Fundamental Considerations

The specific problem presented today encompasses several issues. Overall, we have identified three fundamental considerations: Economic, Social and Sustainability. Economic considerations are based on shareholders' need for economic gains to be generated from the proposed solution. Such considerations include appropriate pricing of transit fares to accommodate and attract the 40-59 age group, who are primarily employed, and least likely to use transit. Additionally, the Regina International Airport has seen a large influx of enplaning and deplaning passengers, reaching upwards to almost 1 million passengers in 2008. These visitors have caused a shortage in taxi supply and as a result require an alternative mode of transportation. This current lack of transportation will negatively impact the local tourism industry. Social considerations are based on consumers' needs for products and services to improve their quality of life. These considerations include the safety of passengers, specifically women, children and the elderly. Also the low income population has had little incentives to explore the potential of the transit system. Additionally, the University of Regina, a node of high transit demand, has 12000 students, many of whom require incentives to make use of the transit system. Sustainability considerations include society's need for products and services to be sourced, manufactured, delivered, used and disposed of with no negative effects on their health, safety and environment. An issue that arises in this problem is the widely spread population over a large area and consequently higher transit vehicular coverage and resulting emissions. Another consideration is the large dependence on car transportation in Regina compared to cities across the nation (see Appendix A). Additionally, the Environmental Protection Agency standards are rising and are more difficult to meet with Regina's 20 year old buses.

Solution Focus

In order to approach a solution for the problem, a focused strategy was made by identifying three areas on which our solution should focus: Environmental Impact, Increased ridership, and Integrative Sustainability.

Environmental Impact

Biodiesel is a fuel that is derived from non-petroleum sources, most commonly soybeans and other feedstock. Using biodiesel reduces greenhouse gas emissions because carbon dioxide released from biodiesel combustion is offset by the carbon dioxide sequestered while growing soybeans or other feedstock. B100 a biofuel consisting of 100% biodiesel reduces carbon dioxide emissions by more than 75% compared with petroleum diesel. B20, a more common biodiesel in colder climates, reduces carbon dioxide emissions by 15% compared with petroleum diesel.

Cost and Convenience

In comparison to alternative fuels, the cost and convenience of biodiesel is an attractive element in our decision for a method to lower environmental impact. Unlike many alternative fuels, biodiesel can be used with minimal modification of existing diesel technologies. Biodiesel can be used in all diesel engines, and can be stored and transported with existing diesel technologies, such as the existing fleet of Regina Transit. Therefore, maintenance costs for biodiesel will be comparable to conventional diesel applications. Additionally, as a liquid, biodiesel can be piped, pumped and funnelled. The availability of biomass is also a factor as British Columbia alone can generate close to 12.3 million tons each year from manufacturing residues. However, high production costs associated with newer fuel alternatives, such as biodiesel make it unprofitable without subsidies. The federal government, fortunately, provides large incentives and subsidiaries for this particular fuel. The production cost of biodiesel is about $0.55/litre compared to $0.46/litre for diesel.

Case studies - Montreal, Brampton

In cold conditions biodiesels turn highly viscous, a potential problem for running biodiesel engines in Regina. Montreal, sharing a relatively similar climate dealt with this problem this problem by mixing a B20 grade diesel their biofuels, thus keeping the liquidity needed for operating temperatures in winter.

<u>Increase Ridership</u>

Increasing transit ridership by converting commuter cars to bus riders represents a substantial opportunity to reduce greenhouse gas savings. According to The Regina Transit Review Team, major qualitative reasons commuters are reluctant to ride the bus are perceived waiting times and walking distances. Converting commuters to transit users to reduce greenhouse gas emissions can be accomplished by pursuing three initiatives. Firstly, improve existing transportation centers to reduce perceived waiting times by creating warm, temporary spaces such as cafes and shops at major transportation nodes for riders. Secondly, strategy to centralize ridership in order to improve existing service without adding substantial transportation infrastructure is essential. Creating a 'student community' area in town where students congregate would reduce walking to transportation hubs while proving a sense of community. Such community creation can be implemented with the introduction of subsidies for student housing development and low-income housing development near transportation hubs. Third, creation of a U-Pass program in which students are given a bus pass as part of their tuition fees. According to the Globe and Mail, in 2006 'municipalities, such as the Kitchener-Waterloo region of Ontario, saw big increases in ridership. Wilfrid Laurier University students were given a discount on U-Passes that has significantly contributed to the region's 11.41-per-cent increase in ridership'. The costs of implementing such a program are relatively minor. In Vancouver, where the mandatory U-pass has been a huge success, students pay 88% of the transit costs through student fees. With only an estimated 2000 students using the transit system per day in Regina, a mandatory U-pass represents an attractive opportunity to reduce personal commuter vehicles from the road. By adopting these policies, we estimate an increase of 12% in Regina's ridership which would translate to a 2.2million reduction in CO_2 emissions per year (Appendix B).

Unsuitable options

Several options considered included hydrogen fuel cells, trains and hybrid Infrastructure to bring in Hydrogen for fuel cells. However, the volatility and non-existent infrastructure for hydrogen discouraged the selection of the option. Additionally, a train, similar to BC's West Coast Express can make use of the existing railroads cost $7 million each, which is well within our budget. However the position of the rail road does not cross high transit demand areas and therefore would require more infrastructure costs. Additionally, Newflyer diesel buses cost $530,000 each plus an additional $300, 000 for a hybrid conversion. The cost of $830,000 per bus for a city of few transit commuters encouraged us to explore an alternative solution to the transit distribution system.

Integrative Sustainability

The most effective transit systems are usually developed in major large cities. However, as a small city, Adelaide, Australia is internationally known for their innovative and cost effective transit services. Similar to Regina, Adelaide is a small city of spread-out, low-density population. From the 1970s to the 1980s, Adelaide struggled with the idea of introducing the Light Rail Transit, however, the cost of implementing such a system would cost too much for a city of its size. In 1989, the O-Bahn was introduced.

The O-Bahn is a transportation system designed for sprawling cities such as Regina of dispersed travel. Its unique rollers and track guided busway steers the bus and allows it to reach speeds of 100km/hr, which is one of a few distinct advantages of the O-Bahn. This highspeed transit, comparable to the railway, is extremely beneficial for travelling between major work and study centers, running across the NW, SE divide of Regina. Another feature of the O-Bahn is its flexibility. Because it is a busway system that runs on a track, the buses are free to drive off the tracks, eliminating the need for travellers to transfer for commuting to suburbs. Also, the O-Bahn is superbly adaptable. The tracks can be built incrementally, different from building one long railway track. Lastly the busses allow the system to be cost efficient and reduce noise pollution in comparison to railway trains. These many advantages has proved to be successful for Adelaide, and will be beneficial for Regina.

Ten Year Return

Table 1. Comparison of B20 bus to traditional Diesel Bus

	Biodiesel	B20	Petroleum Diesel
Cost to produce	$0.55 / EEL*	$0.478/EEL*	$0.46/EEL*
Litre/100km	--	51.92	51.24
Cost per 10 year period (520 000km)	--	$129052.35	$124192.64
Percent Difference	--	3.9%**	--

*EEL: Energy equivalent Litre

**Due to the volatile nature of oil prices the price for production was used to find a percent difference in prices over a ten year period

At 3 million dollars/kilometre a 10km track could be laid diagonally NW to SE with a break in the track to drop off commuters in the down town at a cost of 10million dollars. In Adelaide ridership was boosted 19%. Using predictions based on the Adelaide model this would result in an extra 1.1 million transit trips per year. Retaining current fares the capital investment for infrastructure would be paid off with the increase in additional riders in 16 years.

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Appendix A

Table 1. Mode of transportation for working population in Regina.

Subtopic	Census year		
	2006	**2001**	**1996**
Place of work and commuting to work			
% working at home[49]	5.1	5.9	6.5
Travel to work: % by car, truck or van as driver[50]	79.6	80.3	79.2

Subtopic	Census year		
	2006	2001	1996
Travel to work: % by car, truck or van as passenger	8.1	7.9	8.0
Travel to work: % using public transit	4.2	4.4	5.0
Travel to work: % walking or biking	7.2	6.6	6.9

Table 2. Mode of transportation for working population in Vancouver

Subtopic	Census year		
	2006	2001	1996
Place of work and commuting to work			
% working at home[49]	8.3	8.1	7.7
Travel to work: % by car, truck or van as driver[50]	67.3	72.2	70.6
Travel to work: % by car, truck or van as passenger	7.1	7.0	6.6
Travel to work: % using public transit	16.5	11.5	14.3
Travel to work: % walking or biking	8.0	8.3	7.5

Table 3. Mode of transportation for working population in Toronto.

Subtopic	Census year		
	2006	2001	1996
Place of work and commuting to work			
% working at home[49]	6.8	6.3	5.9
Travel to work: % by car, truck or van as driver[50]	63.6	65.2	65.3
Travel to work: % by car, truck or van as passenger	7.5	6.3	6.7
Travel to work: % using public transit	22.2	22.4	22.0
Travel to work: % walking or biking	5.8	5.4	5.4

Table 3. Mode of transportation for working population in Guelph.

Subtopic	Census year		
	2006	2001	1996
Place of work and commuting to work			
% working at home[49]	6.6	6.3	5.5
Travel to work: % by car, truck or van as driver[50]	76.0	77.9	75.8

Subtopic	Census year		
	2006	2001	1996
Travel to work: % by car, truck or van as passenger	8.5	7.0	9.1
Travel to work: % using public transit	6.0	5.8	5.0
Travel to work: % walking or biking	8.4	8.7	9.2

Table 3. Mode of transportation for working population in Kelowna.

Subtopic	Census year		
	2006	2001	1996
Place of work and commuting to work			
% working at home[49]	10.5	10.6	9.8
Travel to work: % by car, truck or van as driver[50]	81.4	83.3	83.6
Travel to work: % by car, truck or van as passenger	7.7	5.9	6.7
Travel to work: % using public transit	2.7	2.8	1.9
Travel to work: % walking or biking	6.7	6.6	6.6

Appendix B

Assuming the average travel distance in Regina is 6 miles, the average Canadian car gets 1Gallon per 23.9mi fuel efficiency and 19.4lbs of carbon is released for every gallon of fuel burned, a CO_2 savings of x amount is represented by the Equation below.= o ns = "urn:schemas-microsoft-com:office:office" />

(# of riders)*(6mi/day)*(1Gallon/23.9mi)*(19.4lbsCO2/1gallon) = (# of lbs of C02 removed from atmosphere.)