TP 14389E

Integrating Traveller Services: The Ride Points System

Prepared for
Transport Canada

by
IBI Group

April 2005

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Geoff Knapp
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All monetary amounts are in Canadian dollars unless otherwise indicated.

Since some of the accepted measures in the industry are imperial, metric measures are not always used in this report.

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The Transportation Development Centre of Transport Canada served as the technical authority for the project.

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16. Abstract

The Ride Points System (RPS) aims to leverage technological advancements (cellular, locationing, computer processing, etc.) and the popularity of customer loyalty programs to develop a successful ride sharing system that would positively affect traffic congestion and greenhouse gas emissions.

The primary objectives of this project were to: (i) develop a concept design for an efficient system based on the latest technologies; (ii) investigate the marketability and commercial opportunities of a loyalty points-based ride matching system; and (ii) evaluate the business case for the system.

The project involved the completion of five major tasks:

1. A *Literature Review* involved an environmental scan of relevant technologies, the operation and marketing of ride sharing programs, and loyalty programs.
2. A *Legal Review* identified and examined potential legal issues with the overall RPS concept, including implications on automobile insurance and licensing, and safety and security.
3. A *Concept Design* included the definition of functional requirements, development of a high-level system architecture, and development of a theory of operations.
4. A *Focus Group* provided insight into the marketability and public acceptance of the RPS concept.
5. A *Business Case* indicated that, given a number of assumptions (widespread use of GPS/AGPS-equipped mobile devices, resolution of potential issues with automobile insurance, etc.), an RPS is financially viable over a 10-year horizon.

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16. Résumé

Le système de points de voyage (SPV) mise sur les nouvelles technologies (téléphonie cellulaire, localisation, informatique, etc.) et sur la popularité des programmes de fidélisation des consommateurs pour offrir un système de covoiturage efficace, qui permettrait de réduire la congestion routière et les émissions de gaz à effet de serre.

Ce projet avait pour objectifs ce qui suit : (i) définir les principes de base d'un système de points de voyage efficace, fondé sur des technologies de pointe; (ii) évaluer les chances de succès commercial d'un système de covoiturage allié à un programme de fidélisation; (iii) effectuer une analyse de rentabilité du système.

Le projet comportait les cinq tâches suivantes :

1. *Recherche documentaire* : survol des technologies pertinentes, analyse du mode de fonctionnement et de commercialisation des systèmes de covoiturage et des programmes de fidélisation des consommateurs.
2. *Revue des aspects juridiques* : examen des incidences juridiques que pourrait avoir un SPV, notamment sur l'assurance et l'immatriculation des véhicules, et sur la sécurité.
3. *Avant-projet* : définition des exigences fonctionnelles, élaboration d'une architecture de système de haut niveau et établissement des principes de fonctionnement.
4. *Groupe de discussion* : réunion de gens du public pour avoir une meilleure idée des chances du projet de SPV de recevoir un accueil favorable dans la population.
5. *Analyse de rentabilité* : cette analyse a confirmé la viabilité financière d'un SPV sur une période de 10 ans, selon un certain nombre d'hypothèses (grande popularité des appareils mobiles dotés de GPS/AGPS, résolution des problèmes éventuels d'assurance des véhicules, etc.).

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EXECUTIVE SUMMARY

Background

Intelligent Transportation Systems (ITS) include the application of technology to address transportation issues. Through this research and development (R&D) project funded by Transport Canada, the study team explored the application of advanced technologies and leveraging customer loyalty programs to facilitate and promote an innovative dynamic ride matching system. Ride matching is one of a number of potential methods that can reduce greenhouse gas (GHG) emissions by increasing vehicle occupancy and decreasing traffic volume and congestion. This R&D project sought to study the technical feasibility and appropriate business model of a state-of-the-art ride matching prototype deployment: the Ride Points System (RPS).

The purpose of the RPS is to reduce atmospheric emissions through an increase in average vehicle occupancy. The system would induce drivers of private vehicles to accept passengers for urban and inter-urban trips using customer loyalty points (e.g. Air Canada's Aeroplan) as the primary motivator. The proposed RPS would leverage technological advancements (cellular, locationing, computer processing, etc.) and the popularity of customer loyalty programs to develop a successful ride sharing system that would positively affect traffic congestion and GHG emissions.

The primary long-term benefits of a successful ride matching system are:

- Reduced emissions from fewer vehicles using the highway network;
- Reduced congestion, thus improving traffic for general motorists, as well as emergency response mobility; and
- Reduced fuel consumption and environmental impact resulting from reductions in idling vehicles.

Environmental Scan

The environmental scan contained the following components:

- Technology Assessment – The tentative conclusion was that subsequent project activities should consider all available technologies (cellular phones, PDAs, etc.) that may provide either GPS or AGPS capabilities.
- Ride Sharing Programs – A comparable service to RPS was not found during the literature review. Existing ride sharing programs primarily serve users seeking regular trips during peak hours. The driver is not necessarily compensated and, in all of the agencies reviewed, the driver and passengers had to contact each other and make the final arrangements to share a ride.
- Customer Loyalty Programs – Aeroplan and HBC Rewards were best suited for the RPS because they allow for a bulk purchase of points by an RPS agency. In addition, they are recognized programs that already have large customer bases. The final business case was undertaken assuming the use of Aeroplan points as the exchange medium for RPS.
- Marketing – Advertising of the system should be targeted at specific markets (e.g. institutions, companies) using multiple media (flyers, website, newspaper ads, etc.). Initial promotions/challenges (e.g. a draw) can be employed to create a base registered population for the system.

Legal Issues

To assess the legal issues, an Ontario lawyer was commissioned to draft an opinion on legal issues relating to the overall RPS concept. A significant issue was exchanging rewards points, which may be interpreted as having a value, and how this will be perceived by automobile insurance providers. There are potential problems where insurers may deny coverage or require commercial coverage for drivers in the RPS. To mitigate these issues, RPS must not provide incentives that are greater in value than expenses incurred by the driver.

Another area of potential liability for the RPS is related to the security and safety of RPS users. As a service provider, RPS is required to ensure that the services provided are reasonably safe. For numerous reasons (e.g. billing, profiles), prospective users of the RPS would be required to pre-register with the system, including signing a waiver. The pre-registration process could include a security background check of the individual to help screen out potential problem customers.

To address compatibility issues, a need was identified that users, during pre-registration, set up a profile for themselves that includes relevant information and preferences. This information would then be used to filter out non-compatible matches (e.g. smoker/non-smoker). To further manage issues related to the behaviour of users, it was determined that the RPS would manage a feedback system that would prompt users to provide feedback and rate the quality of the trip upon confirmed completion of a ride share.

Concept Design

The development of the Concept Design for the RPS used the ITS Architecture for Canada, as well as the U.S. National ITS Architecture and its supporting documentation, as a basis for the content and framework of the end product. Based on these inputs, the following was developed for the Ride Points System:

- A set of functional requirements;
- Market Package Diagrams, which were customized and combined into a single diagram that represents the Physical Architecture; and
- A concept of operations.

RPS Focus Group

A focus group session was held in Ottawa on February 11, 2005, to provide feedback from potential users on the RPS concept. The feedback was consistent with, and confirmed the results from, the project's research and discussions with the Project Steering Committee. General observations from the focus group session include the following:

- Reaction to the concept as a whole was one of conditional interest. In other words, most of the respondents might use the system if a number of conditions are met.
- A range of communications/access options should be available, including land-line telephone, Internet and e-mail.
- Background checks alleviated personal safety concerns.
- Most concerns about the system focused on issues of convenience and compatibility with co-riders, specifically suitability of pick-up and drop-off locations, notification time, and driving habits or personal characteristics of the co-rider.

Business Case

The business case was developed based on an RPS for the Greater Toronto Area, with a 10-year horizon from development and integration to full-scale deployment and operation. Using origin-destination data for the region, it was predicted that, once established, the RPS would provide service daily to approximately 4,000 users. Based on this, it was assumed that at the ultimate penetration, 30,000 people would be subscribed to the system, with approximately 25% (~8,000) using it on any given weekday. In developing the business case, these numbers were scaled over the course of the deployment.

For the business case, it was assumed that the reward points used for exchange between passenger and driver would be Aeroplan points, which have an estimated purchase cost of $0.035/point. The following provides a summary of exchange values per kilometre:

- Passenger: pay 13 points (value of $0.455),
- Driver: receive 10 points (value of $0.350),
- RPS: receive 3 points (value of $0.105)

The commission detailed above, along with an annual registration fee, represents the primary revenue source for the RPS.

Looking at the net present value at the 10-year horizon with a 3% rate of return, **Table 1** provides a summary of the business case.

Table 1: Business Case Summary

Total Capital Cost	$400,000
Total Operating and Maintenance Cost (NPV)	$10,305,000
Total Revenues (NPV)	$12,710,000
Total Net Present Value	$2,005,000

The results indicate that the system is viable and expected to turn an overall profit of $2 million over 10 years. The profit is largely based on revenues generated near the end of the time frame, once the system has matured substantially and achieved a significant subscriber base.

Next Steps

Building on the research and development results from this project, and prior to pursuing a prototype and/or demonstration project, there is a need for further investigation and resolution of outstanding issues, including:

- *Investigation of ITS Opportunities* – Agencies for traffic management, traveller information and public transit need to be consulted to gauge their interest integrating with the RPS to share data and information.

- *Further Market Analysis* – Additional surveys and focus groups should be undertaken to analyze the sensitivity of RPS to: 1) modal switch, 2) trip purpose, 3) market size, 4) inter-regional vs. intra-regional trips, and 5) differences across a range of urban markets.

- *Pursuit of Partnership Opportunities* – Potential funding sources and partnerships need to be pursued to offset the upfront costs for development, deployment and marketing of an RPS. Potential sources for such funding and/or partnering include: Sustainable Development Technology Canada (SDTC) fund, Future Transport Canada ITS Deployment Initiatives, Bell Mobility Accelerator Fund (for developing advanced wireless products and services) retail businesses as sponsors, public or private businesses with limited parking facilities and municipalities with significant congestion issues.

- *Legal/Insurance Issues* – There are issues relating to potential insurance and licensing issues due to drivers being compensated for their expenses, and there is a need for material discussions with the insurance and licensing agencies/companies to confirm assumptions that have been made and to pursue agreements on these issues.

- *Investigate Alternatives for Security Checks* – It has been assumed that security checks are required to reasonably ensure RPS users' safety and minimize the liability to the operator of the RPS. However, these checks represent the largest operating cost for the RPS, and therefore alternatives should be investigated.

- *Technology Maturity and Market Penetration* – There needs to be either widespread availability and ownership of GPS- and/or AGPS-equipped mobile devices to support the RPS, or concept adjustments to account for a lack of market maturity (e.g. through the use of 'hot-spot' locations for pick-up/drop-off).

SOMMAIRE

Contexte

Les systèmes de transports intelligents (STI) résultent de l'application de solutions technologiques aux problèmes de transport. Au cours de ce projet de recherche et développement (R&D) financé par Transports Canada, des chercheurs se sont penchés sur la possibilité de combiner des technologies de pointe et des programmes de fidélisation des consommateurs pour mettre en place et commercialiser un système de covoiturage original et dynamique. Le covoiturage est une façon, parmi de nombreuses autres, de réduire les émissions de gaz à effet de serre (GES) en augmentant le taux d'occupation des véhicules et en diminuant ainsi le nombre de véhicules sur les routes – et la congestion. Ce projet de R&D visait à étudier la faisabilité technique d'un système de covoiturage d'avant-garde, jumelé à un système de points de voyage (SPV), et à en établir le modèle de fonctionnement en vue du déploiement d'un système prototype.

Le but du SPV est de réduire les émissions polluantes en augmentant le taux d'occupation moyen des véhicules. Le système incitera les conducteurs de véhicules privés à accueillir des passagers pour des trajets urbains et interurbains, en leur faisant miroiter des points de récompense (analogues aux points Aéroplan d'Air Canada). Le SPV proposé miserait sur les nouvelles technologies (téléphonie cellulaire, localisation, informatique, etc.) et sur la popularité des programmes de fidélisation des consommateurs pour offrir un système de covoiturage efficace, qui permettrait de réduire la congestion routière et les émissions de gaz à effet de serre.

Un système de covoiturage efficace offrirait les avantages à long terme suivants :

- réduction des émissions, grâce à la diminution du nombre de véhicules sur les routes;
- allègement de la congestion routière et plus grande facilité de circuler pour tous les automobilistes et pour les véhicules d'intervention;
- réduction de la consommation de carburant et des effets nocifs sur l'environnement, du fait de la diminution des véhicules immobilisés dans les bouchons.

Recherche documentaire

La recherche documentaire a porté sur les éléments suivants :

- Évaluation de la technologie – La conclusion provisoire de cette évaluation est que les activités à venir devraient prendre en compte toutes les technologies existantes (téléphones cellulaires, PDA, etc.) pouvant être dotées d'un GPS ou d'un AGPS.
- Programmes de covoiturage – La recherche documentaire n'a pas permis de mettre au jour un service assimilable au SPV. Les programmes de covoiturage existants s'adressent surtout à des usagers qui cherchent des conducteurs/passagers pour des trajets réguliers pendant les heures de pointe. Le conducteur n'est pas toujours payé et, dans tous les cas examinés, le conducteur et le passager doivent communiquer entre eux pour se fixer rendez-vous.
- Programmes de fidélisation des consommateurs – Les programmes Aéroplan et HBC sont ceux qui conviennent le mieux au SPV parce qu'ils permettent au

gestionnaire du SPV d'acheter un grand nombre de points. De plus, il s'agit de programmes reconnus qui comptent déjà beaucoup d'abonnés. Dans l'analyse de rentabilité finale, on a supposé que les points Aéroplan seraient la monnaie d'échange du SPV.

- Commercialisation – La publicité concernant le système devrait cibler des marchés bien précis (p. ex., établissements publics, entreprises) et utiliser plusieurs supports (circulaires, site Web, annonces dans les journaux, etc.). On pourrait avoir recours à des initiatives spéciales de lancement (p. ex., un tirage) pour recruter les premiers abonnés.

Aspects juridiques

On a demandé à un avocat de l'Ontario de donner son avis sur les questions juridiques touchant le principe général d'un SPV. Un des aspects importants du système est l'échange de points de récompense. Comme ceux-ci peuvent être vus comme ayant une valeur, on peut se demander comment le système sera perçu par les assureurs automobiles. Ils pourraient par exemple refuser de couvrir les risques des conducteurs, ou exiger d'eux qu'ils prennent une couverture commerciale. Pour parer à cette difficulté, la valeur des incitatifs offerts par le SPV ne doit pas dépasser le montant des dépenses faites par le conducteur.

La sécurité des usagers est un autre domaine de responsabilité potentielle du SPV. En tant que fournisseur de services, le gestionnaire du SPV doit veiller à ce que ses services soient raisonnablement sécuritaires. Pour plusieurs raisons (p. ex., facturation, établissement de profils), on devrait demander aux usagers potentiels de s'inscrire à l'avance et de signer un avis de renonciation. Le processus de pré-inscription pourrait comprendre une vérification des antécédents de sécurité de la personne intéressée, ce qui permettrait d'écarter les clients problèmes.

Pour ce qui est de l'appariement conducteurs/passagers, il faudrait demander aux usagers, au moment de la pré-inscription, d'établir leur profil, c'est-à-dire de communiquer des données pertinentes et d'indiquer certaines préférences. On se servirait par la suite de cette information pour prévenir les appariements malencontreux (p. ex., d'un fumeur avec un non-fumeur). Pour mieux gérer les aspects qui touchent le comportement des usagers, il a été déterminé que le SPV devrait être doté d'un système de rétroaction qui inviterait les usagers à exprimer leur degré de satisfaction après une expérience de covoiturage.

Avant-projet

L'Architecture STI pour le Canada et la U.S. National ITS Architecture, ainsi que les documentations connexes, ont servi de base à l'élaboration de l'avant-projet de SPV (forme et contenu du produit final). Les éléments suivants ont été définis :

- exigences fonctionnelles;
- schémas d'ensembles de marché, adaptés et combinés en un schéma unique représentant l'architecture physique;
- principes de fonctionnement.

Groupe de discussion sur le SPV

Une séance de discussion a eu lieu à Ottawa le 11 février 2005. Le but était d'obtenir les commentaires des utilisateurs potentiels sur le concept d'un SPV. Les commentaires exprimés confirmaient la teneur des discussions entre l'équipe de recherche et le Comité de direction du projet. Voici un résumé des observations générales formulées au cours de la séance :

- Dans l’ensemble, le principe a suscité un intérêt conditionnel. Autrement dit, la plupart des participants étaient disposés à utiliser le système, à certaines conditions.
- Une gamme de moyens de communications/d’accès doit être offerte, y compris le téléphone conventionnel, Internet et le courriel.
- La vérification des antécédents a pour effet d’atténuer les craintes pour la sécurité personnelle.
- La plupart des préoccupations exprimées concernaient la pertinence du service et la compatibilité des covoitureurs; on se préoccupait particulièrement du choix des lieux où les passagers seraient ramassés et déposés, du délai de préavis/réservation, et des habitudes de conduite ou des traits personnels des covoitureurs.

Analyse de rentabilité

L’analyse de rentabilité a porté sur un SPV conçu pour la région métropolitaine de Toronto. On a supposé qu’il faudrait 10 ans avant que le système atteigne son plein déploiement. Les données d’une enquête origine-destination effectuée dans la région ont révélé que, lors de sa mise en place, le SPV desservirait quelque 4 000 usagers par jour. On a supposé qu’après avoir atteint son taux de pénétration définitif, le système compterait 30 000 abonnés, et qu’environ 25 p. 100 (soit autour de 8 000) l’utiliseraient chaque jour de la semaine. Pour l’analyse de rentabilité, on a fait graduellement augmenter les chiffres de fréquentation de 4 000 à 8 000, du début à la fin du déploiement.

On a également supposé que les points de récompense échangés entre les passagers et les conducteurs seraient des points Aéroplan, dont le coût d’achat est d’environ 0,035 $/point. Voici comment il est prévu d’échanger les points, par kilomètre :

- Passager : paie 13 points (valeur de 0,455 $)
- Conducteur : reçoit 10 points (valeur de 0,350 $)
- SPV : reçoit 3 points (valeur de 0,105 $)

La commission de 3 points par kilomètre et les frais d’abonnement annuel sont les principales sources de revenus du SPV.

Le tableau 1 présente les résultats sommaires de l’analyse de rentabilité, en tenant compte de la valeur actualisée nette sur 10 ans au taux de rendement de 3 p. 100.

Tableau 1 : Sommaire de l’analyse de rentabilité

Coûts d’immobilisation totaux	400 000 $
Coûts d’exploitation et d’entretien totaux (VAN)	10 305 000 $
Revenus totaux (VAN)	12 710 000 $
Valeur actualisée nette totale	2 005 000 $

Ces résultats indiquent que le système est viable et que l’on peut s’attendre à un bénéfice global de 2 millions de dollars sur 10 ans. Le bénéfice proviendra surtout des revenus générés vers la fin de la période de 10 ans, c’est-à-dire lorsque le système aura atteint sa vitesse de croisière et recruté un nombre substantiel d’abonnés.

Prochaines étapes

Compte tenu des résultats du présent projet, et avant de passer à l'étape du prototype et/ou à un projet de démonstration, il y a lieu d'étudier plus en profondeur et de résoudre certaines questions qui restent en suspens, à savoir :

- *Examen des possibilités du côté des STI* – Entrer en contact avec les organismes responsables de la gestion de la circulation, de l'information à l'intention des voyageurs et des transports publics, afin de mesurer leur intérêt à s'allier avec le SPV pour le partage de données et d'information.

- *Études de marché* – Mener d'autres enquêtes et organiser d'autres groupes de discussion afin d'analyser la sensibilité d'un SPV à ce qui suit : 1) changement modal; 2) but du voyage; 3) taille du marché; 4) voyages inter-régionaux vs intra-régionaux; 5) différences entre différents marchés urbains.

- *Établissement de partenariats* – Trouver des sources de financement potentielles et des partenaires pour couvrir les coûts initiaux de développement, de déploiement et de commercialisation d'un SPV. Parmi les sources de financement et/ou les partenaires potentiels figurent : Technologies du développement durable Canada (TDDC), initiatives futures de déploiement des STI de Transports Canada, Fonds d'accélération de Bell Mobilité (pour le développement de produits et services sans fil de pointe) commerces de détail (comme parrains), entreprises publiques ou privées disposant de peu de places de stationnement et municipalités aux prises avec de graves problèmes de congestion.

- *Aspects juridiques/Assurances* – Des inquiétudes ont été exprimées concernant les problèmes que pourraient avoir les conducteurs avec leur assureur et le bureau d'immatriculation des véhicules, du fait qu'ils sont indemnisés de leurs dépenses. Il y a donc lieu de communiquer avec les compagnies d'assurance et les organismes d'immatriculation des véhicules pour confirmer ou dissiper ces craintes et conclure des ententes au besoin.

- *Chercher des solutions de rechange aux vérifications de sécurité* – On a supposé que des vérifications de sécurité étaient nécessaires pour assurer un degré raisonnable de sécurité des utilisateurs du SPV et minimiser la responsabilité des gestionnaires du système. Ces vérifications représentent toutefois l'élément de coût le plus important du SPV, d'où la nécessité de chercher des solutions de remplacement.

- *Maturité et taux de pénétration de la technologie* – Pour qu'un SPV puisse fonctionner, il faut que les appareils mobiles dotés de GPS et/ou d'AGPS soient largement répandus, ou encore que l'on rende le système capable de fonctionner sans ces appareils (p. ex., en définissant des points de rencontre fixes pour les covoitureurs).

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GLOSSARY

The following definitions and acronyms are provided for reference within this document.

AGPS	Assisted GPS uses the mobile phone network to assist the GPS receiver in the mobile phone to overcome the problems associated with TTFF and low signal levels
API	Application Programming Interface
Cell ID	Approximate centroid of a given geographic region addressed by a given cell-site or cell-sector
FTE	Full-Time Equivalent
GHG	Greenhouse Gas
GPS	Global positioning system using satellites, receivers and software to allow users to determine their exact geographic position
ITS	Intelligent Transportation Systems
PDA	Personal Digital Assistant
RPS	Ride Points System
TTFF	Time to first fix

1. INTRODUCTION

Intelligent Transportation Systems (ITS) include the application of technology to address transportation issues. Through this research and development (R&D) project funded by Transport Canada, the study team explored the application of advanced technologies and leveraging customer loyalty programs to facilitate and promote an innovative dynamic ride matching system. Ride matching is one of a number of potential methods that can reduce greenhouse gas (GHG) emissions by increasing vehicle occupancy and decreasing traffic volume and congestion. This R&D project sought to study the technical feasibility and appropriate business model of a state-of-the-art ride matching prototype deployment: the Ride Points System (RPS).

The purpose of the RPS is to reduce atmospheric emissions through an increase in average vehicle occupancy. The system would induce drivers of private vehicles to accept passengers for urban and inter-urban trips using customer loyalty points (e.g. Air Canada's Aeroplan) as the primary motivator. The proposed RPS would leverage technological advancements (cellular, locationing, computer processing, etc.) and the popularity of customer loyalty programs to develop a successful ride sharing system that would positively affect traffic congestion and GHG emissions.

This report summarizes the study results and presents possible next steps toward deploying a prototype system. Reports prepared for previous tasks are included in **Appendices A**, **B**, and **C** as reference material.

1.1 Background

Under the Kyoto Protocol, Canada has agreed to reduce GHG emissions to 6 percent below 1990 levels by 2012. This represents a 26 percent reduction from projected 2012 levels. Many studies have shown the importance of commuting traffic as a generator of atmospheric pollution and greenhouse gases. It is essential that Canada pursue methods of increasing average vehicle occupancy and reducing the total amount of vehicle traffic. The challenge is to raise awareness and increase interest in such a program.

The idea of carpooling has been around for many years, but turning it into a mainstream practice has proven extremely difficult. Why has public interest waned? The majority of people tend to either drive to their destination without the inconvenience of "picking up" someone, or use the public transportation system. Part of the research for this project was directed at getting to the root of the loss of interest by studying previous carpooling programs and where they have failed.

Objectives

The objectives for the Ride Points System (RPS) can be separated into those related to this ITS R&D project and those related to the ultimate goal of a fully functional ride matching system.

The following were the objectives of the proposed ITS R&D work under this project:

- Develop a concept design for an efficient system based on the latest technologies.
- Investigate the marketability and commercial opportunities of a points-based ride matching system.
- Develop a business model for the Ride Points system.

The following are the ultimate objectives of an operational RPS:

- Increase average vehicle occupancy.
- Decrease overall traffic volume.
- Decrease greenhouse gas emissions.
- Expand on the successful points concept to include other systems/organizations.
- Export the system and points concept to other countries.

There are benefits related directly to this project, as well as long-term benefits, should the concept proposed be eventually implemented. The concept design will be developed based on the results of technology reviews (GPS, cellular locating, etc.) and market analysis. Should a future demonstration project prove to be successful, it could be exported to other markets in Canada and other countries. In addition, the points-based concept could potentially be used to promote other environmental modes of transportation. The primary long-term benefits of a successful ride matching system are:

- Reduced emissions from fewer vehicles using the highway network;
- Reduced congestion, thus improving traffic levels of service for general motorists, as well as emergency response mobility; and
- Reduced fuel consumption and environmental impact resulting from reductions in idling vehicles.

2. STUDY METHODOLOGY

2.1 Task 0 – Project Initiation

A Project Kick-off meeting was held in late January 2004 at the Toronto offices of IBI Group. The meeting was held to introduce the immediate project stakeholders, finalize administrative controls and procedures, establish the Steering Committee for the project, provide an overview of project objectives, and review the project work plan (particularly as it pertained to the short-term deliverables).

The resulting Project Steering Committee established for the project included:

- Lorenzo Mele – City of Markham
- Sophia McKenna – Ministry of Transportation of Ontario
- Stephen Lee – Public Works and Government Services Canada
- Madeleneine T. Betts – ITS Office of Transport Canada

2.2 Milestone Task 1 – Work Plan and Methodology Report

A draft RPS *Work Plan and Methodology Report* was developed and submitted in mid-February 2004 to Transport Canada's Transportation Development Centre (TDC), which served as technical authority on this project. Some feedback was received and incorporated into the work plan presentation for the first Steering Committee meeting.

The first Steering Committee meeting was held at IBI Group's offices in Toronto. IBI Group presented the proposed work plan to the committee. The meeting included significant discussion on existing ride sharing programs and some of the obstacles that they face, particularly relating to insurance issues. The project *Work Plan and Methodology Report* (**Appendix A**) was updated and submitted to TDC in late February 2004.

2.3 Milestone Task 2 – Literature Review Report

Project research was initiated with a comprehensive environmental scan that examined:

- Applicable communications and locationing technologies,
- Ride sharing programs, and
- Loyalty programs.

Based on the results of the environmental scan, the initial concept of the RPS put forth in the project proposal was refined in terms of:

- Time-to-match,
- User access options, and
- Pick-up/drop-off options.

The environmental scan and concept refinement were documented in the draft *Literature Review Report,* which was submitted in late March 2004 to TDC for review. The document was subsequently circulated to the members of the Steering Committee. Comments out of this process were forwarded to IBI Group and a revised *Literature Review Report* (**Appendix B**) was submitted to TDC in early April 2004.

2.4 Milestone Task 3 – Mid-Point Interim Report

The *Mid-Point Interim Report* as described in the *Work Plan and Methodology Report* was to include the following:

- Demand analysis,
- Concept design, and
- Marketing review.

Schedule problems occurred in the summer/fall of 2004 relating to establishing and conducting focus groups for the Demand Analysis task. In consultation with TDC and the Project Steering Committee, a decision was made to complete the *Mid-Point Interim Report* without the Demand Analysis and defer that material to be included in this final report.

However, based on the results of the environmental scan of other Canadian ride sharing initiatives, and subsequent feedback from the Project Steering Committee, the scope of the *Mid-Point Interim Report* was expanded to include an investigation of some of the legal issues relating to ride sharing and compensation of driving expenses.

The draft *Mid-Point Interim Report* was submitted to TDC on November 10, 2004. The document was subsequently circulated to the members of the Project Steering Committee and a conference call was held in late November 2004, to solicit feedback and comments. The *Mid-Point Interim Report* (**Appendix C**) was revised accordingly and submitted to TDC in mid-December 2004.

2.5 Milestone Tasks 4 and 5 – Draft and Final Reports

This document represents the *Final Report* and includes a summary of the results of previous tasks (**Section 3**), as well as:

- Results and analysis of a focus group on the marketability of the RPS, and
- Development of a business case of the RPS.

The *Draft Final Report* was submitted to TDC in March 2005 and subsequently circulated to the members of the Project Steering Committee. Following review of the document, it was updated and submitted as this *Final Report* to TDC in April 2005.

3. RESULTS

3.1 Environmental Scan

The following provides a summary of the results documented in the *Literature Review Report* (**Appendix B**).

3.1.1 Technology Assessment

Technology areas investigated included:

- Cellular communications,
- Integration with cellular networks, and
- Locationing technologies.

The utilization of a wireless network operator infrastructure presumes that the wireless network operators in a given region will provide support for these location technologies and will also provide a suitable application programming interface (API) that can be used by an external end-user application such as RPS. To date, of the Canadian wireless operators, it appears that only Bell Mobility has actively pursued the support of AGPS-based and Cell ID-based location technologies. However, even in this case, Bell Mobility appears to be restricting the use of these location technologies for internally developed applications.

Given that GPS units have increased in sophistication and are dropping in price (commercial Bluetooth enabled GPS units are currently in the order of US$200 per unit), the tentative conclusion was that subsequent project activities, with respect to location technologies, consider all available technologies (e.g. cellular phones, PDAs) that may provide either GPS or AGPS capabilities.

3.1.2 Ride Sharing Programs

The environmental scan of existing ride sharing programs examined both traditional and dynamic systems. For traditional programs, arrangements for sharing a ride are usually made at least one day in advance and they exist for multiple trips. Ride sharing is considered dynamic when the arrangements are made on short notice, typically less than 24 hours, and only last for a single one-way trip. The RPS, as envisioned in this study would be classified as a dynamic program.

For existing successful ride sharing programs, the following common features were noted:

- All of the ride sharing agencies operated as not-for-profit organizations.
- Benefits to the drivers were primarily indirect. These included reduced costs, reduced travel times where high occupancy vehicle (HOV) lanes were present, reduced or waived parking costs at institutions such as universities with carpool parking passes, and reduced operating costs through informal sharing of vehicle costs between passengers and drivers. None of the ride sharing programs reviewed provided direct monetary compensation for the driver.
- Average trip lengths for carpools varied from short hauls of 15 km to longer rides of 75 km.
- In all of the communities and affinity groups researched, a low percentage (less than 6 percent) of the population was registered in existing ride sharing programs.
- The majority of the population registered with the ride sharing agencies were either commuters who worked for the same employer, went to the same university, or had some other affinity with each other. The fear or discomfort of sharing a ride with total strangers limited the demand for ride sharing with unrelated individuals.
- Most of the programs offered a guaranteed return trip (using a commercially available mode of transportation such as taxi services) for users who might not otherwise be able to arrange a ride in the reverse direction.
- Program costs to serve markets of 50,000 people were approximately US$300,000.
- All of the ride sharing agencies marketed their programs extensively, using a wide range of methods including contests, web and e-mail advertisements, and partnerships with other modes of transportation.

A comparable service to RPS was not found during the literature review. Existing ride sharing programs primarily serve users seeking regular trips during peak hours. The driver is not necessarily compensated and, in all of the agencies reviewed, the driver and passengers had to contact each other and make the final arrangements to share a ride.

3.1.3 Customer Loyalty Programs

Table 1 provides a glance at the various points/rewards programs included in the environmental scan.

Based on the results of the loyalty program scan, the Aeroplan and HBC Rewards stood apart as potential matches for the RPS because they allow for a bulk purchase of points by an RPS agency. In addition, they are recognized programs that already have large customer bases. In addition to these two, the Air Miles and Sears Club programs also warrant potential consideration. The final business case was undertaken assuming the use of Aeroplan points as the exchange medium for RPS.

3.1.4 Marketing

The ride sharing programs included in the environmental scan employed a variety of marketing strategies with varying levels of success. The following was concluded from our research:

- The use of multiple media (e.g. website, 1-800 number, flyers/mailouts) for promotion is recommended.
- Targeted marketing (e.g. existing environment programs, companies with limited parking facilities) is recommended.
- Initial promotions/challenges (e.g. a draw) can be employed to create a base registered population for the system.
- The primary motives for participating in the program are the cost savings (fuel, vehicle wear, parking permit, etc.).
- Users are wary of sharing rides with strangers.

Additional information relating to the review of marketing strategies can be found in the *Mid-Point Interim Report* (**Appendix C**).

Table 1: Loyalty Program Summary

Program	Cost of Points Accumulation	Redemption Value	Additional Benefits	Exchange Services	Bulk Purchase for Businesses	Partnering Opportunities
Aeroplan	$0.11 - $0.83 / point earned	$0.013 - $0.03 / point redeemed	Yes – Status Points available to obtain preferential status services	Yes – with the use of www.points.com	Yes – points can be purchased in bulk as vouchers - $0.029 – $0.035 / point	Potential
Air Miles	$20 / airmile earned	$0.45 / airmile redeemed	No	Yes – only from participating partner companies.	No	Potential
HBC Rewards	$0.008 - $0.02 / point earned	$0.0001 - $0.00012 / point redeemed	No	Yes – (zellers, ESSO Extra)	Yes - points can be purchased in bulk - $0.005 / point	Yes
Sears Club	$1 / point earned (Sears Credit Card required)	$0.2 / point redeemed	No	Yes – with the Petro Points program	No	Potential
Shoppers Optimum	$0.1 / point earned	$0.002 / point redeemed	No	Yes – between other Optimum Card Holders	No	No
ESSO Extra	$1 / point earned	$0.0057 / point redeemed	No	Yes – (HBC, other card holders)	No	No
Petro Points	$0.1 / point earned	$0.00057 / point redeemed	No	Yes – (Sears, other card holders)	No	No
PC Points	$0.1 / point earned	$0.001 / point redeemed	No	Yes – (Petro Points)	No	No

Note: Value of Points Redeemed is more indicative of value of points transferred between parties. (i.e. redemption value indicates potential "cash-like" value to recipients)

3.2 Legal Issues

Over the course of the environmental scan and through discussion with stakeholders, potential legal issues arose relating to the driver's automobile insurance coverage as well as customer safety and security. To assess the consequence of these issues, an Ontario lawyer was commissioned to draft an opinion on legal issues relating to the overall RPS concept. A complete review of the legal opinion may be found in the *Mid-Point Interim Report* (**Appendix C**). The following sub-sections summarize the review.

3.2.1 Automobile Insurance

A significant issue with the RPS concept is the exchange of rewards points, which may be interpreted as having a value, and how this will be perceived by automobile insurance providers. It should be noted that the solicited legal opinion is based on an Ontario perspective and there are significant differences between provinces because automobile insurance is legislated provincially.

There are potential problems where insurers may deny coverage or require commercial coverage for drivers in the RPS. To assess the severity and breadth of these potential insurance issues, industry stakeholders were consulted across Canada. The following provides a summary of the results:

- RPS must not provide incentives that are greater in value than expenses incurred by the driver.
- Insurance companies and/or regulators in the particular region where RPS would be deployed would have to be engaged in establishing the incentive scheme.
- It appears that the best place to start is in provinces with provincial insurance systems (BC, Saskatchewan) or strong regulatory regimes (Quebec). In such jurisdictions, there appears to be room for discussion.

3.2.2 Personal Security

Another area of potential liability for the RPS is related to the security and safety of RPS users. As a service provider, RPS is required to ensure that the services provided are reasonably safe. The test that is imposed by the courts is the “reasonable person test”. This test, simply put, requires that the providers of any product or service ensure that the product or service is reasonably safe for the users of that service.

For numerous reasons (e.g. billing, profiles), prospective users of the RPS would be required to pre-register with the system. As part of the pre-registration process, there would need to be a clearly written and binding waiver that the user would be required to sign, which would absolve the RPS and affiliated members from unreasonable exposure in the case of theft or injury.

In addition, the pre-registration process could include a security background check of the individual. Photo ID would be required during the pre-registration process to confirm the applicant’s identity and supplementary information (address, credit, automobile insurance, etc.). It should be noted that this introduces additional issues relating to maintaining and managing this personal information.

Once accepted into the system, each user account would be assigned a unique ID and password. This password would be required at all steps along the process (e.g. trip request, confirmation) to identify the individual as the correct user. The password would also be included as part of the final confirmation from the RPS system when making the ride match to confirm the identity of both driver and passenger.

Other potential security measures to assure identity confirmation included:

- Exchange of ID;
- Forwarding images/photos from user profiles; and
- Description of vehicle (colour, licence plate number).

The most difficult issue to deal with regarding user safety and security is to minimize the risk during the trip. The above efforts are intended to prevent identity theft and/or mis-identification, but do not address situations where a registered user, with no previous record, causes injury to another user. In the short term, the RPS can implement a call-in procedure at the completion of the trip, and monitor ride matches where a significant time has passed since pick-up confirmation. The RPS would first try to contact the users, and if unsuccessful, contact the police with details of the intended trip (e.g. users, origin, destination, vehicle information). A more proactive solution may be feasible in the future, if and when GPS locationing is widely available and integrated into the RPS. In this case, the trip may be monitored (e.g. tracking the location of the GPS-enabled cell phones) and security measures could be implemented if the travel deviates significantly from the planned route, although this itself is likely to create further issues relating to privacy.

3.2.3 Administration and Customer Service

The legal opinion also addressed the administrative and customer service considerations relating to:

- Users who are not dangerous, but not compatible with others; and
- Discrepancies/disputes with accounting (billing and reward points).

To address compatibility issues, a need was identified for users, during pre-registration, to set up a profile for themselves that includes relevant information and preferences. This information would then be used to filter out non-compatible matches (e.g. smoker/non-smoker).

To further manage issues related to the behaviour of users, it was determined that the RPS would manage a feedback system similar to that used for other services, such as eBay. The feedback system would prompt users to provide feedback and rate the quality of the trip upon confirmed completion of a ride share. This feedback information, as well as user preferences, would be available to users when potential ride matches are provided by the system, allowing a user to accept/reject a match based on other users' ratings or preferences. Negative feedback that is founded would be grounds for cancellation of an RPS membership.

Managing other administrative and customer service inquiries would require the establishment of a customer service system to deal with the inquires, supported by a clearly defined accounting system for calculating reward point debits and credits based on a defensible estimation of trip distance.

3.3 Concept Design

The development of the Concept Design for the RPS used the ITS Architecture for Canada,[1] as well as the U.S. National ITS Architecture[2] and its supporting documentation, as a basis for the content and framework of the end product. These ITS Architectures themselves were developed to meet a comprehensive list of user requirements for a broad range of ITS services, including ride matching. The *Mid-Point Interim Report* (**Appendix C**) includes detailed information relating to the development of the RPS Concept Design, and the following sub-sections summarize the results.

3.3.1 Functional Requirements

The definition of functional requirements for the RPS began with identifying relevant User Services and User Sub-Services of the ITS Architecture for Canada. User Services document what ITS should do from the user's perspective. User Sub-Services provide a more focused context and refined definition, and assist in defining project objectives by establishing the high-level services that will be provided to address identified problems and needs.

Based on the mapping to User Services and User Sub-Services of the ITS Architecture for Canada, and a review of the associated User Service requirements, the following functional requirements were identified for RPS:

- RPS shall provide users information on accessing ride matching services.
- RPS shall provide the capability for users to access the system from multiple distributed locations.
- RPS shall provide the capability for users to access the system over multiple types of electronic media (cell phone, internet, PDA, etc.).
- Passenger Request and Driver Offer shall provide the capability for users to request a specific itinerary (date/time, origin, destination, restrictions/preferences).
- RPS shall include a Ride Matching function based on current passenger requests and driver offers.
- RPS shall include the capability to perform Ride Matching in real time.
- RPS shall include an Electronic Payment Service feature.
- RPS shall provide a clearinghouse capability for reward points financial transactions.
- RPS shall include the capability for providers to have their billing (relating to reward point credits/debits) arranged through a third-party business.
- RPS shall include electronic safeguards against fraud and abuse.
- RPS shall automatically generate needed reports and financial documentation.
- RPS user account information shall be accessible over the Internet.

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[1] www.its-sti.gc.ca/Architecture/english/static/content.htm

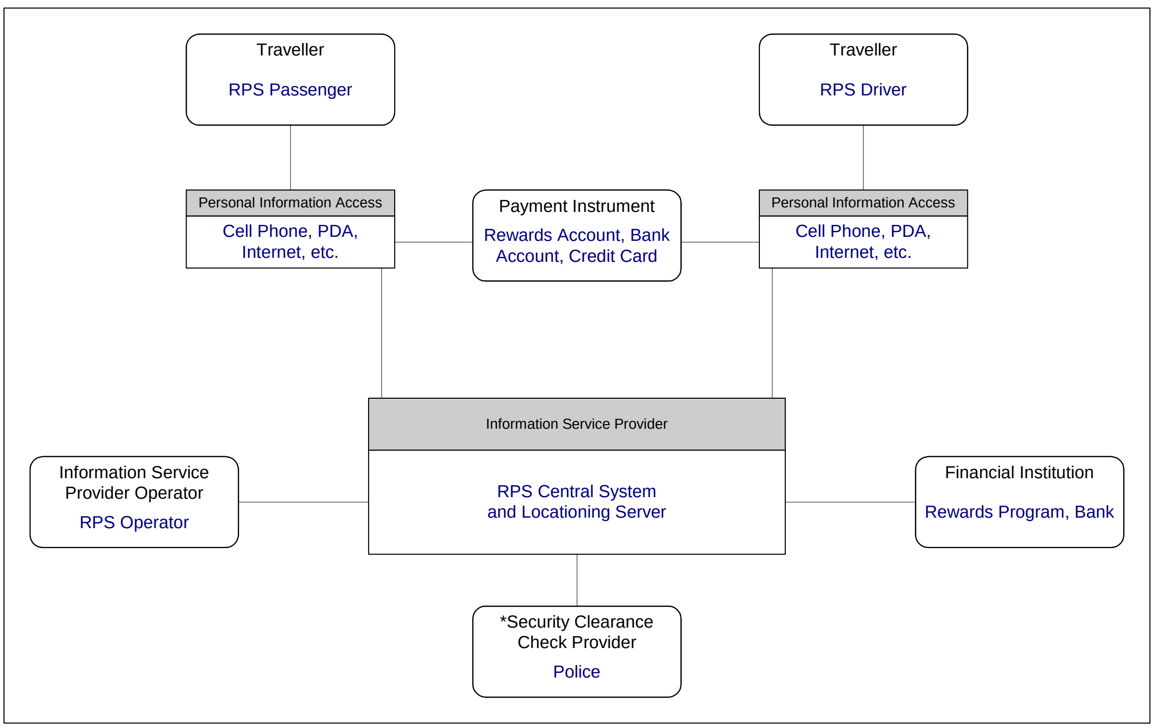
[2] www.iteris.com/itsarch

- RPS shall provide the capability to gather market information needed to assist in the planning of service improvements.
- RPS shall provide the capability to gather market information needed to assist in the maintenance of operations.

3.3.2 System Architecture

The ITS Architecture for Canada includes Market Packages, which are defined for specific ITS services (at a level similar to User Sub-Services) and provide an accessible, deployment-oriented perspective to the architecture. Corresponding Market Package Diagrams illustrate the physical elements (systems and communication links) in an easy-to-understand presentation of the ITS service.

Based on the mapping of User Services and User Sub-Services of the ITS Architecture for Canada, the corresponding Market Package Diagrams were customized and combined into a single diagram that represents the Physical Architecture for the RPS. **Figure 3-1** illustrates a high-level representation of the resulting RPS System Architecture.



* New element (in comparison to the ITS Architecture for Canada)

Figure 3-1: Interconnection Diagram for the RPS

3.3.3 Concept of Operations

Building on the RPS System Architecture, the process of the Theory of Operations (from the U.S. National ITS Architecture) was used to present the operational concepts of the RPS, as described in **Sections 3.3.3.1** and **3.3.3.2**.

3.3.3.1 Ride Matching Processes

Figure 3-2 illustrates the flow of information that would take place when matching passengers and drivers, and is supplemented with the following description:

1. A prospective pre-registered passenger accesses the RPS, using some form of Personal Information Access (e.g. cell phone, internet, land line), to request a ride. For security purposes, a unique password is included in the passenger input to confirm the RPS user. Also included is requested origin, destination and trip time. The system would be designed to accept this information quickly and provide an option to search for nearby hot-spots should the user not know the appropriate codes. The website would have a GIS-based GUI that would allow users (drivers and passengers) to find the closest hot-spot based on the user's current location.

2. Similar to #1, a prospective pre-registered driver accesses the RPS, using some form of Personal Information Access (e.g. cell phone, internet, land line), and provides similar information to offer a ride.

3. In a mature system, and where users have AGPS-equipped mobile devices, this is the process through which the RPS processes the locationing information provided by the mobile device to determine the users' current locations.

4. This is the process through which the system identifies drivers and passengers with similar trip characteristics. Depending on the maturity of the system and the population of users, the lead time may need to be considerable (e.g. trip may need to be planned hours in advance). As the system matures and the user population grows, the time to identify matches is expected to decrease and the option of short-term planning may become more feasible. Included in the matching process is an estimation of trip distance to be used for determining reward point debits and credits.

5. Once the system identifies a potential match, it notifies the driver and passenger using their preferred Personal Information Access method (e.g. cell phone, internet, land line). The users are provided with the information about the ride, including departure time, changes to origin/destination if applicable, and other information (i.e. smoker/non-smoker, gender, customer rating) related to other user. The user (passenger or driver) may then choose to approve the match or reject it, in which case the system would continue to search for other matches.

6. If both the passenger and driver approve the match, the system sends a final notification to both users. This contact would include information to assist the passenger in identifying the driver's vehicle (i.e. make/model/colour of driver's vehicle, license plate details, hair colour of driver, name).

7. The driver picks up the passenger at the agreed time and location. It is the passenger's responsibility at this point to confirm the successful pick-up.

8. At the completion of the trip, the driver and passenger both call the RPS to confirm the drop-off. The purpose of this call is both to ensure user safety and to provide an opportunity to provide feedback related to the trip (e.g. rate

the other user). To encourage passengers (who will be charged/debited for the ride) to call in, the cost of the ride will be discounted for confirmed trips.

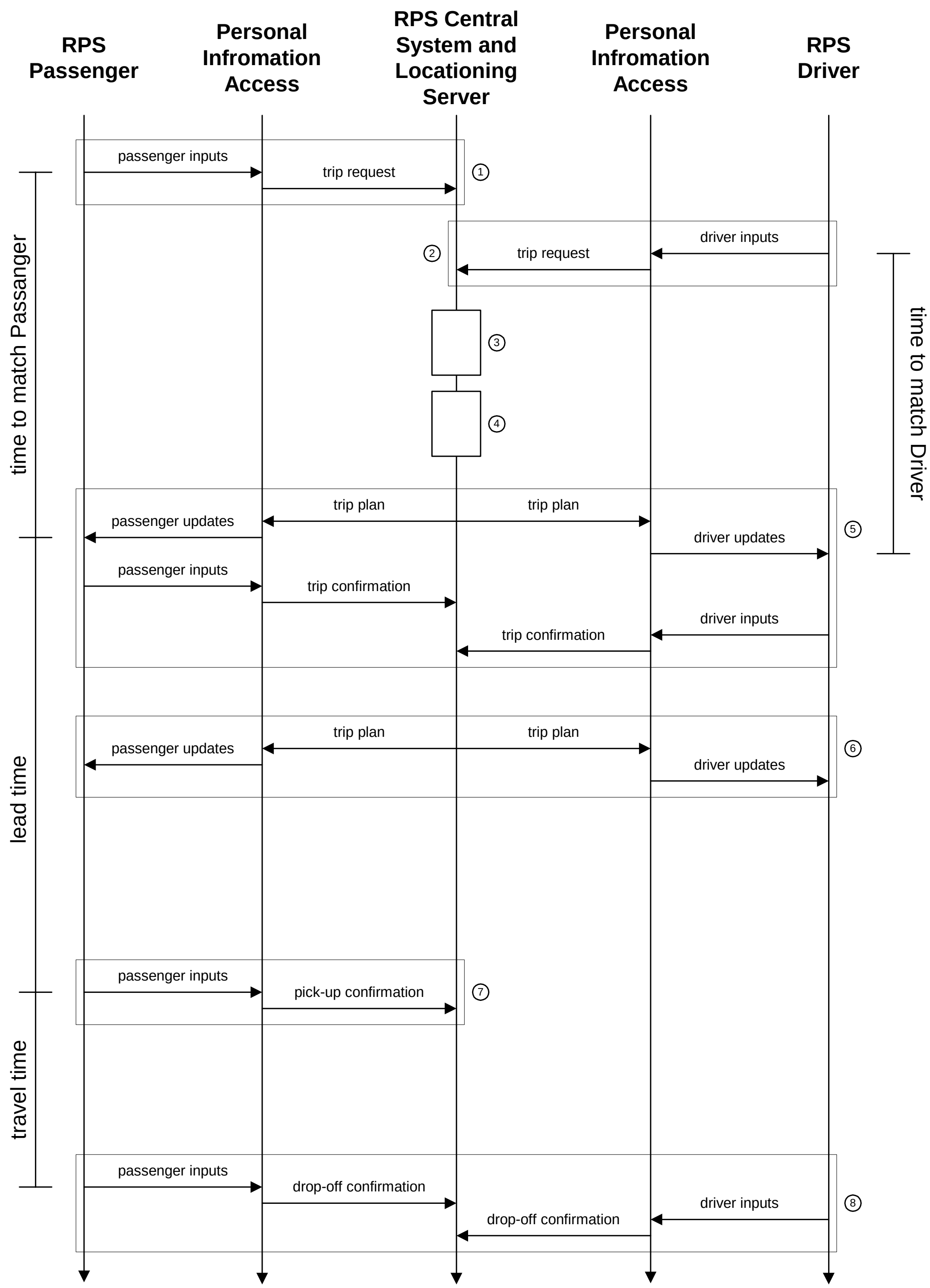


Figure 3-2: RPS Concept (ride matching)

3.3.3.2 Back Office Processes

Figure 3-3 illustrates the flow of information for functions required to support the primary ride matching objective of the RPS, and is supplemented with the following description:

1. To maintain the RPS and to facilitate customer service with users, the RPS will support an interface with a system operator. This will include updating RPS configurations, user profiles and user accounts.

2. The RPS will require perspective users to register an account. This will include the user setting up a profile (e.g. preferences, rewards account, billing information, account password) and the RPS using a third-party provider (likely the police) to run a security check on the potential user.

3. The RPS will provide a customer service interface (e.g. internet-based) that will allow users to query their account balance, current bill and other information (e.g. feedback rating).

4. The RPS will provide functionality to reconcile account balances and debits. This will include user account inquires, billing and payment from users (from bank or credit card).

5. In co-ordination with the account billings, the RPS will provide functionality for the purchase of reward points and assignment of points to a user's rewards account.

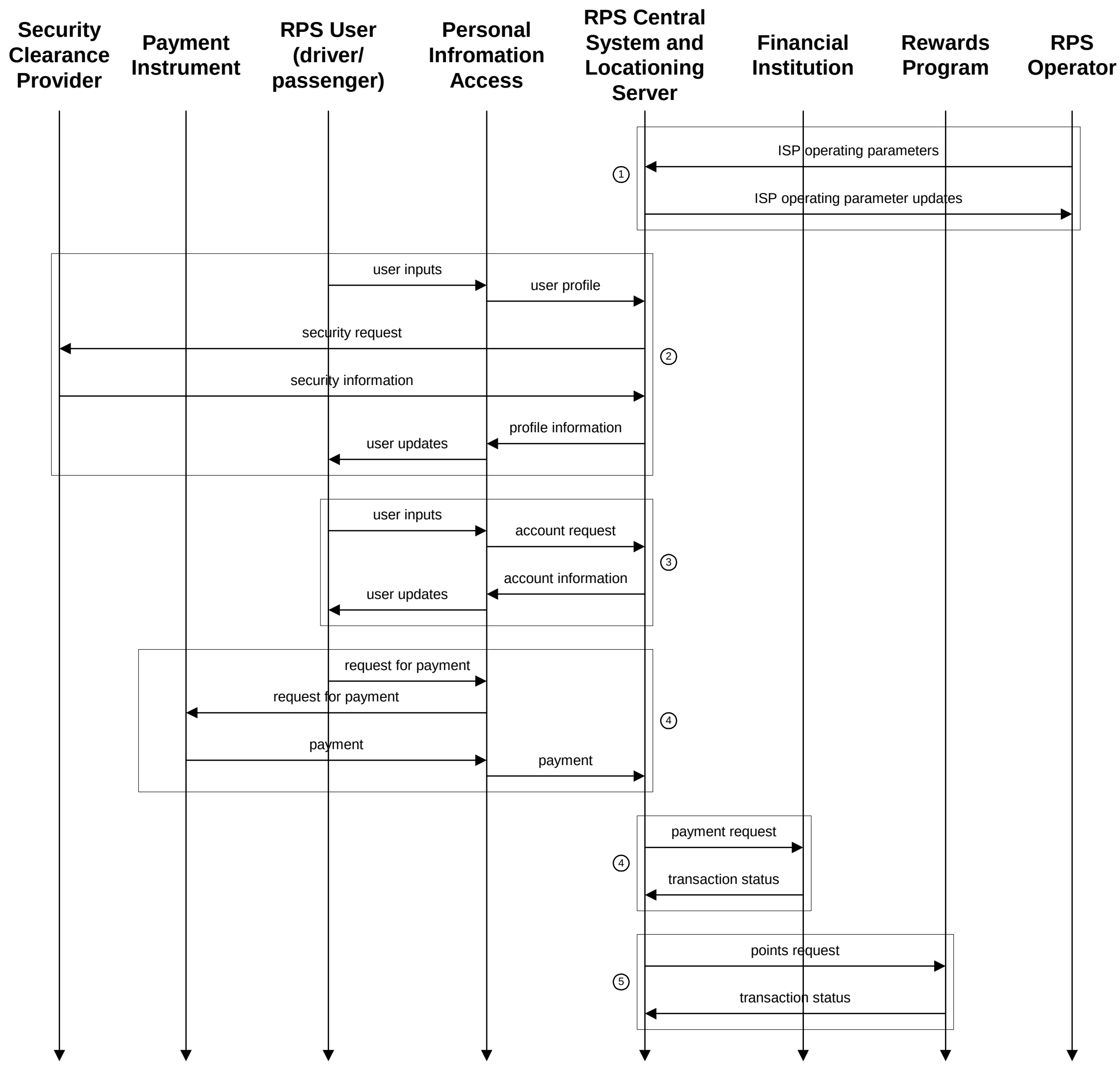


Figure 3-3: RPS Concept (back office)

3.3.4 Additional Integration Opportunities

In addition to the core RPS functionality defined as part of the Concept Design, opportunities for integration to other ITS initiatives were identified, including:

- 511 Traveller Information Services, and
- On-demand Transit Services.

3.4 RPS Focus Group

In normal circumstances, participants for focus groups are selected from a pool of unrelated persons and their backgrounds are usually intended to represent all or part of the demographic profile of the intended market for the product or service. Initially, the project team tried to coordinate with a large company in the Greater Toronto Area (GTA) to use a number of its employees for the focus group. The company was in the midst of consolidating a number of offices dispersed throughout the GTA and, due to limited parking, both employer and employee were interested in commuting alternatives. There were delays associated with obtaining corporate approval for their involvement. These delays led the project study team to select a separate group of 12 individuals with a more constrained demographic profile. The focus group had the following characteristics:

- Most focus group participants were in their forties, and all had post-secondary degrees, which may not be representative of the eventual RPS user demographic.
- The average annual income was below $45,000.
- Home and work locations, normal transportation modes and trip distances ranged widely.

The focus group session was held in Ottawa on February 11, 2005, and was facilitated by Nils Larsson. The procedure followed was to issue participants a questionnaire (**Appendix D**), which included an introductory description of the RPS concept. The questionnaire was completed prior to the guided focus group discussion.

Despite the limitations to the demographic structure of the group, the session provided insights on the potential public reaction to the RPS system. In fact, the feedback was consistent with, and confirmed the results from, the research and discussions with the Project Steering Committee. General observations that can be made from the focus group session include the following:

- Reaction to the concept as a whole was one of conditional interest. Most of the respondents might use the system if different conditions are met.
- There was skepticism about mobile communication technologies in general, and the consensus seemed to be that communication with the RPS dispatch system should be possible using a variety of mediums, including land-line telephone, Internet and e-mail.
- Personal safety did not appear to be a major issue, since it was assumed that background checks would limit the risk.
- Most concerns about the system focused on issues of convenience and compatibility with co-riders, specifically suitability of pick-up and drop-off locations, notification time, and driving habits or personal characteristics of the co-rider.
- Trip distances and notification times appeared to be somewhat polarized in this sample – anticipated trip lengths ranged from fairly short (under 10 km) to quite long; and desired notification times seemed to cluster around short (well under one hour) and long (24 hours or more) notice times.
- The use of points as currency had a mixed reaction: some negative from those who had found certain points systems to be inflexible, but acceptance

by others that points instead of cash might be necessary to keep the system informal enough to avoid raising issues of commercial insurance or taxation.

Appendix D provides a detailed summary of the results from the questionnaire and focus group discussions.

3.5 Business Case

3.5.1 Assumptions

The business case was developed based on an RPS for the Greater Toronto Area, with a 10-year horizon from development and integration to full-scale deployment and operation. In establishing the business case it was necessary to make assumptions relating to customer uptake and participation. Where possible, these assumptions were based on relevant statistics drawn from the literature review.

A governing assumption for full-scale deployment was the availability and widespread ownership of GPS- and/or AGPS-equipped mobile devices. **Sections 3.5.1.1** to **3.5.1.4** provide a summary of other assumptions made for the business case.

3.5.1.1 Daily RPS Transactions

The number of daily transactions (or matches) managed by the RPS has direct implications on both the costs and revenues of the system.

The average number of daily transactions in the horizon year (i.e. for full-scale operation) was based on 2001 Transportation Toronto Survey data for the GTA. This survey has a 5% sample of all households in the GTA (total population: 6.5 million) and captures complete trip characteristics for a typical full weekday. Through this survey, a comprehensive origin-destination matrix was generated that is complemented with numerous demographic characteristics (**Appendix E**).

To estimate the horizon year number of daily transactions, it was assumed that the number of trips diverted to the RPS will be 1/1000 (0.1%) for inter-regional travel (e.g. York Region to Toronto), and 1/10,000 (0.01%) for intra-regional travel (e.g. within Hamilton). These assumptions are based on a conservative penetration rate and are consistent with other established systems observed in the literature review. The lower percentage for intra-regional travel represents the decreased number of expected short-distance matches.

Based on the above assumptions, the daily RPS transactions in the horizon year were estimated to be 4,000. Of these transactions, the ratio of inter-regional to intra-regional is approximately 3:1. The breakdown of these trips is presented in **Appendix E**. It was assumed that daily RPS transactions will be achieved gradually through the 10-year horizon, as illustrated in **Figure 3-4**. For the purpose of this analysis, only weekdays were considered.

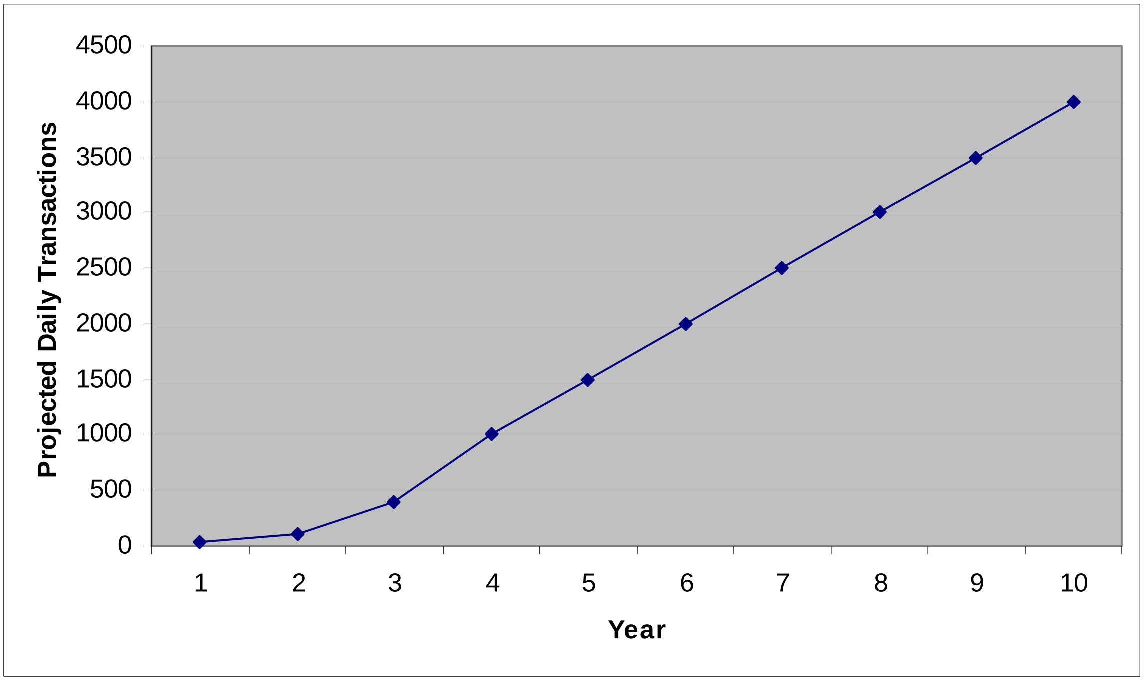


Figure 3-4: Daily RPS Transactions

3.5.1.2 RPS Subscribers

The number of RPS subscribers (registered users) was estimated based on the number of daily transactions. Each transaction represents two subscribers successfully matching (~8,000). Once deployed, the matching percentage maintained by the system must be sufficiently high in order to not lose choice customers – the system must be reliable to the users. Thus, it is assumed that at the ultimate penetration, 30,000 people (less than 0.5% of population) would be subscribed to the system, with approximately 25% (~8,000) using it on any given weekday. It is assumed that the number of RPS subscribers will be achieved gradually through the 10-year horizon, as illustrated in **Figure 3-5**.

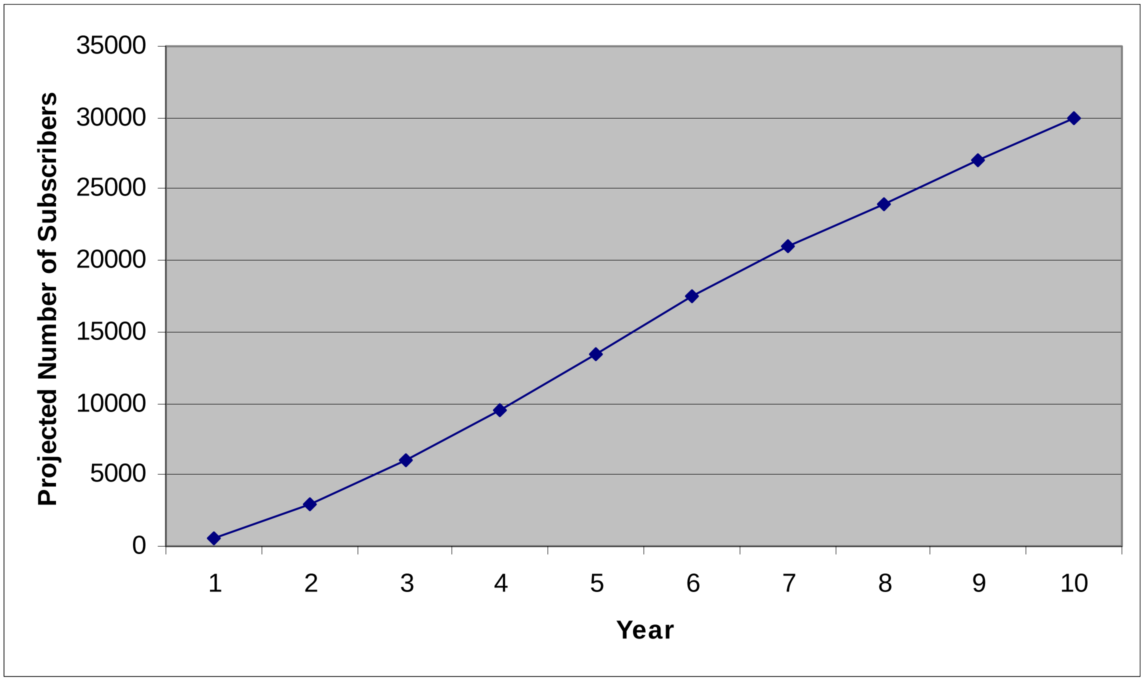


Figure 3-5: RPS Subscribers

3.5.1.3 Average Trip Distance

The average distance for a trip was conservatively estimated to be 25 km, given the 3:1 ratio of inter-regional to intra-regional trips.

3.5.1.4 Customer Considerations

When setting the transaction fees for the system, it is important to examine them from the perspective of both the driver and the passenger to ensure that they represent reasonable incentives and charges, respectively.

For the business case, it was assumed that the reward points used for exchange between passenger and driver will be Aeroplan points, which have an estimated purchase cost of $0.035/point. The following provides a summary of exchange values per kilometre:

- Passenger: 13 points (value of $0.455),
- Driver: 10 points (value of $0.350),

The RPS would then retain the difference between the two, which is 3 points (value of $0.105/km). It was assumed that the RPS operator would be able to sell accumulated points to generate operating funds, either to passengers for use in the system, or back to Aeroplan (would require an agreement).

The following are examples of typical trips that may occur in an RPS in the GTA:

- *East York to the airport (~35 km)* – Passanger pays 455 points (value of $15.92), driver receives 350 points (value of $12.25), and RPS retains 105 points, or $3.67.

- *York Region to downtown Toronto (~20 km)* – Passanger pays 260 points (value of $9.10), driver receives 200 points (value of $7.00), and RPS retains 60 points, or $2.10.

- *Hamilton to downtown Toronto (~65 km)* – Passanger pays 845 points (value of $29.57), driver receives 650 points (value of $22.75), and RPS retains 195 points, or $6.82.

In all cases, the values generated suggest that the system would be viable. Drivers would receive sufficient incentive to nearly cover all perceived costs of operating a vehicle, and within the range of established reimbursement rates from employers, and could use the savings to pay for parking, etc. Passengers would pay fees commensurate to the distance travelled, cheaper than standard taxi fares and more expensive than transit, in line with the relative level of convenience of each. Thus, the proposed revenue scheme is expected to be successful in attracting customers to the system.

For the purposes of the business case, the transaction fee retained was rounded to $0.1/km.

3.5.2 Capital Costs

At the outset of any deployment, there are certain capital costs that must be incurred. In the case of a new technology or system application, these costs can be significant as there are usually increased development costs. For the RPS, the capital costs associated with deployment relate to the development and implementation of the back office functionality, as well as the development of cellular positioning technology.

The estimated back office capital costs are broken down as follows:

- A primary and a backup server to allow for redundancy. The servers must contain sufficient storage capability to maintain the RPS database, and must have sufficient processing capability to allow for matching processes of an expanded database population. ($20,000)

- An Interactive Phone Response system to receive and process incoming calls from users. This includes necessary hardware, such as a phone switch, as well as the system development fees. ($50,000)

- Design and development of the RPS software. This is limited to the back office software as the need for application software for the user devices is not expected at this time. ($100,000)

- Installation and integration of the software and hardware components. ($20,000)

- Design and development of the RPS website. ($10,000)

In addition to the development and deployment of the back office functionality, there is an additional requirement for processing locationing data from mobile devices. This is valued at $200,000 initially, and includes the following:

- The triangulation component of the location server (interacts with the client on the mobile station and triangulates the position using the AGPS information communicated from the wireless handset);

- Additional software to interface real-time positioning data with a matching application to determine optimum fit based on available users. There would also have to be a complementary application developed for the target wireless device;

- The hardware required to host the system (the location server).

In all, the capital costs for the development of the back office and positioning functionality were estimated to be $400,000. This estimate is consistent with other systems (from literature review) that had capital costs of US$300,000 and did not include the locationing functionality of the RPS.

3.5.3 Operating and Maintenance Costs

Various cost components were considered in determining estimated operations and maintenance costs for the system.

3.5.3.1 Site Lease/Utilities

General site costs, including leasing space for operations and associated utilities, are expected to be in the order of $5,000/month. This would be sufficient space to allow for the expansion of operations expected in the early period, and would include appropriate space for servers and any other required hardware.

3.5.3.2 Website Hosting and Support

The web hosting and support costs are estimated at $100/month over the life of the system, with decreasing market costs compensating for the increased level of traffic anticipated as the system matures.

3.5.3.3 Marketing

Marketing the system is important to help expand the subscriber base. In addition, marketing the system to current subscribers also increases use. Both of these activities result in improved matching success rates. Marketing of the system was set at $50,000/year. This could include both general (e.g. newspaper, fliers) and targeted (e.g. workplaces) advertising as well as joint activities with other alternative transportation modes (e.g. car-sharing, transit).

3.5.3.4 Locationing Data

The maintenance and licensing of the triangulation component of the location server was estimated in the order of $100,000 annually.

3.5.3.5 Staffing

Staffing of the RPS was priced to accommodate increasing market penetration. At the outset, the system would be run by one person performing all management and customer service duties, and supported through part-time IT service to look after the servers and hardware. At Year 2, a single Full-Time Equivalent (FTE), dedicated to maintenance of the system, would replace the IT service. At Years 3, 4 and 6, an additional FTE would be brought in to provide customer support. Thus, ultimately, the RPS would be run by:

- One manager ($80,000/year), responsible for management, marketing, etc.,
- Three customer service representatives ($50,000/year), responsible for membership, customer support, etc.,
- One IT staff ($80,000/year), responsible for system operation and maintenance.

As there would be a need to promote the RPS and expand the subscriber base, the compensation for manager and customer service positions could be made up of a guaranteed base salary plus a performance-based commission component.

3.5.3.6 Security Checks

As identified by the review of legal issues relating to the RPS and by the Focus Group, there is a need for the RPS to perform background security checks on RPS subscribers. Based on anecdotal information, it was learned that teachers in Ontario are subject to a background security check once every three years. Using this as a guide, it was assumed that security checks (estimated at approximately $100/check and assumed to be performed by the Police) would be performed for each new user and every three years thereafter. By far, this cost represented the highest on-going cost to the RPS, topping $1 million by year 7.

3.5.4 Revenues

Revenues would be generated through two means in the RPS. First, customers would pay registration fees each year to be included in the system. Second, the RPS would receive a commission each time a matched trip is completed.

3.5.4.1 Registration Fees

The registration fee would provide multiple benefits to the system. It would generate income directly for the system to help pay operating and maintenance costs (e.g. security checks). It would also increase subscriber participation in the system because people tend to use services they've paid for and invested in at a higher rate than those that are free. Finally, it would also reduce costs by limiting subscribers to those that will likely use the system more, thus reducing the number of unnecessary and costly security checks that would have to be performed.

Based on the focus groups, it was decided to set a registration fee of $55/year. In order to promote early buy-in from users, this registration fee would be phased in gradually, beginning at $0/year for the first two years to capture as much market share as possible, and then slowly worked up to the cap as the system gained exposure and usage.

3.5.4.2 Transaction Fees

As discussed in **Section 3.5.1.4**, the transaction fee for operation of the RPS was assumed to be $0.1/km.

3.5.5 Calculations

The final business case, based on the costs and revenues detailed in the previous sub-sections, is presented in **Appendix F**. The analysis looks at the Net Present Value at the 10-year horizon with a 3% rate of return. **Table 2** provides a summary of the business case.

Table 2: Business Case Summary

Total Capital Cost	($400,000)
Total Operating and Maintenance Cost (NPV)	($10,305,000)
Total Revenues (NPV)	$12,710,000
Total Net Present Value	$2,005,000

The results indicate that the system could be viable and expected to turn an overall profit of $2 million over 10 years. The profit is largely based on revenues generated near the end of the time frame, once the system has matured substantially and achieved a significant subscriber base.

As illustrated in **Figure 3-6**, the system turns a profit for the first time in Year 6. In Year 6 the RPS has 17,500 total subscribers, and 2,000 daily weekday transactions.

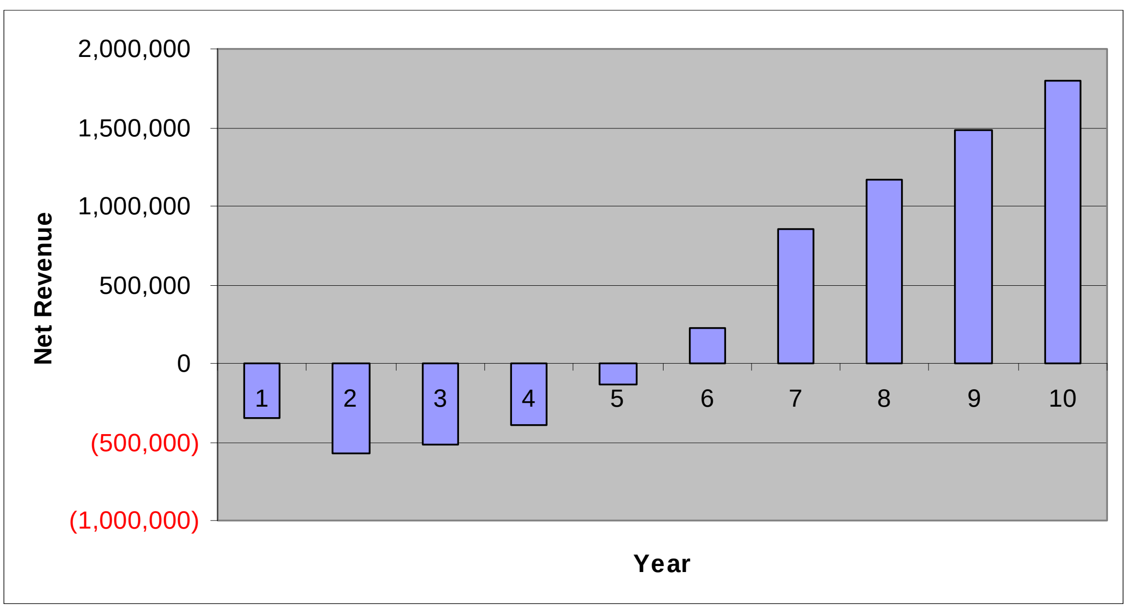


Figure 3-6: Annual Net Revenue

However, as illustrated in **Figure 3-7**, it is not until Year 9 that its cumulative net value is positive.

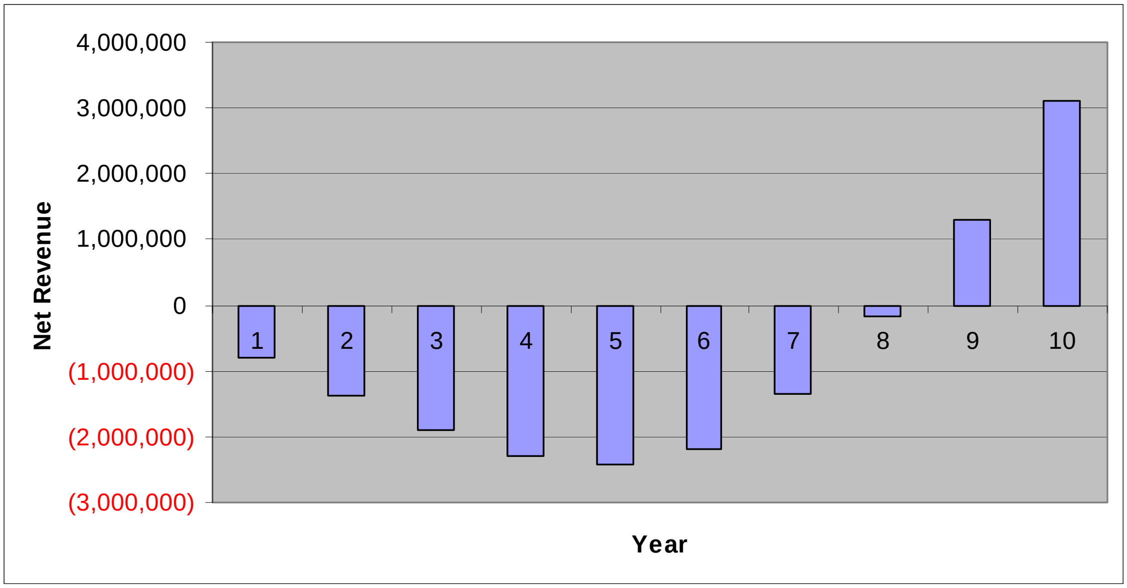


Figure 3-7: Cumulative Net Revenue

On the cost side, it should be noted that the security check costs account for nearly 60 percent of the total capital and operating and maintenance costs. Thus, changes to the Security Check policy or the unit cost would have a significant impact on the overall business case.

Taxes have not been factored into the business case directly. However, it can be assumed that capital and operating costs can be written off and losses carried over. Based on these assumptions, it is likely that the tenth year of operation would be the first year that taxes would be owed, and would be based on between $2 million and $3 million.

4. NEXT STEPS

Figure 4-1 illustrates the development plan for the RPS. This project addressed the initial research and development steps of the RPS and resulted in the development of a high-level concept design for the technical and management elements of the RPS, and a qualitative analysis of the business case.

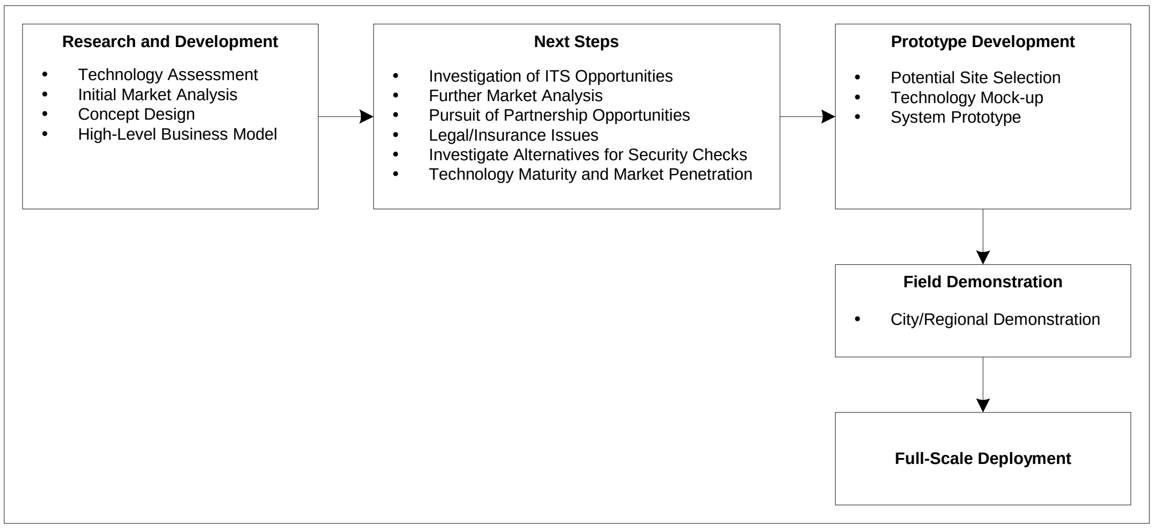


Figure 4-1: RPS Development Plan

Prior to moving forward with a prototype and/or demonstration, there is a need for a more detailed quantified analysis and further investigation and resolution of outstanding issues. These next steps include the following:

- *Investigation of ITS Opportunities* – There are a number of areas where the RPS has the ability to integrate with and enhance other ITS services. The RPS trips could provide probe vehicle data (e.g. travel times) to Advanced Traffic Management Systems (ATMS), which would be particularly beneficial in areas with limited detectorized surveillance. As indicated in **Section 3.3.4**, real-time information could be shared between the RPS and future 511 Traveller Information Services. The RPS could also complement on-demand transit services. It is recommended that agencies for traffic management, traveller information and public transit be consulted to gauge interest in future integration with the RPS.

- *Further Market Analysis* – The concept design and business case were developed with a number of assumptions, which were made based on a review of other ride matching initiatives, a limited focus group, and past experience with ITS deployments. These assumptions should be further examined through expanded surveys and focus groups and through modelling exercises. Key elements that should be investigated and analyzed for sensitivity include: 1) the degree of modal switch, 2) trip purpose, 3) market size, 4) differences between inter-regional and intra-regional trips, and 5) differences across a range of urban markets.

- *Pursuit of Partnership Opportunities* – The business case also emphasized the considerable up-front costs of development, deployment and marketing of an RPS. For this reason, it is recommended that potential funding sources and partnership opportunities be pursued. Potential sources for funding and/or partnering include: Sustainable Development Technology Canada (SDTC) fund, Future Transport Canada ITS Deployment Initiatives, Bell Mobility Accelerator Fund (for developing advanced wireless products and services), retail businesses as sponsors, public or private businesses with limited parking facilities and municipalities with significant congestion issues.

- *Legal/Insurance Issues* – The legal review of the RPS concept highlighted the issues relating to potential insurance and licensing issues due to drivers being compensated for their expenses. The business case is based on the assumption that, if driver compensation is less than that typically used for employer-employee reimbursement, the issue can be negotiated. It is recommended that material discussions, based on the concept design, be pursued with the insurance and licensing agencies/companies to confirm the assumption and, if possible, reach an agreement on the issue.

- *Investigate Alternatives for Security Checks* – As identified in the business case, security checks represent the largest cost associated with operating the RPS. These security checks were identified as a need to address personal security and minimize RPS liability by ensuring that the service is reasonably safe for its users. To minimize costs, it is recommended that alternatives for these security checks be investigated.

- *Technology Maturity and Market Penetration* – Although the business case developed in **Section 3.5** indicates that the concept of the RPS is financially viable, it is based on the assumption of widespread availability and ownership of GPS- and/or AGPS-equipped mobile devices. Development of a prototype deployment in the interim could consider concept adjustments to account for a lack of market maturity (e.g. through the use of ‘hot-spot’ locations for pick-up/drop-off).

Appendix A

Work Plan and Methodology Report
(February 2004)

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LIST OF FIGURES

1. INTRODUCTION

This Work Plan and Methodology Report outlines the process that shall be followed to complete the Integrating Travel Services – The Ride Points System project. This report outlines the tasks to be completed and the time line that they will be completed under. Key dates for Steering Committee review and meetings are included.

1.1 Background

With the signing of the Kyoto Protocol, it is essential that Canada pursue methods of increasing average vehicle occupancy and reducing the total amount of vehicle traffic. The challenge is to raise awareness and increase interest in such a program.

The purpose of Ride Points is to increase the efficiency of automobile use, and thereby reduce atmospheric emissions, by developing a system that will induce drivers of private vehicles to accept passengers for a large percentage of urban and inter-urban trips.

The main concept of the Ride Points System entails the introduction of a new value based exchange system. The use of "reward" points has proven successful in other industries, and it is the intention of this R&D project to study its effectiveness as a basis for promoting environmentally friendly transportation. As a product of this part of the study, a business model will be developed for the sustainable operation of the system. As part of the business plan, potential users of the system (rural/urban, commuters, etc.) and partners (cellular providers, public agencies, etc.) will be identified.

Another aspect of the system that will be researched as part of this project will be the necessary technologies and system logic to support it. This will include the locating of users and their intended origins and destinations and the matching of drivers and passengers.

In addition, the system developed will ensure that the offering of rides and/or the accepting of rides, is simple, safe and convenient for both parties. Pre-registration of both parties would be mandatory through the system.

The proposed Ride-Points System will leverage technological advancements (cellular, locationing, computer processing, etc.) and the popularity of customer award programs (e.g. Air Canada's AeroPlan, Shoppers Drugmart's Optimum) to develop a successful ride-sharing sharing system that will positively impact traffic congestion and GHG emissions.

2. PROJECT METHODOLOGY

The following sections provide an overview of the six Project Tasks envisioned and provide a schedule detailing how the required Transport Canada deliverables map to these tasks.

2.1 Task 1: Comprehensive Work Plan and Methodology Report

A draft Work Plan and Methodology Report shall be prepared describing the tasks that will be undertaken to complete the R & D project, as well as a detailed schedule of the work and for deliverables and meetings.

This draft report shall be reviewed at the 1st Steering Committee Meeting. The report shall then be revised and finalized based on the feedback from this meeting.

2.1.1 DELIVERABLES

- Draft Work Plan and Methodology Report (this document)
- 1st Steering Committee Meeting
- Final Work Plan and Methodology Report

2.2 Task 2: Literature Review

2.2.1 LITERATURE REVIEW

The Literature Review task will rely on the efforts of the entire team. Redknee will lead the technology assessment. The primary purpose of the technology assessment will be to narrow the technical options available for the purpose of an operational/technical trial and to confirm whether existing location technologies as well as mobile device form factors (and associated Man-Machine Interfaces) have matured to a sufficient degree for the purpose of a end-to-end trial of the Ride Points environment.

The UNB will focus on the review of the current state of various ride sharing initiatives. This information will help feed into the demand and market analyses. The following topics will be researched:

- What kinds of rideshare programs are working? Describe them in terms of:
    1. Locating potential participants.
    2. How are passengers and drivers matched?
    3. How is the driver compensated?
    4. How much lead-time is required for matching?
    5. How is the program administered?
    6. How are users motivated to participate in the program?
- Describe the communities that have successful rideshare programs.
- What types of trips tend to be rideshared? How long are these trip lengths? What times of day do they tend to occur? Where are the origins and destinations characteristics?
- What are the demographics of the rideshare participants?

IBI Group will draw from other similar environmental scan efforts and support both of these efforts.

2.2.2 CONCEPT REFINEMENT & DEFINITION

The focus of this sub-task shall be to further refine the overall system concept of the Ride Points system. This will include:

- Advancing a vision for how the program will function from a user's perspective – Which mediums will or will not be included? How long before travelling will user's "check-in"? Will passengers be picked up at "hot-spots" or wherever they want? The vision will evolve over the course of the project with influences from the technology assessment, user focus groups, etc.

- Establishing a preliminary economic engine that will drive the system – further defining the value system to be employed.

- Identify stakeholders that may be positively or negatively impacted by a deployment.

2.2.3 DELIVERABLES

- Literature Review report that shall include the results of the technology review and environmental scan of other ride matching initiatives and concepts. The report shall also include the refined Ride Points concept.

2.3 Task 3: Mid-Point Interim Review

2.3.1 DEMAND ANALYSIS

The purpose of the demand analysis is to determine the likelihood of user buy-in to the Ride Points system. A set of focus groups shall be held to understand the needs and expectations of users from a ride-matching system. The following questions would be posed for consideration by the focus groups:

- Would you be using the system primarily as a driver? Passenger? Both?

- What medium would you want to use to access the Ride Points system? Cellular phones? PDAs? Blackberry? Internet?

- What incentives program would you like Ride Points to be linked with? Aeroplan, Shoppers Optimum, Air Miles, PetroPoints, Etc.

- As a driver:

  - Would you consider using the system for urban travel? Sub-urban? Inter-city?

  - Would you feel safe picking up pre-registered passengers?

  - How long would you be willing to wait for a match?

  - How much out of your way would you be willing to pick-up passenger? drop-off?

- As a passenger:

  - Would you consider using the system for urban travel? Sub-urban? Inter-city?

  - Would you feel safe entering a vehicle of a pre-registered driver?

  - How long would you be willing to wait for a match?

  - How far would you walk/travel to get to a pick-up location?

Based on the results of the focus groups, the Project Team shall work to establish demand requirements that would support efficient matching within the system. This would include identifying minimum population size, minimum population density characteristics, as well as any other geographical/urban planning considerations (i.e. high-volume corridors, high-demand nodes, etc.)

2.3.2 CONCEPT DESIGN

The first step in developing the final Concept Design for the Ride Points system shall be to combine the results of the technology assessment, literature review and user needs focus groups/demand analysis to prepare a set of overall system requirements pertaining to technical operation. The requirements will include, at a minimum, statements regarding:

- Matching Processes:
  - Meeting locations (hot-spots or full/partial flexibility)
  - Recommended maximum response times for match
  - Allowable detour distance for match
- Pre-registration processes:
  - Use of registration fees
  - Security processes
- Value system
  - Driver-Passenger relationships
  - Interchange with other incentive programs

The concept design shall be furthered by the development of a system architecture. The architecture will map to the ITS Architecture for Canada and will make use of market packages where appropriate. The system architecture will serve to identify internal relationships between system components, as well as external relationships to outside partners.

2.3.3 MARKETING REVIEW

Under the marketing review, the Project Team will examine promotional aspects of prior successful and unsuccessful ride-matching applications. This will serve to establish a recommended marketing approach for a potential pilot deployment. The work will build off the Literature Review that painted a picture of the target market (i.e. user demographics, types of trips, etc.). The marketing review will include examining lessons-learned with respect to:

- Issues related to specific communication mediums (i.e. internet, newspaper, etc.);
- Promoting service through current company-based carpool programs;
- Key selling points (i.e. convenience, pricing, rewards, etc.); and
- Other marketing characteristics.

2.3.4 DELIVERABLES

- Mid-Point Interim Report, including the results of the demand analysis effort, as well as the final concept design and system architecture.

- 2^{nd} Steering Committee Meeting

2.4 Task 4: Final Review and Draft Final Report

The final review shall include the completion of any unfinished research and further investigating any issued that were raised during the 2^{nd} Steering Committee Meeting. The main focus of the task, however, will be building the business case for a pilot project, as discussed in the following sub-section.

2.4.1 BUSINESS CASE

The institutional, jurisdictional, and legislative issues inherent with deployment of an advanced ride-matching system shall be researched. A market analysis to determine the vendor makeup and preliminary costs for deployment shall be undertaken. This will feed into the development of the business case for deployment. The business case will factor in direct and indirect benefits of deployment and contrast those to the costs of a full-scale procurement.

2.4.2 POTENTIAL PILOT SITES

As part of the results of this task, we shall recommend cities in Canada possessing favourable attributes for a pilot study. Stakeholder outreach efforts shall be undertaken to contact these cities to determine their interest in participating in a pilot. It should be noted that detailed operational description of the pilot study will not be included under this task.

2.4.3 DELIVERABLES

- Draft Final Report, expansion of the Interim Report to include the market analysis/business case, jurisdictional/legislative issues and recommended pilot sites.

- 3^{rd} Steering Committee Meeting

2.5 Task 5: Final Report and Project Summary

Following the 3rd Steering Committee Meeting, the IBI team shall revise the Draft Final Report to reflect the comments of the committee. The final report will conform to the Transportation Development Centre Publication Standards and Guidelines for Contractors (TP 929).

A Project Summary report shall be prepared that will provide a project synopsis and high-level system overview.

2.5.1 DELIVERABLES

- Final Report

- Project Summary Report

These reports shall be distributed to the Steering Committee and the client in hard and soft form.

2.6 Project Schedule

Figure A1 summarizes the schedule for the work plan and the various submissions.

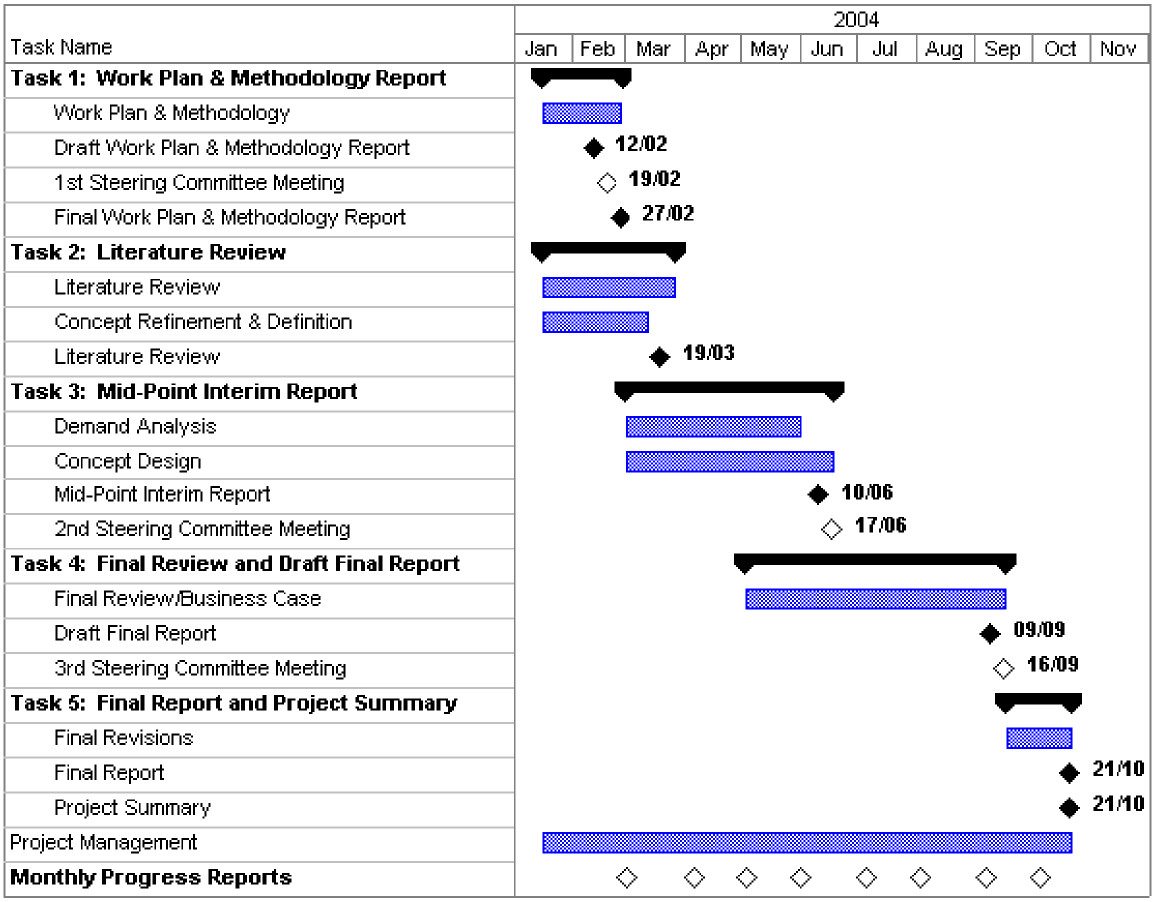

Figure A1: Project Schedule

Milestone Deliverable Dates:

- Task 1: Final Work Plan and Methodology Report – February 27, 2004
- Task 2: Literature Review – March 19, 2004
- Task 3: Mid-Point Interim Report – June 10, 2004
- Task 4: Draft Final Report – September 9, 2004
- Task 5: Final Report and Project Summary – October 21, 2004

Steering Committee Dates:

- Work Plan and Methodology Review – February 19, 2004
- Mid-Point Interim Review – June 17, 2004
- Final Report Review – September 16, 2004

3. PLAN FOR FURTHER DEVELOPING AND COMMERCIALIZING RESULTS

Figure A2 illustrates the development plan for the Ride Points System. This project represents the first step in the process of bringing the system to fruition. Before pursuing a prototype deployment it is important to ensure the technical feasibility of the concept, complete a concept design, and develop a promising business case. The efforts of this project's research will focus specifically on these issues, and the anticipated results, summarized in the final report, will establish a positive prospectus for moving forward to a demonstration phase. As noted in Section 3.2, that if this project determines that the concept of the Ride Points System is not either technically or economically feasible, the research undertaken is not lost as it may be relevant and valuable for other initiatives.

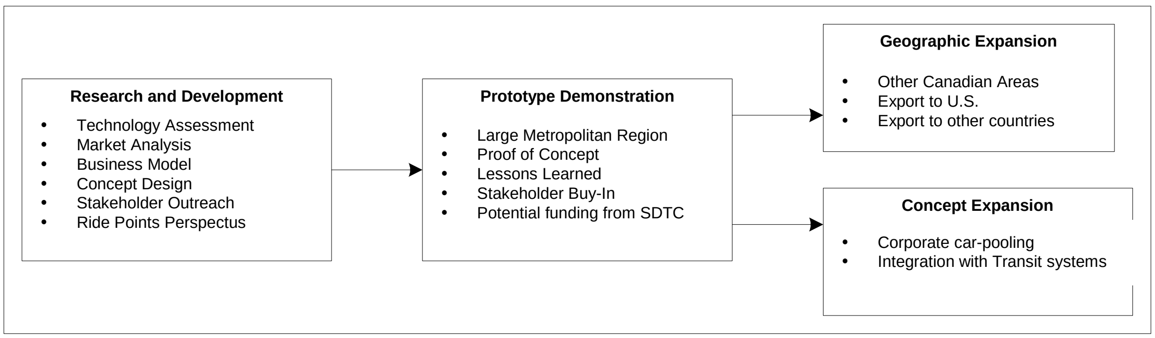

Figure A2: Ride Points Development Plan

With the feasibility of the system concept established, the next stage following this study will be to develop a prototype in a large metropolitan region. Funding for the demonstration project would be pursued from municipal, provincial, and federal governments. A specific funding source may be the Sustainable Development Technology Canada (SDTC) fund. The purpose of the prototype deployment will be to provide proof of the Ride Points concept and to achieve stakeholder buy-in from potential partners.

Building on the lessons learned from the prototype deployment, and assuming funding from potential partners, it is envisioned that the system will be expanded to other Canadian regions, and potentially further to the U.S. and abroad. In addition, if the system is successful, the concept of reward points may be expanded, or integrated with existing programs, to promote other environmentally friendly transportation alternatives.

Appendix B

Literature Review Report
(April 2004)

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1. INTRODUCTION

With the signing of the Kyoto Protocol, it is essential that Canada pursue methods of increasing average vehicle occupancy and reducing the total amount of vehicle traffic. To that end, Transport Canada has allocated funding for the concept research and development of an incentive-based, dynamic ride-matching system: Ride Points.

The purpose of the Ride Points System (RPS) is to increase the efficiency of automobile use, and thereby reduce atmospheric emissions, by developing a system that will induce drivers of private vehicles to accept passengers for a large percentage of urban and inter-urban trips through the use of "reward points". The use of reward points has proven successful in other industries, and it is the intention of this Research & Development project to study its effectiveness as a basis for promoting environmentally friendly transportation.

The proposed Ride Points System will leverage technological advancements (cellular, locationing, computer processing, etc.) and the popularity of customer award programs (e.g. Air Canada's AeroPlan, Shoppers Drugmart's Optimum) to develop a successful ride-sharing sharing system that will positively impact traffic congestion and GHG emissions.

This report presents the results of the technology assessment and literature review task. Based on these results, the system concept is refined to address key areas that need focus in advancing a state-of-the-art ride-matching system.

1.1 Background

The Technology Assessment and Literature Review Task represent the second milestone toward the Project goal. Stemming from the results of this Task, the Project Team will progress to the next stage as outlined in the Work Plan, which includes:

- Demand Analysis, including focus groups to determine the likelihood of user buy-in;
- Concept Design, integrating the results from the Demand Analysis into the Revised System Concept presented at the conclusion of this Report; and
- Marketing Review, examining the promotional aspects of prior successful and unsuccessful ride-matching applications.

The final stage of the effort will look to a potential deployment by examining the business case of the system, and identifying potential pilot sites.

1.2 Report Overview

The work undertaken for this task includes a Technology Assessment, Environmental Scan, and Concept Refinement.

The Technology Assessment (Section 2.0) reviews existing location technologies, with a focus toward integration within a telecommunications network.

The Environmental Scan (Section 3.0) will examine the current state of various ride sharing initiatives. The effort will identify lessons learned with relation to user demographics and system operation for both successful and unsuccessful ventures.

The final Section 4.0 will build off of the results from the Technology Assessment and Literature Review to establish a refined system concept. This will include a discussion on key issues and identify stakeholders that may be positively or negatively impacted by deployment.

2. TECHNOLOGY ASSESSMENT

As indicated in Section 1, the proposed Ride Points System is based on users dialling in through cellular phones to make trip offers/requests, and using the some form of technology to locate the user. This section provides a review of the aspects of location technologies as they relate to the cellular industry.

2.1 Cellular Communication

This section provides a high-level summary of the current environment of cellular communication in North America.

The term cellular is derived from the fact that the communications systems use a large number of low-power wireless transmitters to create cells. As a cellular user travels between cells, their active communication service is transferred seamlessly between the transmitters of each cell.

The first cellular networks established in North America in the early 1980s were based on analog services. Since then, demand has increased significantly and these analog services had capacity issues. As a result, cellular networks in North America have been migrating to digital standards, including:

- **Code Division Multiple Access (CDMA)** – employs a commercial adaptation of military spread spectrum and works by digitizing multiple conversations, assigning a code (known to sender and receiver), and then dicing the signals into bits and re-assembling.

- **Time Division Multiple Access (TDMA)** – allows multiple calls to share the same channel by having the conversations transmitted alternately over short allocated slots of time.

- **Global System for Mobile (GSM)** – is based on TDMA and convert voice and access information to digital data, and communicates those data bursts during brief assigned time slots.

It appears that GSM, or some combination of GSM and CDMA, will likely become the universal standard. For this reason, this document focuses on location technologies that relate to the above cellular standards.

2.2 Integration with Cellular Networks

2.2.1 INTEGRATION

There are a number of standards initiatives for specifications to integrate cellular networks with value added Location Services (LCS), such as the Ride Points System. The GSM 03.71 and 3GPPP 23.071 telecommunication specifications address standards for GSM-based networks. The standards prescribe the interconnection requirements and parametric attributes associated with integrating a Gateway Mobile Location Center (GMLC) with the core network infrastructure. A GMLC provides the functionality required to support LCS. Similarly, the Telecommunications

Industry Association (TIA) standard, TIA-881, provides for comparable interconnection requirements of a Mobile Positioning Centre (MPC) with the core network infrastructure of an ANSI (TDMA and CDMA) based network provider.

Although the terms and nuances of the interfaces associated with the GSM and ANSI specifications vary, in each case, the Location Gateway (i.e. the GMLC and MPC) will communicate with the Home Location Register (HLR) and Visitor Location Register (VLR) for the purpose of extracting the current Cell-ID associated with a given cellular user. The HLR is the database that contains all subscriber data required for call handling and mobility management for the service provider of the user, while the VLR is the similar database for network provider where a roaming user is located.

To the extent that an additional triangulation fix is required to determine the location of a user, the Location Gateway may interconnect with an incremental triangulation server. This triangulation server is referred to as the Serving Mobile Location Centre (SMLC) or Location Measurement Unit (LMU), for the GSM and ANSI environment respectively. The triangulation server may in turn support several triangulation technologies – although the following appear to be the most prevalent:

- Global Positioning System (GPS)
- Assisted GPS (AGPS)
- Time Difference of Arrival (TDOA)
- Enhanced Observed Time Difference (E-OTD).

The above technologies are described in more detail in the Section 2.3.

2.2.2 APPLICATION PROGRAMMING INTERFACE

In the telecommunications industry, there have been several parallel developments of Application Programming Interfaces (API) for end-user applications (e.g. Ride Points). The most prevalent Location/Mobility API structures are presently defined by the Open Mobile Alliance (OMA) Mobile Location Protocol (MLP) and the Parlay Mobility (part 6) API. The OMA MLP provides for an Extensible Markup Language (XML) based API, while Parlay provides support for both a Common Object Request Broker Architecture (CORBA) based and XML based API structure. In either case, the index key is an attribute which is associated with a given Mobile Station, while the response would include the geographic coordinate of the Mobile Station's current location in a given geodetic standard (e.g. the World Geodetic System 1984 based on the WGS84 ellipsoid). As per the paper, "Convergence of PC and Mobile Applications and Services", XML based APIs as provided by various network providers will likely evolve to form a constituent part of a 'Web Services' environment.

2.2.3 CELLULAR PHONE OPERATING SYSTEMS

The recent advent of operating systems designed specifically to address the constraints of mobile devices (e.g. with respect to screen size and power constraints), coupled with increasingly advanced handset capabilities, appear to provide for a suitable environment for the purpose of hosting a distributed Ride Points environment. In particular, it appears that a suitable Human-Machine Interface (based loosely on contemporary GUIs) could be developed for the purpose of providing an interface that would provide information in a readily comprehensible and intuitive manner. Operating systems of note that warrant further investigation (depending on handset commercial availability) include Palm, Symbian, and Microsoft Windows Mobile Edition. In addition to providing the framework for a GUI based environment, these operating systems could provide programmatic access to key telephony functionality (it its supported by the underlying device) such as the ability to establish a data session for the purpose of exchanging data with a centralized server. To the extent that a given phone does not support these capabilities, a default capability such as an IVR (Interactive Voice Response) based system could be employed on a contingent basis.

2.3 Location Technologies

The intent of this subsection is to provide a review of the findings with respect to each location technology. Further information regarding these technologies may is available from the references included in Section 2.5. In addition, **Appendix B1** provides a primer on GPS technology.

It should be noted that, with the exception of GPS, the use of the technologies included in this section requires support of the wireless network operator, which may also require the deployment of incremental infrastructure.

2.3.1 CELL ID

Cell ID is currently the most widely deployed solution, but provides the most coarse form of triangulation provided by wireless network operators. Generally, the approximate centroid of a given geographic region addressed by a given cell-site or cell-sector is returned. The accuracy of this method is directly correlated to the approximate radius of the 'coverage area' provided by the cell/sector which varies in the order of 200 metres for a dense urban environment to up to 3,000 metres for a suburban-rural environment. The Cell ID method is generally supported by the existing 'baseline' signalling mechanisms utilized by wireless network operators (GSM 09.02 and ANSI-41 in the case of GSM and ANSI carriers respectively). However, incremental generic software upgrades may be required for the core network infrastructure to fully support the acquisition of the Cell ID information via the procedures prescribed in GSM 03.71 and TIA-881.

In practice, a unique numerical identifier is typically returned by the serving VLR, which may be translated to a set of geographic coordinates (of the cell/sector centroid) by the Location Server. In turn, the Location Server provides the geodetic information to the application.

2.3.2 GPS

With GPS, the mobile device undertakes the actual triangulation calculation via applicable hardware/software that may either be integrated within the mobile device or provided via an external module. In other cases, an OEM GPS module may be coupled with a wireless modem for the provision of geographic information to a designated server.

Relative to other location technologies, GPS is differentiated by the fact that it does not necessarily require the cooperation of a wireless network operator. That is, GPS may operate in 'user-plane' mode whereby location information is exchanged between the mobile device and the application by using existing wireless data services (e.g. GPRS, 1XRTT) and existing internet infrastructure.

Although the accuracy of GPS is sensitive to factors that reduce the given mobile devices 'visibility' to the GPS satellite constellation (e.g. obstructions such as buildings), accuracy in the order of 15-30 metres (with a 95% confidence level) is achievable under normal (unobstructed) conditions. This accuracy can be augmented considerably, to the order of 2-3 metres, if 'differential' GPS (where a fixed GPS reference signal facilitates in the triangulation fix) is employed in a given region. GPS does have an issue with respect to the time to 'First Fix' – which can be as high as 15 minutes from a 'cold start' (unit is turned on with no assistance data being provided with respect to its current location) condition.

2.3.3 ASSISTED GPS (AGPS)

AGPS mitigates some of the shortcomings of basic GPS with respect to the long initial time-to-fix time and sensitivity to signal degradation - at the expense of additional complexity.

In the case of AGPS, GPS triangulation is assisted by an AGPS assistance server (the SMLC or LMU referenced in Section 2.2) located in the wireless carrier's network. Specifically, an assistance message is formulated based on the mobile station's approximate location (as typically determined by the cell/sector) and provided to the mobile station. The mobile station uses the data in the assistance message to quickly acquire the signal from visible GPS satellites and, in turn, provide the acquired signal information back to the server for subsequent processing. The AGPS assistance server uses the information received from the mobile station to triangulate the position of the mobile station and forward the result to the location server, which in turn provides the information to the end-application (e.g. Ride Points) in the prescribed format. More recently, some vendors (e.g. SIRF) have developed 'multi-mode' GPS units that can operate in an AGPS and GPS mode (typically the initial fix is provided with the aid of an assistance signal – while subsequent location fixes are provided autonomously).

The accuracy of AGPS solutions are expected to match the FCC requirements for handset based solutions of 50 metres @ 67% confidence and 150 @ 95% confidence. As AGPS solutions have generally been optimized to meet the requirements of emergency '911', the time to first fix is in the order of 3-5 seconds.

2.3.4 TIME DIFFERENCE OF ARRIVAL (TDOA)

TDOA utilizes sensitive receivers, located on a subset of existing network operator cell-sites, in order to triangulate the position of a device. TDOA relies on a highly accurate common time-reference and a known signal (e.g. a call attempt from a mobile station) in order to triangulate the position of the mobile station. The receivers are tied to a triangulation server that undertakes the actual triangulation calculations. Typically, the mobile station has to be in range of 3 or more receivers for an accurate location fix to be determined.

The accuracy of TDOA solutions are expected to match the FCC requirements for network based solutions of 100 metres @ 67% confidence and 300 @ 95% confidence. Given that TDOA requires 3 or more receivers to be within range of a mobile station, TDOA typically needs to be complemented with an alternative default method – such as Cell ID.

2.3.5 ENHANCED OBSERVED TIME DIFFERENCE (E-OTD)

With E-OTD, incremental hardware/software in the handset assists in the triangulation function by listening to reference signals which emanate from radio transceivers located on a subset of network operator cell-cites. For a given triangulation function, the handset acquires the reference signal and then communicates that information to an E-OTD server which undertakes the actual triangulation function. As in the case of TDOA, the mobile station has to be in range of 3 or more transceivers for an accurate location fix to be determined.

The accuracy of E-OTD solutions are expected to match the FCC requirements for handset based solutions of 50 metres @ 67% confidence and 150 @ 95% confidence. Given that E-OTD requires that the mobile station be in range of 3 or more transceivers, E-OTD typically needs to be complemented with an alternative default method – such as Cell ID.

2.3.6 SUMMARY

Table B1 provides a summary of the location technologies.

Table B1: Location Technologies

Technology	Cooperation of Wireless Service Provider Required	Accuracy
Cell ID	Yes	200-3,000 metres
GPS	No	2-30 metres
AGPS	Yes	50-150 metres
TDOA	Yes	100-300 metres
E-OTD	Yes	50-150 metres

2.4 Ride Point System Perspective

The utilization of a wireless network operator infrastructure presumes that the wireless network operators in a given region will provide support for these location technologies and will also provide a suitable API that can be used by an external end-user application, such as Ride Points. To date, of the Canadian wireless operators, it appears that only Bell Mobility have actively pursued the support of AGPS based and Cell ID based location technologies. However, even in this case, Bell Mobility appears to be restricting the use of these location technologies for internally developed applications.

Given that GPS units have increased in sophistication, while dropping in price (commercial Bluetooth enabled GPS units are presently in the order of $200 USD per unit), the tentative conclusion is that a Ride Points System would best be served by a GPS-based device as supported by the Ride Points application (which would be hosted on a server).

To that end, the subsequent project activities, with respect to location technologies, will focus on how GPS based technologies can be coupled with applications resident with PDA (Personal Digital Assistants) and/or hybrid mobile stations, as well as how a Ride Points server may be used to provide 'assistance data' from time-to-time to the GPS unit as required.

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3. RIDESHARING – ENVIRONMENTAL SCAN

The goal of the environmental scan is to summarize the various types of ride sharing and car-pooling programs that are currently in existence and to identify those that are successful.

Specific objectives of this effort include the following:

- Providing a summary of the different types of ridesharing programs, listing their advantages and disadvantages, and their levels of success;
- Reviewing the characteristics and salient features of specific ridesharing programs;
- Identifying those characteristics contributing to the success or failure of existing ridesharing programs;
- Reviewing policies of government that favour or encourage ridesharing; and
- Recommending critical positive attributes of potential cities for a possible pilot study.

Under this task, a literature review was conducted through searches at available websites, University libraries, other archiving sources and phone surveys to provide information for the future demand and market analysis. Information sources are found in Section 3.5. The effort was focused on identifying the characteristics of successful rideshare programs. The following topics were researched:

- The approaches used by successful programs to locate potential participants, match passengers and drivers, compensate drivers, motivate users, and administer the program;
- The types of trips that tend to be rideshared, the length of these trips, the times of day that these trips tend to occur, and origin and destination characteristics;
- The factors considered by participants when deciding whether or not to rideshare;

- Measures of success for existing programs such as the number of users, the percentage of carpools formed, and costs;

- The reasons why some ridesharing programs have failed.

Key attributes of successful rideshare communities are summarized (Section 3.3).

3.1 Ride Share Programs

Existing ridesharing programs can be characterized as traditional or dynamic depending on the length of time required for matching the driver and passengers, and the frequency of these arrangements. In traditional programs, arrangements for sharing a ride are usually made at least one (1) day in advance and they last for more than one single trip. Ridesharing is considered dynamic when the arrangements are made on short notice, typically less than 24 hours, and only last for a single one-way trip. Hall and Quershi (1997) have defined dynamic ridesharing as "An automated process by which individuals find ride-matches on a trip-by-trip basis". The Ride Points System currently under study would be classified as a dynamic program.

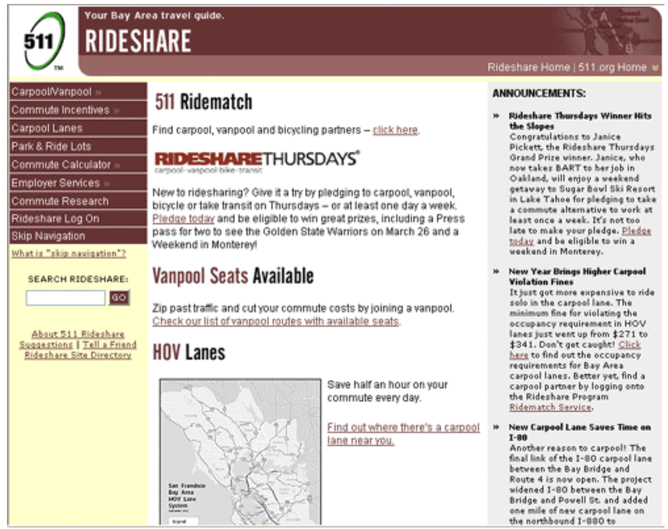

Figure B1: 511 Ridematch

The advantages, disadvantages and levels of success for traditional and dynamic programs as they were reported in the literature are reviewed in subsequent sections.

3.1.1 TRADITIONAL RIDESHARING PROGRAMS

Traditional ridesharing first emerged in North America during the first oil crisis in the 1970's. Commuters at the time were encouraged to share rides with others to conserve energy. Environmental and congestion concerns brought about a renewed interest by transportation professionals in ridesharing in the late 1980's which has continued to the present.

Many agencies at different levels of government and not-for-profit organizations in the United States and Canada have been established to promote traditional ridesharing by matching potential drivers and passengers. These agencies maintain databases of participants willing to rideshare, their trip characteristics such as origins and destinations, and their desired times of travel. Both drivers and passengers can request a list of names and telephone numbers for candidates whose trips match their own. Using the information, subscribers of the ridesharing agencies make their own arrangements for sharing rides. Agencies services also include updating their databases periodically, maintaining matching software, processing requests for new matches, marketing their services, and providing employee assistance and outreach. As a result of the ridesharing agencies, most ridesharing trips are traditional ones between commuters.

The success rate for traditional rideshare programs has been difficult to measure because there is typically no follow-up survey after the user has been given the contact list. Pisarki (1997) argued that insufficient funding has been allocated in the United States to accurately monitor the effectiveness of these ridesharing programs. He believed that definitive measures such as introducing high occupancy lanes (HOV) were needed to relate matches to actual carpool formations that were sustainable. Census figures since have shown that carpooling has declined in both absolute numbers and relative shares since 1970.

Pisarski (1997) also reviewed national statistics on carpooling in the United States and found that only 13.4 percent of commuters carpooled in 1990. The percentage has declined from 20 percent in 1980. These statistics included family members sharing a ride. Hall and Qureshi (1997) found that 80 percent of carpool partners were either spouses or co-workers. Pisarski argued that the percentage of carpoolers declined over the decade because of the increased availability of automobile ownership, the decline of family household size, and the increasingly dispersed population, employment centres, and work schedules.

Several researchers (Hunt and McMillan, 1997) have studied factors that influence a person's decision to rideshare. The most commonly quoted one was an unwillingness to travel with strangers. Other factors included parking cost, increased ride time, and the relationships amongst carpool participants. Golob and Giuliano (1996) summarized factors that carpoolers consider when seeking carpool partners. They found that:

> *"Safety concerns with regard to both car and drivers are viewed as very important. These concerns can presumably be addressed if one knows or meets a driver in advance when choosing carpool partners. Knowing whether or not a potential partner smokes also emerged as a factor of significance. Finding a partner of the same sex is considered to be an unimportant factor. Working at the same company was rated as important by only one-third of the respondents, but living in the same neighbourhood was rated higher."*

In summary:

- Traditional carpooling or vanpooling between commuters is the most common type of ridesharing.
- The potential market for traditional ridesharing between non-family members is less than 10 percent of commuters.
- A fear of riding with strangers is one of the most common reasons for the low percentage of ridesharing between unrelated parties.
- Successful ridesharing programs must also address safety concerns with the car and driver, smoking preferences, and alternatives for the drive home.
- The benefit to the driver must outweigh the inconvenience of picking up passengers.

3.1.2 DYNAMIC RIDESHARING PROGRAMS

Dynamic ridesharing can be formally arranged through a ridesharing agency or casually matched such as hitchhiking. Casual or instant carpooling has been more successful than dynamic ridesharing through an agency. Casual carpools have been occurring in the Shirley Highway corridor in the Washington, D.C. area and on the Oakland Bay Bridge in San Francisco to take advantage of HOV lanes. Individuals wanting rides along these corridors gather at park-and-ride lots and other locations and are picked up by drivers going to the same destination (Turnbull, 1999). These arrangements are successful because the driver does not have to detour very far from the corridor to pick up passengers and receive the benefit of the HOV lanes, transit is available back to the park-and-ride lots if the passenger cannot carpool on the return trip, and passengers usually travel in pairs following an informal protocol to not leave a potential passenger alone. (Spielberg and Shapiro, 2001).

The Federal Transit Administration (FTA) in the United States funded several dynamic ridesharing activities in the early 1990's in Bellevue and Seattle, Washington, and in Sacramento and Los Angeles, California. These programs were based on the concept of "smart travelers" riding on "smart vehicles". Intelligent Transportation Systems (ITS) would be used to monitor traffic conditions and the origins and destinations of passengers seeking a ride. Matches between drivers and passengers would be automated allowing trips to be arranged on short notice. It was also envisioned that the computer system could be programmed to provide HOV drivers with the best and fastest route in prevailing traffic conditions (Niles, 1995) (Casey et al, 2000). The dynamic ridesharing components of these "Smart Systems" were not very successful.

Figure B2: Drive2Day

Golob and Guiliano (1995) evaluated the Los Angeles pilot project that was field-tested in 1994. The pilot project included an Automated Ridematching Service (ARMS), which allowed individuals already registered with the traditional ridesharing agency to use their touch-tone phone to find rideshare partners quickly and effectively for either regular carpooling or an occasional emergency ride home. Participants entered changes in their regular travel times using the touch tone phone and received a computer generated list of people to contact who lived and worked near them with similar schedules. The individual could then choose to call some or all of the people on the list, or record a message that Smart Traveler automatically delivered to potential carpool partners. Potential partners could then call the individual back if they were interested in sharing a ride. This automated call-up feature was a unique aspect of the service. Other new features included one-day only service and 24-hr/day availability. The ability to record messages, which the computer then uses when dialling potential rideshare matches was intended to help speed responses. Golob and Guiliano found that the automated ridematching service was not successful for a number of reasons:

- There was insufficient demand from registrants in a traditional rideshare database for a dynamic service such as ARMS. This was attributed to the fact that people are not inclined to give rides to or take rides from people they do not know. Systems like ARMS would be a last resort.

- The Los Angeles demonstration had additional management and organizational burdens due to the size of the venture. Technically complex systems require careful development and monitoring. Demonstrations ought to be no larger than is necessary to adequately test a product or concept and summary data requirements should be identified in the project planning phase.

- The users did not grasp the services provided. Callers used ARMS primarily to find new partners for a regular carpool rather than to arrange one-time trips.

The University of Washington in Seattle successfully developed and operated a dynamic ridematching system between 1995 and 1997 using the internet and e-mail. The developers followed the recommendations from the Los Angeles study and tested their ridematching technology on students and staff at the University of Washington rather than a larger group of users. The Texas Transportation Institute assessed the project in 1999 (Turnbull). Results and conclusions from their study are summarized below.

- The system operated for 15 months without any major technical problems. Maintenance and operation were simplified by the self-contained nature of the project.

- Six percent of the requests for matches actually resulted in a carpool. This is comparable to results for traditional rideshare programs where a significant limitation continues to be concerns about sharing rides with strangers. Other incentives may be needed to encourage greater ridesharing. These may include HOV facilities and parking incentives.

- Less than 10 percent of the carpools formed were for dynamic ridesharing. Over 90 percent were traditional ridesharing trips between staff commuting to and from the University during peak hours. However, the system appeared to have reached a new group of potential rideshare participants because there was only a 20 percent overlap with the Metro rideshare program. This was partially attributed to the use of new technologies.

- Issues that may have limited the use of the system included implementation before the real boom in Internet use, the technology available at the time for the dynamic ridematching was cumbersome, and the project may have been viewed by potential users as too temporary or experimental.

- The authors concluded that additional tests of dynamic ridesharing services should be considered at other universities, single large employers, or major employment centers.

Hall and Qureshi (1997) compared results from the Los Angeles pilot project to theoretical demand based on a statistical analysis. They concluded that:

> *"For a congested freeway corridor, the number of trips generated per unit time and space should be sufficient to yield a reasonably large population of potential ride-matches for a DR (dynamic ride) system. Unfortunately, as demonstrated in the experiment, theory and practice are not the same…. At best, one might expect a one in five chance of someone offering a ride when trip patterns are similar."*

Hall and Qureshi (1997) believe that dynamic ridesharing would not be successful in practice until some direct incentive is created for offering rides and a better system than the telephone is developed for contacting ride-matches. They also warn that financial remuneration may result in carpoolers falling under common carrier regulations.

Casey et al (2000) summarized the possible reasons for the low level of success for agencies that have implemented dynamic ridesharing. They included:

- A lack of awareness of the programs;

- A deficiency in the number of driver participants and offered rides;

- Insufficient incentives such as HOV lanes to rideshare;

- A concern about sharing rides with strangers;

- The time factor to receive a matchlist and contact possible trip providers; and

- The need to obtain a match for a return trip.

3.2 Experience and Case Studies of Successful Ridesharing Programs around the World

The following section summarizes the experience gained in ridesharing programs in different parts of the world. The programs are described in terms of:

- locating potential participants;
- matching passengers and drivers;
- compensation for the driver;
- required lead-time for matching;
- program administration;
- the types of trips that are rideshared, their length, the times of day they occur, and the characteristics of their origins and destinations; and
- the demographics of the users.

3.2.1 CANADA

3.2.1.1 Whistler, British Columbia

Whistler, British Columbia is a ski resort attracting over 2 million visitors per year. The Whistler Way! Rideshare Program is a partnership between the municipality, BC Transit and the Jack Bell Foundation (JBF Rideshare). The formal ridesharing through the JBF Rideshare Program is offered between Squamish - Whistler and Pemberton-Whistler, with the former trip pair being more successful. Details of the program are given in **Appendix B2**.

Figure B3: Jack Bell RideShare

3.2.1.2 Universities

Traditional ridesharing programs are offered at three universities in Ontario, the University of Toronto (UTM) in Mississauga, McMaster University in Hamilton, and York University in Toronto. Details on these programs are provided in **Appendix B2**.

3.2.2 UNITED STATES OF AMERICA

3.2.2.1 California and New Jersey

California and New Jersey encouraged ridesharing between 1990 and 1995 through the introduction of high occupancy vehicle (HOV) lanes and by requiring large employers to establish trip reduction programs during this period. The employers relied on the ridesharing agencies as a primary source of information and technical assistance for matching drivers and passengers. California repealed the trip reduction regulations in 1995.

3.2.2.2 RIDES for Bay Area Commuters

RIDES for Bay Area Commuters, a nonprofit organization in the San Francisco Bay area, completed a survey of commuters in 1995. They found that the demand for ridesharing more than doubled over the last 10 years, and that 19 percent of commuters in their service area carpooled or vanpooled. Smith and Beroldo (2002) surveyed a group of commuters from 1996 to 2001 who received service from the RIDES agency. They found that commuters who switched from a single-occupancy vehicle to a more positive commute mode (i.e. carpooling, vanpooling, riding transit, biking, walking, or telecommunicating) continue to use the new mode for approximately 2 years, and that approximately 10 percent continue to use the new mode indefinitely.

3.2.2.3 Redmond, Washington

The city of Redmond, Washington has established an automated ridematching system that can be used by individuals seeking a single ride. It was identified in the Federal Transit Administration's state of the art report on ITS (Casey et al, 2000) as an agency offering dynamic ridesharing services. Details of the program are given in **Appendix B3**.

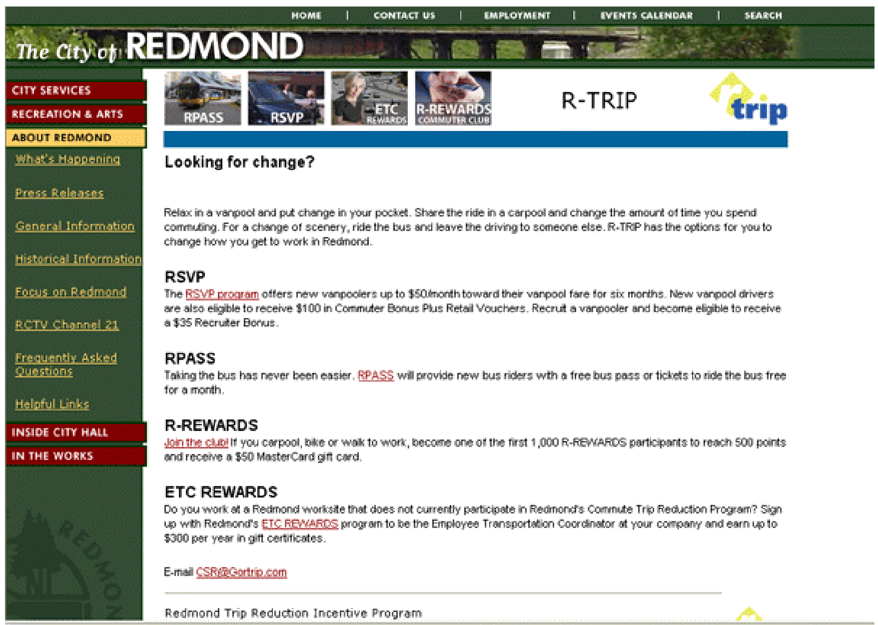

Figure B4: City of Redmond

3.2.2.4 Missoula, Montana

The Missoula Ravilla Transportation Management Association (MR TMA) operates a ridesharing program typically used by middleclass workers looking for rides to and from their jobsite. MR TMA typically receives three to five rideshare requests per week, one to two of those are for one-time, or dynamic rides. Missoula was also identified in the Federal Transit Administration's state of the art report on ITS (Casey et al, 2000) as an agency offering dynamic ridesharing services. Details are given in **Appendix B3**.

3.2.3 UNITED KINGDOM

Liftshare was founded in 1997 as the largest agency that provides a national car-sharing service in the United Kingdom. Services are available to anyone who travels in the UK including institutions such as schools and hospitals, business centers, sporting events, and various levels of government ranging from villages and parishes to countries. Details are given in **Appendix B4**.

3.2.4 GERMANY

3.2.4.1 Daimler-Chrysler/Baden-Wurttemberg

Daimler-Chrysler AG and partners, in association with the German State of Baden-Wurttemberg, have been developing and testing telematic-supported mobility services for up-to-date brokerage of carpooling opportunities since 1998. The trial operation indicated that the program offered good prospects, especially with larger companies. Marketing was required to attract and retain clientele. As well, technical effort for automated brokering could be realized at a very reasonable cost. The research in Germany represented the closest study related to the telecommunications component of the current proposed Ride Points system. (ITS International, 2001)

3.2.5 SUMMARY

In the review of the literature for existing successful ridesharing programs, the following common features were noted:

- All of the ridesharing agencies operated as not-for-profit organizations.

- Benefits to the drivers were primarily indirect. They included reduced costs such as lower toll fees, reduced travel times where high occupancy vehicle (HOV) lanes were present, reduced or waived parking costs at institutions such as universities with carpool parking passes, and reduced operating costs through informal sharing of vehicle costs between passengers and drivers. None of the ridesharing programs reviewed provided direct monetary compensation for the driver.

- Average trip lengths for carpools varied from short hauls of 15 km to longer rides of 75 km. The average ridesharing trip in Redmond, Washington was 15 km (10 mi) compared to 30 km in Seattle, Washington, and 30 to 75 km in Whistler, British Columbia.

- In all of the communities and affinity groups researched, a low percentage (less than six percent) of the population was registered in existing rideshare programs, as shown in Table B2.

Table B2: Registered Users

Program	Population	No. Registered in Program	Percentage
University of Toronto in Mississauga	8,000	150	1.9%
York University	No data	620	Indeterminate
Los Angeles	10,000,000	600,000	6.0%
University of Washington	39,000	400	1.0%
Missoula	75,000	300	0.4%

- The majority of the population registered with the ridesharing agencies were either commuters who worked for the same employer, went to the same university, or had some other affinity with each other. The fear or discomfort of sharing a ride with total strangers had limited the demand for ridesharing outside of groups who had something else in common.

- Most of the programs research offered a guaranteed return trip (using a commercially available mode of transportation such as taxi services) for users who might not otherwise be able to arrange a ride in the reverse direction.

- Program costs to serve markets of 50,000 people were approximately US$300,000. Similar costs were reported for a rideshare service in Houston, Texas, although the market size in this case was not available.

- All of the ridesharing agencies marketed their programs extensively using a wide range of methods including contests, advertising on the web and by e-mail, and by advertising in partnership with other modes of transportation.

3.3 Environmental Scan Summary

The proposed Ride Points system is intended to be a dynamic ridesharing service using telematics technology for connecting participants making carpooling arrangements on a trip-by-trip basis with short lead times. The system administrator would make the arrangements between the driver and passengers and the participants might not be in direct contact until they actually meet to share a ride. Drivers would be compensated using a points based reward system.

A comparable service was not found during the literature review. Existing ridesharing agencies primarily serve traditional ridesharing participants seeking regular trips between groups of commuters during peak hours. The driver is not directly compensated; and, in all of the agencies reviewed, the driver and passengers had to contact each other and make the final arrangements to share a ride.

The demand for dynamic ridesharing is currently very low. In 1990, less than 15 percent of commuters in the United States carpooled and most of the commuters sharing a ride were family members. Less than 10 percent were traditional carpools who may use an agency to make ridesharing arrangements. Agencies offering dynamic ridesharing report that only a small percentage of their participants are interested in dynamic ridesharing. Less than 10 percent of the carpools formed through an agency testing dynamic ridesharing in Seattle were for one-time trips.

Possible reasons for the low level of success for agencies that have implemented dynamic ridesharing are:

- A concern about sharing rides with strangers.
- Insufficient incentives for drivers to offer a ride.
- A lack of awareness of the programs.
- The need to obtain a match for a return trip.

Agencies matching participants for traditional ridesharing have had success in limited applications because they have been able to address these key factors. Groups of commuters from the same neighbourhoods, employers, or schools tend to form carpools because they have something else in common besides sharing their vehicles. This affinity between participants helps to overcome the fear of sharing a ride with a stranger.

Successful ridesharing programs also provide incentives to the drivers such as reduced parking costs, access to HOV lanes, and reduced operating costs through informal arrangements between the driver and the passengers. None of the agencies operate for profit or offer direct compensation to the driver. One author noted that directly compensating the driver might result in the service falling under common carrier regulations.

Awareness is promoted through extensive advertising by existing services using methods such as contests, web advertising, e-mail, and combined promotions with transit. Successful ridesharing programs also have alternative arrangements for the return trip, such as a guaranteed ride home.

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3.5.1 GENERAL SOURCES OF INFORMATION

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- Quest, the university’s catalogue, and WorldCat, a catalogue of libraries throughout the world;
- Websites for the Victoria Transport Policy Institute, ITS Canada, TAC, and the Centre for Sustainable Transportation
- TRB’s TRIS database
- Website for PATH (Partners for Advanced Transit and Highways) at the University of California
- FHWA website
- The transportation research library for the United Kingdom

- Websites for the OECD program on sustainable transport, the European Federation for Transport and Environment, and the Institute for Transportation and Development Policy.

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3.5.3 WEBSITES

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Website for JBF RideShare in Vancouver, http://www.ride-share.com/rideshare.html

Website for Drive2Day – Ridesharing in Europe <http://www.drive2day.de/index.lxjsp;jsessionid=1252361076430281612 >

Partners for Advanced Transit and Highways <http://www-path.eecs.berkeley.edu/> and its partners

FHWA including The Federal Highway Administration, Planning and Environment website (www.fhwa.dot.gov/environment)

The U.S. Department of Energy’s Center for Excellence in Sustainable Development (www.sustainable.doe.gov/transprt/trintro.htm) information on sustainable community transportation planning.

National Technical Information Service <http://www.ntis.gov>

The Volpe National Transportation Center (http://ohm.volpe.dot.gov) is a leading transportation research institute.

ITS Canada < http://www.itscanada.ca/english/index.htm>

Transportation Association of Canada (www.tac-atc.ca)

Transport Canada (www.tc.gc.ca)

Centre for Sustainable Transportation (www.web.net/~cstctd) is a research institute dedicated to encouraging more sustainable transportation policy.

The Transport Research Laboratory (www.trl.co.uk) sponsors and publishes a wide range of studies on traffic, transportation management, traffic safety and traffic calming.

Sustainable Urban Travel bibliography (http://omni.ac.uk:8099/LCZHMC/bibs/sustrav) containing mostly UK material but quite a bit of other European and International.

The Institute of Highways and Transportation (www.iht.org) is the primary organization for transportation professionals in the U.K. Institute of Transportation Engineers (www.ite.org).

The Institute of Logistics and Transport (www.iolt.org.uk) is a major research organization that provides many resources for transportation planning and analysis.

The Organization for Economic Co-operation and Development (OECD) has a program devoted to Environmentally Sustainable Transport (www.oecd.org/env/trans) which is examining a wide range of possible strategies.

European Federation for Transport and Environment (T&E, www.t-e.nu) is a European umbrella for non-governmental organisations promoting an environmentally responsible approach to transport.

The Institute for Transportation And Development Policy (www.ITDP.org) is an organization that supports sustainable transportation policies throughout the world, including in developing countries.

Go Boulder (http://go.boulder.co.us/pubs/publications_menu.html) is an excellent example of a community-base TDM program.

The Rides Program (www.rides.org) provides commute trip reduction services in the San Francisco region.

Transportation Control Measures Directory (http://yosemite.epa.gov/aa\tcmsitei.nsf) provides a searchable database of TDM strategies, programs and case studies.

4. LOYALTY PROGRAMS – ENVIRONMENTAL SCAN

The primary factor for the success of the Ride Points System is the economic framework that will provide motivation for the drivers to offer rides and the passengers requesting them. There are no ride-sharing initiatives that offer direct incentive to drivers to encourage participation. Traditionally, the benefit has been the reduced costs associated with shared tolls, parking and other fees. The Ride Points System will be more direct in the incentive provided to drivers, by having a system of points which passengers pay for rides with and drivers earn.

A points system is being proposed as opposed to a cash system for various reasons. The primary reason has to do with insurance industry limitations – a system using cash would be less differentiable from a carrier service (i.e. taxis). Another concern with a cash system is that it would be much more difficult to attain a balance between motivating drivers and being attractive to passengers. A points system allows for an easier balance because the value of points to each individual is variable (based on what their reward target is).

This section examines key considerations when establishing a new loyalty program and contains a scan of existing programs in the Canadian market.

4.1 Establishing a New Program

There are various aspects to be considered in establishing a new loyalty program for the Ride Points System. Hughes and Pine (2004) examined the development of the Safeway Savings Club, one of the more successful loyalty programs in the US retail market, and summarized the "must's" for any loyalty program. According to the research, any loyalty program must be:

- Easy to use – a Ride Points System program should have a logic that is straight-forward for both passengers and drivers to determine the value of the trip.
- Provide immediate rewards – a Ride Points System program should offer rewards, particularly to drivers, at an early stage in order to gain customer buy-in.
- Have value that is worth it from the customer's perspective – a Ride Points System program should provide sufficient benefit to attract and retain new drivers; at the same time, the system cannot be too expensive to passengers or they may be lost as customers.
- Be targeted to customers whose behaviour you are trying to change – the Ride Points System should target single-occupancy vehicles, and avoid transit or pedestrian traffic. This can be achieved through marketing, as well as by setting up the rewards of the loyalty program to be auto-related.
- Be limited to what you can afford to spend – the Ride Points System loyalty program must find the balance between driver and passenger trip values that provides sufficient revenue for the system to maintain its day-to-day operations. Clearly funding should not be relied on when establishing this balance.
- Have a published exit strategy – this rule does not apply to a system-developed loyalty program, as the exit strategy would be linked with the demise of the system itself, and therefore service can't really be lost.

There are two general characteristics to a loyalty program: point exchange and point accumulation. In order to encourage continuing/repeat use, it is important to establish an increasing rate of reward for customers. This was highlighted by Fowler (2003): "Create differentiation within your loyalty programme." Whether this means offering more points for the mile, priority service for long-term customers or thank-you cards during the holidays, special recognition goes a long way to providing more value for more loyal members.

One of the greatest strengths of loyalty programs is collecting information – producing a rich customer data set for planning (Peppers, 2002). The Ride Points System would be able to provide valuable information both internally (in terms of which neighbourhoods, employment centres, institutions, etc. to target for membership growth), as well as externally to other public agencies (for example, high volume transportation corridors). The Ride Points System should include a data processing/analysis package that automatically produces standard reports.

Ultimately, it is the recommendation of this report, at least for the initial deployment, to leverage off pre-existing loyalty programs for the following reasons:

- Customer recognition – introducing the Ride Points System to the public with its own loyalty program adds an unknown/element of complexity from the user's perspective. One way to make the system simpler is to use an existing loyalty program. By doing this, users will already have a feel for the value of the points. The only risk in doing this is that some users might not be interested in the selected program. However, one would suspect that having a new program would not be more appealing to these users.

- Users don't like being enrolled in different programs – users don't like to be involved in numerous loyalty programs (Thackston, 2000). A 1996 survey found that, of those that participate in loyalty programs, only 35% belong to more than 3. In addition, combining the services offered with those of multi-faceted loyalty programs can provide cross-marketing gains (Fowler, 2003), which could translate to increased participation.

- Reduce technical risk – establishing and operating a loyalty program requires a large amount of resources, and can be very expensive (Scott, 2002). It is a long-term strategy that requires foresight and a strong commitment to stay the course (Teoh, 2001). The Ride Points System would most likely first be implemented as a pilot, and in that role, does not justify the costs associated with beginning a loyalty program. By leveraging off an existing system, the costs are predictable (batch purchases of points), and the cost of administration is off-loaded.

4.2 Established Programs

This section provides an overview of the various Reward Points programs available throughout Canada. Program details and partnering opportunities are discussed in an effort to determine the potential liaison between Ride Points and these existing Reward Points programs. The following programs are highlighted:

- Aeroplan
- Airmiles
- Hbc Rewards
- Sears Club
- Shoppers Optimum
- ESSO Extra
- PETRO Points
- PC Points

Review of each program provided the following information:

- Points accumulation, value, redemption and exchange
- Available benefits associated with programs (e.g. member status levels for preferential service)
- Partnering Opportunities including cost, distribution and system handling of points

A summary table is provided at the end of this section detailing the pertinent information to the Ride Points program. Comments on the feasibility of program incorporation are also provided.

4.2.1 AEROPLAN

The Aeroplan program involves the accumulation of Aeroplan miles, the currency of the Aeroplan program, which are collected by using an extensive list of airline, financial, retail/services/entertainment, telecommunication, hotel and car rental partners. The collected Aeroplan miles can then be exchanged for rewards including air travel, hotel accommodations and retail products/services, etc.

The purchase of a return flight from Toronto to Montreal ($300-$500) will earn 600 points ($0.5 – $0.83 per point) and between Toronto and Paris ($800-$1000) will earn 7000 points ($0.11 - $0.14 per point). The Aeroplan program allows consumers direct purchase of Aeroplan miles (points) valued at approximately $0.04 per point. Incentive programs such as RidePoints can purchase bulk points for $0.029 – $0.035 per point depending on quantity purchased. 15,000 points can be redeemed for a return flight between Toronto and Montreal ($0.02 - $0.03 redemption value per point) and 60,000 points for a flight between Toronto and Paris ($0.013 - $0.016 redemption value per point).

Points exchange is available between various other rewards programs with the use of www.points.com points exchange service, initial exchange is free but additional exchange opportunities require a yearly subscription fee of $19.95 USD. Subscription to yearly service provides bonus points of 700 Aeroplan miles (approximately $0.04 per point).

When travelling aboard eligible flights Aeroplan members can collect Aeroplan Status Miles that are added together at the end of every year to determine Aeroplan status for the following year. Collect enough Aeroplan Status Miles and members could reach Aeroplan Prestige, Aeroplan Elite, or Aeroplan Super Elite status that carry exclusive benefits such as access to Executive Lounges and free upgrade vouchers.

The Aeroplan program offers a business incentives option for businesses to purchase bulk miles for distribution to employees. Miles must be purchased in certificate denominations that can be given to recipients for addition to recipients account.

Cost of points (miles): 250,000 to 2.5 million miles - 0.035 CA$/mile; More than 2.5 million miles - 0.029 CA$/mile. An additional administrative/processing fee of $0.002/mile is required for all transactions and an optional $300 per order of certificates can be paid for certificates to carry company logo. GST and PST must also be applied to each order.

A potential scenario for the Ride Points program is to purchase a series of certificates that can be purchased by passengers to offer drivers. The miles would be re-circulated throughout the Ride Points System.

4.2.2 AIRMILES

The Air Miles program provides consumers an opportunity to collect Air Miles points towards consumer products and flights with major retailers and airlines. Similar to Aeroplan, Air Miles are accumulated through a large number of business partners. However, Air Miles is primarily associated with retail products and services with points being accumulated from purchased goods or services. This includes miles accumulated with the purchase of airline tickets but not the actual flight miles themselves.

All partners differ in the number miles provided for every dollar spent. For example, WestJet Airlines provides 1 Air Mile for every $20 spent when booking flights online or over the phone while the Liquor Control Board of Ontario retail stores provides 1 mile for every $25 spent. Similarly, using an American Express Air Miles Gold Card provides 1 mile for every $15 spent.

The range of miles required to obtain a flight from Toronto to Montreal is 800 to 1100 miles. This translates to a mile redemption value of $0.45 per mile (assuming 1100 miles and a flight cost of

$500). From Toronto to Paris the range in miles required is 4600 to 8900. With a $1000 flight cost and 8900 miles the mile redemption value is approximately $0.11 per mile.

Exchange services are also available from partner companies to transfer sponsor accumulated points to Air Miles, the opposite points transfer does not seem to be available.

No additional benefits are outlined for the Air Miles Rewards program.

The Air Miles program has business sponsorship opportunities where businesses can provide Air Miles to customers.

4.2.3 HBC REWARDS

The Hbc Rewards program is a retail products- and services-based points system where consumers can earn points for shopping at the Hudson's Bay Company (Hbc) family of stores (the Bay, Zellers, Home Outfitters and online at DealsOutlet.ca) and at partner companies (e.g. ESSO, Travelodge Hotels, etc.).

The program offers two types of points, base and bonus points. For every dollar spent at an Hbc family store 50 base points are received ($0.02 per point). After 75,000 base points are collected for a given year, gold membership status is obtained and for every dollar spent an additional 50 bonus points are received therefore reducing the cost per point to $0.01. In addition gold level members require a lesser number of points for available rewards. Consumers that use an Hbc Credit Card with either a standard Hbc rewards card or gold rewards card will receive an additional 25 bonus points per dollar spent ($0.013 per point for standard membership and $0.008 per point for gold membership).

A $100 Hbc Gift Card can be obtained for 900,000 points ($0.0001 per redemption point) with a standard membership and for 825,000 points ($0.00012 per redemption point) with gold membership.

Exchange services are available with the Hbc family of companies and the ESSO Extra points program. Points can be transferred to and from the Hbc companies and the ESSO program.

No additional benefits are outlined for the Hbc Rewards program.

The Hbc Rewards program also offers a business incentives program. Bonus points can be purchased in bulk (minimum purchase of 10,000 points) at a cost of $0.50 per 1000 points ($0.005 per point) plus GST. Once registered companies have access to an online company account where they can redistribute points to other cardholders or print certificates for distribution. Discussion with Hbc services staff indicated no issues with the Ride Points program and a willingness to cooperate based on Ride Points needs. An alternative option of Hbc gift cards was also suggested by Hbc staff as a potential solution for the Ride Points program. Gift Cards carry a dollar value but no cash can be obtained only store credit value when purchases are made that are less than the card value.

4.2.4 SEARS CLUB

Sears Club is a similar program to that offered by Hbc. The Sears Club points program is a retail products and services program where consumers can earn points from purchases at Sears stores and partnering companies (e.g. Petro Canada, Roots, etc.). The Sears Club program differs from the Hbc system by highlighting the partnering companies for points collection and that points can only be collected by using the Sears Credit Card.

The program provides one point for every dollar spent at Sear stores. Points collected at partner companies differ but in the case of Petro Canada purchases points can be collected for both the Petro Points program and the Sears Club system.

A $100 Sears Club Gift Certificate can be obtained for 500 Sears Club points ($0.2 per redemption point).

Exchange services are available to and from the Petro Points program.

No additional benefits are outlined for the Sears Club program.

The Sears Club program does not offer a business incentives purchase option but partnering opportunities exist.

4.2.5 SHOPPERS OPTIMUM

The Shoppers Optimum program is a retail products and services points program that allows consumers to collect points when making purchases at Shoppers Drug Mart stores. Collected points can only be redeemed at Shoppers stores for a discount on in-store products.

SHOPPERS DRUG MART

The program provides approximately 10 points for every dollar spent at Shoppers stores (value: $0.1 per point). Bonus points are available on marked products providing consumers an opportunity to obtain greater than 10 points per dollar spent. A CIBC Visa Optimum card can be obtained to further increase number of points obtained for each transaction. The Visa Optimum card provides 5 points for every dollar spent anywhere the card is accepted and an additional 50% in points when used at Shoppers stores.

A $75 discount can be obtained with the redemption of 34,000 points ($0.002 per redemption point).

Exchange services are available between friends and family members. Points from one account can quickly and easily be transferred online by entering both of the Optimum card numbers.

No additional benefits are outlined for the Optimum points program.

The Shoppers Optimum program does not provide a business incentives or partnering program. Optimum points can only be transferred between friends and family members using the exchange services mentioned above.

4.2.6 ESSO EXTRA

The ESSO Extra points program is similar to the Shoppers Optimum system in that consumers can only collect points by making purchases at ESSO store locations. However, ESSO Extra points can be redeemed for ESSO products and those provided by partnering companies (e.g. Chapters, Tim Horton's, etc.).

Every dollar spent at ESSO locations provides a minimum of one ESSO Extra point. A CIBC ESSO Visa card can be obtained to increase the number of points obtained for each transaction. The CIBC ESSO Visa provides double points at ESSO store locations for every dollar spent and 1 point for every dollar spent anywhere Visa is accepted.

$20 in gas can be obtained with the redemption of 3500 points ($0.0057 per redemption point).

Exchange services are available between other ESSO Extra card members and with various points programs, primarily the Hbc Rewards program. ESSO Extra points can be transferred to or from the Hbc Rewards program at no extra charge. Other program transfers available involve the use of www.points.com exchange service (As mentioned earlier a yearly fee applies).

No additional benefits are outlined for the ESSO Extra program.

The ESSO Extra points program does not provide a business incentives or partnering program. Companies can link all cards to one account but points can only be obtained from ESSO store purchases.

4.2.7 PETRO POINTS

The Petro points program allows consumers to obtain points when making purchases at Petro-Canada locations and at program partner stores (e.g. Ramada Inn, Sprint Canada, etc.).

Every dollar spent at Petro-Canada locations provides 10 Petro points ($0.1 per point).

$20 in gas can be obtained with the redemption of 35,000 Petro Points ($0.00057 per redemption point).

Exchange services are available with the Sears Club program and the President's Choice points system. Points can be transferred to and from the Petro Points system and each of the two other rewards programs. In addition, the Sears Club card can be linked with the Petro Points card in order to provide points for both programs with every Sears Card purchase at Petro Canada locations.

No additional benefits are outlined for the Petro Points program.

The Petro Points program does not provide a business incentives or partnering program. Companies can link all cards to one account but points can only be obtained from Petro-Canada store purchases.

4.2.8 PRESIDENT'S CHOICE FINANCIAL PC POINTS

The PC Points program is a consumer-based program associated with the use of President's Choice Financial services. PC bank cardholders can obtain PC points when shopping at associated grocery stores. Although points are only obtained at a limited group stores, points can be redeemed for a large range of products or services, including available flights and vacations.

Every dollar spent at participating grocery stores (e.g. Loblaws, Fortinos, etc.) provides 10 PC Points ($0.1 per point). Holders of a PC MasterCard receive 10 points for every dollar spent anywhere the card is accepted. Additional points can be obtained by using the PC Financial tools, such as paying bills from your PC Financial account.

$20 in groceries can be obtained with the redemption of 20,000 PC Points ($0.001 per redemption point).

Exchange services are available with the Petro Points program, as mentioned above.

No additional benefits are outlined for the PC Points program.

The PC Points program does not provide a business incentives or partnering program.

4.2.9 SUMMARY

Table B3 provides a glance at the various points/rewards programs discussed above.

Table B3: Loyalty Program Summary

Program	Cost of Points Accumulation	Redemption Value	Additional Benefits	Exchange Services	Bulk Purchase for Businesses	Partnering Opportunities
Aeroplan	$0.11 - $0.83 / point earned	$0.013 - $0.03 / point redeemed	Yes – Status Points available to obtain preferential status services	Yes – with the use of www.points.com	Yes – points can be purchased in bulk as vouchers - $0.029 – $0.035 / point	Potential – Further discussion with Aeroplan Services required.
Air Miles	$20 / airmile earned	$0.45 / airmile redeemed	No	Yes – only from participating partner companies. Transfer from Air Miles to other programs not available	No	Potential – Further discussion with Air Miles Services required. (contact: sponsorhotline @airmiles.ca)
Hbc Rewards	$0.008 - $0.02 / point earned (Gold Membership status enables additional points per dollar spent)	$0.0001 - $0.00012 / point redeemed (Gold Membership status provides a small reduction in required points for rewards)	No	Yes – with Hbc Family of companies and the ESSO Extra points program	Yes - points can be purchased in bulk - $0.005 / point	Yes - (contact: Joanna Walker – 416-861-6935)
Sears Club	$1 / point earned (Sears Credit Card required)	$0.2 / point redeemed	No	Yes – with the Petro Points program	No	Potential - Further discussion with Sears Club services required. (contact: Public Affairs – 416-941-4423)
Shoppers Optimum	$0.1 / point earned	$0.002 / point redeemed	No	Yes – between other Optimum Card Holders	No	No

Program	Cost of Points Accumulation	Redemption Value	Additional Benefits	Exchange Services	Bulk Purchase for Businesses	Partnering Opportunities
ESSO Extra	$1 / point earned	$0.0057 / point redeemed	No	Yes – with Hbc Rewards, through www.points.com and with other ESSO Card holders	No	No
Petro Points	$0.1 / point earned	$0.00057 / point redeemed	No	Yes – with Sears Club program, PC Points program and between other Petro Points Card holders.	No	No
PC Points	$0.1 / point earned	$0.001 / point redeemed	No	Yes – with Petro Points program	No	No

Note: Value of Points Redeemed is more indicative of value of points transferred between parties. (i.e. Redemption value indicates potential “cash-like” value to recipients)

Based on the results of the loyalty program scan, the Aeroplan and Hbc Rewards stand apart as potential matches for the Ride Points System because they would allow for a bulk purchase of points by a RPS agency. In addition, they are recognized programs that already have large customer bases. In addition to these two, the Air Miles and Sears Club programs also warrant further investigation. Further contact with the above four organizations is needed to establish the ideal match for partnering with RPS.

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5. CONCEPT REFINEMENT OF THE RIDE POINTS SYSTEM

The first step in refining the Ride Points System concept is to examine several key issues:

- How long before travelling will user's check-in?
- Which mediums will be included?
- Where will passengers be picked up?
- What is the economic engine that will drive the system?

Following from this, the system concept can be refined both in terms of the technology and the functionality. Finally, stakeholders that may be impacted are identified.

Due to the need for an initial threshold of participation to be achieved to ensure sufficient numbers for the matching of drivers and passengers, we envision a number of phases of deployment to the Ride Points System. The initial deployment would be the most basic technologically, with transitional growth to incorporate enhanced functionality (e.g. real time matching) as participation levels increase, and the maturity and accessibility of technologies increases.

5.1 Time-to-Match

Originally envisioned to be a short-notice dynamic ride-matching system, in reality, the true issue is the time it will take to identify matches. Users accessing the system fifteen minutes prior to making the trip are not likely to delay their departure time to see if a match exists. This is especially true for drivers, since they are not relying on the passengers to make their trip. Passengers may choose to find alternate modes if they experience long delays.

In essence, the time to find matches is a function of various parameters. First and foremost, the total number of active system users – the more people making trips, the more possible combinations there are from which to find matching origins and destinations. Secondly, geographical constraints including overall boundaries and high-volume corridors can impact the types of requests being made to the system. Promoting the system along such corridors could target people with similar travel patterns, increasing the likelihood of matching users.

One strategy to improving matching capabilities is to target larger corporations or institutions that have many employees with similar destinations. Leveraging off existing carpool or ride-matching services in collaboration with these institutions would provide a good seed population that has at least one of the origin-destination locations already matched.

At the initialization of the system, it may be overly optimistic to set a fifteen minute time-to-match parameter. A more realistic target for when the system starts up is to have users identify their trips in the 24-hour period prior to making the trip (i.e. the evening before). As the system evolves and the user population grows, the time-to-match can be shortened, and users can be encouraged to communicate with a shorter lead time.

5.2 User Interaction

Given the continued proliferation of cellular phones, as well as their portability and convenience, it is essential that the Ride Points System support the use cellular phones for the purpose of offering and requesting trips. However, to maximize the number of potential users of the system, it is recommended that other mediums be supported by the system architecture, including:

- Internet – users would be limited in that they would be forced to make their requests/offers prior to departing from their origin or destination. This is acceptable for making requests/offers the evening before, but would lose value as the system evolves and the time-to-match decreases.

- Blackberry – system not as widespread as the cellular phone, and no added functionality present.

- Telephone (landline) – on its own, this system lacks the portability that would allow users to make offers/requests on the road. However, this could be easily added as a supporting medium for a cellular-based system at little to no cost.

5.3 Passenger Pick-up

There are three options with regards to passenger pick-up and drop-off locations:

A. Direct pick-up at any location and drop-off at any location

B. Pick-up at designated areas and drop-off at any location

C. Pick-up at designated areas and drop-off at designated areas

Section 2 examined relevant technologies related to locating the passengers and drivers. Given the limited maturity and availability applicable technologies, an initial deployment may be best served by the use of designated areas, or “hot-spots” as a default. Another reason for the use of hot spots is that although a system may be able to identify the exact location of a passenger, drivers cannot be expected to navigate to this location without support. Current navigation technologies are available in the form of in-vehicle terminals that provide road maps and directions. However, these technologies are still not in common use, and it is unclear whether these terminals will become more widespread. For this reason, initially the pick-up location shall be at hot spots or default locations.

Once the passenger is in the vehicle, there is no issue with respect to navigation. Thus, the drop-off location is not restricted technologically. However, it may still be a good idea to allow the driver to have the option of dropping off the passenger at their destination or at the nearest hot spot.

As the system evolves and access to locationing and navigation technologies become more widespread, the direct pick-up at any location could be revisited.

5.4 Economic Considerations

There is a range of expenses to be borne by RPS. These include:

- Amortization of initial system development costs;
- Core office management and overhead costs;
- Liaison with cellular service providers, points companies and other key actors;
- Carrying out of security checks on individuals;
- Member fulfilment, including monthly statements etc.;
- Running costs of the computer system, including operator interventions;
- Marketing of the system;
- Development costs in new regions of Canada; and
- Development costs in other markets.

Income could include the following:

- Membership fees, to cover costs of security checks and other set-up costs;
- Surcharge on points transfer between accounts;
- Surcharge on points purchased by members to replenish accounts;
- Advertising to users when they call in;
- Fees charged to cellular service providers, in return for increased business.

As a requirement, the system once operational cannot operate at a deficit, as it is unlikely that government would subsidize it for the implication that the funding is at the expense of public transit. To that end, the income generated must equal the total expenses incurred in operation.

The primary source of operating funds will most likely be the surcharges on point transfer/purchase. Based on the results of the loyalty program scan, the Aeroplan and Hbc Rewards stand apart as potential matches for the Ride Points System because they would allow for a bulk purchase of points by a RPS agency. In addition, they are recognized programs that already have large customer bases. In addition to these two, the Air Miles and Sears Club programs also warrant further investigation. Further contact with the above four organizations is needed to establish the ideal match for partnering with RPS.

If it is assumed that insurance companies will accept “reasonable compensation” for drivers, then the points earned should be equivalent or less than a normal rate of compensation in governments or private firms, e.g. currently around $0.40 per kilometre travelled. In the RPS case, compensation would be shared in the case where 2 or more passengers are involved.

5.5 Refined System Concept

Based on the previous sections, the refined system concept to be considered for an initial deployment is as follows:

- Users will dial in via cellular phones, land-lines or internet the evening before and enter information for trips the following day;
- Users will communicate preferred time of trip, origin of trip and ultimate destination.
- Once a match has been made by the system server, the driver and passenger will be contacted to confirm.
- With both confirmed, the driver picks up the passenger at the designated pick-up area.
- Upon successful completion of the trip, both passenger and driver are required to call the system to confirm drop-off.
- System computes value of trip and applies additions/subtractions to both driver and passengers account.

The most significant modification to the original concept scoped out in previous work is with relation to the time-to-match and the associated importance of automatic locationing. Seeing as the initial deployment would lack the necessary population size to provide fast matches on a consistent basis, extending the matching time boosts the likelihood of success, and ensures user satisfaction. However, by requiring users to make offers/requests earlier, the importance of locationing technology, at least at the initial stage, is lessened. This functionality would be elevated in importance as the system advances, and the possibility of short-term matches is increased. At that point, GPS locationing, as identified in the technology assessment, could be relied upon to provide trip origin information for equipped users.

The primary advantage of the Ride Points System in relation to other ride-matching systems lies in using direct incentives to lure drivers. As identified in the Literature Review, the ability to attract drivers to the system is fundamental to the success of any dynamic ride-matching system, and by refining the concept to focus on this key asset, the likelihood of success is greatly improved.

5.6 Stakeholders

There are various stakeholders that could be impacted positively or negatively by the implementation of the Ride Points System. Through subsequent tasks for this project, the majority of these stakeholders will be consulted to assess their interest and/or concerns, and to ensure that the final concept design for the Ride Points System complies with relevant legal/insurance regulations. Stakeholders include:

- The Federal Government would be expected to provide seed money to establish the system. The government would also be responsible for regulations of such programs.
- The Provincial governments could promote inter-regional use by introducing more HOV lanes on highways.
- Municipal governments would be responsible for encouraging uptake of the system by large employers by offering parking tax breaks. The municipality itself could be expected to promote usage of the Ride Points System to its employees by offering preferential parking. The municipality could increase the benefit to users by increasing the number of HOV lanes on major arterials.

- Companies or institutions with a large employee pool would be encouraged to promote usage to users by offering incentives such as preferential parking. In particular, companies or institutions that already are involved in a car-pool or traditional ride-sharing program would be ideal for introducing users that already have bought in to the general idea of ride-sharing.

- Transit agencies, taxies and other public transportation carriers would be impacted by a potential drop in demand for their services. Although the target market is drivers of single-occupancy vehicles, inevitably some percentage of Ride Points System users will be previous transit users.

- Insurance companies would be asked to accept drivers in the Ride Points System as general commuters as opposed to a private public transportation carrier. Although drivers may be receiving financial incentive to receive a passenger, they are allowed reasonable compensation to account for their costs, which the "reward points" would likely represent.

- Car manufacturers would be relied upon in a future deployment that includes automatic locationing and navigation features. As mentioned previously, these features could be added once the number of users increases and the time-to-match can be consistently in the 15-minute range.

- Cell phone providers would be relied upon for system support as their medium would be the primary method of registering trip offers/requests. The support could include flat fee for the agency in exchange for free incoming calls from users.

- The rewards company would be required to allow for bulk purchase of points by the RPS agency. In addition, they could be asked to manage the financial side of the system (i.e. transferring points from one user to another) at a fee.

APPENDIX B1

GPS PRIMER

INTRODUCTION

From its introduction in 1992, GPS systems, equipment, applications and software are still evolving rapidly. Currently there is a multitude of affordable, hand-held, and mobile global positioning system receivers on the market. Today's hand-held and mobile GPS devices for global positioning found on the market are much more precise and affordable than ever.

This is a brief on the GPS technological functioning principles and views of its future development as a increasingly popular technology.

THE TECHNOLOGY

There are at present two radio-navigation satellite networks in the world, one American (Navstar GPS) and one Russian (Glonass). Both were designed originally to support military applications and requirements. While Navstar GPS has, the Russian system seems to have failed in generating any significant civil application market. The European Galileo system may offer a real alternative to the establishment of a de facto monopoly of Navstar GPS and American industry.

The US Navstar GPS comprises of 24 satellites in orbit that uses the L band: L1 frequency band (centred at 1575.42 MHz) and L2 frequency band (centred at 1227.6 MHz). L1 and L2 carry an encrypted signal reserved for military use. L1 also carries an unencrypted signal for civilian use.

Each element of the signal is derived from a single atomic clock aboard each satellite. Besides the L1 carrier, the structure of the signal available for civilian use consist of a unique 1023-bit-long coarse acquisition code (C/A code), which repeats each millisecond, P-code (Y-code, military usage) and a 50-bps navigation message containing ephemeris data (satellite position, clock, health, and other parameters).

The coarse acquisition code is a pseudorandom noise (PRN) code (spread-spectrum), that is, a sequence of digital 1s and 0s that appear to be randomly distributed like noise, but are exactly reproducible by the GPS receiver.

The GPS receiver can demodulate the signals from satellite by generating the exact replica of the satellite's PRN codes. Otherwise, the receiver registers the GPS signal simply as noise. Matching the codes and using the satellite's navigation message also enables the receiver to calculate how long it took the signal to be transmitted, as well as the coordinates x, y and z of the satellites. At least four satellites must be within view for this data to be acquired. When fewer than four are observable in areas like cities, GPS can be augmented with corrections derived from known land sites.

The accuracy depends on measurement accuracy and configuration of the satellites. Errors depend on physical parameters, such as ionosphere delay of the signal and orbit uncertainties, and on the selective availability (SA) factor introduced by the US Department of Defence (DOD). SA is a deliberate degradation of the satellite data for non-military users, achieved by "dithering" the satellite clock and introducing errors into the navigation message data. With SA, total measurement errors are estimated at 35 metres, without it, they are reduced to 8 metres.

The relative position of the satellites supplying signal at the time of measurement add further distortion. Clustered satellites add a multiplier of 5, scattered satellites a multiplier of 1.5 to the measurement error. In total, the error can reach the 100 metres mark once all sources are considered.

The technology used for modulating and transmitting the signals from the satellites is CDMA and spread-spectrum (PRN) respectively. CDMA modulation scheme offers some protection against multi-path for the reflected signals by assigning a unique code to each transmission using the same frequency. The spread-spectrum nature of the signals provided a processing gain against noise and interference.

The GPS signal level received on Earth is extremely weak. The satellite antenna output is about 50W of which half is allocated to civilian use. Minimum received power is –160 dBW. Greater frequency diversity and increased signal power are under consideration as the national commercial and public infrastructure comes to rely more heavily on Navstar GPS.

Differential GPS

Differential GPS (DGPS) is an extension of the GPS system that uses land-based radio beacons to transmit position corrections to GPS receivers. DGPS reduces the effect of selective availability, uncertainty of the relative positions of satellites within the view, measurement errors, propagation delay, etc., and can improve position accuracy to better than 10 metres. Error estimates are computed at a reference receiver and transmitted in real time over a radio link to GPS users, which through calculations compensate their readings.

Where available, US Coast Guard provides such services free of charge on marine radio frequencies (285-325 KHz). About 50 beacon sites are involved located along coastal waterways, the Great Lakes, and inland waterways in the continental US.

DGPS can estimate a position within a metre or less if the user is close enough to a reference station and if the time delay of the corrections transmitted over the radio link is not too great.

WAAS, LAAS

GPS is already installed in a large number of aircrafts as an aid to navigation with a 100-metre accuracy. Traditionally aircraft navigation relies on a web of land based radio beacons that guide the aircraft zigzagging en route to their destination. While flying over oceans, they have to relay on the inertial navigation system, which can result in being several kilometres off course. With GPS, an aircraft can accurately fly a direct route to its destination without aligning itself with beacons allowing for a more efficient path. The technology that aircrafts need to broadcast their GPS positions to air traffic control, known as ADS-B (Automatic Dependent Surveillance-B) is also being developed by the FAA.

Today when an aircraft descends towards a runway, it is guided by VHF, UHF Glideslope and UHF based distance-measuring equipment (DME). Both systems use radio signals to give pilots navigation information for non-precision approaches at cloud ceilings of 90-120 metres. The pilots then turn to visual information to align the aircraft with the runway and actually land the plane.

Large airports use the more sophisticated Instrument Landing System (ILS) for precision approaches that can land planes with little or no visibility.

GPS is already substituting the costly VOR and DME systems in many small commercial airports, many of which had no landing aids at all and could be used only for a cloud ceiling of at least 300 metres to 5 Km.

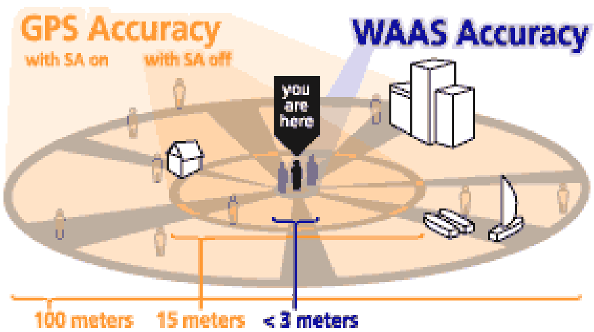
Wide Area Augmentation System (WAAS) is being developed by FAA to provide aircraft with precise navigation services with radar signals used only as a back-up system. WAAS provides navigation help from the time the planes move onto the runway all the way through a category 1 precision approach, a ceiling of 60 metres. WAAS relies on a network of 25 ground references stations across USA, which receives GPS signals and determines any errors in the position information derived from satellites. Error correction data is relayed to one or two master stations, where correction information for specific geographical region is computed and then sent to one of four uplink stations where it is transmitted to a geostationary communications satellite. The satellite broadcasts the correction information to the WAAS-ready GPS receivers onboard the aircraft, increasing position accuracy from 100 metres to less than 3 metres. WAAS Data is transmitted from the GPS Satellites embedded in the civilian data stream.

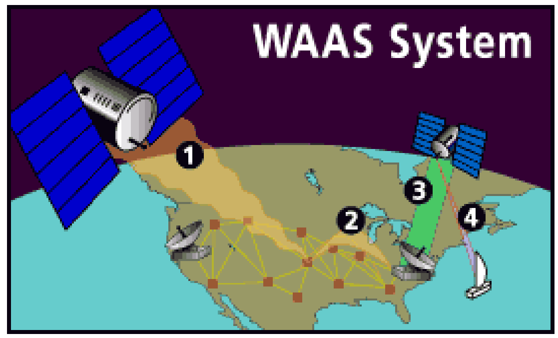
Japan’s MTSAT and Europe’s EGNOS are similar systems that will be compatible with WAAS onboard equipment.

WAAS cannot replace instrument landing systems for landing aircraft when ceiling and visibility drops below 60 metres and 0.8 Km. For that reason FAA is developing the Local Area Augmentation System (LAAS).

LAAS is based on ground-based GPS receivers to calculate signal errors but for smaller geographic areas of 30-45 km radius, it can bring GPS to less than a 1-metre accuracy and allow nearly blind landings. The system will also be used for airport surface navigation. LAAS data will be transmitted directly to aircraft on a VHF radio channel.

ADS-B is also expected to be used in the next generation of collision avoidance systems. Today's technology, called Traffic Collision Avoidance System (TCAS-III), uses radar to look ahead for conflicts, and then, based on that information provides pilots with colour-coded warnings on their instrument panel of impending potential conflicts. TCAS-IV, a GPS-based collision avoidance system, is under development and in the preliminary testing process.





Neither WAAS or LAAS are yet operational or approved for any life safety application.

Accuracy Summary

- **100 metres**: Accuracy of the original GPS system, which was subject to accuracy degradation under the government-imposed Selective Availability (SA) program.
- **15 metres**: Typical GPS position accuracy without SA.
- **3-5 metres**: Typical differential GPS (DGPS) position accuracy.
- **< 3 metres**: Typical WAAS position accuracy.
- **<1 metre**: Typical future LAAS position accuracy.

THE FUTURE

Spectrum coordination between GPS systems and other satellite-based communications providers is negotiated on an international basis by national representation to the World Radiocommunication Conference sponsored by ITU.

The provision of two new civilian or commercial-use signals, over and above the one available today is central to the upgrade of the Navstar GPS system. The Block IIF satellites will transmit a civilian code at L2, in addition to the one at L1. The third civilian signal will be added at a yet unspecified frequency.

The Europeans are planning to launch their own GPS system called Galileo. A 21-satellite system yet to be defined but likely built off the Russian Glonass system. This system will use the L5 band centred at 1176.45 MHz, which will create a possible interference with the Navstar system. The Galileo satellite radio-navigation system, to be launched by 15 EU members, enables any individual to determine his or her position or the location of any moving or stationary object to within one metre, using only a small cheap individual receiver. Galileo will be run by civilian bodies. Nevertheless, other than frequency co-ordination issues, the American and European systems will be co probable.

APPLICATIONS

GPS systems are used in a variety of applications. Here we list some of them:

- Maritime navigation.
- Aeronautical navigation and air traffic control: landing and take off positioning control for planes.
- Terrestrial navigation: location of vehicles. Mapping.
- Car Insurance Industry: measurement of Km driven, time of trip, theft-risk areas, etc, the insurance company charges based on driving habits.
- Cellular Phones and Personal Digital Assistants: for soft handoff procedures.
- Vehicular progress, tracking and guidance. (911-Emergency Medical Services: Paramedics and call location coordination).
- Real time land surveying and grading: bulldozer-mounted GPS system controlled by computer and land survey plans in CAD format.

PROCUREMENT OF GROUND-BASED MOBILE GPS SYSTEMS

The flexibility of the existing hand-held and mobile systems in the market in relation to future upgrades is diverse. Today, receivers with straight GPS, DGPS and WAAS augmentation capabilities, which satisfies most applications are applicable. The use of either one of these augmentation services will depend on their availability. In the case of DGPS, the service needs to be offered in the geographic area of interest through a network of RF beacons. On the other hand, the American WAAS augmentation system is already available throughout North America.

Most of the receivers have PC connection capabilities, which allows for data downloads and uploads.

It is expected that in the future there will be multi-system and multi-frequency receivers capable of receiving in any of the available GPS systems (Navstar, Galileo etc.). The assignment of new frequencies is still in the consulting stages, but once resolved, it will add more versatility and application capabilities to this technology. Procurement may want to consider receivers are capable of operating off of various GPS platforms and operating frequencies.

APPENDIX B2

RIDE SHARING PROGRAM DESCRIPTIONS – CANADA

Whistler, British Columbia

The Whistler Way! Rideshare Program is a partnership between the municipality, BC Transit and the Jack Bell Foundation (JBF Rideshare).

JBF Rideshare, a non-profit contracted service, is the company that has been hired to administer the program. BC Transit is the Provincial Crown Corporation that administers public transit in Victoria and all municipalities outside of the Greater Vancouver Regional District. BC Transit pays all administration costs, while passengers cover the operation costs through fairs.

The Whistler Way! Rideshare program is functioning well for the most part. The formal ridesharing through the JBF Rideshare Program is offered between Squamish - Whistler and Pemberton-Whistler. The most common users of the program are permanent and seasonal residents and employees, especially young people who don't own their own vehicles. Whistler is a tough market to have ridesharing due to the seasonality of jobs and the shift work involved in running a destination resort. Workers seem to require more flexibility than is available through a ridesharing program.

Various companies around town have informal ridesharing happening. For example the Resort Municipality of Whistler (RMOR) offers reserved parking spots to commuters that have registered internally as 3+carpools. They also have a lot of staff from Squamish and Pemberton that are 2 person carpools. They do not get preferred parking in the free lots.

RMOR does not have pay parking in its staff lots or in its village day parking lots. In Whistler, it is difficult to maintain rideshare participants. People wishing to use the service must register with the program through the website or by calling a toll-free phone number. They sign up for various time periods, often a membership with a flat fee for one month of ridesharing with unlimited use.

For the most part, riders must register their requests for pickups in advance so that the program managers can plan the route for each day. However there are some people who use the service in a method similar to conventional taxi services.

The RMOW puts ads in the local paper and puts ads on the local radio station periodically to promote ridesharing. Registration and information can also be accessed through the website. In September, they have a 2-week long community wide commuter challenge where all the commuting options are promoted.

JBF Rideshare also has brochures and has done presentations to various businesses around town. There are signs with a 1-800 number along the highway between Squamish and Whistler.

Carpooling is more successful between Squamish and Vancouver (that part of the program is also administered by JBF Rideshare). The most frequent users of the program are commuters who work for businesses with stable year round employees with jobs that have the same hours winter, spring, summer and fall regardless of how many tourists are in town.

The most common trips, between Squamish and Whistler (a 65 - 75 km one way route) takes approximately 45 - 60 minutes to drive. Pemberton to Whistler is approximately 32 km one way usually taking 20 - 30 minute drive.

Most trips occur from7 - 8 am and 3 - 6 pm. However many workers have different working hours resulting in regular use of the service throughout the day.

The typical origin of the program is Squamish. The most common destination is Whistler Village/Benchlands.

University of Toronto – Mississauga

The University of Toronto (UTM) in Mississauga has a carpooling and ridesharing program on campus with parking vouchers for those who participate. Students are the vast majority of participants. Only two carpool permits have been sold to staff.

Participants do all the ridematching themselves using carpooltool.com, a Canadian website devoted to organizing carpooling and ride sharing. UTM decided to go with carpooltool.com because they could make their own title page for the website.

Potential rideshare/carpoolers sign up at the university's parking office to arrange for permit sharing and permit purchase. Permit sharing involves two vehicles travelling on different days to share the same parking permit number. University officials explain the rules of the carpool to each group and compliance is closely monitored to ensure that there is a minimum of two people per car. Participants make arrangements themselves for any additional compensation for drivers.

Most participants signed up for the ridesharing and carpooling with someone in mind, as opposed to actually searching for someone else to ride with. UTM reports that there is not much matching taking place through carpooltool. Students originally thought that by signing up, UTM would find them a match, however UTM only provides the contact mechanism.

Students like the program because it guarantees them a parking spot, either in the general lot, or the prime spots next to the buildings, depending on paid parking options. Parking spaces are not oversold, and currently 60 percent of available carpool spots have been sold. UTM also initiated an "Emergency Ride Home" in the case that some of the people that carpooled in the morning found themselves without a drive in the evening. There have been no instances of anyone needing an "Emergency Ride Home".

This was the first year for the program, and UTM sold more carpool passes than they thought they would. They believe it was successful. Out of 8000 undergraduates, there are 150 participants in the program.

McMaster University – Hamilton, Ontario

The Alternative Commuting & Transportation Office at McMaster University operates a rideshare program for its 25,000 students, staff, and faculty. McMaster's ACT Office is responsible for the marketing and communications aspects of the carpooling and ridesharing programs, while McMaster's Parking & Transit Services is responsible for operations (enforcement of program and issuing permits). The responsibility for policy development is share between the two groups. Rideshare enrolment is made up of 70% students and 30% staff/faculty and rides typically takes place during the daytime hours, with a couple of evening carpool permits being issued.

McMaster differentiates between "ridesharing" and "carpooling". Carpoolers have to register with Parking & Transit Services, and there are certain responsibilities they have and rewards they get for carpooling. Alternatively, ridesharing is an informal arrangement and, while the University helps ridesharers get connected, they do not register them.

The rideshare program is marketed using posters around campus, flyers, mail-outs to parking permit holders, prizes (ex. an all-inclusive lunch for four at a local restaurant), promotion at events (ex. university recruitment events, first-year student orientation, Welcome Week, Off-Campus living fair), the ACT web site, and incentives ($15 in free gas and $10 taxi). The primary motives for participating in the program are the cost savings (fuel, vehicle wear, parking permit, etc.) and priority prime parking spaces made available to carpoolers. The cost of parking is split between all members of carpool, whereas the costs for fuel, wear-and-tear are informally negotiated by members of the carpool.

There are several ways passengers and drivers can be matched. Users can find their own rideshare matches by finding people with corresponding schedules through their faculties and classes and through the website www.carpool.ca, which is available to students at the university. Also, the ACT Office uses a postal code-based software to manually match participants.

York University – Black Creek Transit Management Association

This is a web-based program using carpool.ca, where individuals themselves organize their transportation, and BCTMA provides the mechanism. It has been operating since 2001. People can include their name, phone #, email, and contact others to arrange their travel. Drivers are not compensated, and all costs are shared between carpoolers. The incentives include reduced parking costs (as costs are shared between carpoolers), and registered carpoolers can receive 4-6 free parking vouchers in case they cannot use the carpool one day. There is no preferential carpool parking at York yet, but they are looking at it.

Students and staff tend to be the most frequent users of system; faculty does not use it. There are around 620 registered carpoolers, and 420 seeking matches, but there are probably more people, as some may carpool without registering. It is considered a successful program as many people indicate that they would not know how to address their transportation needs without this program. Staff are eligible to use the Emergency Ride Home in case they cannot meet up with their carpool in the evening, and people appreciate that resource. On average, 5-10% of registered users of ERH use it. Students are ineligible for the ERH.

APPENDIX B3

RIDE SHARING PROGRAM DESCRIPTIONS – USA

Los Angeles Smart Traveler Automated Ridematching Service

On June 30, 1994 the Los Angeles Smart Traveler was incorporated into the I-800-COMMUTE service of the local ridesharing agency as a field test of ITS technology. The Smart Traveler project offered traffic, transit and ridematching information using multi-media kiosks, touch-tone telephones, and PC modem links.

The Smart Traveler project included an automated ridematching service (ARMS). This feature allowed individuals already registered with the ridesharing agency to use their touch-tone phone to find rideshare partners quickly and effectively. It was designed to provide individuals with lists of potential compatible rideshare partners for either regular carpooling or an occasional emergency ride home. For the purposes of finding either regular rideshare partners or a once only ride, participants entered changes in their regular travel times using the touch tone phone and received a computer generated list of people to contact who lived and worked near them with similar schedules. The individual could then choose to call some or all of the people on the list, or record a message that Smart Traveler automatically delivered to potential carpool partners. Potential partners could then call the individual back if they were interested in sharing a ride. This automated call-up feature was a unique aspect of the service. Other new features included one-day only service and 24 hr/day availability. The ability to record messages, which the computer then dials, and leaves with the potential rideshare match was intended to help speed responses.

The existing rideshare agency was estimated to have 600,000 records in its ridematch database. The population of the Los Angeles region at the time was in excess of 10 million people. ARMS was initiated offering service to a subset of 68,000 registrants from the rideshare database. Potential users received a one-page letter describing the service and an identification number.

Golob and Giuliano evaluated the Los Angeles Smart Traveler Automated Ridematching Service (ARMS) in 1996. The service was not very successful for a number of reasons including technology problems, insufficient marketing of the service, a lack of demand, and too broad a scope for the field test.

The system did not function correctly throughout the life of the evaluation. Problems with the technology included:

- Automated messaging feature was inoperable for some periods;
- Automated reports identifying problems were not available soon enough;
- Errors in the reports made it difficult to evaluate functional problems.

User surveys revealed that:

- Offering “instant” ridesharing for single occasions lacks support if the parties do not know each other.
- Registrants in the ridesharing database indicated that the need to make alternative travel arrangements for their regular commute is a rare event. When they cannot use the normal mode of travel, the majority have alternatives available at home or work and did not require the service offered by ARMS.
- None of the commuters who used ARMS were seeking a one-time ride. The system was used as another way to find regular carpool partners.

Golob and Guiliano concluded that:

- There was no significant demand by registrants in the existing rideshare database for a flexible rideshare service such as ARMS.

- People are not inclined to give rides to or take rides from people they do not know. Systems like ARMS would be a last resort.

- Technically complex systems require careful development and monitoring.

- The users did not understand the services provided. Callers used ARMS primarily to find new partners for a regular carpool rather than to arrange one-time trips.

Recommendations by Giuliano, Hall and Golob (1995)

- Demonstrations ought to be not larger than is necessary to adequately test a product or concept. Large scale demonstrations add a management and organizational burden that should be avoided if possible.

- Summary data requirements should be identified in the project planning phase.

Seattle Smart Traveler

The Texas Transportation Institute completed an assessment of the Seattle Smart Traveler system in 1999. Their findings are summarized in this section.

The University of Washington in Seattle successfully developed and operated a dynamic ridematching system between 1995 and 1997 using the Internet and e-mail. The system was designed to match drivers and passengers for both traditional and dynamic ridesharing. Users accessed the website using identification numbers or passwords, completed an application form on-line which included their phone number and e-mail address, and requested a trip. Three types of potential matches could be requested: regular commute trips, additional regular trips, and occasional trips. The system was designed to be user friendly by developing pull-down menus of potential origins and destinations. Chances of a match were increased by requesting a time range for departures and arrivals. The system identified potential matches and automatically generated and sent and e-mail of phone numbers to the user. Making the actual connection between potential partners was left up to the users.

The Smart Traveler System was marketed to students, faculty and the staff of the University in coordination with the transit and regional rideshare programs. The University of Washington is the largest employer in the city of Seattle and has a student base of approximately 39,000. Promotional methods included printed materials, insulated mugs, the web page and e-mail. Approximately 400 individuals registered in the system over the 15-month demonstration. The largest number of participants at one time was 200 because the system was updated quarterly. Total projects costs were approximately $250,000 which was similar to the costs for developing a new rideshare computer system for the Houston area. Results and conclusions from the project are summarized below.

- The system operated for 15 months without any major technical problems. Maintenance and operation were simplified by the self-contained nature of the project.
- Approximately 700 matches were requested; 150 matches were made, and 41 carpools (6 percent of the requests) were actually formed. This is comparable to results for traditional rideshare programs.
- Over 90 percent of the trips registered were traditional commute trips and were on average less than 30 km (20 miles). The remaining trips were identified as recurring, non-commute trips or dynamic trips.
- Twenty percent of the use occurred outside the normal business day (8:00 am to 5:00 pm). The commute trips were generally concentrated during the morning (7-9am) and evening (4-6pm).
- The majority of users were faculty and staff (68 %). The remaining 32 percent was comprised of students.
- The system appeared to have reached a new group of potential rideshare participants because there was only a 20 percent overlap with the Metro rideshare program. This was partially attributed to the use of new technologies.

Several issues that may have limited the use of the system were also identified.

- The project may have been implemented a little before the real boom in Internet use.
- The technology available at the time for the dynamic ridematching was cumbersome. For example, the number of screens required to register and request a match could be greatly reduced given current technology.

- The project may have been viewed by potential users as too temporary or experimental.
- Other incentives may be needed to encourage greater ridesharing. These may include HOV facilities and parking incentives.
- A significant limitation continues to be concerns about sharing rides with strangers.

The authors concluded that additional tests of dynamic ridesharing services should be considered at other universities, single large employers, or major employment centers.

Redmond, Washington

The city of Redmond, Washington has established an automated ridematching system that can be used by individuals seeking a single ride. Redmond is the seventh most populous city in King County and the fifteenth most populous city in the State of Washington, with a residential population of over 46,000. It encompasses an area of over 16.6 square miles and is located less than 20 miles east of downtown Seattle at the north end of Lake Sammamish. The city is well known as a center of technology and the location for a number of nationally known high-tech and biomedical companies. Among these are Microsoft, Nintendo, AT&T Wireless, and Medtronic Physio-Control.

The Greater Redmond Transportation Management Association (GRTMA) has instituted an automated ridematching service for carpools and vanpools on the Internet that can also be used by individuals seeking a single ride. It is an employer and map-based system. Anyone in King, Snohomish, Pierce, Kitsap, and Island counties can register for the program. Individuals register themselves, providing an e-mail address, password, and their home address or a nearby intersection. A map appears with the location indicated for verification by the registrant. The registrant's trip schedule then is entered and the user has the ability to indicate preferences such as whether they wish to drive or ride, ride with smokers or non-smokers, or ride with employees of specific companies (only for employees of TMA member companies). A map showing the requestor's location and the location of potential matches are displayed on the screen (Figure 5-2) together with their names and methods of contacting them. E-mails can be automatically sent to any of the persons on the list.

Individuals can change their information at any time or remove themselves from the system if they have found satisfactory ridesharing arrangements, moved, changed jobs, etc. Every three months, e-mails are automatically sent to all registrants asking for their continued interest in participation. Non-respondents are automatically removed along with those responding in the negative.

The system was essentially designed by the end users (company employees) who indicated the features they wanted in a rideshare program. A contract was signed with Puget Sound Systems Group in November 1998 to develop the rideshare software. An early version of the system was tested in April 1999. Map Objects is the geographic information system (GIS). The database is accessed by SQL Server. Cost to date has been $278,000. GRTMA owns the system and has licensed Puget Sound Systems Group to sell the system to other agencies. It is anticipated that the purchase price will be about $50,000 to $100,000.

With the system residing on the Internet, the GRTMA has no involvement in day-to-day operations and virtually no system maintenance is required. A GRTMA staff person spends a small amount of time monitoring the Web site. The host computer (a PC server with a Windows NT operating system) is located at City of Redmond offices. GRTMA gets a system-generated report on utilization once a week. GRTMA is looking to add features such as bus schedules and fares. The rideshare database currently contains about 1,200 registrants. There are no statistics available on carpool formation yet. An employer survey on commuting is required annually by the State of Washington. This survey, to be conducted in Spring 2000, will allow a comparison with the previous year and provide information on the change in carpool and vanpool use. Initial indications are that there is not much call for one-time rides. (Casey et al, 2000)

Since the FTA report in 2000, the transit agencies in Redmond have used the ridesharing system to create what is now called RideshareOnline.com. Participants register and receive instant feedback of potential carpool/vanpool partners they can contact. A generic email is already created to help get them started. They can also customize this email or call the other person directly if they provided a contact phone number.

GRTMA has a variety of promotions throughout the year to encourage people to register in RideshareOnline. In a campaign planned for this year, participants are eligible to win many prizes including a trip to Hawaii. The first 50 people each week who register or update their current data in the program, receive a 12-oz Starbucks Coffee beverage free and their name is entered into the drawing. Posters, post cards, email and the web site are used to promote the program.

People are matched based on their origin address and final destination with a numbering system of the best match to less potential match.

A vanpool driver doesn't have to pay the monthly vanpool fare since they are the driver. They also receive up to 40 personal use miles on the van and if they want to use more, they pay a .34 per mile fee. Everyone in the vanpool is part of a guaranteed ride home program so they do not get stuck. There are also backup vanpool drivers in case the main driver takes vacation, sick, etc. Each van is also required to have a bookkeeper that can also be the driver. Drivers and bookkeepers are required to take a 4 hour class before the van is released to the group and there is a background check for tickets, etc.

Since most of the commuters travel between 6 & 9am in the morning and 3:30 - 6pm, that is the main times for trips. Most vanpools are coming from the suburbs between 6 and 9 am and 3:30 and 6 pm with an average of 10 miles one way.

Missoula, Montana

Missoula, Montana is a city of about 75,000 residents and home to the University of Montana. There are many communities within a 30 to 50 mile radius from the city that are more economical to live in and offer a rural setting that people like, however, residents need to commute long distances to go to work or school in the city center.

The Missoula Ravilla Transportation Management Association (MR TMA) operates a ridesharing program in a region 135 miles long by 90 miles wide which is typically used by middleclass workers looking for rides to and from their jobsite. The rideshare program, in operation since 1997, how has over 300 names in the carpool database, more than double the number from two years ago. Close to 30 regular carpools have been formed. MR TMA typically receives three to five rideshare requests per week, on to two of those are for one-time rides. The MR TMA also offers a subscription commuter vanpool program, the only one in the state, which currently has 7 routes and 95 users. They have not concentrated a great deal of their efforts within the city since there is a good local bus service.

The rideshare program is marketed in several ways. A local group in Missoula called Missoula In Motion, promotes the rideshare/carpool program through their employer outreach coordinator. They have displays and brochures made available at various employment sights and other groups within the city. The financial incentive and environmental benefits are the main reasons users are motivated to participate in the program.

Passengers and drivers are matched after each individual completes a Rideshare Application. User information is entered into a database, which was created specifically for matching riders based on zones set up within the city and the outlying areas. A computer program, called GeoMatch, matches users based on where each lives and works. Most of the ridematching software is very expensive and requires a full time person to keep up-to-date. The current version of this software costs approximately $5,000.

The MR TMA currently has an individual who responds to the requests and keeps the data updated. Rideshare matches are normally requested and provided by telephone (mail or fax can also be used) and replies are generally made within 48 hours. Matchlists usually take about four minutes to generate and they are sent to the individuals with a tip sheet on how to set up carpools. A great deal of work is involved in developing the database so there is enough data to provide good match situations. Mr TMA pays $600 for annual maintenance, technical support and software upgrades. Reports are generated afterwards that tell how many carpools and individuals use this program, plus how many miles and emissions are saved.

The financial arrangement of each carpool is set up within each user group. Generally, they share the driving responsibilities and no money is exchanged, however, if one user doesn't drive then they would typically pay the driver a share of the gas money.

The University of Montana and two local hospitals also have ridematching databases. The MR TMA is currently looking into a more elaborate ridematching program which would combine all of these into one and it would allow an individual to find matching rides on their own. If they expand the program it would eventually be available statewide.

APPENDIX B4

RIDE SHARING PROGRAM DESCRIPTIONS - UNITED KINGDOM

Liftshare

Liftshare was founded in 1997 as the largest agency that provides a national car-sharing service in the United Kingdom. Services are available to anyone who travels in the UK including institutions such as schools and hospitals, business centers, sporting events, and various levels of government ranging from villages and parishes to countries.

Once one has registered his/her journey and submitted the information on line, liftshare will search the database for possible matches and give the person the detailed of other people going the same way. Then the person can contact any one via e-mail. It is free to cancel the membership. Another way of getting service is group service. Group could be defined by geography (village, town, city, country or region), function (company, school, university or hospital), location (business park or industrial estate), or activity, etc. There are three types of services for groups, public groups, private groups (has restricted access) and branded car-sharing schemes. Branded car-sharing schemes are designed by Liftshare to help people with their own car-sharing scheme that can be accessed via their intranet or website. Branded car-sharing schemes are fully automated administration, which have the abilities to enter multiple row of data, amend membership and user details, analyze data to identify unmet transport needs, analyze location data and upload into Geo-coder for cluster and route mapping, add and integrate information regarding local public transport services, etc.

It is free to search for drivers or passengers. The financial benefits for passengers and drivers are obvious. The average cost of fuel is 10p per mile and Liftshare recommends that each passenger pay 5p per mile. Therefore, a driver, who takes one passenger, will halve the fuel costs, two passengers will cover the fuel costs and 3 passengers will make the driver gotten some repays of running the car.

Liftshare is not responsible for any journeys that do not wok out as planned. The drivers and passengers who register their journeys are under no legal obligation to their traveling companions or to liftshare to make any journeys.

Middlesex University Car Sharing Scheme (http://www.mdx.ac.uk/24-7/liftshare/index.htm)

The Middlesex University has subscribed this program to Liftshare. Through the scheme, students and staff can find or offer a lift for journeys to and from the university and between campuses. The scheme can be used for individual journeys and it is not necessary to commit oneself to everyday of the week. Also, it can be used for private journeys, e.g. a lift home for the weekend. This scheme could help everyone to share journeys to and from University, save money for individuals, less traffic on roads, and improve environment. Anyone who wants to take car sharing through the scheme just need to register their details and the journey that he/she wish to share, then detailed information about possible liftshare contacts will be mailed to them through e-mail.

Drift Logistics Park Car Share (http://www.dirft.com/tenants_car.asp)

Drift Logistics Park was conceived as a major distribution and manufacturing development in the late 1980s and early 1990s. Drift Logistics Park is located within 4 miles of the M1/M6/A14 interchange at the heart of the UK. The interchange links Birmingham and the north west of the UK, Felixstowe (one of the largest deep sea ports), and London in the south and Newcastle in the north. As a part of the national liftshare scheme, the Drift car-share scheme has been set up to help all the onsite employees find others traveling the same way as them, and they can share a car and the costs. The scheme is free. Once one registered and entered the journey details, a list of potential matches will be displayed. Drivers and passengers are linked together online. One has no obligation to share with the same person every day but the system will show the options. Also, users can find people to go for other events, such as football match, weekends, and the airport. Besides the social and environmental benefits, it was estimated that sharing a car to work everyday can save the average commuter about 1,000 pounds per year.

The University of Sheffield Car Share Scheme (http://portland.shef.ac.uk/carshare/)

As a part of Intergrated Transport Policy, which commits to a sustainable and healthy environment, the University's Transport Policy Group initiates this scheme in order to promote car sharing within the University of Sheffield. Car sharing has been proven to be an effective way of reducing peak hour congestion and car parking problems in the University.

It was found that single occupant drivers make around 40% of journeys to the University before the introduction of car sharing. Benefits of car sharing are the following:

- Help to reduce air borne pollutants such as lead and other heavy metals;
- Free additional road space and help reduce congestion and the need for more car parking spaces;
- Save money - travelling with others enables to reduce transport costs by up to £1,000 a year;
- Reduce the stresses of peak hour travel either by not having to drive or by having company to talk with; and
- Meet new people from the University or your locality.

The driver will be considered as a car-sharing driver when he/she completes the parking application form and indicates to be a car-sharing driver. To be a car-sharing passenger, one just need to register online in University related website.

The car-sharing scheme is flexible. Driver and passengers are registered online, the drivers can search for passenger, share cars with others, and update their records online; the passengers can search for drivers, leave their own details so that drivers can contact them, and update their records.

By taking part in the scheme, one need not be committing himself to car sharing permanently and can agree to drop out any time. A driver can charge the passengers as long as the driver does not make a profit from the charge. The charge should be divided equally between the numbers of people in the car, including the driver. The drivers are under no obligation to continue to share with anyone who is not compatible.

There is also a special service — "Emergency Ride Home for Passengers". If the driver that a certain passenger rely on has to leave early or rush home unexpectedly during a working day, the registered car share passenger may take a taxi to home or local destination, obtain the receipt for the fare, and reclaim it later at the administer office. However, the passenger may be stranded because the driver who left in an emergency may also reclaim the cost of public transport and/or taxi used to return home.

Appendix C

Mid-Point Interim Report
(December 2004)

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1. INTRODUCTION

The Ride Points System (RPS) is an innovative concept that leverages technological advancements and the popularity of customer rewards to develop and operate a ride-sharing program. The benefits of a successful ride-sharing program are obvious; an increase in vehicle occupancy decreases the number of vehicles on the road, and thereby positively impacts traffic congestion and GHG emissions.

The purpose of this R&D project is to research the technical and financial aspects, as well as the social preferences, relating to the viability of the RPS. The final product of this project is to undertake a preliminary business analysis for the deployment of an RPS and to identify the next steps to lead to such a deployment.

1.1 Review

The first step in this R&D effort was the Literature Review, which investigated the following:

- *Technology assessment* – cellular communications and locationing technologies.
- *Ride-sharing programs* – environmental scan of the current programs in Canada, the U.S., and internationally.
- *Loyalty programs* – environmental scan of current reward programs in Canada and a review the pros/cons of establishing RPS' own reward program.

The report concluded with a summary of the results, which identified a number of short- and long-term refinements to the original concept for the RPS, including:

- *Time-to-match* – although short-notice dynamic matching is the ultimate goal of the RPS, initial deployments may use longer lead times to ensure sufficient matches. Thus there is no requirement for GPS or other locationing technology in an initial RPS deployment.
- *User interaction* – to maximize potential users, RPS must support access media in addition to cellular phones, including internet, PDA/Blackberry and tradition landline telephones.
- *Passenger pick-up* – initial RPS deployments will likely limit passenger/driver meeting places to designated 'hot-spot' locations, with a move toward fully flexible meet locations with more widespread access to locationing technologies and greater number of RPS users.

1.2 Purpose of this Report

The final Workplan and Methodology Report identified the tasks for this interim report:

- **Demand Analysis** – determine the likelihood of user buy-in to the RPS concept and identify key features and minimal levels of service for a successful program.
- **Concept Design** – build on the initial RPS concept and the results of the literature review to develop functional requirements and a system architecture for the RPS.

- **Marketing Review** – examine promotional aspects of existing successful and unsuccessful ride-matching programs.

Due to a number of delays in arranging the focus groups for the demand analysis, that task has been shifted to be part of the final report deliverables. A benefit of this shift is that a clearly defined concept design is developed as part of this phase of the project, and can be presented and suitably discussed with potential users to assess the true demand for an RPS program.

Based on this adjustment in tasks, this interim report includes the results of the Concept Design (Sections 2) and Marketing Review (Section 2.4) tasks.

As part of the preparation of this report, the RPS Team commissioned an Ontario lawyer to draft an opinion on legal issues relating to the overall RPS concept. This opinion (see **Appendix C1**) addressed aspects of insurance and personal security and is summarized in Section 4. The remaining steps in this project and a discussion of how to proceed is included in Section 5.

2. CONCEPT DESIGN

The ITS Architecture for Canada, as well as the U.S. National ITS Architecture and its supporting documentation, were developed to meet a comprehensive list of user requirements for a broad range of ITS services, including ride-matching. As such, the following sub-sections draw on the ITS Architecture for Canada as a resource to refine the concept for RPS.

2.1 Functional Requirements

The definition of functional requirements for the RPS begins with identifying relevant User Services and User Sub-Services of the ITS Architecture for Canada. User Services document what ITS should do from the user's perspective, and User Sub-Services provide a more focused context and refined definition. The concept of User Services and Sub-Services assists in defining project objectives by establishing the high level services that will be provided to address identified problems and needs.

Table C1 provides a summary of the User Services and Sub-Services identified as relevant to the RPS concept.

Table C1: Relevant User Services and User Sub Services

User Service / Sub-Service	Description
1.1 Traveller Information	The Traveller Information user service provides travellers with information prior to their departure to assist them in making mode choices travel time estimates and route decisions. The sub-services of the Traveller Information user service address four major functions which are: (1) Available Services Information (2) Current Situation Information (3) Trip Planning Service and (4) User Access. Information is integrated from various transportation modes and other information sources and is presented to the user for decision making.

User Service / Sub-Service	Description
1.1.2 Interactive Traveller Information	Provides tailored information in response to a traveller request. Both real-time interactive request/response systems and information systems are supported, which "push" a tailored stream of information to the traveller based on a submitted profile. The traveller can obtain current information regarding traffic conditions, road and weather conditions, transit services, ride share/ride match, parking management, and pricing information. A range of two-way wide-area wireless and wireline communications systems may be used to support the required digital communications between traveller and the information service provider. A variety of interactive devices may be used by the traveller to access information prior to a trip or en-route to include phone, kiosk, Personal Digital Assistant, personal computer, and a variety of in-vehicle devices. Successful deployment of this user sub-service relies on availability of real-time transportation data from roadway instrumentation, probe vehicles, parking managers, transit providers, or other means.
1.1.3 Real-Time Ridesharing Information	Enhances the Interactive Traveller Information sub-service 1.1.2 by adding an infrastructure to provide travellers with dynamic information regarding potential ridesharing opportunities.
1.3 Ride Matching and Reservation	The Ride Matching and Reservation user service expands the market for carpools and vanpools by providing real-time ride-matching information along with reservations and vehicle assignments. The sub-services of Ride Matching and Reservation provide the following functionality: (1) Rider Request (2) Transportation Provider Services and (3) Information Processing. This will also include a billing service to the providers.
1.3.1 Ride Matching	Provides user with a pre-planned, non-real time, ride matching capability.
1.3.2 Real-Time Ride Matching	Enhances the Interactive Traveller Information sub-service by adding functionality to provide dynamic ridesharing/ride matching capability.
4.1 Electronic Payment Services	The Electronic Payment Services user service allows travellers to pay for transportation services by electronic means. Between the four sub-services of the Electronic Payment user services the following functionality is provided: (1) Electronic Toll Collection, (2) Electronic Fare Collection, (3) Electronic Parking Payment, and (4) Electronic Payment Services Integration. It may, as envisioned, also serve broad non-transportation functions and may be integrated with credit and debit cards in banking and other financial transactions.

User Service / Sub-Service	Description
4.1.4 Traveller Services Payment	Enhances the Interactive Traveller Information user sub-service by making infrastructure provided business directory and reservation services available to the user. The same basic user equipment is included. This user sub-service provides multiple ways for accessing information either while en-route in a vehicle using wide-area wireless communications or pre-trip via wireline connections.

For each User Sub-Service, the ITS Architecture defines a number of hierarchical requirements to provide the ITS service. The ITS Architecture for Canada was developed to provide a common framework to guide ITS deployments that are interoperable, but is not intended to be technology or implementation-specific. As such, User Service Requirements are applicable to different system designs and encompass a broad range of possibilities. The User Service Requirements defined for the services listed in **Table C1** have been reviewed to identify high-level functional requirements applicable to the RPS. The following provides a summary of these requirements:

- RPS shall provide users information on accessing ride-matching services.
- RPS shall provide the capability for users to access the system from multiple distributed locations.
- RPS shall provide the capability for users to access the system over multiple types of electronic media (cell phone, internet, PDA, etc.).
- Passenger Request shall provide a user the capability to request a specific itinerary by specifying but not be limited to the following:
    - Date/time of pick-up.
    - Origin
    - Destination
    - Specific restrictions or preferences.
- Driver Offer shall provide a user the capability to offer a specific itinerary by specifying but not be limited to the following:
    - Date/time of pick-up.
    - Origin
    - Destination
    - Specific restrictions or preferences.
- RPS shall include a Ride Matching function that will, based on current passenger requests and driver offers (including restrictions/preferences), provide users with the available ridesharing options.
- RPS shall also include the capability to perform Ride Matching in real time.
- RPS shall include an Electronic Payment Service feature.

- RPS shall provide a clearinghouse capability for reward points financial transactions.
- RPS shall include the capability for providers to have their billing (relating to reward point credits/debits) arranged through a central clearinghouse.
- RPS shall include electronic safeguards against fraud and abuse.
- RPS shall automatically generate needed reports and financial documentation.
- RPS user account information shall be accessible over the internet.
- RPS shall provide the capability to gather that market information needed to assist in the planning of service improvements.
- RPS shall provide the capability to gather that market information needed to assist in maintenance of operations.

2.2 System Architecture

The ITS Architecture for Canada provides a unified framework for integration to guide the co-ordinated deployment of ITS programs within the public and private sectors. It offers a starting point from which stakeholders can work together to achieve compatibility among ITS elements to ensure unified ITS deployment for a given region. It is for this reason that it is important that the architecture defined for the RPS be based on, and remain compliant with, the ITS Architecture for Canada.

The ITS Architecture for Canada is based on a group of User Services that define the functionality of ITS components and the information flows among ITS elements to achieve total system goals. The User Services are hierarchically organized into User Service Bundles, User Services, User Sub-Services, and User Service Requirements. Section 2.1 used the relevant User Services to define the high level functional requirements for this project.

The ITS Architecture for Canada includes separate Logical and Physical Architectures. The Logical Architecture defines processes and data flows between processes required to support the User Services defined for the ITS Architecture for Canada. The Physical Architecture provides a physical representation (though not a detailed design) of the important interfaces, in the form of Architecture Flows. It also identifies major system components, in the form of Subsystems and Terminators. The Physical Architecture provides a high-level structure around the processes and data flows defined in the Logical Architecture.

For the purpose of RPS, the architecture developed in the following sub-sections provide the Physical point of view (e.g. equipment, entities, and information flows). The physical elements that are identified provide linkages to Logical elements (processes and low-level data flows) that are required for detailed design. Using the ITS Architecture for Canada as a reference, relevant Process Specifications can be identified for each Subsystem, as well as relevant Data Flows for each Architecture Flow. As part of the physical view presented here, high-level functions/processes have been identified for key physical entities.

As discussed in Section 1.1, due to the current market penetration of GPS technology, and to ensure greater participation in the short term, the concept for the RPS has been expanded as to not focus on locationing technology for real time matching. However, supporting architectures for GPS solutions (e.g. AGPS equipped cellular phones, PDAs, etc.) has also been developed and can be found in **Appendix C2**.

2.2.1 PROCESS

As part of the development of the ITS Architecture for Canada, Market Packages were defined for specific ITS services (at a similar level as User Sub-Services), and provide an accessible, deployment oriented perspective to the architecture. They are tailored to fit, separately or in combination, real world transportation problems and needs. Market Packages group physical elements into focused implementation oriented views. Physical elements include entities (Subsystems and Terminators) and Architecture Flows. Subsystems represent the agencies, systems, and equipment that perform ITS functions. Terminators define the boundary of ITS, and represent the people, systems, and general environment that interface to ITS. Architecture Flows are the exchanges of information between physical entities.

Market Package Diagrams illustrate the physical elements (systems and communication links) in a easy to understand presentation of the ITS service. **Figure C1** illustrates an example of a Market Package Diagram for the Ride Matching Market Package.

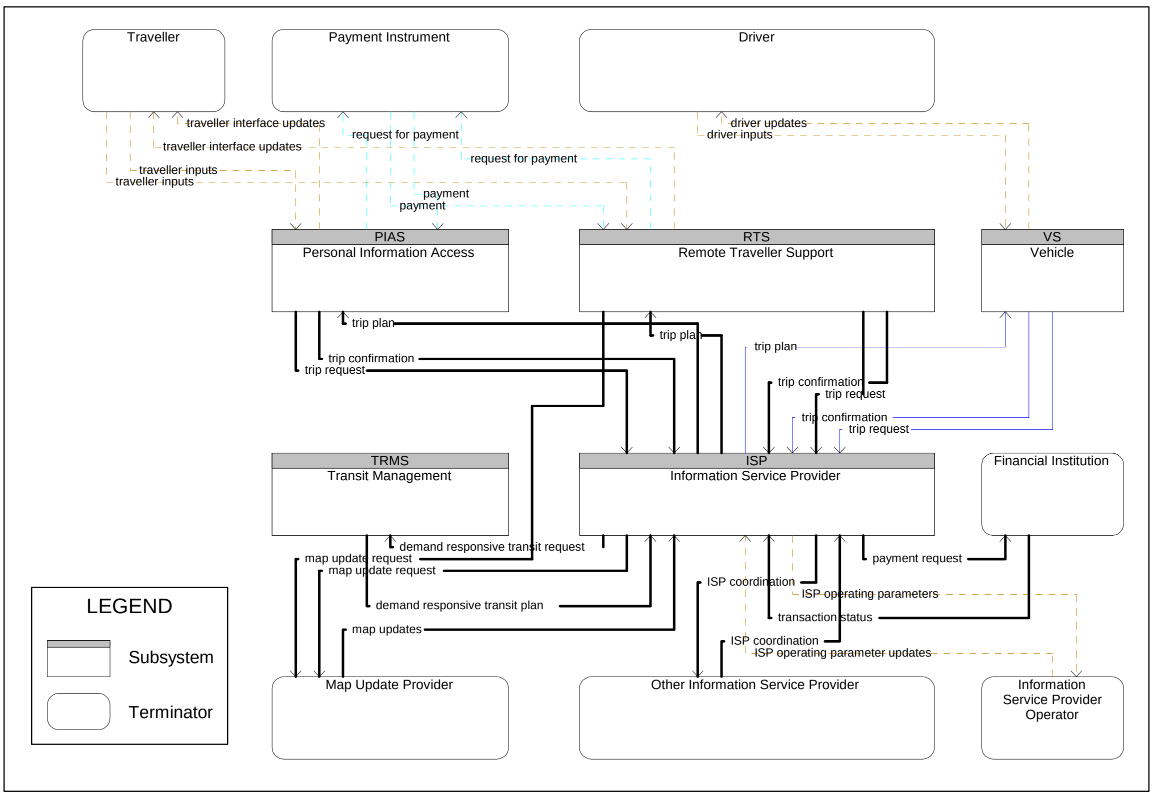

Figure C1: Market Package Diagram for Ride Matching

In general, Market Packages map to one or more User Sub-Service. **Table C2** illustrates the relevant Market Packages for RPS based on the User Sub-Services identified in Section 2.1.

Table C2: Relevant Market Packages

User Sub-Service	Market Package
1.1.2 Interactive Traveller Information	ATIS2 Interactive Traveller Information
1.1.3 Real-Time Ridesharing Information	ATIS8 Ride Matching
1.3.1 Ride Matching	
1.3.2 Real-Time Ride Matching	
4.1.4 Traveller Services Payment	ATIS7 Traveller Services Payment and Reservation

Based on the concept refinements identified in the Literature Review Report and the functional requirements defined in Section 2.1, the relevant Market Package Diagrams can be customized to provide an RPS perspective. This customization includes:

- removing unnecessary entities and information flows
- identifying the remaining physical entities as the appropriate agency/technology
- modify or add elements and information flows as required.

Once the separate diagrams have been customized, they are combined into a single diagram that represents the Physical Architecture for the RPS. The merging of these diagrams is based on common entities found within each of the packages. For example, the RPS Central System is included in each of the customized Market Packages.

2.2.2 RPS ARCHITECTURE

Using the process described in Section 2.2.1, the three separate Market Package diagrams were customized and merged and **Figure C2** provides a simplified view for the RPS Physical Architecture. Due to the number of entities and information flows involved, the physical views is presented as an interconnection diagram. Interconnection diagrams simply identify interfaces between the entities, but do not indicate the specific content or direction of the information flows. **Appendix C3** provides a supplementary table that summarizes the complete list of Architecture Flows, including the source and destination entities and the information exchanged. These Architecture Flows are the basis for the concept of operations illustrated in Section 2.3. In addition, high-level functions are identified (**Table C3**) for the physical subsystems to provide a context of the underlying Logical elements. It should be noted that processes/functions are only defined for subsystems, as Terminators are considered the boundary and therefore their functionality is not defined by the architecture, just the information shared with the entity. For example, the RPS will

NOTE: Modified and new elements (in comparison to the ITS Architecture for Canada) are indicated by a single and double asterisk (*), respectively.

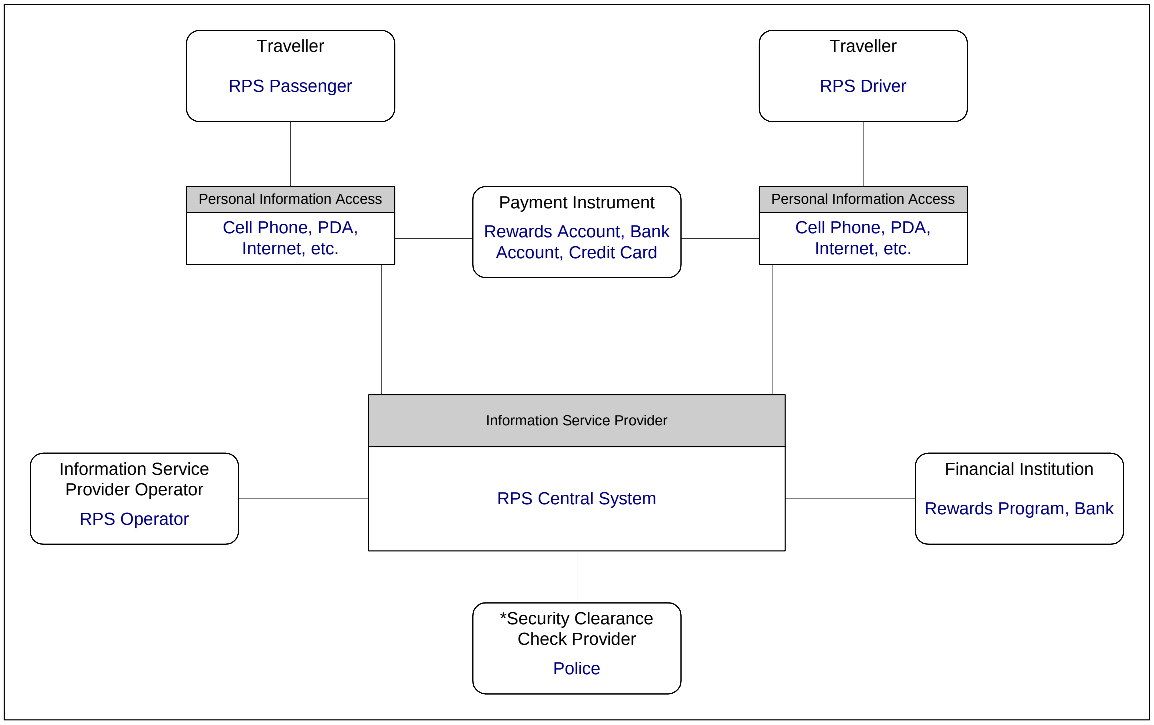

Figure C2: Interconnection Diagram for the RPS

Table C3: High Level Functions/Processes for the RPS

Process/Function	Market Package	Subsystem
Provide Trip Planning Information to Traveller	ATIS2, ATIS7, ATIS8	Information Service Provider
Confirm Traveller's Trip Plan	ATIS2, ATIS7, ATIS8	Information Service Provider
Provide ISP Operator Interface for Trip Planning Parameters	ATIS2, ATIS7	Information Service Provider
Screen Rider Requests	ATIS8	Information Service Provider
Match Rider and Provider	ATIS8	Information Service Provider
Report Ride Match Results to Requestor	ATIS8	Information Service Provider
Confirm Traveller Rideshare Request	ATIS8	Information Service Provider
Collect and Update Traveller Information	ATIS2, ATIS7	Information Service Provider
Select Other Routes	ATIS2, ATIS8	Information Service Provider
Process Traveller Rideshare Payments	ATIS8	Information Service Provider
Collect Price Data for ITS Use	ATIS2, ATIS7	Information Service Provider
Provide Traffic and Transit Advisory Messages (potential future)	ATIS2, ATIS7	Information Service Provider
Calculate Vehicle Route (potential future)	ATIS8	Information Service Provider
Provide Vehicle Route Calculation Data (potential future)	ATIS8	Information Service Provider
Provide Personal Payment Instrument Interface	ATIS2, ATIS7, ATIS8	Personal Information Access
Get Traveller Personal Request	ATIS2, ATIS7, ATIS8	Personal Information Access
Provide Traveller with Personal Travel Information	ATIS2, ATIS7, ATIS8	Personal Information Access
Provide Traveller Personal Interface	ATIS2, ATIS7, ATIS8	Personal Information Access

2.3 Concept of Operations

The process of the Theory of Operations (from the U.S. National ITS Architecture) is used to present the operational concepts of the RPS. **Appendix C4** provides a complete discussion of the process for the Theory of Operations.

The following sub-sections summarize the ride-matching process and supporting back-office processes of the RPS.

2.3.1 RIDE MATCHING PROCESS

Figure C3 illustrates the flow of information that will take place when matching passengers and drivers, and is supplemented with the following description:

1. A prospective pre-registered passenger accesses the RPS, using some form of Personal Information Access (e.g. cell phone, internet, land line, etc.), to request a ride. For security purposes, a unique password is included in the passenger input to confirm the RPS user. Also included is requested origin, destination and trip time (depending on the maturity of the system, locations may or may not be 'hot-spot' based). The system would be designed to accept this information quickly, and provide an option to search for nearby hot-spots should

the user not know the appropriate codes. The website would have a GIS-based GUI that allows users to find the closest hot-spot based on the customer's current location.

2. Similar to #1, a prospective pre-registered driver accesses the RPS, using some form of Personal Information Access (e.g. cell phone, internet, land line, etc.), and provides similar information to offer a ride.

3. This is the process through which the system identifies drivers and passengers with similar trip characteristics. Depending on the maturity of the system and the population of users, the lead time may need to be considerable (e.g. trip may need to be planned hours in advance). As the system matures and the user population grows, the time to identify matches is expected to reduce and the option of short-term planning may become more feasible. Included in the matching process is an estimation of trip distance (see Section 4.3.1) to be used for determining reward point debits and credits.

4. Once the system identifies a potential match, it notifies the driver and passenger using their preferred Personal Information Access method (e.g. cell phone, internet, land line, etc.). The users are provided with the information about the ride including: departure time, changes to origin/destination if applicable, and other information (i.e. smoker/non-smoker, gender, customer rating, etc.) related to other user. The user (passenger or driver) may then choose to approve the match or reject it in which case the system continues to search for other matches.

5. If both the passenger and driver approve the match, the system sends a final notification to both users. This contact would include information to assist the passenger in identifying the driver's vehicle (i.e. make/model/colour of driver's vehicle, license plate details, hair colour of passenger, names, etc.).

6. The driver picks up the passenger at the agreed time and location. It is the passenger's responsibility at this point to confirm the successful pick-up.

7. At the completion of the trip, the driver and passenger both call the RPS to confirm the drop-off. The purpose of this call is both to ensure user safety, as well as to provide an opportunity to provide feedback related to the trip (e.g. rate the other user). To encourage passengers (who will be charged/debited for the ride) to call in, the cost of the ride will be discounted for confirmed trips.

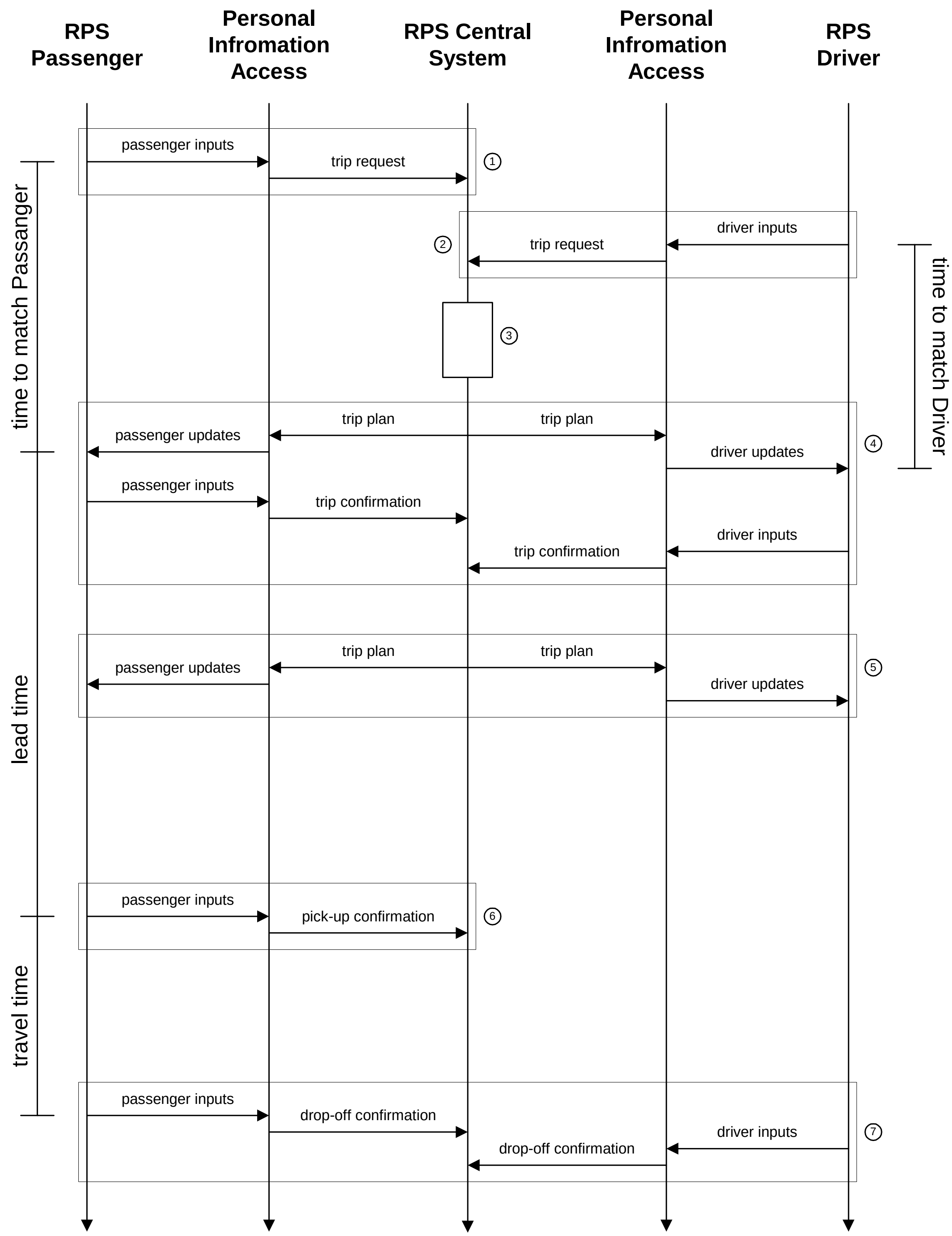

Figure C3: RPS Concept (ride-matching)

2.3.2 OTHER SYSTEM PROCESSES

Figure C4 illustrates the flow of information for functions required to support the primary ride-matching objective of the RPS. The following discusses these functions:

1. To maintain the RPS and to facilitate customer service with users, the RPS will support an interface with a system operator. This will include updating RPS configurations, user profiles and user accounts.

2. The RPS will require perspective users to register an account. This will include the user setting up a profile (e.g. preferences, rewards account, billing information, account password, etc.) and the RPS using a third party provider (likely the police) to run a security check on the potential user.

3. The RPS will provide a customer service interface (e.g. internet-based) that will allow users to query there account balance, current bill and other information (e.g. feedback rating).

4. The RPS will provide functionality to reconcile account balances and debits. This will include user account inquires, billing, payment from users' (from bank or credit card).

5. In co-ordination with the account billings, the RPS will provide functionality for the purchase of reward points and assignment of points to a users' rewards account.

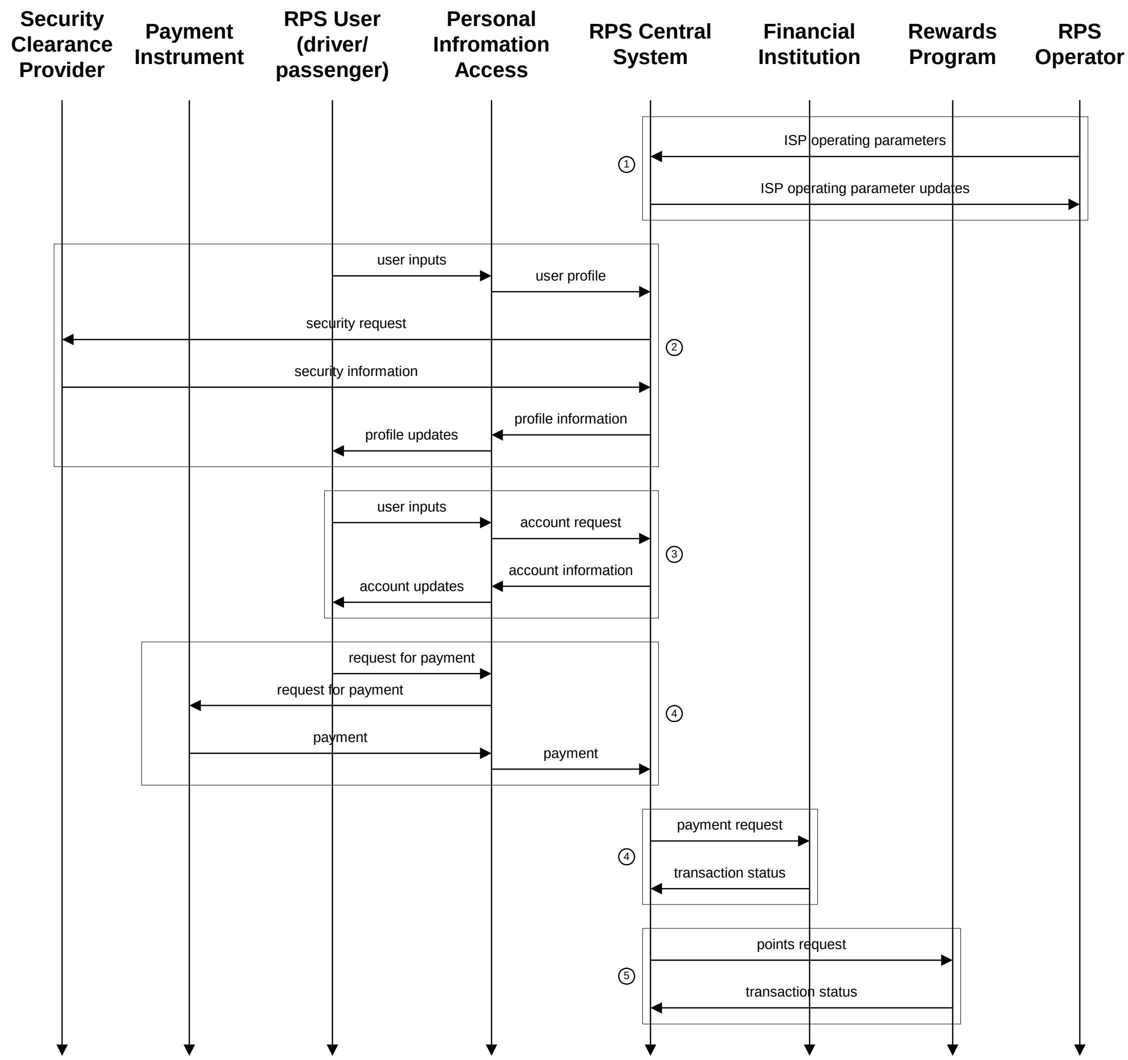

Figure C4: RPS Concept (back office)

Inherent to any dynamic ride-matching system is the need for easy and fast information exchange. Passengers and drivers interact with the system at several points each for one ride, and if the invested time is too great, this could deter system usage. There is an emphasis to create user-friendly customer interfaces while still extracting the necessary information from customers. There are various aspects to consider in planning these interfaces:

- The system should have a memory, allowing it to recognize customers and access a ride log to help shorten input times of information. Similarly, there should be the option of setting up short-cuts for commonly-used locations, trips, etc.

- Due to the large number of customer-central interactions, the system must be designed with ease and speed in mind. Touch-tone dialing of codes on the phone must follow an intuitive structure and should have the minimum number of key strokes to convey the appropriate information.

2.4 Additional Integration Opportunities

In addition to the core RPS functionality presented in the previous sub-sections, there are other opportunities that have been identified for integration with the RPS.

2.4.1 511 TRAVELLER INFORMATION SERVICE

A great deal of information is collected via various ITS systems. In the U.S. a nationwide three-digit telephone number, 511, has been designated for the provision of access to traffic information. A '511 Deployment Coalition' has been working for the past several years to support the deployment of 511 throughout the U.S. A similar effort is now underway in Canada. For a number of years, ITS Canada has been monitoring the developments in the United States and laying the groundwork for the completion of two major tasks:

- The Canadian Radio-Television and Telecommunications Commission (CRTC) application to reserve the 511 three-digit number for the purposes of a travel and weather information service; and

- The establishment of a Canadian 511 Consortium to lead the application and provide stewardship of the Canada 511 Development Program through deployment.

From the perspective of the ITS Architecture for Canada, future 511 systems that may be deployed will represent an Information Service Provider. These services will consolidate relevant traveller information from multiple sources (e.g. traffic management systems, weather services, etc) and distribute comprehensive information to users of the system.

An RPS could benefit significantly from integrating with a 511 system, as follows:

- Traveller information could be input into the RPS system, such as traffic conditions (e.g. accidents, closures, construction activities, etc.), and then passed on to users to facilitate mode and route choices; and

- The 511 system could advise travellers of the existence of the RPS and provide information on how to access the RPS, or potentially provide direct access the RPS.

Depending on information available in the system (e.g. if travel times are calculated for completed rides) an RPS may also represent source of traveller information that is of use to a 511 system.

Integration between an RPS and a 511 system would be accomplished by a Centre-to-Centre (C2C) interface between the systems.

2.4.2 ON-DEMAND TRANSIT

Traditionally, on-demand transit provides mobility to the elderly and handicapped with an affordable and efficient alternative transportation service. On-demand systems can generally be divided into two categories: a direct service route (i.e. taxi cab services), and another in which sharing is allowed.

Although on-demand was originally aimed at meeting the needs of this special segment of the population, once it was implemented, it became popular among people from other groups, such as non-disabled passengers from lower density areas and other areas with limited conventional transit service.

The need for on-demand transit and its operation are similar in many regards to ride-sharing initiatives like RPS. As such, there would be a potential for varying levels of integration between the RPS with local on-demand transit systems. The benefits of integration could include increased participation in both systems and provide greater service for their users.

Similar to above, integration between an RPS and an on-demand transit system would be accomplished by a Centre-to-Centre (C2C) interface between the systems.

3. MARKETING REVIEW

An effective marketing strategy was identified as a critical component for the Ride Points System. To assist in developing a marketing plan, strategies used by other rideshare programs (those identified in the Literature Review) are briefly described in the following sub-sections and followed by a summary of key features for each program reviewed during the environmental scan.

3.1 Marketing Strategies

3.1.1 WHISTLER, BC

The Resort Municipality of Whistler (RMOW) puts ads in the local paper and puts ads on the local radio station periodically to promote ridesharing. Registration and information can also be accessed through the website. Usually in September, they have a 2-week long community wide commuter challenge where all the commuting options are promoted.

JBF Rideshare also has brochures and has done presentations to various businesses around town. There are signs with a 1-800 number along the highway between Squamish and Whistler.

Table C4: Whistler Program Summary

Program Characteristics	· Traditional ridesharing service operated by a non-profit agency (the Jack Bell Foundation) under contract to BC Transit · BC Transit pays administration costs · Passengers cover operating costs
Matching Process and Incentives	· Reserved parking for registered carpools with 3+ people per car · Registration for ridesharing through a website or toll-free phone number. Sign-up is for varying period most often one month for a flat fee with unlimited use. · Pickups are usually requested in advance although service is sometimes used as a taxi service.
Trip Characteristics	· Most common are 65-75 km one-way taking approximately 45-60 min and 32 km one-way taking 20-30 min. · Usual travel times are 7-8am and 3-6pm.

User Characteristics	· Employees, especially young people who don't own their own vehicles
Program Success	· "functioning well for the most part"
Program Disadvantages	· Workers seem to require more flexibility than is available through a ridesharing program

3.1.2 MCMASTER UNIVERSITY – HAMILTON, ON

The rideshare program is marketed using posters around campus, flyers, mail-outs to parking permit holders, prizes (ex. an all-inclusive lunch for four at a local restaurant), promotion at events (ex. university recruitment events, first-year student orientatation, Welcome Week, Off-Campus living fair), the ACT web site, and incentives ($15 in free gas and $10 taxi). The primary motives for participating in the program are the cost savings (fuel, vehicle wear, parking permit, etc.) and priority prime parking spaces made available to carpoolers. The cost of parking is split between all members of carpool, whereas the costs for fuel, wear-and-tear are informally negotiated by members of the carpool.

Table C5: McMaster University Program Summary

Program Characteristics	· Traditional ridesharing service operated by the Alternative Commuting and Transportation (ACT) Office at the university · ACT Office is responsible for matching, marketing and communications · University's parking and transit services issues permits and enforces the program
Matching Process and Incentives	· Carpoolers have to register with Parking and Transit Services · Incentives include $15 in free gas and $10 for taxis and prime parking spaces · Parking costs are split between registered carpoolers · Informal arrangements are made for vehicle expenses · Website www.carpool.ca is available to students for matching plus the ACT Office uses a postal code-based software for matching · ACT Office will also match students for unregistered ridesharing without the benefits.
Trip Characteristics	· Rides typically occur during the daytime with only a couple of evening permits being issued
User Characteristics	· 70 percent students and 30 percent staff/faculty · 25,000 students, staff and faculty
Program Success	· N/A
Program Disadvantages	· N/A

3.1.3 LOS ANGELES SMART TRAVELER AUTOMATED RIDEMATCHING SERVICE (ARMS)

On June 30, 1994 the Los Angeles Smart Traveler was incorporated into the I-800-COMMUTE service of the local ridesharing agency as a field test of ITS technology. The Smart Traveler project offered traffic, transit and ridematching information using multi-media kiosks, touch-tone telephones, and PC modem links. ARMS was initiated offering service to a subset of 68,000 registrants from the rideshare database. Potential users received a one-page letter describing the service and an identification number. The service was not very successful for a number of reasons including technology problems, insufficient marketing of the service, a lack of demand, and too broad a scope for the field test.

Table C6: Los Angeles ARMS Program Summary

Program Characteristics	· Dynamic ridesharing service operated by the local ridesharing agency as a field test in 1994. · The test was government funded.
Matching Process and Incentives	· Individuals registered with the agency could find rideshare partners quickly using a touch-tone-phone. · Users were provided a list of potential partners who they had to contact themselves. · System would record a message by the user and then automatically dial potential partners and play the message.
Trip Characteristics	· N/A
User Characteristics	· N/A
Program Success	· No. It was implemented as a field test of ITS technology.
Program Disadvantages	· Problems with technology · Users unwilling to share a ride with strangers · Users did not understand the system due to insufficient marketing

3.1.4 SEATTLE SMART TRAVELER

The University of Washington in Seattle successfully developed and operated a dynamic ridematching system between 1995 and 1997 using the Internet and e-mail. The system was designed to match drivers and passengers for both traditional and dynamic ridesharing. The Smart Traveler System was marketed to students, faculty and the staff of the University in coordination with the transit and regional rideshare programs. The University of Washington is the largest employer in the city of Seattle and has a student base of approximately 39,000. Promotional methods included printed materials, insulated mugs, the web page and e-mail. Approximately 400 individuals registered in the system over the 15-month demonstration. The largest number of participants at one time was 200 because the system was updated quarterly.

Table C7: Seattle Smart Traveler Program Summary

Program Characteristics	· Dynamic ridesharing service operating by the University of Washington I Seattle between 1995 and 1997. · The project was government funded. · Total costs were approximately $250,000 USD.
Matching Process and Incentives	· Designed to match drivers and passengers for both traditional and dynamic ridesharing · Users accessed a website using ID numbers and passwords, completed an application form on-line including a time-range for arrivals and departures. · The system identified potential matches and automatically generated and sent an e-mail of phone numbers to the user. · Users made the actual contact with potential partners.
Trip Characteristics	· 90% of trips were traditional commute trips · Average length was less than 30 km (20 mi). · Commute trips were generally concentrated during 7-9am and 4-6pm. · 20% occurred outside the 8am to 5 pm time period.
User Characteristics	· 68% were faculty and staff and 32% were students. · Only 20% overlap with the Metro rideshare program, i.e. program reached a new group of potential participants. · Student base of 39,000
Program Success	· The system operated for 15 months without any major technical problems. · Utilization was comparable to traditional rideshare programs.

Program Disadvantages	· Technology available at the time was cumbersome to use. · Other incentives such as HOV facilities and parking incentives were needed to encourage greater participation.

3.1.5 REDMOND, WASHINGTON

The Greater Redmond Transportation Management Association (GRTMA), in the city of Redmond, Washington has established an automated ridematching system that can be used by individuals seeking a single ride. GRTMA has a variety of promotions throughout the year to encourage people to register in RideshareOnline. In a campaign planned for this year, participants are eligible to win many prizes including a trip to Hawaii. The first 50 people each week who register or update their current data in the program, receive a 12-oz Starbucks Coffee beverage free and their name is entered into the drawing. Posters, post cards, email and the web site are used to promote the program.

Table C8: Redmond Program Summary

Program Characteristics	· Greater Redmond Transportation Management Association operates an automated ridematching service for carpools, vanpools, and dynamic ridesharing · Costs to develop the system from 1998 to 2000 was $278,000 USD. · System resides on the internet and the GRTMA has no involvement in the day-to-day operations.
Matching Process and Incentives	· Individuals register themselves on-line providing an e-mail address, password, and their home address or a nearby intersection. · The registrant's trip schedule is entered along with preferences such as smokers or non-smokers or employees of specific companies. · Participants receive instant feedback on potential carpool/vanpool partners they can contact. A generic e-mail has been created to get them started or they can phone potential partners. · People are matched based on their origin address and final destination with a numbering system of the best to worst match.
Trip Characteristics	· Most trips are from the suburbs with an average length of 10 miles one way. · Travel times are between 6 and 9 am and 3:30 and 6 pm.
User Characteristics	· The service is used by commuters. · Population of 46,000
Program Success	· The rideshare database contained 1,200 registrants in 2000.
Program Disadvantages	· N/A

3.1.6 MISSOULA, MONTANA

The Missoula Ravilla Transportation Management Association (MR TMA) operates a ridesharing program in a region 135 miles long by 90 miles wide. The rideshare program is marketed in several ways. A local group in Missoula called Missoula In Motion, promotes the rideshare/carpool program through their employer outreach coordinator. They have displays and brochures made available at various employment sights and other groups within the city. The financial incentive and environmental benefits are the main reasons users are motivated to participate in the program.

Table C9: Missoula Program Summary

Program Characteristics	· Traditional and dynamic ridesharing service operated by the Missoula Ravilla Transportation Management Association since 1997. · Matching software costs $5,000 and 600 per year for support. One individual keeps the software updated and responds to requests.
Matching Process and Incentives	· Individuals are matched after completing a rideshare application. · GeoMatch software is used to match users based on zones where they live and work. · Matches are normally requested and provided by telephone (mail or fax can also be used). · Matchlists usually take about 4 minutes to generate and are received by individuals within 48 hours of a request along with a tip sheet on how to set up carpools. · Arrangements for cost sharing are made within each user group. Generally they share driving responsibilities and no money is exchanged unless one user doesn't drive.
Trip Characteristics	· Service is concentrated on the suburbs within a 30 to 50 mile radius of the city. · The city has a good transit service
User Characteristics	· Typically used by middleclass workers looking for rides to and from their jobsites. · Missoula's population is 75,000
Program Success	· In operation since 1997 and had 300 names in the database by 2000.
Program Disadvantages	· N/A

3.2 Summary

The ride-sharing programs summarized in the previous employed a variety of marketing strategies, with varying levels of success. In one case, Los Angeles, the unsuccessfulness of the program was not related to the marketing, but to the maturity of the technology used.

- In general, the following can be concluded from our research of existing programs and their marketing strategies:
- the use of multiple media (e.g. website, 1-800 number, and flyers/mailouts) for promotion are recommended;
- focused marketing (e.g. existing environment programs, companies with limited parking facilities) is recommended;
- initial promotions/challenges (e.g. a draw) can be employed to create a base registered population for the system; and
- the primary motives for participating in the program are the cost savings (fuel, vehicle wear, parking permit, etc.); and
- users are wary of sharing rides with strangers.

4. LEGAL OPINION

As referred to in Section 1.2, an independent legal opinion was prepared to help identify potential and possible liabilities concerning the implementation of the RPS. A copy of this opinion can be found in **Appendix C1**. Two major potential areas of liability identified included:

- Motor vehicle accidents while using the system, and
- Criminal activity by users of the system.

These areas can be further aggregated into specific libel situations, including:

- Damage to the driver's car due to a motor vehicle accident while engaged on an RPS trip;
- Personal injury or death suffered by a driver or a passenger due to a motor vehicle accident while engaged on an RPS trip;
- Personal injury or death suffered by third parties due to a motor vehicle accident while engaged on an RPS trip;
- Personal injury or death suffered by a driver or a passenger, due to criminal activity by one of the parties during an RPS trip;
- Perceived loss due to a driver not obtaining the number of RPS points he/she believes himself/herself to be entitled to, and similarly with regard to the payment of points by the passenger;
- Possible refusal, by insurance companies, to provide non-commercial coverage to RPS drivers, on the grounds that they are engaged in a commercial activity.

The following sub-sections look at the two major areas of liability, as well as issues with the administration of the system, in further detail and include some discussion on minimizing the RPS liability.

The legal opinion also identifies the need for RPS to have good insurance coverage, and presumably lawyers, to take care of lawsuits that may occur despite the precautions discussed below. Also implied is the need to have a staff position that focuses on customer security.

4.1 Automobile Insurance

A significant issue with the RPS concept is the exchange of rewards points, which may be interpreted as having a value, and how this will be perceived by automobile insurance providers. The legal opinion states:

> *The major concern for drivers is the issue surrounding liability and possible exclusions under their policies of insurance. Insurance policies usually make exclusions coverage for private individuals operating as carriers or taking compensation for carrying passengers. These exclusions are limited by section 250 of the Insurance Act R.S.O. 1990, c. I.8, which sets out the limitations that a policy of insurance may contain…*

Briefly stated, the laws relating to Ontario vehicle insurance state that insurance companies are not liable for claims made while "*the automobile is used as a taxicab, public omnibus, livery, jitney or sightseeing conveyance or for carrying passengers for compensation or hire*". There are a number of exceptions, and one them is "*the occasional and infrequent use by a person of the person's automobile for the carriage of another person who shares the cost of the trip*".

The RPS system would be compensating drivers for carrying passengers. Our legal opinion states that:

> *Fundamental to whether an arrangement made between a driver and a passenger which would lead to a loss of coverage is whether or not the arrangement of a "commercial nature". If it is found that the arrangement is commercial, then the amount of the fee to be paid becomes irrelevant.. In order to ascertain whether or not an arrangement is commercial in nature, the court will examine whether or not the arrangement itself is definitive in outline…. The Ride points System… is definitive and formal in nature… This hurdle must be overcome by making arrangements with the insurance companies for an allowance to participate in the Program. If not, in my opinion, the insurer will have the right, if the exclusion is allowed by virtue of section 250 above, to deny coverage should an accident occur for which the driver is negligent.*

4.1.1 DISCUSSION

It should be noted that the legal opinion is based on an Ontario perspective and insurance legislation is provincially- and territorial-based.

Compared with home insurance, auto insurance is much more complex. Although provincial and territorial government regulations for home insurance allow for considerable variation from company to company, the product itself is generally similar everywhere in Canada. However this is not so with auto insurance, where little variation is permitted within a particular province and territory, but between jurisdictions there can be great differences.

Many insurers compete in the home and automobile insurance marketplace. While home insurers compete on coverage, service and price, automobile insurers, on the other hand, compete mainly on service and price alone. Because it's compulsory, automobile insurance is highly regulated.

The preceding section outlined potential problems with insurance company not providing coverage, or requiring commercial coverage, for 'driver' users of the RPS. If this problem is widespread, it would kill the prospects for implementing RPS. In order to assess the severity and breadth of these potential insurance issues, industry stakeholders were consulted across Canada. The results of these consultations are summarized in **Table C10**.

Table C10: Summary of Insurance Industry Consultations

Agency	Scope	Assessment
Insurance Bureau of Canada	National	Noted that it took 10 years for the Red Cross to obtain provincial legislation that forced the insurance industry to agree that volunteer drivers could be reimbursed for mileage costs.

Agency	Scope	Assessment
Insurance Company, Allstate	National	Allstate does not charge an additional premium or a commercial rate for being the driver of a car pool. While the driver may be reimbursed for gas and other expenses, it is looked upon as a regular activity/route, a recurring driving pattern. Additionally, Allstate does not charge an additional premium for those that occasionally volunteer to drive patients for hospital appointments, or drive a van for a social outing such as church. However, Allstate would likely error on the side of caution. Since a central computer is providing the matches, and user do not know each other or have a common work place, Allstate would consider the RPS a commercial operation.
Independent Broker, Ontario	Provincial - Ontario	Suggested that there was a possibility of building support for the RPS concept. Emphasized that the best approach would be to work with several "Personal Lines" managers in insurance companies (e.g. Dominion, Aviva and ING), instead of going for a top-down approach through the provincial governments.
Saskatchewan Autofund	Provincial - Saskatchewan	An initial assessment was that the rewards system would violate the allowed uses of basic plate insurance in Saskatchewan, as compensation is generally prohibited for passenger transportation unless a public service vehicle plate is being used. However, subsequent discussions indicated that Car Pooling is considered OK. Compensation for volunteer drivers are also OK, as long as the organizations specify the driver. They also indicated that an arrangement may be negotiated, and that a positive outcome would be likely, and as long as the RPS did not alienate the taxi industry too much.
Insurance Corporation of British Columbia	Provincial - British Columbia	The Insurance Corporation of British Columbia does not refuse to provide coverage simply on the basis that the owner and/or driver of a vehicle may receive some form of compensation for operating the vehicle. However the use to which the vehicle is put is a very important rating factor and changes in that use may result in an additional premium being charged to reflect the risk. In the event of a claim, if the owner has failed to rate the vehicle correctly according to its use, they may be in breach of their coverage and a claim may be denied or monies paid by ICBC on their behalf to third parties may be recovered directly from them. Similar to Saskatchewan, an agreement with the provincially run insurance industry may be feasible.

Agency	Scope	Assessment
Société de l'assurance automobile du Québec	Provincial - Québec	Policies will be shifted to commercial if compensation exceeds expenses.

As illustrated above, the reaction of the insurance industry varies, but some general points emerge:

- the RPS points system must not provide rewards that are greater than expenses;
- there would need to be negotiation and agreement with insurance companies and/or regulators in the particular region where RPS would be deployed; and
- it appears that the best place to start is in provinces with provincial insurance systems (BC, Saskatchewan) or at least strong regulatory regimes (PQ). In such jurisdictions, there appears to be room for discussion.

Similar to this issue with automobile insurance, in 2000 the Ontario Highway Transportation ruled that vehicles of users of the Allo-Stop ride-sharing program (between Ottawa and Montreal) should be considered as 'public vehicles' and that drivers should have to pay a $500 regulatory licensing fee. Based on the ruling, Allo-Stop was required to cease operations in Ontario, but continue to successfully operate throughout Quebec. Further details of the Allo-Stop system can be found in **Appendix C5**.

4.2 Personal Security and Liability

The second area of potential liability for the RPS is related to the security and safety of RPS users. The legal opinion states:

> *The laws of Ontario put an obligation upon any service provider to ensure that the services provided are reasonably safe for the individuals using that service. The test that is imposed by the courts is the "reasonable person test". This test, simply put, requires that the providers of any product or service, must ensure that the product or service is reasonably safe for the users of that service. Fundamental to the obligation of any provider is that a system be developed to ensure that the product or service remains safe for the purchasers and users of the product or service.*

The legal opinion particularly emphasized the importance of personal security for the users of the RPS system:

> *One of the most common areas of potential liability to users of the System is through the theft and use of an individual's identity, identification and/or cell phone for the purpose of obtaining rides. In this scenario, the driver or passenger could possibly pass for a member. Liability for the safety of passengers and drivers alike would be at risk.*
>
> *While no security system is perfect, the System should take precautions reasonable to ensure that all participants are properly identified, vetted and cleared for possible risks. Releases should be obtained from potential members so that a standard security check can be performed. Proper identification should be issued to all users. Waivers by users of the system regarding liability of accidents and/or illegal acts committed by members should be provided to the System. Insurance must be obtained by the organization to cover accident, negligence and assault coverage.*

4.2.1 DISCUSSION

For numerous reasons (e.g. billing, profiles, etc.) there is a requirement for prospective users of the RPS to pre-register with the system. As part of the registration process, there would need to be a clearly written and binding waiver that the user would be required to sign, which would absolve the RPS and affiliated members from unreasonable exposure in the case of theft or injury.

As identified in the architecture, the registration process would include a security background check of the individual. Individuals with criminal records would be excluded from participation with RPS. Additionally, photo ID will be required during the registration process in and effort to ensure the applicant is who they say they are, and to confirm supplementary information (address, credit, automobile insurance, etc.). This registration process would represent the first step in the RPS organization ensuring that the service is safe for it's users.

Each user account will have an associated unique password. This password will be required to be entered by the user at all steps along the process (e.g. trip request, confirmation, etc.) to identify the individual as the correct user.

Similarly, a unique 'ride keyword/phrase' will be included as part of the final confirmation from the RPS system when making the ride match. This keyword/phrase can then be used by each user (driver and passenger) to confirm the identity of the other user when meeting.

Other potential security measures to ensure identity confirmation that could be considered are:

- Exchange of ID;
- Forwarding images/photos from user profiles; and
- Description of vehicle (colour, license plate number).

The most difficult issue to deal with respect to user safety and security is to minimize the risk during the ride-share. The above efforts are intended to prevent identity theft and/or mis-identification, but do not address situations where a registered user, with no previous record, causes injury to another user. In the short term, the RPS can monitor ride matches where a significant time has passed since pick-up confirmation, and first try to contact the users, and if unsuccessful, contact the police with details of the intended trip (e.g. users, origin, destination, vehicle information, etc.). A more proactive solution may be feasible in the future, if and when GPS locationing is widely available and integrated into the RPS. In this case, the trip may be monitored (e.g. tracking the location of the GPS-enabled cell phones) and security measures could be implemented if the travel deviates significantly from the planned route, although this itself is likely to create further issues relating to privacy.

4.3 Administration and Customer Service

There are a couple of administrative and customer service issues that the RPS must address, relating to unhappy customers, including:

- users that are not dangerous, but not compatible with others; and
- discrepancies/disputes with accounting (billing and reward points).

4.3.1 DISCUSSION

As part of the registration process described in Section 4.2.1, users will be required to set up a profile for themselves that includes relevant information and preferences. This information would then be used to filter out non-compatible matches (e.g. smoker/non-smoker) and minimize complaints about other users.

To further manage issues related to the behaviour of users, the RPS will manage a feedback system similar to that used for other services, such as ebay. The feedback system will prompt users to leave feedback and rate the quality of the trip upon confirmed completion of a ride-share. This feedback information, as well as user preferences, would be made available to users when potential ride-matches are provided by the system, and this would allow a user to accept/reject a match based on the other users rating or preferences.

In the extreme case that a user receives a certain number of negative feedback comments, the system could first issue a warning, and potentially cancel the membership.

Managing other administrative and customer service inquiries will require the establishment of a customer service system to deal with the inquires, and supported by a clearly defined accounting system for calculating reward point debits and credits based on a defensible estimation of trip distance. It should be noted that this distance estimation, and related reward point calculations, be included with potential ride-matches are provided by the RPS.

5. NEXT STEPS

As indicated in Section 1, the purpose of the Final Report is to develop a business case, for or against, the deployment of an RPS and identify the next steps to lead to such a deployment. The Literature Review and this Interim Report represent significant work, including technical, institutional, jurisdictional, and legislative investigation, to support the development of financial framework to assess the feasibility of the RPS.

The preceding sections clarified aspects of the RPS concept and identified some of the issues and challenges to implementing an operation RPS, even as a prototype deployment. The most significant issue identified relates to how the automobile insurance of a RPS driver may be impacted by participating in the RPS program. Potential impacts include a denial of claim if it occurs while providing a ride, or increase in premiums due to being classified as commercial operation. In either case, a risk of a denied claim or increased insurance premiums, a potential 'driver' user would not be willing to participate in an RPS program. Therefore, it is essential prior to an RPS deployment (e.g. pilot project) that an agreement be reached with the relevant (provincial/territorial) automobile insurance providers that drivers under the RPS program are covered, without addition premiums. As indicated in Section 4.1.1, this will require that any incentive (e.g. reward points) provided to the driver not be in excess of acceptable costs for the trip.

As there have been indications that such agreements may be feasible, this R&D project will proceed as planned. For the development of the business case, reward points incentives will be limited to conventional reimbursement rates for mileage (e.g. $0.38 per kilometre).

In order to complete the financial analysis and business case for the Final Report, the following summarizes the remaining tasks:

- **Market Analysis** – quantify service standards (e.g. access medium, time to match, maximum acceptable detours from pick-up/drop-off, security assurance, etc.) and acceptable rewards structure (e.g. cost for passengers, rewards for drivers). This task will draw on the results of this report to clearly present the RPS concept to potential users and facilitate the collection of accurate feedback. Initially intended to be accomplished as a set of focus groups, this may be accomplished through other means (e.g. surveys, published information) to allow the task to be completed in short order.

- **Financial Analysis** – estimate direct and indirect benefits of a mature full-scale deployment and contrast those to the corresponding estimated capital and operating costs. As indicated previously, a successful business case will be considered in the case where the RPS is assessed as being financially self-sufficient.

- **Pilot Site Identification** – in the case of a successful business case, potential pilot site locations. Site selections will take into consideration the results of literature review and market analysis of existing programs, as well as recommendations to begin in provinces with government run automobile insurance.

APPENDIX C1

LEGAL OPINION ON THE RIDE POINTS SYSTEM

GIBSON & MACLAREN LLP

BARRISTERS • SOLICITORS • NOTARIES

Reply to Bruce D. Marks
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Our File: 5875

September 14, 2004

Mr. Nils K. Larsson
Larsson Consulting Ltd.
130 Lewis Street
Ottawa, Ontario
K2P 0S7

Dear Sirs:

Re: Opinion on the Ride Points system

You have asked us to provide an opinion to you regarding helping identify potential and possible liabilities concerning the implementation of the Ride Points System (the "System") as presented to us in your Literature Review Report Dated April 6th, 2004.

In the preparation of this opinion, you have provided to us the above referenced Literature Review Report only.

We have identified two major potential areas of liability to the System, there may be more.

1. Criminal Activity by users of the System; and
2. Motor Vehicle Accidents;

The Liability of the System

The laws of Ontario put an obligation upon any service provider to ensure that the services provided are reasonably safe for the individuals using that service. The test that is imposed by the courts is the "reasonable person test". This test, simply put, requires that the providers of any product or service must ensure that the product or service is reasonably safe for the users of that service. Fundamental to the obligation of any provider is that a system be developed to ensure that the product or service remains safe for the purchasers and users of the product or service.

The service proposed by the Ride Points System is a matching service, which matches drivers with riders, providing a rewards system to encourage users. Drivers would earn points or credits for providing transportation to riders.

The proposal is such that the System will use the tracking, identification and locating systems already part of the participant's cell phone providers' phone systems in order to arrange rides for users.

Lost or Stolen Cell Phones

One of the most common areas of potential liability to users of the System is through the theft and use of an individual's identity, identification and/or cell phone for the purpose of obtaining rides. In this scenario, the driver or passenger could possibly pass for a member. Liability for the safety of passengers and drivers alike would be at risk.

While no security system is perfect, the System should take precautions reasonable to ensure that all participants are properly identified, vetted and cleared for possible risks. Releases should be obtained from potential members so that a standard security check can be performed. Proper identification should be issued to all users. Waivers by users of the system regarding liability of accidents and/or illegal acts committed by members should be provided to the System. Insurance must be obtained by the organization to cover accident, negligence and assault coverage.

Only members should be allowed to participate in the System.

Driver's Insurance

The major concern for drivers is the issue surrounding liability and possible exclusions under their policies of insurance. Insurance policies usually make exclusions coverage for private individuals operating as carriers or taking compensation for carrying passengers. These exclusions are limited by section 250 of the *Insurance Act* R.S.O. 1990, c. I.8, which sets out the limitations that a policy of insurance may contain.

It states:

250 (1) The insurer may provide under a contract evidenced by a motor vehicle liability policy, in one or more of the following cases, that, except as provided in the Statutory Accident Benefits Schedule, it shall not be liable while,

....

(c) the automobile is used as a taxicab, public omnibus, livery, jitney or sightseeing conveyance or for carrying passengers for compensation or hire;

....

Certain Rules Excepted

(4) Clause (1) (c) does not include,

(a) the use by a person of the person's automobile for the carriage of another person in return for the former's carriage in the automobile of the latter;

(b) the occasional and infrequent use by a person of the person's automobile for the carriage of another person who shares the cost of the trip;

(c) the use by a person of the person's automobile for the carriage of a temporary or permanent domestic servant of the insured or his or her spouse or same-sex partner;

(d) the use by a person of the person's automobile for the carriage of a client or customer or a prospective client or customer; or

(e) the occasional and infrequent use by the insured of the insured's automobile for the transportation of children to or from school or school activities conducted within the educational program. R.S.O. 1990, c. I.8, s. 250 (4); 1999, c. 6, s. 31 (6).

That the system is compensating drivers for carrying passengers is without doubt.

In *McMillan v. Pawluk*, [1976] 2 S.C.R. 789, the Supreme Court of Canada ruled the test in determining whether or not a person is a guest within the meaning of the phrase "guest without payment" is whether the purpose of the transportation is social only or whether it is in performance of a contractual obligation or otherwise for a commercial or business purpose. When transportation is provided pursuant to a mutual undertaking to repay by providing further transportation, it cannot be said to be "social only".

In *Labadie v. Co-operator's Insurance Assn*., (1974) 4 O.R. 325, the Court examined the provisions of the Insurance Act, which contained essentially the same provisions as it does now, above reproduced. The Court in that instance decided that the wording "occasional and infrequent use" has a restricted meaning to be interpreted against the insurer who drafted the insurance policy.

Fundamental to whether an arrangement made between a driver and a passenger which would lead to a loss of coverage is whether or not the arrangement of a "commercial nature". If it is found that the arrangement is commercial, then the amount of the fee to be paid becomes irrelevant.

In order to ascertain whether or not an arrangement is commercial in nature, the court will examine whether or not the arrangement itself is definitive in outline.

The Ride Points System proposes to compensate drivers by way of allocating a certain number of points or credits to them from the credit accounts of the passengers. This point system is definitive and formal in nature. Users of the System would members of a definitive class of persons, in that they would be required to join up, or be entitled to a membership by virtue of their ownership of a cell phone . Booking arrangements would be made through a central system and points allocated according to a set scheme or formula. The drivers would be entitled to exchange their credits or points for goods, services or cash.

This hurdle must be overcome by making arrangements with the insurance companies for an allowance to participate in the Program. If not, in my opinion, the insurer will have the right, if the exclusion is allowed by virtue of section 250 above, to deny coverage should an accident occur for which the driver is negligent.

Should this be the case, it may follow that a driver or user may seek damages from the System on the basis that they were not aware that this exception existed. The System should require a waiver to cover this possibility.

In summary, in order to limit the liabilities of the Ride Points System, a vetting and identification system should be put in place. Waivers should be obtained from users of the System regarding liability for criminal acts, accidents and the insurance issue.

The above opinions set forth above are subject to the following qualifications;

(a) we have assumed the genuineness and authenticity of all documents submitted to us as originals and the conformity to authentic original documents of all documents submitted to us as certified true copies or as reproduction, including documents received by facsimile transmission or email.
(b) We have relied, to the extent we have considered proper, representations made by officers of the System. Such factual matters have not been independently investigated or verified.
(c) As we are qualified to practice law only in the Province of Ontario, we express no opinion concerning the laws of any other jurisdiction.

This opinion is furnished for the exclusive use of the persons to whom it is addressed, and may not be relied upon by any other person, except with prior written consent by the author.

Yours very truly,

Gibson & MacLaren LLP

Bruce D. Marks
BDM:ag
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APPENDIX C2

SUPPORTING GPS LOCATIONING ARCHITECTURE

1.0 INTRODUCTION

The use various of different location positioning technologies such as A-GPS, CELL-ID, E-OTD, had been discussed in the previous Literature review report. The Ride Point system will be using location technologies for three primary reasons: 1) to collect ride requestor's current location, 2) to collect the driver's current location, 3) to track the ride progress for safety purposes.

As noted in the literature review, with the exception of GPS, the other location technologies require that a Network Operator deploy and/or support a triangulation technology where a given triangulation technology is associated with distinct accuracy constraints. For the purpose of this analysis, it is assumed that a Network Operator has deployed a suitable triangulation technology and has made available a suitable interface or API for the purpose of extracting the location of a given mobile station (subject to all necessary regional regulatory and privacy considerations).

This Appendix provides an description of two potential technological alternatives for supporting the Ride Points System:

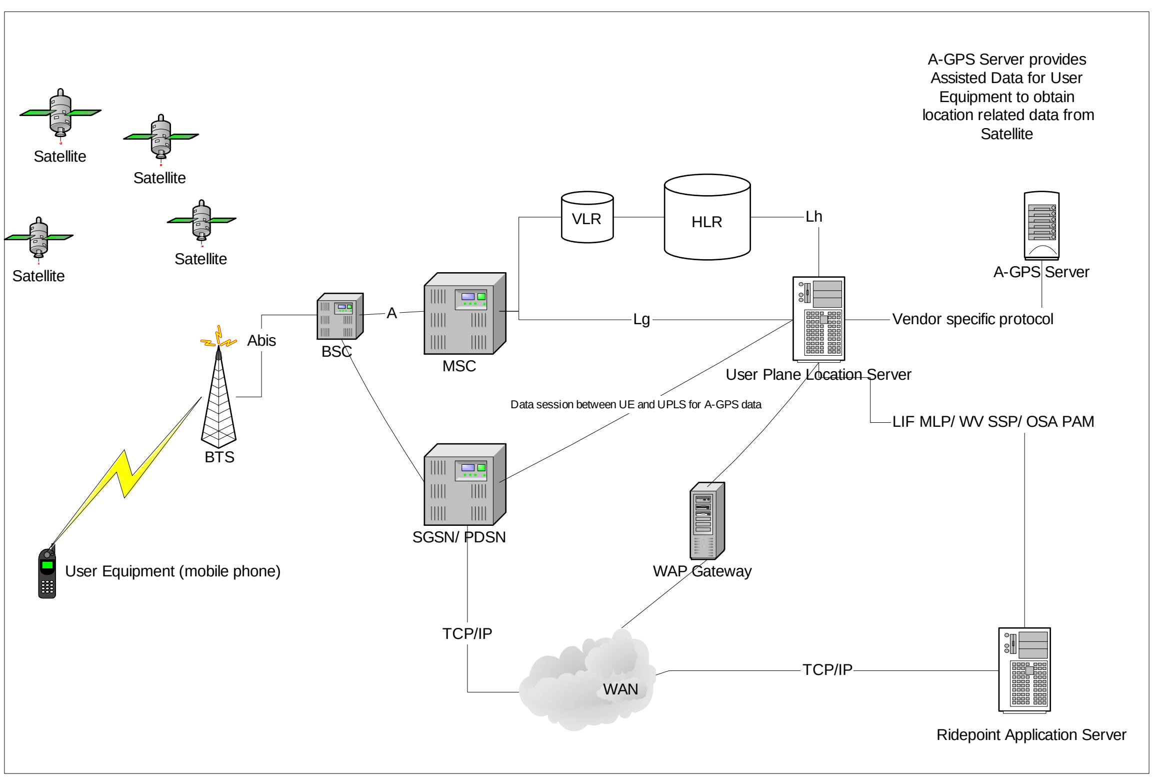
Where the network operator supports a location technology and associated interface or API. While several technologies can potentially provide the requisite degree of resolution, the use of A-GPS technologies will be assumed for the purpose of this analysis.

Where the network operator provides a bearer level (data/voice) connectivity. A GPS based solution will be assumed in this scenario.

2.0 GPS ALTERNATIVES

2.1 A-GPS Based System Solution

The following diagram is a typical network description for an A-GPS based location platform. It contains an overview of the involved core network entities.



2.1.1 FUNCTIONAL DESCRIPTION PER NETWORK ELEMENT

User Equipment

For the purpose of this analysis, user equipment shall be characterized as a mobile phone (typically a smartphone or PDA with GSM/GPRS or1XRTT/CMDA functionality) which incorporates an AGPS or GPS chipset depending on which scenario is being contemplated. Note that user equipment may be comprised of a mobile phone in conjunction with an external module/device which incorporates AGPS or GPS technologies. In the later case, the mobile phone would communicate to the external module via an applicable interface and communication protocol (e.g. Bluetooth) for the purpose of providing 'user equipment' for the purpose of this analysis.

For the purpose of this analysis, it is assumed that the user equipment can host mobile applications to support user interaction activities such as user input data collection and server information distribution. User may potentially use the application to make Ride offering/requests and for displaying ride progress. Mobile applications can leverage other popular mobile phone operating systems including J2ME, Palm OS, Symbian, Microsoft Pocket PC and Qualcomm Brew.

BTS (Base Transceiver Station)

In cellular system the Base Transceiver Station terminates the radio interface. Each BTS may consist of a number of TRX (Transceiver), typically between 1 and 16.

BSC (Base Station Controller)

The BS (Base Station) consists of a BSC and one or more BTS (Base Transceiver Station). The BSC is responsible for the exchange of messages towards the MSC (Mobile Switching Center) and the BTS. Traffic and signaling transferred between the MSC and MS (Mobile Station) will usually pass transparently through a BSC.

MSC (Mobile Switching Centre)

A Mobile Switching Centre is a telecommunication switch or exchange within a cellular network architecture which is capable of interworking with location databases.

SGSN (Serving GPRS Support Node)

Specific to a GSM/GPRS environment, the SGSN provides the functionality associated with Mobile Switching Centre for a data/packet environment. For example, the Serving GPRS Support Node keeps track of the location of an individual MS (Mobile Station) and performs security functions and access control.

PDSN (Packet Data Serving Node)

Specific to a CDMA/1XRTT environment, a Packet Data Serving Node is responsible for the establishment, maintenance and termination of a PPP (Point to Point Protocol) session towards the MS (Mobile Station). It may also assign dynamic IP addresses in addition to supporting Mobile IP functionality. It provides a similar function to the GSN (GPRS Support Nodes) found in GSM and UMTS networks.

WAP Gateway

A WAP (Wireless Application Protocol) Gateway accesses web content for a mobile. It is capable of converting HTML (Hypertext Markup Language) pages to WML (Wireless Markup Language) pages, but much of the content accessed from WAP Gateways has already been specially authored in WML.

VLR (Visitor Location Register)

The Visitor Location Register contains all subscriber data required for call handling and mobility management for mobile subscribers currently located in the area controlled by the VLR.

HLR (Home Location Register)

The Home Location Register is a database within the HPLMN (Home Public Land Mobile Network). It provides routing information for MT (Mobile Terminated) calls and SMS (Short Message Service). It is also responsible for the maintenance of user subscription information. This is distributed to the relevant VLR (Visitor Location Register) or SGSN (Serving GPRS Support Node) through the attach process and mobility management procedures such as Location Area and Routing Area updates.

WAN

A network that provides data communications to a large number of independent users spread over a larger geographic area than that of a LAN (Local Area Network). It may consist of a number of LAN connected together.

A-GPS Server

Provide Assistance GPS data for A-GPS handset to select the appropriate satellites. It may also optionally calculate the handset's current location.

User Plane Location Server

A User Plane Location Server (UPLS) is essentially a GMLC/MPC (location center in GSM/CDMA) which supports User Plane AGPS. It is the first point of contact for an external LCS client and performs the necessary authentication, authorization and throttling for location client requests. An UPLS is also responsible for obtaining location information. A typical User Plane Location Server will support a hybrid location technology solution: Cell-ID mapping for low accuracy location request and A-GPS for high accuracy. In the case of high accuracy method is not available due to any reason, low accuracy method will be use as the back up mechanism.

In the case of low accuracy positioning method, the UPLS make query to the target subscriber's HLR. Since HLR contains a record of target subscriber's serving MSC/Cell-ID, it will return the Cell-ID information back to UPLS. The UPLS will contain a pre-loaded database with all the Cell-ID to Latitude / Longitude mapping and thus UPLS will be able to find out the approximate current location of the target subscriber (150 meters to 3000 meters.)

In the case of high accuracy position method, it interacts with A-GPS Server and client handsets for determining A-GPS handset's current location. The next section contains more detail information of A-GPS technology within current wireless industry environment.

2.1.2 A-GPS TECHNOLOGY USAGE WITHIN RIDE POINTS SYSTEM

As discussed before, Assisted GPS (A-GPS) is a network-assisted GPS technology where the performance of GPS search time can be reduced from minutes to seconds. It allows the use of weaker signals than non-assisted GPS counterpart; A-GPS handsets include A-GPS chipset and software.

In the current wireless communication market, there are two types of A-GPS protocol implementation: Control Plane and User Plane.

Control Plane

Control Plan protocols are protocols for controlling the radio access bearers and the connection between the User Equipment and the network from different aspects. The relevant functional architecture and interface points have been standardized in both GSM (3GPP) and CDMA (3GPP2) standard bodies. A control plane A-GPS implementation utilizes control channels used for signaling between the A-GPS equipped equipment (e.g. mobile phone) and the network to exchange assistance data required for A-GPS location fix. Note that the network operator normally has to deploy incremental infrastructure as well as upgrade core network infrastructure in order to support the Control-Plane mode of A-GPS.

User Plane

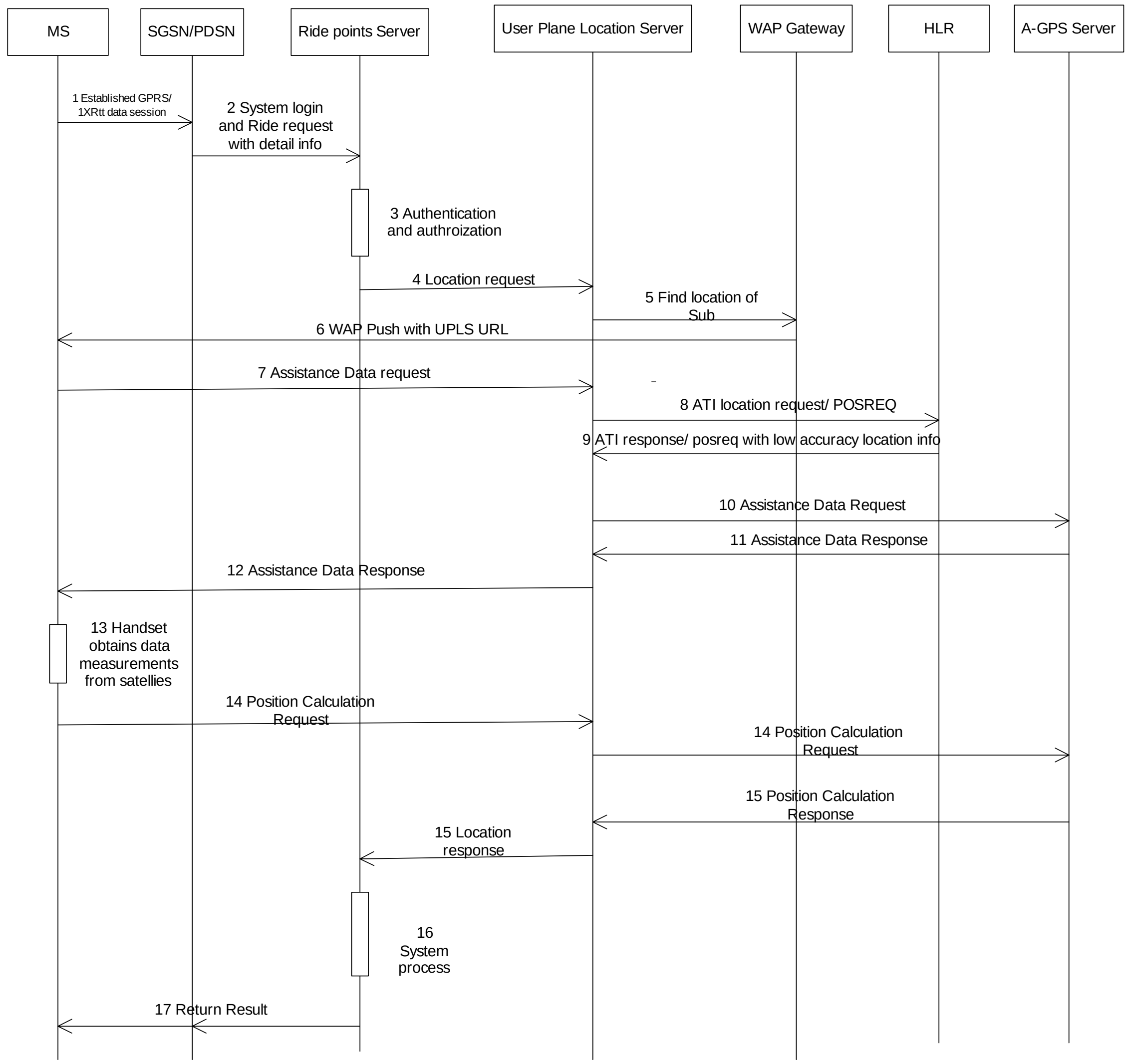
User plane allows GPS-specific information to be communicated via an available bearer channel (normally via GPRS or 1XRTT and TCPIP) between the user equipment and the location server. User plane has multiple characteristic making it the immediate choice for A-GPS (or GPS based) implementation. For instance: User plane enables full A-GPS functionality with minimal network changes since data bearer such as GPRS/1XRTT IP connection can be used to transfer A-GPS assistance data and to carry positioning protocol exchanges between handset and network.

At this point in time, there are no ubiquitous standards for a User Plan mechanism – and therefore each implementation tends to be vendor (chip-set) centric (e.g. Snaptrack, Sirf, Global Locate). Open Mobility Alliance (OMA) is currently finalizing a standard for Secure User Plane Location Service (SUPL) which will provide a more standardized way to implement U-Plane A-GPS technology.

User-Plane implementation will very likely be the implementation choice, particularly where GPS technologies are leveraged or where the Network Operator has not deployed a control plan mechanism. Note that the User Plane mechanism can potentially complement a Control Plan environment – however that scenario is presently under investigation in the applicable standard bodies.

2.1.3 USE CASES CALL FLOW

The following call flow is based on A-GPS positioning technology implementation. Note Step 5 to 15 can be supported by Mobile Operator's core network and thus should be transparent to Ride points system. Note that this analysis does not address commercial issues (such as the cost per location request which may constitute a material cost for an operational service).



Step 1

Ride points system user decided to perform a ride request. The user makes use of his/her handset and initial a GPRS (GSM) or 1xRTT (CDMA) data session with his ride points handset application.

Step 2 -3

Request arrives at Ride points application server and the server performs all necessary verification on user (user id/ password) and authorization for service request. Example of data sent to ride points application server can potentially include service location (can be current location in which ride points system can determine via UPLS, time of request and number of passenger needed). In this case, the request is for the user's current location; therefore, Ride points system makes a request to obtain user's current location from User Plane location Server.

Step 5-6

User Plane A-GPS technology requires a data session between handset and Location Server; in the case of network initiated traffic (application makes the request), it is necessary for the Location Server to trigger the handset to start a data session through the use of WAP push. A message with the location server's ip address will be 'pushed' to the handset and triggering the application on the handset to start a data session.

Step 7

Upon setting up a data session, the handset begins the location request transaction with a request of A-GPS satellite information request; it needs to obtain the instruction from A-GPS server for performing measurement; typically 4 satellites will be use to provide the necessary information for positioning computation. The handset can supplied its current serving MSC/BTS information to the User plane location server and the server can in turn use this information to provide the A-GPS server with a set of rough user current location information (in latitude and longitude). From this information, A-GPS server can determine which 4 satellites should be used by the handset to perform measurement. In the case where handset does not support providing current serving MSC/BTS information, Step 8 to 9 is necessary.

Step 8-9

In the case where A-GPS handsets do not provide serving MSC/BTS information, the Location Server can obtain the information from HLR through messages such as Any Time Interrogation and Provide Subscriber Location as defined in GSM MAP or POSREQ as defined in CDMA IS-848. Location Server performs serving MSC/BTS to latitude/longitude mapping. Note that in certain scenarios (where the users approximate (i.e. city) location is known – these steps may be optional based on the specific A-GPS technology employed. In this case, the approximate location would be used to generate the assistance data which will be supplied in the next steps to the mobile station.)

Step 10-12

User Plane Location Server sends an assistance data request with initial latitude/longitude info. A-GPS returns a response with the proper satellite information and Location Server relay this back to the handset.

Step 13

Handset performs raw data measurement from 4 different satellites. These are the essential data for location computation. For MS-based handset (not shown in this call flow), the position can be computed on the handset. For MS-assisted handset, the handset will send a position computation request back to the Location Server. One advantage MS-assisted handset is that it is more secure since location information is kept and computed on a secure server.

Step 14-15

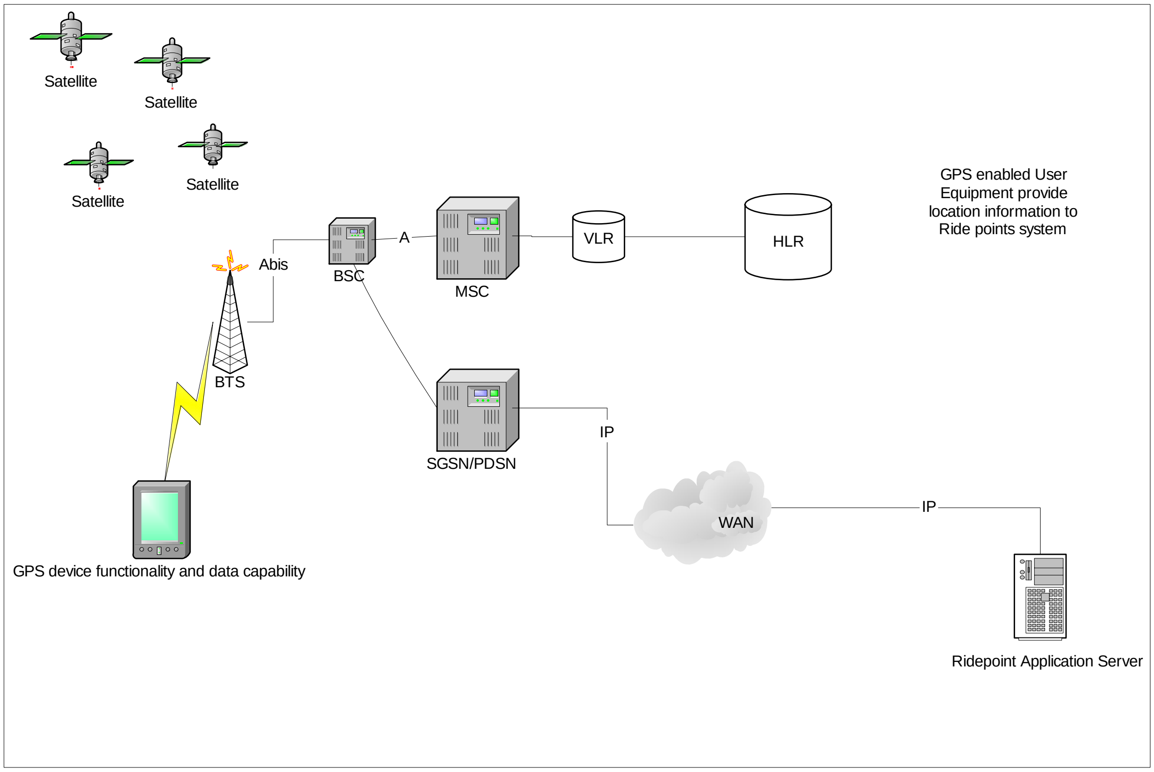
Handset request location computation to User Plane Location Server and the Server relays it to an A-GPS server for computation. The end result is then return to the Ride points system.

Step 17-18

Ride points system process the user's current location information and perform all the necessary actions (such as updating database, matching driver offers, mapping to Geographic Information system to display map, etc) and returns the status to the user.

2.2 GPS Based Technology Solution

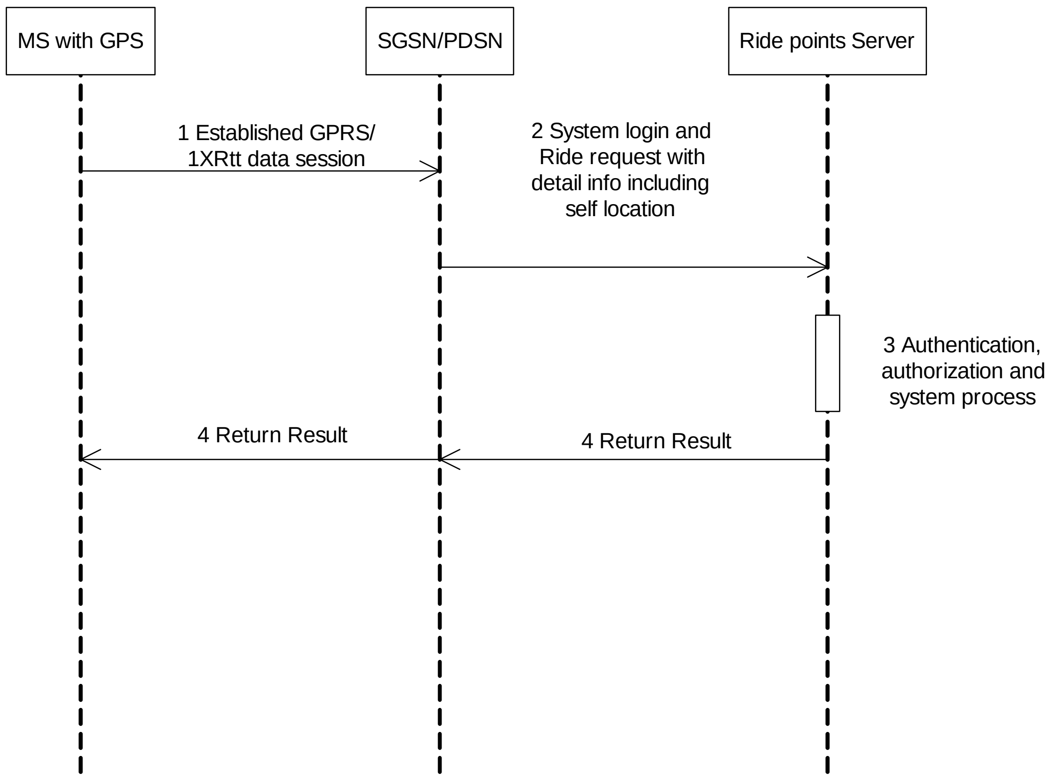
The following diagram shows a sample network diagram of a GPS based Ride points system



In a GPS based system, the user device has on board capability of obtaining its own location information. As a result, network operator support is reduced to just providing mobile data session access. A potential user device setup can consist a Bluetooth enabled GPS standalone device or PDA; such device can connect to Ride points application Server through a Bluetooth enabled cell phone with GPRS/1XRTT session. The vendor of the GPS device / PDA will need to provide an open source platform for 3rd party to develop client application.

2.2.1 GPS USE CASES CALL FLOW

Below is a sample call flow for GPS based Ride points system:



Step 1

The user device initialled a data session

Step 2

User performs ride request through on device application and the request was sent through the data session.

Step 3

Ride points Server perform authentication, authorization and all the necessary system process.

Step 4

Ride points system sends return status back to client.

3.0 CANADIAN WIRELESS OPERATOR A-GPS SUPPORT

Currently Bell Mobility has already implemented A-GPS location system in their network and most of the phone they sold since 2002 supports A-GPS. They have a comprehensive developer program to provide support for 3rd party location service application developer. For more information, please visit http://developer.bellmobility.ca.

Other carriers have not apparently deployed A-GPS or any other triangulation technology to date.

APPENDIX C3

ARCHITECTURE FLOWS FOR THE RPS

Source Entity	Architecture Flow	Destination Entity
Financial Institution (bank)	transaction status	Information Service Provider Subsystem
Financial Institution (rewards program)	transaction status	Information Service Provider Subsystem
Information Service Provider Operator	ISP operating parameter updates	Information Service Provider Subsystem
Information Service Provider Subsystem	payment request	Financial Institution (bank)
Information Service Provider Subsystem	*points request	Financial Institution (rewards program)
Information Service Provider Subsystem	ISP operating parameters	Information Service Provider Operator
Information Service Provider Subsystem	*account information	Personal Information Access Subsystem
Information Service Provider Subsystem	*profile information	Personal Information Access Subsystem
Information Service Provider Subsystem	trip plan	Personal Information Access Subsystem
Information Service Provider Subsystem	**security request	**Security Clearance Check Provider
Payment Instrument	payment	Personal Information Access Subsystem
Personal Information Access Subsystem	*account request	Information Service Provider Subsystem
Personal Information Access Subsystem	*drop-off confirmation	Information Service Provider Subsystem
Personal Information Access Subsystem	payment	Information Service Provider Subsystem
Personal Information Access Subsystem	*pick-up confirmation	Information Service Provider Subsystem
Personal Information Access Subsystem	trip confirmation	Information Service Provider Subsystem
Personal Information Access Subsystem	trip request	Information Service Provider Subsystem
Personal Information Access Subsystem	*user profile	Information Service Provider Subsystem
Personal Information Access Subsystem	request for payment	Payment Instrument
Personal Information Access Subsystem	driver updates	Traveller (driver)
Personal Information Access Subsystem	*user updates	Traveller (driver or passenger)
Personal Information Access Subsystem	*passenger updates	Traveller (passenger)

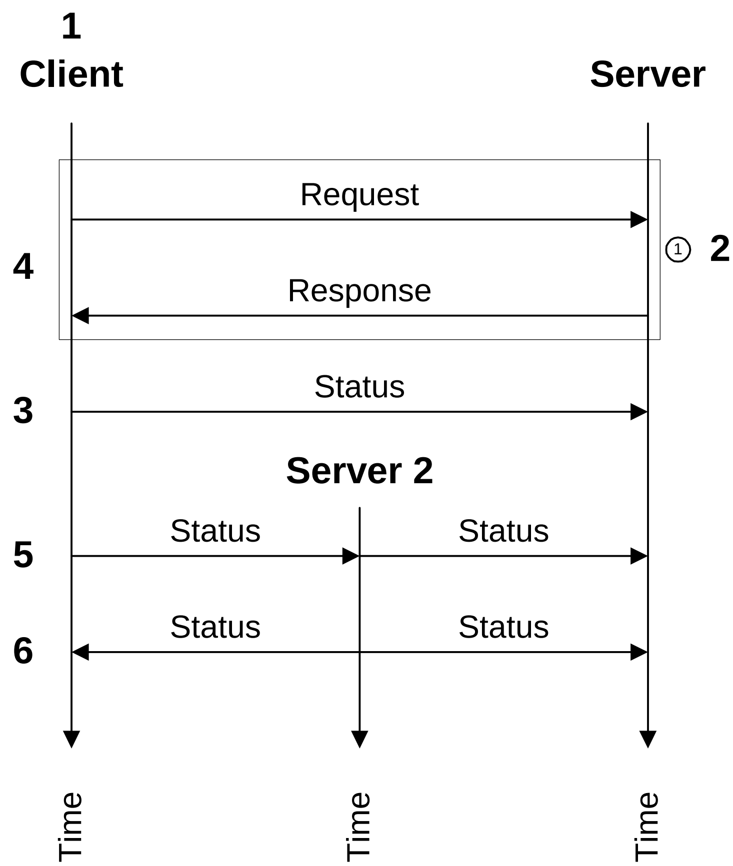
Source Entity	Architecture Flow	Destination Entity
**Security Clearance Check Provider	**security information	Information Service Provider Subsystem
Traveller (driver)	driver inputs	Personal Information Access Subsystem
Traveller (driver or passenger)	request for payment	Personal Information Access Subsystem
Traveller (driver or passenger)	*user inputs	Personal Information Access Subsystem

APPENDIX C4

U.S. NATIONAL ITS ARCHITECTURE – THEORY OF OPERATIONS

Theory of Operations present high-level, narrative, technical descriptions of the operation of each Market Package, and are intended to serve the transportation professional who is involved in ITS planning and/or implementation. Theory of Operation are described through the use of transaction sets that illustrate the sequence of information exchange (or an example of the sequence of information exchange) between architecture entities to implement the service. Transaction set diagrams, when suitably customized, should illustrate the technical roles, responsibilities and procedures of entities from an ITS architecture point-of-view (who sends what information to whom, and when).

Transaction set diagrams have a common notation that is shown in the following exhibit. The numbers on the exhibit correspond to the numbered items in the list below.



1. Architecture physical entities (Subsystems and Terminators) are represented as labeled vertical lines in the diagrams. While in the example above the two entities are labeled "Client" and "Server", in the diagrams these entities will have the names associated with Subsystems and Terminators in the architecture (e.g. "Information Service Provider" or "Traveler"). Time can be viewed in the diagrams as top (sooner) to bottom (later). No particular time scale is implied in the architecture diagrams.

2. Each diagram has a series of numbers in circles that associate sections of the diagrams with the textual description of the operation described separately (the numbers are not intended to illustrate a specific sequence of events).

3. Architecture flows are represented as horizontal arrows in the diagrams, originating and ending at ITS architecture entities. Some architecture flows may appear more than once on the

diagram. This is to indicate that the particular architecture flow is involved in the operation of several aspects.

4. Boxes are drawn around groups of architecture flows that are intended to be in a specific sequence in describing the operation. A sequence of flows in a "box" may repeat. For example, in several of the traveller information transaction set diagrams, there is a sequence of architecture flows allowing a traveller to set trip parameters and then request and receive a trip plan responsive to those parameters. The traveler may choose to modify the parameters and request again (and again…) until deciding to select a specific trip plan.

   Architecture flows that are not in boxes may be issued at any time. Another way of saying this is that the transactions may be "asynchronous" to other architecture flows or transaction sets of architecture flows. While it may be tempting for an analyst to put a pair of flows in a box, such as "operator inputs" from an operator to a subsystem and "operator status" from a subsystem back to an operator, it is probably best not to when there are scenarios where either of these flows may occur first.

   Finally, there are many cases in the architecture where request/response flows (such as illustrated in the above exhibit) are a part of a Market Package. The architecture supports several operational concepts for this exchange of information. A single request may result in a single response. Or this set of flows may actually be subscribe/response flows, where the request is issued once, and many responses (at regular intervals or on conditional events) may occur. If regional or project operational concepts are developed using these transaction set diagrams, it is recommended that the type of request/ response used be documented in the associated annotation.

5. In order to conserve space in the diagrams, when the same flow is issued from an entity to multiple receiving entities, it may be illustrated as shown as an arrow with multiple heads. For example, the exhibit above shows the Client sending a status flow to both the Server and to Server 2.

6. Similarly, bilateral architecture flows (i.e. pairs of flows with the same information description in opposite directions between entities) may be illustrated with two-headed arrows. This assumes of course that either flow may occur at the same time in the sequence of flows (or they may be asynchronous). An example of such a flow would be the architecture flow "incident information" that goes in both directions between an Emergency Management Subsystem and a Traffic Management Subsystem.

APPENDIX C5

LITERATURE REVIEW ADDENDUM – ALLO-STOP

Allo-Stop was established in 1983 by two Quebecoises entrepreneurs, Claire Patenaude and Jo Spratt. Safer than hitchhiking and cheaper than the bus, the idea quickly took root in Quebec, with offices opening as far east as Chicoutimi, and later spread into Ontario, where the Toronto office opened in 1990.

Members call up one of the Allo-Stop agencies and tell them where they are headed and Allo-Stop puts them in touch with other passengers and drivers travelling to the same place; they agree on a meeting place and share in the cost of transportation.

To alleviate concerns regarding safety, it is Allo-Stop's policy to ensure that there are at least two passengers on every trip.

Due to concerns of unfair competition offered by mostly unregulated companies, Voyageur, Trentway and Greyhound bus companies filed a complaint against Allo-Stop with the Ontario Highway Transport Board (OHTB). The companies argued that Allo-Stop had a definite "cost advantage" in being able to provide transport to its members without having to train or license its drivers, and that it was eroding their business.

On May 2, 2000, the OHTB ruled against Allo-Stop and they were forced to cease activities in Ontario by an Order of that Board. The ruling found that Allo-Stop's activities do not fall under the definition of ‘car pool’ in the Public Vehicles Act because car pools are used by ‘commuters’, a term that was not clearly defined prior to the court proceedings for the Allo-Stop case. During the proceedings, ‘commuters’ was defined to include only people travelling on a regular basis between home and work and between the suburbs and the city. Having ruled that Allo-Stop's drivers are not car pooling, the cars are therefore considered to be ‘public vehicles’, meaning that an Allo-Stop driver would have to pay a $500 licensing fee for the vehicle.

Appendix D

RPS Focus Group

Appendix D1

RPS Description/Questionnaire

RidePoints: An Overview Feb. 11/05

RidePoints, or RPS, is a real-time carpooling service that uses wireless technologies and global positioning systems to match potential drivers and passengers, and uses a loyalty points exchange system to compensate the driver for travel expenses. Here are some of the main features of the system:

- Applicants who wish to join our system will undergo a background criminal check, and those who want to be able to offer rides are checked to make sure they have good driving records;
- In areas where there is an adequate pool of members, drivers and passengers can be matched within a few minutes;
- You will have a choice of methods to activate the system – you can use your mobile phone or PDA if it has GPS; but you can also arrange rides by using the internet, e-mail or text messaging;
- The RPS system will match offers with requests to ensure a minimum of detours and delays for both parties, and to provide optimum compatibility (e.g. smoker vs. non-smoker). You will also be able to screen out any individual offers that you prefer not to accept;
- Safe and convenient pick-up and drop-off points will be developed to ensure a maximum of convenience and ease of recognition;
- The RPS system transfers frequent flyer points from the passenger to the driver, according to the distance driven. If you are a frequent passenger and run short of points, you can transfer points from an existing loyalty card or buy more on a cost-recovery basis;
- A post-ride rating system will be established to allow both the driver and passenger to leave feedback on their experience. This feedback rating will then be accessible for future transactions and will allow those users to view the feedback prior to accepting the RPS match.

Background Information

Name or code: ____

Age: ___________ Max. formal education level: ________________

Sex: Male |____| Female |____|

Income bracket: under $30k |____| $30k-$50k |____| $50k-$75k |____|
$75k-$100k |____| over $100k |____|

Do you have/own: 1 car |____| 2 cars |____| Bike |____| Other |_____________________|

Do you use: Aeroplan |____| Air Miles |____| Other |________________________|

Home location: Inner city |____| Inner suburbs |____| Suburbs |____| Out of town |____|

Work location 1: Inner city |____| Inner suburbs |____| Suburbs |____| Out of town |____|
Approx. distance from home, km.|____| Number of trips per week |____|
Walking |____| Bus |____| Car |____| Other |______________________|

Work location 2: Inner city |____| Inner suburbs |____| Suburbs |____| Out of town |____|
Approx. distance from home, km.|____| Number of trips per week |____|
Walking |____| Bus |____| Car |____| Other |______________________|

Other location you go to on a regular basis Inner city |____| Inner suburbs |____| Suburbs |____| Out of town |____|
Approx. distance from home, km.|____| Number of trips per week |____|
Walking |____| Bus |____| Car |____| Other |______________________|

Questions about RidePoints concept:

1. What are your views on mobile phones, PDAs etc. – would you be willing to use one in order to be able to use the RPS system ?

   ____

   ____

2. If the RPS service is as described, would you be likely to join and use it ?

   ____

3. What do you think of linking points benefits to ride sharing ? How do you feel about RPS being added to the list of partners linked to your points card ?

   ____

   ____

4. Would you be willing to pay an annual fee ? How much would you be willing to pay ?

   ____

   ____

5. How often do you think you would use the service ?

   ____

   ____

6. Would you use it primarily as a driver or passenger, or both ?

   ____

7. What kind of trips do you think you would make, and what distance ?

   ____

   ____

   ____

8. How long in advance would you want to arrange trips ?

   as a driver ____

   as a passenger____

9. What would be your preferred RPS access methods - mobile / PDA, internet, e-mail or telephone ?

10. What is your view on the best pick-up and drop-off arrangements ?

11. If you were making a pick-up, how far out of your way would you be willing to go ?

12. How long would you be willing to wait for the system to identify a match ?

13. What would be your security concerns ? How could these be addressed ?

14. What kind of things might bother you or make you feel uncomfortable about sharing a ride?

15. Do you have other fears or reservations about the system, as you understand it ?

16. Other comments

Appendix D2

Questionnaire Results

RidePoints Focus Group - Participant Characteristics 1

Name or code	JF	JU	HTL	DM	WC
Age	52	54	52	49	45
Sex	F	F	F	M	M
Maximum educational level	MSc	MA	Postgrad	BSc	PhD
Income bracket (1 to 5)	4	3	1	3	1
Number of cars / bike / other	1/1/0	0/1/0	0.5/1/0	0.5/1/0	0.5/0/0
Incentive cards used - Aeroplan	Y	Y	Y	Y	Y
Incentive cards used - Air Miles					
Incentive cards used - other			Y		
Type of home location (1 to 4)	1	1	1	1	2
Type of work location 1 (1 to 4)	1	1		3	4
Approx. distance from home, km.	3	0		11	200
No. of 1-way trips per wk - walking	10	0			
No. of 1-way trips per week - bus					
No. of 1-way trips per week - car				10	2
No. of 1-way trips per week - other					
Comments		Home office			Car pool to
Type of work location 2 (1 to 4)	1	1			
Approx. distance from home, km.	1	2			
No. of 1-way trips per wk - walking	1				
No. of 1-way trips per week - bus					
No. of 1-way trips per week - car					
No. of 1-way trips per week - other		2			
Comments		several clients			
Other regular destination type (1 to 4)	4	1.5	1	2	
Approx. distance from home, km.	15	2	1.5	10	
No. of 1-way trips per wk - walking			10		
No. of 1-way trips per week - bus					
No. of 1-way trips per week - car	4			2	
No. of 1-way trips per week - other		1			
Comments					
General comments		Non-driver, uses taxis	Non-driver, does not work		

RidePoints Focus Group - Participant Characteristics 2

Name or code	GP	AV	CC	DT	MM
Age	68	56	44	53	65
Sex	M	M	F	F	F
Maximum educational level	PhD	B.Eng	MSc	MSc	Masters
Income bracket (1 to 5)	1	3	1	1	1
Number of cars / bike / other	1/0/0	1/2/lots	0.5/1/0	1/0/0	1/0/0
Incentive cards used - Aeroplan		Y	Y	Y	
Incentive cards used - Air Miles				Y	
Incentive cards used - other					
Type of home location (1 to 4)	1	4	2	4	1
Type of work location 1 (1 to 4)	1	4	1	1	
Approx. distance from home, km.	0	0	13.5	80	
No. of 1-way trips per wk - walking	0	0			
No. of 1-way trips per week - bus					
No. of 1-way trips per week - car			10	6	
No. of 1-way trips per week - other					
Comment	Home office	Home office			
Type of work location 2 (1 to 4)				4	
Approx. distance from home, km.				0	
No. of 1-way trips per wk - walking				0	
No. of 1-way trips per week - bus					
No. of 1-way trips per week - car					
No. of 1-way trips per week - other					
Comment				Home office	
Other regular destination type (1 to 4)	1	1.5	2.5	1	1
Approx. distance from home, km.	5	15	10	80	2
No. of 1-way trips per wk - walking					4
No. of 1-way trips per week - bus					
No. of 1-way trips per week - car	4	2	2	4	
No. of 1-way trips per week - other					
Comment			Misc. trips		
General comments				Couple has 2 cars	Retired, non-driver

RidePoints Focus Group - Participant Characteristics 3 and Summaries

Name or code	KGK	M	Summary comments	Summari
Age	26	23	Average age	49
Sex	M	F	Sex	7 F, 5 M
Maximum educational level	M.Arch	BA	Maximum educational level	12 post secondar
Income bracket (1 to 5)	1	2	Income bracket (1 to 5)	1.8
Number of cars / bike / other	1/1/0	1/0/0	Number of cars / bike / other	9 cars (75
Incentive cards used - Aeroplan	Y	Y	Incentive cards used - Aeroplan	9 (75%
Incentive cards used - Air Miles	Y		Incentive cards used - Air Miles	2 (17%
Incentive cards used - other	Esso		Incentive cards used - other	2 (17%
Type of home location (1 to 4)	1	1	Type of home location (1 to 4)	1=8, 2= 3=0, 4=
Type of work location 1 (1 to 4)	1	1	Type of work location 1 (1 to 4)	1=7, 2= 3=1, 4=
Approx. distance from home, km.	7	5	Avg. distance from home, km.	32
No. of 1-way trips per wk - walking			Avg. trip distance per wk - walk	7.5
No. of 1-way trips per week - bus		6	Avg. trip distance per wk - bus	6
No. of 1-way trips per week - car	14	4	Avg. trip distance per wk - car	207
No. of 1-way trips per week - other			Avg. trip distance per wk - other	0
Comment				
Type of work location 2 (1 to 4)			Type of work location 1 (1 to 4)	2
Approx. distance from home, km.			Avg. distance from home, km.	1
No. of 1-way trips per wk - walking			Avg. trip distance per wk - walk	0.5
No. of 1-way trips per week - bus			Avg. trip distance per wk - bus	0
No. of 1-way trips per week - car			Avg. trip distance per wk - car	0
No. of 1-way trips per week - other			Avg. trip distance per wk - other	4
Comment				
Other regular destination type (1 to 4)	2	1	Type of work location 1 (1 to 4)	1.7
Approx. distance from home, km.	10	2	Avg. distance from home, km.	13.9
No. of 1-way trips per wk - walking			Avg. trip distance per wk - walk	4.8
No. of 1-way trips per week - bus			Avg. trip distance per wk - bus	0
No. of 1-way trips per week - car	10	8	Avg. trip distance per wk - car	73.3
No. of 1-way trips per week - other			Avg. trip distance per wk - other	2
Comment				
General comments				

RidePoints Focus Group - Participant Questions 1A

Name or code	JF	JU	HTL	DM	WC
1 Views on mobile phones, PDAs etc., would you use for RPS?	Don't own either and don't want so far.	Very useful	What if you have no cell phone or PDA ?	Yes	Yes
2 Would you be likely to join RPS ?	possibly -- if security sorted out.	maybe / probably	Maybe	Possibly	Yes
3 What do you think of linking points benefits to ride sharing ?	depends on plan - - wouldn't want to get pile of useless points or point debt	Non-driver, so couldn't earn points, use points from other sources?	Depends on what kind of points / plan	Sounds good	Save money a save energy, great
4 Would you be willing to pay an annual fee ? How much ?	for what? If similar to cell phone plans -- pay as you go and different	Currently pay $1500-$2000 / year on taxis, would pay 10%	Max. $10 per year	$30	Yes, $20 to $
5 How often do you think you would use the service?	1-2 times per mo, similar to taxi usage	Only when taxi too expensive or unavailable	once a month max.	2 to 4 times per week as passenger, 10 times as driver	Twice a mor
6 Would you use it as driver or passenger or both ?	if secure, cheap and convenient both	Passenger	passenger	Both	Both
7 What kind of trips would you make and what distance ?	sort -- in town	Wherever taxi fare > $20, so 10-15 km.	for out of town trips > 50 km	To areas (1) or (2) as passenger, to (3) as driver	Visiting frien also to wor
8 How long in advance would you want to arrange trips: as driver / as passenger ?	similar to taxi	one week for pre-arranged meetings, 24 hrs for others	24 hrs.	1 day / 1 day	2 to 7 days a driver, 1 to 7 passenger c instant
9 What would be your preferred RPS access methods ?	Telephone	Internet or e-mail as second choice	cell phone	E-mail, phone, mobile phone (in order)	Internet, e-m PDA, telepho (in order)

RidePoints Focus Group - Participant Questions 2A

	Name or code	GP	AV	CC	DT	MM
1	Views on mobile phones, PDAs etc., would you use for RPS?	Mobile phones destroy sex lives, conversation	Why is PDA or cellphone needed?	Would not get mobile phone just for RPS	Don't want text messaging or phones as only contact	PDA is solutic looking for problem, us mobile phon
2	Would you be likely to join RPS ?	Only if landlines are included	No	Yes	With more detail, quite possibly	Not sure, nee more info
3	What do you think of linking points benefits to ride sharing ?	?	Cost sharing of car would be better for me	Like the linkage	Depends on range and type of points v. service given	Fine
4	Would you be willing to pay an annual fee ? How much ?	$50 per year	small amount	Under $50	Not up-front	No
5	How often do you think you would use the service?	Once a week	Seldom	Once a week	depends	Twice a week average
6	Would you use it as driver or passenger or both ?	Both	As driver	Passenger	Both	Passenger
7	What kind of trips would you make and what distance ?	Evening social purpose, 10 km; daytime shopping 5 km	Longer trips	Visiting, shopping for trips over 200 km	Dinner parties - 150 km return; work trips up to 1000 km	Suburban ma shopping
8	How long in advance would you want to arrange trips: as driver / as passenger ?	0.5 day / 3 hours	1 day / 1 day	one day	24 hrs / 24 hrs	NA / 2 days
9	What would be your preferred RPS access methods ?	Landline telephone	Should be able to use a variety of means	E-mail or telephone	Internet / BBS with authentication	E-mail or telephone

RidePoints Focus Group - Participant Questions 3A and Summaries

Name or code	KGK	M	Summaries
1 Views on mobile phones, PDAs etc., would you use for RPS?	Yes, if secure enough	Ok with mobile phone	5 respondents are generally positive, 4 ambivale 3negative
2 Would you be likely to join RPS ?	Yes	Probably not - if can't get ride with friends, would prefer bus	4 positive, 6 ambivalent or conditional, 2 negativ
3 What do you think of linking points benefits to ride sharing ?	Attractive because it does not require money	Points are better than cash	6 are positive, 5 ambivalent or conditional
4 Would you be willing to pay an annual fee ? How much ?	$50 to $70	Would use seldom, so less than $50	Average of $55 for 7 clear responses, 2 others u $50.
5 How often do you think you would use the service?	once or twice a week	maybe 5 times per year	Average of 4.4 times per month for 9 clear responses
6 Would you use it as driver or passenger or both ?	More as driver	As passenger	5 say both, 2 say as Driver, 5 say as passenger
7 What kind of trips would you make and what distance ?	Within city limits, less than 10 km.	Within city, less than 10 km.	A great deal of variation in responses, from 5 responses at about 10km, to 5 who would use it distances ranging from 80 km to 1000 km
8 How long in advance would you want to arrange trips: as driver / as passenger ?	1 day as driver, a few minutes as passenger	1 day as driver, 3 to 5 days as passenger	2 for rapid responses "like taxi" or for under 3 ho 9 responses for 24 hours, one for more than one
9 What would be your preferred RPS access methods ?	E-mail or internet	Cell phone if out of house, or e-mail	As first choice, 6 for landline phone, 3 for cellpho 3 for internet, 6 for e-mail. As second choice, 1 e-mail. One respondent wants all possible mean

RidePoints Focus Group - Participant Questions 1B

	Name or code	JF	JU	HTL	DM	WC
10	What are best pick-up and drop-off arrangements?	My house, my office	My house-office	Designated pickup in inner city, drop off as requested	Not sure	Select gather points
11	If making a pick-up, how far out of your way would you be willing to go?	1 to 2 blocks	N/A	Max. 1 Km	1 to 2 km, depends on trip length	10 km
12	How long would you be willing to wait for a match?	10 minutes	up to 1 hour before departure	15 minutes	4 to 6 hours	10 minute:
13	What would be security concerns? How could these be addressed?	Would only want to go with neighbours. Want to be able to refuse ride on the spot	Willing to risk unpleasantness, but some women would want to select gender	Very concerned about undesirable driver - want to see driver profiles first	Would be concerned. Need system like E-Bay to rate your ride	none
14	What kind of things might bother you or make you feel uncomfortable?	Smoking, bad driving, bad-humoured drivers or passengers	The need to be social when your mind is elsewhere, or shyness	Not liking the person	Passenger or especially drive using a cellphone, poor driver, bad hygiene	waiting, everyone shou be on time
15	Do you have other fears or reservations about the system?	Paperwork - if it involves lots of e-mails or letters, would quit	Complexity. If it isn't easy I won't do it.	What if you are passenger only and run out of points. What if a driver and too many points ?	Not as such	Safet is big is: - need to chec driver's recorc
16	Other comments	Good luck. How does this compare to LETS system or shared car service?	1. Seems useful for environment. 2. Might be financial advantage, cars v. expensive			It is a great id to have a real time car-pooli system, I like and will participate

RidePoints Focus Group - Participant Questions 2B

	Name or code	GP	AV	CC	DT	MM
10	What are best pick-up and drop-off arrangements?	Pre-set time, not phone calls	Should be at discretion of passenger	Drop off close to home especially at night	Clear time & location conventions set by RPS	No views
11	If making a pick-up, how far out of your way would you be willing to go?	3 km	Depends on schedule		Depends on trip length - could be 15 km for 75 km trip	NA
12	How long would you be willing to wait for a match?	30 minutes	1 day as driver	10 to 20 minutes	Depends	1 day max
13	What would be security concerns? How could these be addressed?	Driver responsibility - need to pre-screen for speeding etc.	Extensive list, doubt if they could be satisfied	Driving behaviour, criminal background	Want photo on website, need member ombudsman to handle complaints	None
14	What kind of things might bother you or make you feel uncomfortable?	Smokers, people talking on cell phones	As driver, music prefs, personal hygiene, smoking, crime check, purpose, contents of luggage. As passenger, all above plus driving habits, vehicle condition, insurance coverage. Amount of info I want about other party far exceeds amount of checking that I am willing to undergo.	Too long a waiting time in unsafe areas	If no problem resolution process, no simple ID or verification	below-standar personal hygiene, verba diarrhea
15	Do you have other fears or reservations about the system?	None		Seems to overlap with OC Transpo system for older people	Should be inclusive on technologies. Contact methods flexible, system reliable. Could be of great value for long distances. Website needs location map of contact points.	No
16	Other comments					

RidePoints Focus Group - Participant Questions 3B and Summaries

<table>
<tr><th colspan="2">Name or code</th><th>KGK</th><th>M</th><th>Summaries</th></tr>
<tr><td>10</td><td>What are best pick-up and drop-off arrangements?</td><td>Specific spots in central areas</td><td>Designated spots in public areas (malls, bus stations)</td><td>2 responses for home or office location, 5 for designated pick-up or drop-off spots, 1 for mutua agreement, 2 no views or open.</td></tr>
<tr><td>11</td><td>If making a pick-up, how far out of your way would you be willing to go?</td><td>within 5 minutes</td><td>An extra 5 to 10 minutes max.</td><td>5 respondents for maximum of a few blocks or u 10 minutes, 3 say that it depends on schedule or length.</td></tr>
<tr><td>12</td><td>How long would you be willing to wait for a match?</td><td>Not longer than departure time</td><td>24 hours</td><td>4 respondents for less than 15 minutes, 3 for one day, others between.</td></tr>
<tr><td>13</td><td>What would be security concerns? How could these be addressed?</td><td>Background checks on driving record; ID card</td><td rowspan="4">How people are picked up and legal liability issues. These could be addressed by having meetings so you can get to know passengers and drivers. Need research into liabilities, then get people to sign contracts. Not knowing the person and reliability of person picking me up are main concerns - if I am on my way somewhere I don't want to be late.</td><td rowspan="4">A wide range of responses. Many cite multiple possible impediments: security (but it is assume that security checks would deal with actual dangers); liability and insurance issues; possible irritants related to personal behaviour and drivin habits.

A strong theme is apprehension about the amour checking and scrutiny that all applicants (includin the respondents) would have to undergo in order be approved as RPS users.</td></tr>
<tr><td>14</td><td>What kind of things might bother you or make you feel uncomfortable?</td><td>Clash of personalities & music choice</td></tr>
<tr><td>15</td><td>Do you have other fears or reservations about the system?</td><td>Privacy issue - hooking up to central GPS</td></tr>
<tr><td>16</td><td>Other comments</td><td>Should have more focus groups with various types of groups</td></tr>
</table>

Appendix D3

Analysis of Questionnaire and Discussion

Analysis of RPS Focus Group

Comments made in the questionnaires and at the discussion are relatively consistent, but reveal a wide range of responses. The following questions were included in the questionnaire, and also formed the basis of most discussion. Responses from both sources are therefore organized under these headings. A complete list of responses can be found in **Appendix D2**.

1. *Views on mobile phones, PDAs etc., would you use for RPS?*

   In the questionnaire, 5 respondents were generally positive, 4 ambivalent, and 3 responded negatively. The discussion reinforced this range of viewpoints, with several discussants expressing negative or skeptical views on recent communication technologies. Some comments made:

   - *Use of cellphones could be very annoying… And dangerous if he is driving while talking...*
   - *You have a neat idea, but what is the problem? If it is urban congestion, then do like London with a fee. But if problem is suburban (low density) traffic, it is different - You should address the problem directly and let the technology follow…*
   - *This (core issue) has nothing to do with technology…*
   - *Complexity or too much technology would keep people like me away.*

   One discussant suggested that fancy technologies might not be necessary for measuring distance for the purpose of calculating distance - *You could have pre-defined stations that would be a known distance apart (wouldn't need GPS in this case).*

2. *Would you be likely to join RPS?*

   Of questionnaire respondents, 4 were positive, 6 ambivalent or conditional, and 2 were generally negative. During the discussion, the ambivalent answers provide the most interesting information:

   - *First reaction – Mummy said don't ride with strangers…*
   - *Relevant issues include safety, driving habits, personal hygiene, whether they smoke, what is in their luggage if the police pull you over etc…*
   - *Also would I want to subject myself to the checks required for the kind of clearance we want?...*
   - *Iif I am going to a meeting, I get in my car and go, don't want to depend on anyone. If I am late I won't want to pick anyone up.*

3. *What do you think of linking points benefits to ride sharing?*

   6 questionnaire respondents were positive, 5 were ambivalent or conditional. During the discussion, comments included:

   - *Why is there so much emphasis on points – is it just to get around taxi issue?*
   - *Points might get you in same problem as the LETS (Local Employment Trade System) system. I was in this system, but couldn't trade points for anything I wanted – there were 200 people offering massage etc., but no takers (Note: point would only be applicable if RPS points had no exchange value outside of rides).*

4. *Would you be willing to pay an annual fee? How much?*

   Answers to this question were surprising, in that the amount that respondents were willing to pay was greater than expected. Analysis of questionnaire results indicated that the average for 7 responses was $55, with 2 other respondents offering under $50.

5. *How often do you think you would use the service?*

   From the questionnaire 9 respondents estimated that they would use the system an average of 4.4 times per month. However, this average masks the fact that there are a few who would use it several times a week, and another group that would use it only a few times a month.

6. *Would you use it as driver or passenger or both?*

   A fairly even split is indicated by questionnaire responses, with 2 predicting a role primarily as driver, 5 as passenger and 5 as both.

7. *What kind of trips would you make and what distance?*

   The large variation in questionnaire responses reflects the fact that some of the group live in the central city and have short distances for commuting or personal trips (5 predicted trips of about 10 km); while a few live out of town and have much longer trips, ranging from 80 km. to longer.

8. *How long in advance would you want to arrange trips: as driver / as passenger?*

   Again, there was a considerable spread in questionnaire responses. Two wanted rapid responses "like a taxi" or for under 3 hours, nine respondents felt that a 24 hour period would be suitable, and one for more than one day. During the discussion, it was clear that this issue was a fairly major one:

   - *if I am going to a meeting, I get in my car and go, don't want to depend on anyone. If I am late I won't want to pick anyone up).*

   At the other end of the spectrum is this advocate for long lead times*:*

   - *For us (living in the country) the system would be great. We have to plan our trips carefully and long in advance. Reliability is very important. 24 hr in advance is good for me, because I need to also arrange a Plan B. In the city, Plan B would be taking a taxi, the bus or biking, so no problem. Someone in suburbs has same problem as me, with very infrequent service, maybe every two hours. People in that situation wouldn't spontaneously decide to go on a ride. So RPS could be very good but would be used with longish lead times by people like me.*

9. *What would be your preferred RPS access methods?*

   As first choice, 6 questionnaire respondents would want to use a landline phone, 3 would opt for cellphones, 3 for internet and 6 for e-mail. One respondent wants all technical means to be possible. This is generally consistent with the discussion, which downplayed technology and emphasized flexibility of access to and use of the system. e.g. "*The nice thing about taxis is simplicity of calling the (human) dispatcher, I tell them where I want to go, they tell me how long it will be before I am picked up etc."*

10. *What are best pick-up and drop-off arrangements?*

2 responses for home or office location, 5 for designated pick-up or drop-off spots, 1 for mutual agreement, 2 no views or open. The discussion brought out some interesting points. Pick-up or drop-off at home was seen as a convenience and even a safety feature for evening travel, but another respondent felt that a pick-up at home was an intrusion on his privacy.

Several discussants suggested that public pick-up or drop-off spots, such as exist in San Francisco, would be preferable because of the ease of coordination and visibility. A safety aspect was also related to this: on the one hand, a public pick-up spot would allow the driver to scan the passenger and the passenger to scan the car, so that either party could opt out at the last minute. On the other hand, it was suggested that there is an inherent risk to picking up a stranger at a public stop.

11. *If making a pick-up, how far out of your way would you be willing to go?*

Five respondents were willing to make detours of only a few blocks or up to 10 minutes in time, but three said that it would depend on their schedule (the degree of rush) or the trip length.

12. *How long would you be willing to wait for a match?*

Responses ranged widely: four respondents wanted less than 15 minutes, three opted for one day, and others had preferences between these two extremes. This is consistent with answers to question (8).

13. *What would be security concerns? How could these be addressed?*
14. *What kind of things might bother you or make you feel uncomfortable?*
15. *Do you have other fears or reservations about the system?*

Responses to these three questions tended to overlap, and are therefore treated together. There was a wide range of questionnaire responses. Many cited multiple possible impediments: security (but respondents seemed to accept that security checks would deal with actual dangers); liability and insurance issues; possible irritants related to personal behavior and driving habits. A strong theme was apprehension about the amount of checking and scrutiny that all applicants (including the respondents) would have to undergo in order to be approved as RPS users.

Some specific comments on safety and security issues:

- *This (RPS) sounds like hitchhiking from a security viewpoint (some danger). But these days even buses are a security problem.*
- *Mainframe is vulnerable to hacking. There is a privacy issue, being hooked up to GPS, people will know where you are.*
- *How would you select people (criteria for admission to RPS), liability issues if something goes wrong– who is responsible, who could you sue ?.... RPS*
- *I would be happy if the central system had a photo of the driver/passenger and of the car.*

Appendix E

Estimation of Daily RPS Transactions

Estimated RPS Transactions - Trip Matrix

FROM: \ TO:	City of Toronto	Durham	York	Peel	Halton	City of Hamilton	Niagara	City of Guelph	Wellington	Town of Orangeville	City of Barrie	Simcoe	City of Kawartha Lakes	City of Peterborough	Peterborough	City of Orillia	Total
City of Toronto	4,184,700	106,200	388,200	295,900	50,000	13,700	5,700	3,500	1,900	1,900	6,500	15,000	2,600	1,800	1,100	700	5,079,400
Durham	107,100	837,300	33,200	8,600	1,600	600	900	300	200	0	500	2,500	9,700	3,400	2,300	500	1,008,700
York	388,500	33,700	1,056,700	58,000	6,400	1,900	1,200	600	400	1,000	7,000	23,200	1,400	500	500	500	1,581,500
Peel	298,200	8,700	58,900	1,501,300	94,200	13,400	4,000	4,200	4,400	7,700	3,100	9,600	300	500	300	300	2,009,100
Halton	50,000	1,700	6,700	93,400	605,000	67,500	7,600	4,900	4,400	800	400	1,300	100	100	-	100	844,000
City of Hamilton	13,800	700	1,900	13,200	66,900	877,200	23,400	2,200	900	100	100	500	400	100	100	100	1,001,600
Niagara	5,300	1,000	1,100	3,700	7,600	23,000	923,600	700	200	100	300	500	200	-	-	100	967,400
City of Guelph	3,300	400	600	4,000	4,900	2,400	700	213,900	18,600	300	-	400	-	-	100	-	249,600
Wellington	1,800	200	400	4,300	4,300	800	100	18,400	49,200	1,600	100	200	-	-	-	-	81,400
Town of Orangeville	2,100	100	900	7,400	700	100	100	300	1,600	41,200	100	800	100	-	-	-	55,500
City of Barrie	6,400	400	7,000	3,000	400	100	100	100	100	100	187,400	47,200	200	-	-	3,300	255,800
Simcoe	14,900	2,500	23,400	9,100	1,200	500	700	400	200	900	47,200	291,100	700	200	100	18,900	412,000
City of Kawartha Lakes	2,300	9,400	1,500	300	100	400	100	-	-	-	200	600	92,100	6,900	2,000	500	116,400
City of Peterborough	1,800	3,400	400	500	100	100	100	-	-	-	-	300	6,700	164,800	29,300	-	207,500
Peterborough	1,000	2,100	300	200	100	100	-	100	-	-	-	100	2,100	29,100	25,500	100	60,800
City of Orillia	900	500	400	200	100	-	100	-	-	-	3,200	19,100	300	100	-	54,000	78,900
Region Total	5,082,100	1,008,300	1,581,600	2,003,100	843,600	1,001,800	968,400	249,600	82,100	55,700	256,100	412,400	116,900	207,500	61,300	79,100	14,009,600

Estimated RPS Transactions - Trip Matrix

FROM: \ TO:	City of Toronto	Durham	York	Peel	Halton	City of Hamilton	Niagara	City of Guelph	Wellington	Town of Orangeville	City of Barrie	Simcoe	City of Kawartha Lakes	City of Peterborough	Peterborough	City of Orillia	Total
City of Toronto	418	106	388	296	50	14	6	4	2	2	7	15	3	2	1	0	1,312
Durham	107	84	33	9	2	0	0	0	0	0	0	3	10	3	2	0	252
York	389	34	106	58	6	2	1	0	0	0	7	23	1	0	0	0	627
Peel	298	9	59	150	94	13	4	4	4	8	3	10	0	0	0	0	657
Halton	50	2	7	93	61	68	8	5	4	0	0	1	0	0	0	0	298
City of Hamilton	14	0	2	13	67	88	23	2	0	0	0	0	0	0	0	0	209
Niagara	5	0	1	4	8	23	92	0	0	0	0	0	0	0	0	0	133
City of Guelph	3	0	0	4	5	2	0	21	19	0	0	0	0	0	0	0	55
Wellington	2	0	0	4	4	0	0	18	5	2	0	0	0	0	0	0	35
Town of Orangeville	2	0	0	7	0	0	0	0	2	4	0	0	0	0	0	0	15
City of Barrie	6	0	7	3	0	0	0	0	0	0	19	47	0	0	0	3	86
Simcoe	15	3	23	9	1	0	0	0	0	0	47	29	0	0	0	19	146
City of Kawartha Lakes	2	9	2	0	0	0	0	0	0	0	0	0	9	7	2	0	31
City of Peterborough	2	3	0	0	0	0	0	0	0	0	0	0	7	16	29	0	58
Peterborough	0	2	0	0	0	0	0	0	0	0	0	0	2	29	3	0	36
City of Orillia	0	0	0	0	0	0	0	0	0	0	3	19	0	0	0	5	28
Region Total	1,314	251	628	651	298	210	134	55	36	15	86	147	32	58	37	28	3,978

Inter-region	0.10%
Intra-region	0.01%

Appendix F

Business Case Calculations

Business Case Calculations

Year	0	1	2	3	4	5	6	7	8	9	10	Net Present Value
Assumptions												
Daily Transactions		30	100	400	1000	1500	2000	2500	3000	3500	4000	
Subscribers		500	3000	6000	9500	13500	17500	21000	24000	27000	30000	
New Subscribers		500	2500	3600	4500	5500	5500	5000	5000	5000	5000	
Returning Subs		0	500	2400	5000	8000	12000	16000	19000	22000	25000	
Registration Fee		0	0	10	20	30	40	55	55	55	55	
Costs												
Capital												
Development and Deployment (back office)	(200,000)											(200,000)
Cellular locationing integration	(200,000)											(200,000)
Operating and Maintenance												
Site lease/utils		(60,000)	(60,000)	(60,000)	(60,000)	(60,000)	(60,000)	(60,000)	(60,000)	(60,000)	(60,000)	(511,812)
Web hosting & support		(1,200)	(1,200)	(1,200)	(1,200)	(1,200)	(1,200)	(1,200)	(1,200)	(1,200)	(1,200)	(10,236)
Marketing	(50,000)	(50,000)	(50,000)	(50,000)	(50,000)	(50,000)	(50,000)	(50,000)	(50,000)	(50,000)	(50,000)	(476,510)
Locationing Data		(100,000)	(100,000)	(100,000)	(100,000)	(100,000)	(100,000)	(100,000)	(100,000)	(100,000)	(100,000)	(853,020)
Staffing		(100,000)	(160,000)	(210,000)	(260,000)	(260,000)	(310,000)	(310,000)	(310,000)	(310,000)	(310,000)	(2,120,021)
Security Checks ($100/per)		(50,000)	(250,000)	(360,000)	(616,667)	(816,667)	(950,000)	(1,033,333)	(1,133,333)	(1,233,333)	(1,333,333)	(6,333,849)
Total	(450,000)	(361,200)	(621,200)	(781,200)	(1,087,867)	(1,287,867)	(1,471,200)	(1,554,533)	(1,654,533)	(1,754,533)	(1,854,533)	(10,705,449)
Revenues												
Registration Fees		0	0	60,000	190,000	405,000	700,000	1,155,000	1,320,000	1,485,000	1,650,000	5,506,341
Transaction Fees ($0.1/km)		15,000	50,000	200,000	500,000	750,000	1,000,000	1,250,000	1,500,000	1,750,000	2,000,000	7,203,301
Total	0	15,000	50,000	260,000	690,000	1,155,000	1,700,000	2,405,000	2,820,000	3,235,000	3,650,000	12,709,642
Annual Net	(450,000)	(346,200)	(571,200)	(521,200)	(397,867)	(132,867)	228,800	850,467	1,165,467	1,480,467	1,795,467	2,004,194