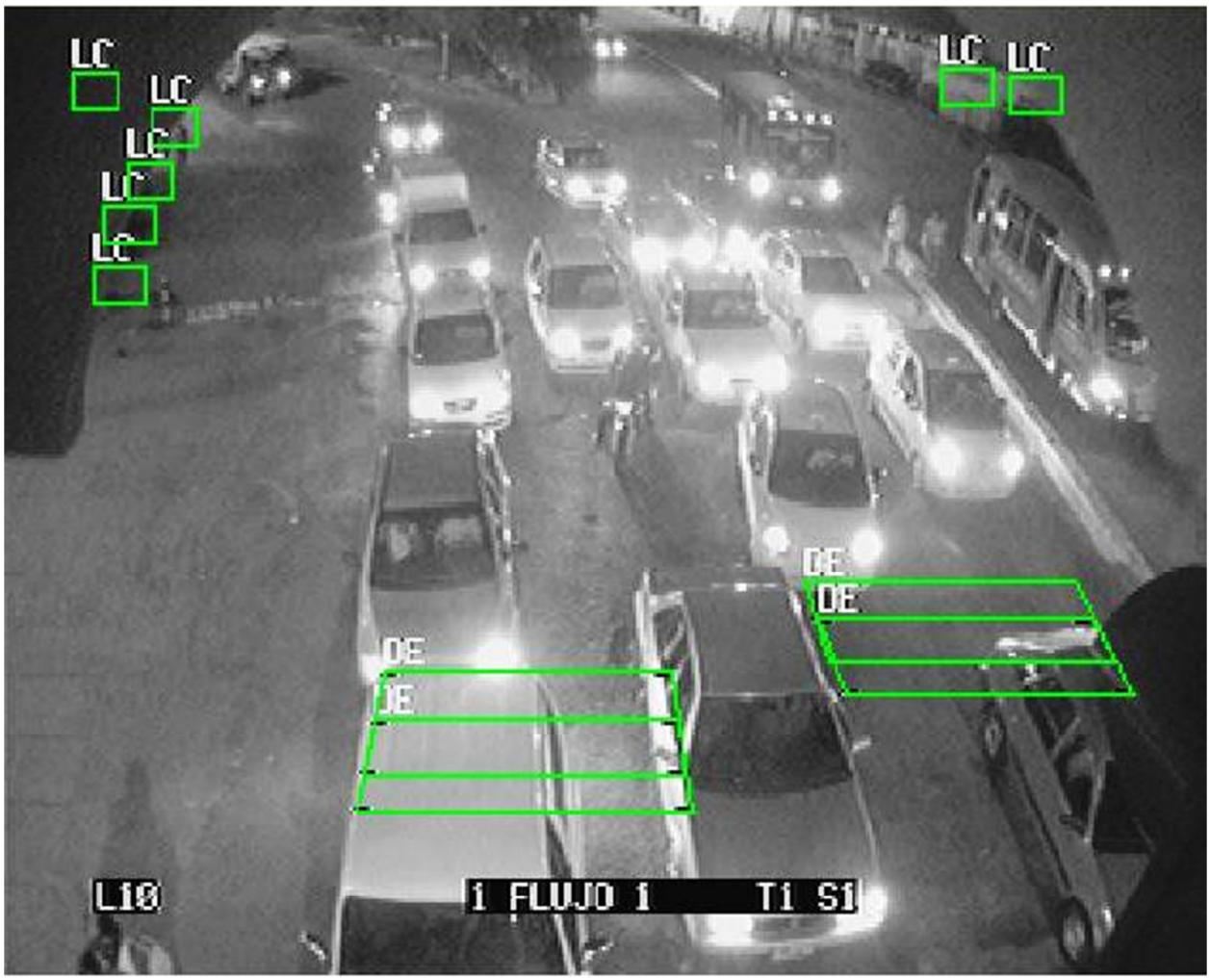

Figure – ITERIS Vantage SCOOT detectors on Calle El Espinal

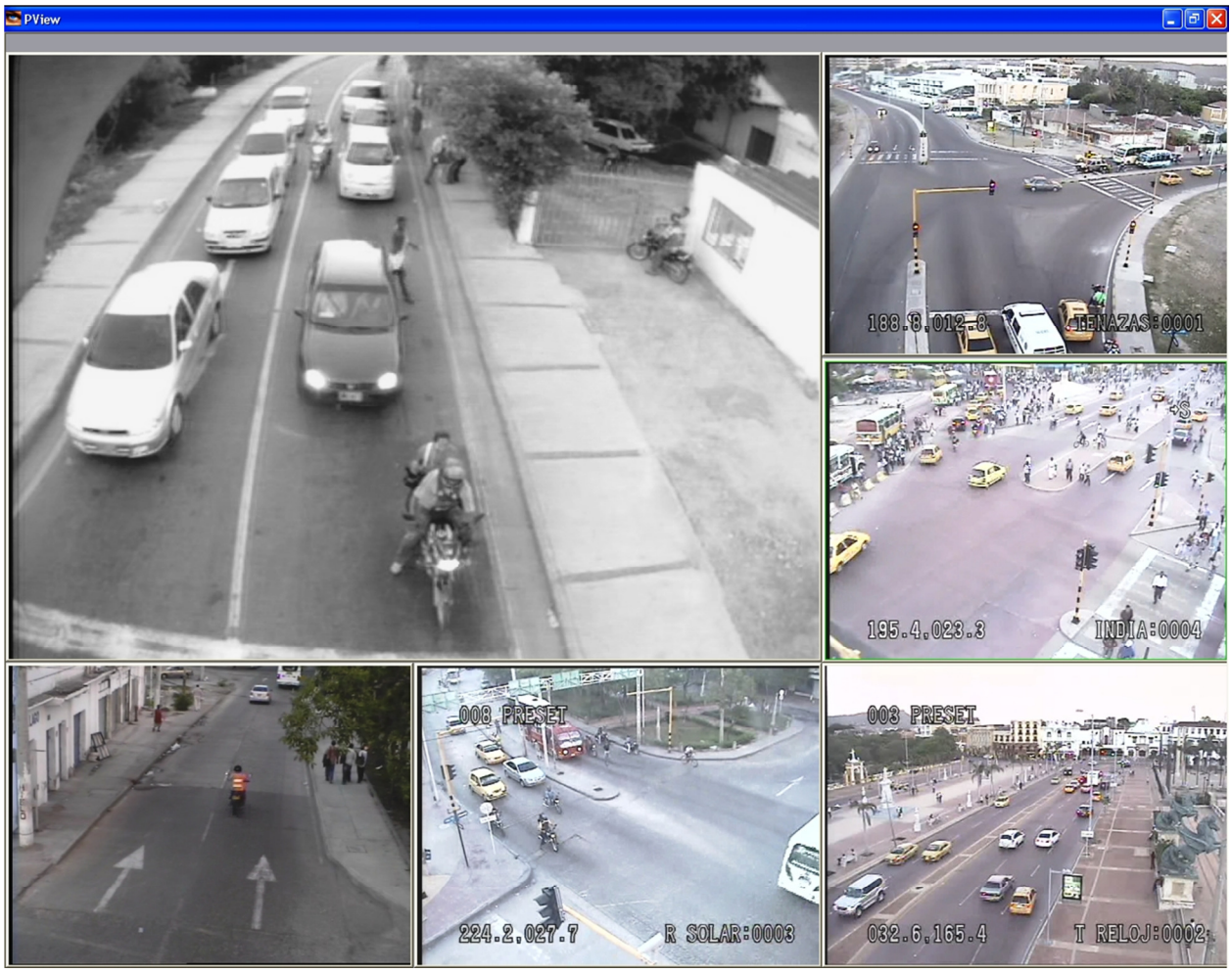

Figure – DALMEIER video split showing ITERIS Vantage & PTZ cameras

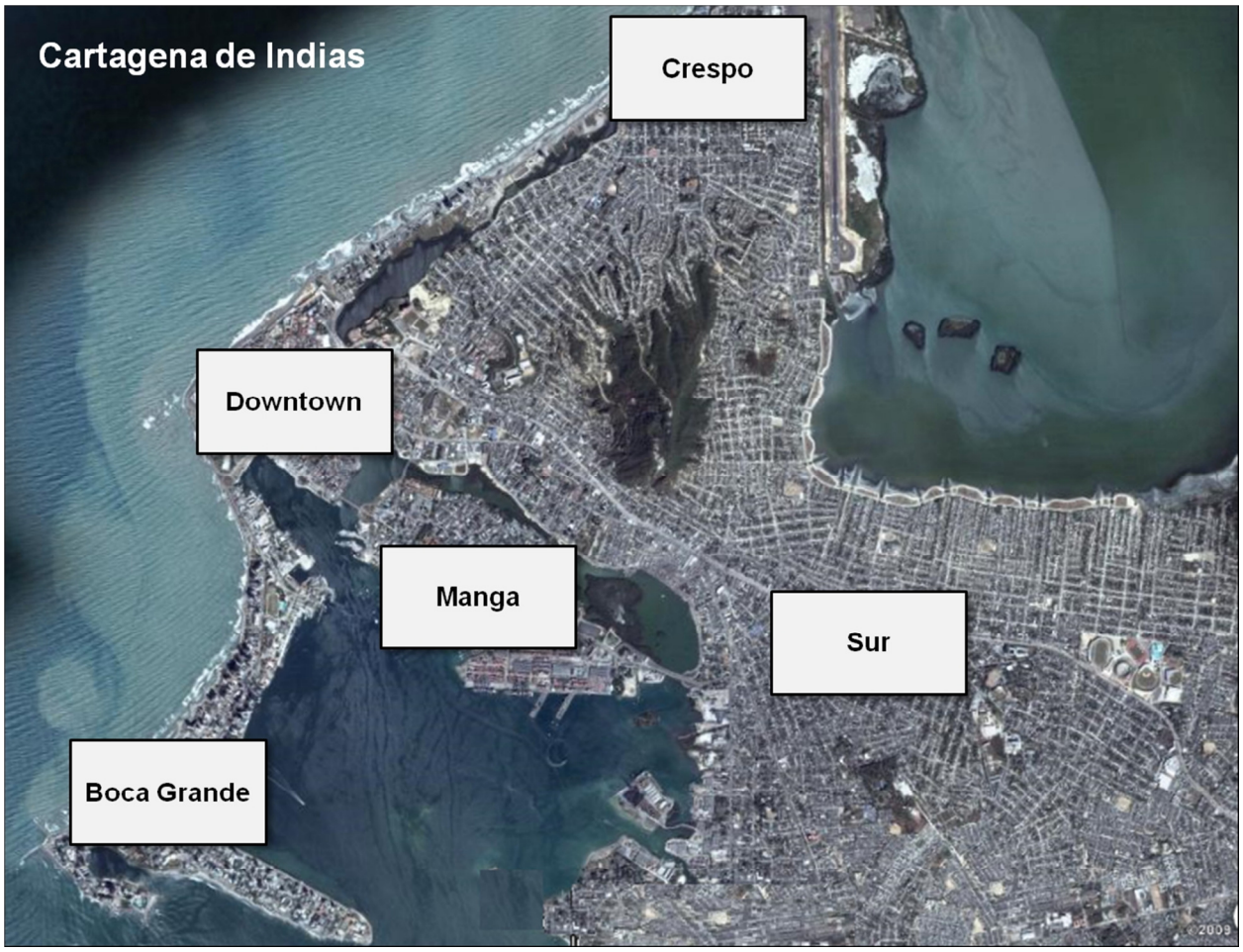

Figure – Cartagena traffic corridors

Corridor	Travel time saving [h/year]	Gas saving [USD/year]
Downtown – Boca Grande	104.000	130.000
Downtown – Manga	190.000	237.000
Downtown – Crespo	276.000	345.000
Downtown - Sur	504.000	630.000
Total	**1.074.000**	**1.342.000**

Figure – Travel time and gas savings

Savings	1 year [USD]	5 years [USD]
Travel time related	1.342.000	6.710.000
Operational	132.000	660.000
Total	**1.474.000**	**7.370.000**

Figure – Total savings