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**Building upon Strathcona County's Integrated Transportation Master Plan for a Healthy,
Vibrant, and Sustainable Community**

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Abstract

Strathcona County (County), with a population of over 92,500 (2013 census), is the fourth largest municipality in the Province of Alberta (Province), after the cities of Calgary, Edmonton, and Red Deer. Set in the centre of Alberta's energy and agricultural heartland, and situated immediately adjacent to the central eastern part of the City of Edmonton, the County is a thriving, successful and vibrant community, and one of the 25 area member municipalities in Alberta's Capital Regional Board (CRB) - an organization established by the Province to develop a long-range plan to manage growth in Alberta over the next 50 years. The County's long-term goal is to grow to about 132,000 people in 30 years by 2044, integrating land use policies with transportation system planning in a way that is socially, economically, cultural and environmentally sustainable; through sound governance; and so as to create a healthy, dynamic and livable community, working in concert with neighbouring municipalities. The ultimate objective is to accommodate the County's targeted expansion by enhancing mobility through a wider travel mode choice, to manage transportation demand with optimal infrastructure construction (system management), to increase public transit ridership, and to promote active transportation as a form of healthy living. To plan for the future in a holistic manner, the County has initiated a series of related studies in recent years including the Integrated Transportation Master Plan (ITMP), the Municipal Development Plan (MDP), the Transit Master Plan (TMP), the Sustainable Rural Roads Master Plan (SRRMP), and the Strathcona County Trails Strategy. As well, several specific area growth management strategy studies (e.g. the Bremner Growth Management Strategy and the Colchester Growth Management Strategy), and many other area concept plans (ACP) and area structure plans (ASP) studies were conducted. This paper was focused on relating how the ITMP process was used to help shape and steer the County into the future. It explained the conceptual idea and key elements of integrating land use with transportation planning, using the County's objective of sustainable development as an illustrative example; but doing so in a generalized way, so as to provide a suitable framework that other similar-sized communities might mimic. The County's effort has demonstrated that integrated and interactive planning need not only be the purview of larger metropolitan areas, and that there was room for medium size urban and suburban centres to take on and benefit from this type of planning approach. The conclusions drawn were that an integrated transportation planning study increased the chance of success; that traditional transportation macro models as a planning tool while useful were sometimes too complicated to build and were data hungry; that successful implementation could be achieved only through cooperation between different internal departments and different regional government agencies having jurisdiction, with input and buy-in of citizens and stakeholders; that planning efforts were successful only if they were vigorously followed; and finally that realization of great visions needed the support of clear policies and directives from decision makers. To monitor project progress, quantifiable performance indicators were used.

1.0 Introduction

Strathcona County (County), with a population of over 92,500 (2013 federal census data), is the fourth largest municipality in the Province of Alberta (Province), after the cities of Calgary, Edmonton, and Red Deer. The County is a specialized and unique municipality, meaning its jurisdiction includes a large urban centre (the hamlet of Sherwood Park with a total population of 64,700) and a significant rural area of farms, acreages and eight (8) smaller hamlets (for a total population of 27,800). It is also the home to Canada's largest oil refinery complex and North America's third largest petrochemical complex.

Set in the centre of Alberta's energy and agricultural heartland, and situated immediately adjacent to the central eastern part of the City of Edmonton, at a distance of some three hours of driving north of the City of Calgary, the County is a thriving, successful and vibrant community, and one of the 25 area member municipalities in Alberta's Capital Regional Board (CRB) - an organization established by the Province to develop a long-range plan to manage growth in Alberta over the next 50 years.

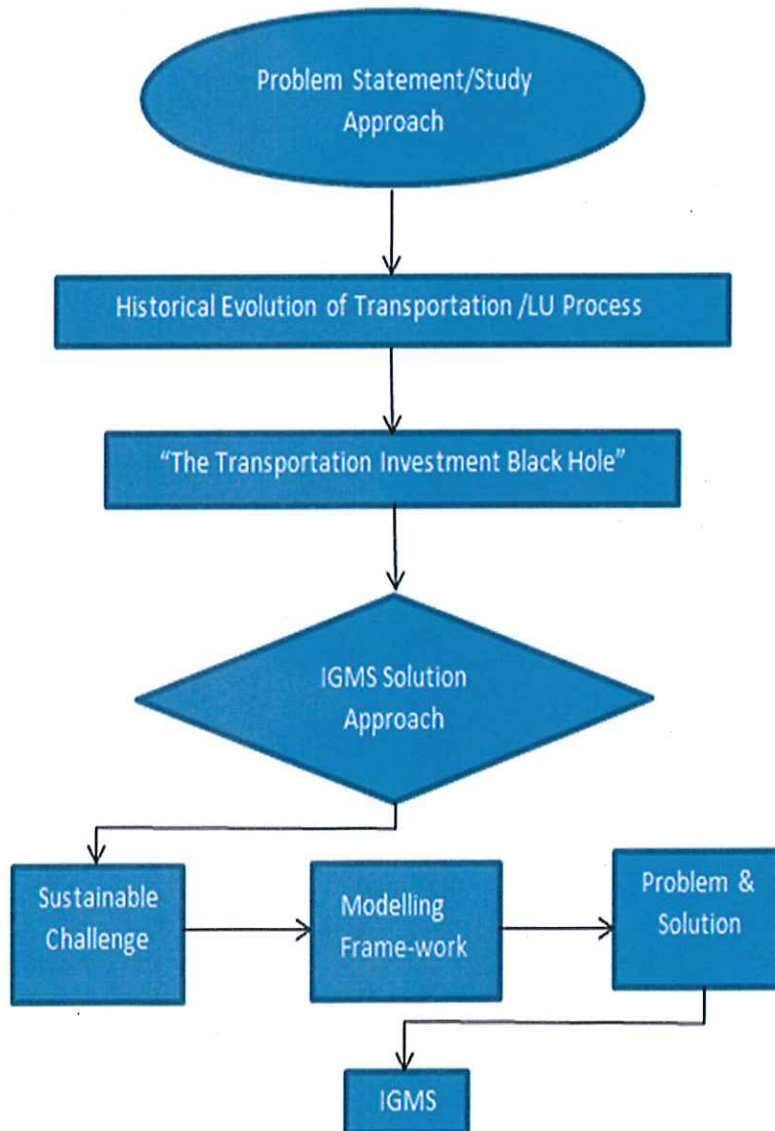
2.0 Background, Goals, and Objectives

The County's long-term goal was to grow to about 132,000 people in 30 years, projected to be in 2044, integrating land use policies with transportation system planning in a way that was socially, economically, culturally and environmentally sustainable (the triple bottom line); and so as to create a healthy, dynamic and livable community, working in concert with neighbouring municipalities; and in line with the County's five pillars of sustainability principles (economy, governance, social, culture and environment). The ultimate objective was to accommodate the County's targeted expansion by enhancing mobility through a wider travel mode choice; to manage transportation demand with optimal infrastructure construction (system management); to increase public transit ridership, and to promote active transportation (human powered) as a form of healthy living. To plan for the future in a holistic manner, the County has initiated a series of related studies in recent years including the Integrated Transportation Master Plan (ITMP)[6], the Municipal Development Plan (MDP), the Transit Master Plan (TMP) [8], the Sustainable Rural Roads Master Plan (SRRMP)[7], and the Strathcona County Trails Strategy. As well, several specific area growth management strategy studies (e.g. the Bremner Growth Management Strategy and the Colchester Growth Management Strategy), and many localized area concept plans (ACP) and area structure plans (ASP) studies were conducted. This paper was focused on relating how an integrated growth management strategy (IGMS)/integrated transportation master plan (ITMP) process was used as an overarching and guiding document to help shape and steer the County into the future. It explained the key concepts and elements of integrating land use with transportation planning, using the County's objective of sustainable development as an illustrative example; but doing so in a generalized way, so as to provide a suitable framework that other similar-sized communities might mimic. The County's effort demonstrated that integrated and interactive planning needed not only be the purview of larger metropolitan areas, and that there was room for medium size urban and suburban centres (of less than 200,000 people) to take on and benefit from this type of planning approach [1]. The conclusions drawn were that an integrated transportation planning study increased the chance of success; that traditional transportation macro models as a planning tool while useful were

sometimes too complicated to build and were data hungry; that successful implementation could be achieved only through cooperation between different internal departments and different regional government agencies having jurisdiction, with input and buy-in of citizens and stakeholders; that planning efforts were successful only if they were vigorously followed; and finally that realization of great visions needed the support of clear policies and directives from decision makers and politicians. To monitor project progress, quantifiable performance indicators were used.

3. Presentation Flow Chart

The following flowchart outlined the presentation approach of this paper, adopted for an integrated growth management strategy (IGMS) as applied to the County's ITMP:



4. Problem Statement and Solution Approach

The problems to be addressed in an ITMP were many and varied, with transportation engineering and land use planning being the two primal driving forces of development. The relationship between changes in land use patterns and transportation infrastructure was however complex, with each influencing the other. Land use factors such as development density, type, mix, activity centre parking policy; and transportation factors such as accessibility, connectivity, roadway network design, active transportation, transit availability, and mobility management; were often intertwined.

At the County, the adoption of an integrated smart growth land use policies, supported by an effective and efficient transportation network that promoted all modes of travel, has helped to create a balance towards reaching a healthy, livable, vibrant, economic, livable, and sustainable community. To achieve the County's goals, five overarching guiding principles were used:

Guiding principle #1: Integrate transportation with the County's social/environmental/economic sustainable framework. Social sustainability was built on social inclusion, community connectedness, social responsibility, and health and well-being. Environmental sustainability was focused on effective land use, air emission, energy, water, and material use. Finally, economic sustainability recognized the need for a shift from historical conventional approaches while maintaining a vibrant and thriving County.

Guiding principle #2: Integrate the County's transportation system with other regional initiatives to align the County's policies with those of the Capital Region Board (CRB), Alberta transportation (AT), the City of Edmonton, the City of Fort Saskatchewan, Beaver County, Lamont County, Sturgeon County, and Leduc County, the Alberta Industrial Heartland Association (AIHA), the Edmonton International Airport (YEG), and both the Canadian Pacific (CP) and Canadian National (CN) Railways.

Guiding principle #3: Integrate transportation and land use planning by adopting a smart growth concept of providing mixed-use communities and compact settlement, where viable.

Guiding principle #4: Improve public transit. The intention was however not to eliminate private automobiles but the target was to serve 50 passengers per capita annually by the end of a ten year period.

Guiding principle #5: Promote transportation multi-modal choice to include active transportation which was human powered, transit, goods movement, and automobile.

The transportation planning and engineering problems were then identified and a study approach formulated.

Problem Statement:

- Should land use precede or lag behind transportation planning
- Historically land use and transportation planning often worked in silos resulting in a disconnect between the final form and shape of development and the ultimate transportation network

Study Approach:

- Previously engineers and planners used as analysis tools separate and independent land use and transportation planning models as analytical tools. The modern approach was to use hybrid models often referred to as TLUM (transportation land use models). However, a lot of these models were static in nature. As well they were all very data hungry. A preferred methodology was to adopt a dynamic and flexible integrated growth management strategy (IGMS) approach that was less dependent on the use of traditional mathematic models
- For transportation, all modal choices were considered
- For land use, a myriad of development density, type, mix, price were considered

5. Evolution of the Transportation Process in North America

To help to understand the urban planning process as it related to transportation in North America, it would be useful to review the evolution of the traditional planning process.

Historically, conventional urban transportation planning in North America started with the United States Federal Aid Highway Act in 1925. This mammoth funding program resulted in a widespread and intensive investment in highway construction across the country in the 1950's and the 1960's that was highly aggregated, but which was unfortunately insensitive to societal concerns and needs. Sparkled by the Freeway Revolt in the late 1950's against San Francisco's massive highway construction, transportation planners were forced to change their mindset and strategy, and to come up with a new planning process that was flexible, and which would result in creating future developments that were long term sustainable [5]. During all this time, eight (8) distinct periods were identified:

19th Century

- Transportation planning preceded land use development
- Development and settlement evolved around canals and waterways; and later the national railway system

1925

- United States federal government initiated the Federal Aid Highway Act
- Huge investment were made in highway infrastructure
- Legalized planning procedures resulted in highly aggregated form of planning

1946 – 1955

- WWII ended; there was a general optimistic economic outlook
- With birth of the baby boomers, city population exploded; there was an explosive increase in vehicle ownership
- There was a beginning awareness of the relationship between transportation and land use planning
- Planning was done by hand with little or no computing capabilities

1955 – 1964

- Mainframe computer came of age; debut of the UTPS (Urban transportation planning system) model
- The classic Lowry land use model (1964) was first introduced; growth of the empirical models
- Models were designed to forecast vehicles growth only which further stimulated roadway needs

1965 – 1969

- United States federal government continued its huge freeway expansion program
- The 3 C planning process was adopted (continuous, cooperative, comprehension)
- The 4 step planning process was adopted (trip generation, trip distribution, trip assignment, and modal split)

Late 1960 to Mid-1970

- The traditional urban transportation planning (UTP) process was no longer popular
- There was more focus on public transportation
- High speed passenger rail transportation emerged

Mid 1970 to Late 1980

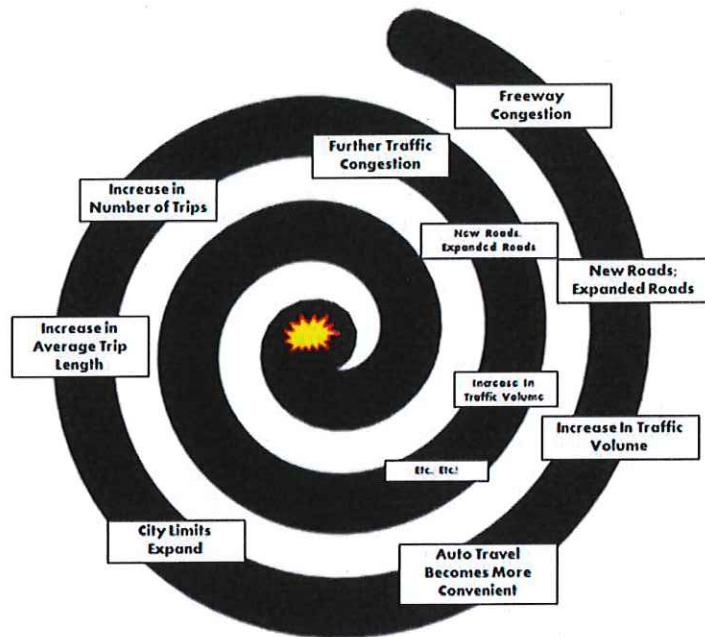
- World oil crisis hit the market – awakening to the “vehicle only” vulnerability
- Micro-statistical disaggregated analysis and models emerged with wider use of personal computers
- Transportation and land use planning relationship was emphasized
- A new breed of models (MePlan; other Lowry derivative models) were developed

1990 to Now

- The freeway construction program ended; massive highway construction became a way of the past
- ISTEA (Intermodal Surface Transportation Equity Act), TEA21, promoting the use of public transport, was launched in the United States
- Urban transportation needs were still expanding
- Innovative and new ways to solve transportation problem {transportation system management (TSM) without resorting to major capital construction, intelligent transportation systems (ITS)} were explored
- Strategic planning {transportation demand management (TDM) designed to control travel demand, vehicle kilometres travelled (VKmT) reduction, sustainability} became key

5. Transportation Investment Black Hole

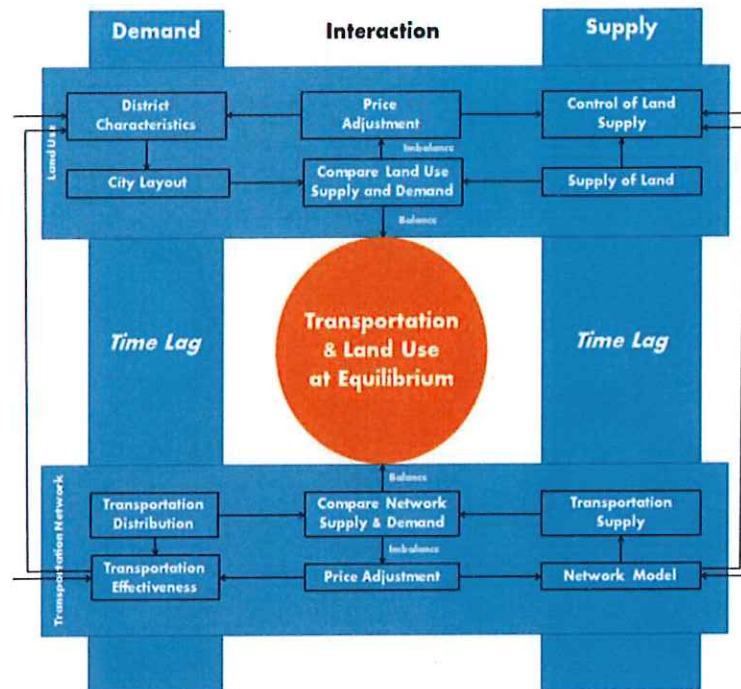
Based on historic development, it became clear that the once popular lopsided strategy and overly simplistic policy of massive public investment in highway infrastructure proved to be unsustainable in the long term. The provision of an over-abundance of high capacity freeways and arterials encouraged long distant trip journeys and promoted suburban sprawl, which in turn generated a renewed demand and further growth in traffic, resulting in more congestion, spiraling into a bottomless pit and endless appetite for the construction of more highways. The high volume of vehicular trips, the mushrooming and the springing-up of low density suburban communities, and the never ending construction of freeways and highway arterials, all helped to drive governments into a fiscal transportation infrastructure investment black hole.



6. Transportation and Land Use Planning Models

Following current best practice procedures, the transportation/land use model EMME was developed for the County's ITMP study, based on the classic Lowry model. The Lowry model [3] was first developed in 1964 for the Pittsburgh region in Pennsylvania and one of the first transportation/land use models. Its formulation was rather simple; but it depicted well the intrinsic relationship between these two major areas. The core assumption of the Lowry model was that regional and urban growth (or decline) was a function of the expansion (or contraction) of the basic sector, which was referred to as exogenous employment that met non-local demand (goods and services which were exported outside the urban area). The Lowry model had several obvious limitations. It was notably a static model, which did not tell anything about the evolution of the transportation/land use system. Furthermore, current economic changes were mostly in the service (non-basic) sectors, forming the foundation of urban productivity and dynamics in many metropolitan areas. Under such circumstances the model was likely to be inaccurate in the major service-oriented metropolitan areas of today. The Lowry model also did

not consider movements of freight in urban areas, which were very significant and had impacts on the friction of distance. The development of Lowry derivative models [2] attempted to correct this fundamental shortcoming. It represented the land (or floor-space or housing) market with endogenous prices and market clearing in each period. It also used export base theory to link population and non-basic employment to exogenous forecasts of export industry. The Lowry model formulation as well as the Lowry derivative model framework was given below:



For the County’s ITMP model, two future time horizons were studied: 2021 representing a near term study of 10 years, and 2044 representing the long term study of 30 years.

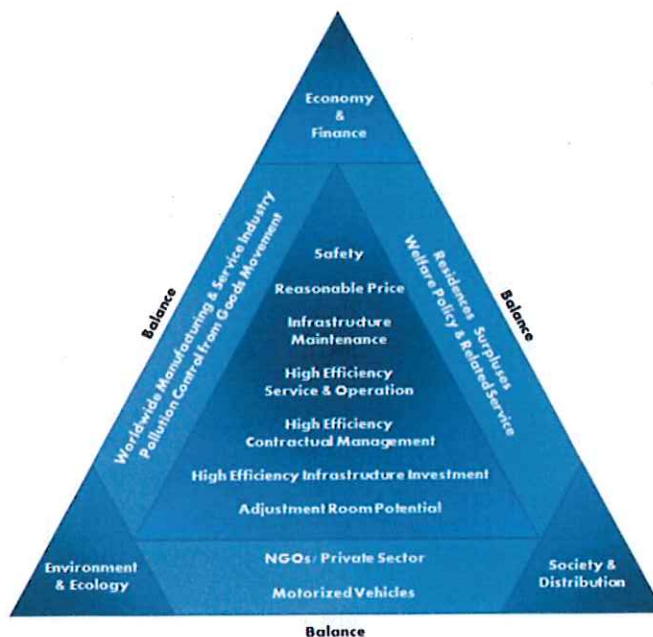
7. The Sustainability Challenge

The sustainable ITMP development challenge for the County was to balance the triple bottom line of achieving economy and finance prosperity; maintaining culture and heritage mentioned under Section 2; with environmental and ecological equilibrium which needed to be in conformance to the five guiding principles mentioned under Section 4; at the same time satisfying societal needs and ensuring the equitable distribution of precious finite resources through sound governance principles.

The challenge to the County included building an effective and efficient roadway access network; developing a mobility policy for its citizens and for goods using all modes of transportation; providing a safe, secure and integrated transportation system; creating a vibrant, desirable, healthy, and livable environment for its citizenry (the 2014 “MoneySense” magazine has since ranked Strathcona County as the number 2 best small sized city to live in Canada);

providing an attractive investment opportunities for businesses with affordable housing; minimizing and preserving the environmental impact to cultural and historical heritage (the County is home to 75 percent of refining in Western Canada); providing a high quality standard of living; ensuring equitable distribution of societal wealth; exploring any possible missed opportunities for sustaining continued growth; and promoting high efficiency in infrastructure and managerial investment.

The bridges to be built to span between the three apexes of a balanced triangular or pyramidal relations between economic, social, and environment, were not problems of engineering only, and could not be based on the sole reliance on the use of a single transportation and land use model, however detailed and accurate that model was able to depict the current and forecast the future conditions. Effective public involvement and stakeholders input, and the buy-in of outcome decisions by citizens, were keys to any transportation/land use plan's success; as the public needed to perceive that policy directions were on the right track, and have value. As well as engineering which dealt with transportation and infrastructure investment issues, focus must also be on the promotion of the resource based economy (oil and petroleum in this case), a possible external manufacturing and service industry as salable goods that the province and the world at large wanted; on pollution control from goods movement; on the cooperation between non-governmental entities; on exploring the deployment of new, inexpensive, multi-goaled technological advances; on the well management of a healthy residential and commercial land bank; on the equitable balance of social welfare with increased and affordable taxation; on fiscal and administrative policy; and a host of other fiscal considerations. The balanced triangular relationship was depicted in the following diagrams:



8. The ITMP Solution

The conventional transportation planning process in the past has been criticized for its insensitivity to issues beyond the technical problems facing the engineers. The planning scene has however been changing rapidly. In his transportation book [4] with Professor Eric Miller of the University of Toronto, Professor Michael D. Meyer of the Georgia Institute of Technology has summarized some of the important changes in urban transportation planning concept in recent years. A greater emphasis today was on the use of alternative transportation that included public transit, and active mode of transportation, to replace the single mode of vehicle travel. It should be noted however that in much as the focus today was on public transit and alternative modes of transportation for an overall sustainable system, they would obviously not be able satisfy all of the economic activity needs of a dynamic, urban, and vibrant community; so that the important role of high speed freeways, arterials and collectors in the movement of passengers, goods and freight could not be undermined either [9]. In devising any solution, the County was cognizant that some of the many problems faced by and impacted upon on the sustainability of transportation included: the County's auto-dependency form and culture; the long distance between major destinations that was typically suited for motorized vehicles; the severe northern climate during the winter months; and the high auto ownership with a low perceived cost of transportation.

	Traditional Approach	IGMS Approach
1	Emphasis on quantitative & technical analysis; Support for large scale investment planning	Provide multi-faceted influence; Focus on investment, lifestyle, land use development, pricing policy
2	Emphasis on roadway network efficiency & service level; e.g. speed & travel time	Multimodal transportation integration; broader vision; set feasibility thresholds
3	Focus on traveling from point A to point B within a city context	Consider use of transportation on regional development, consider economic development of the country
4	Focus on passenger transport	Also consider freight and goods movement; Effort to increase productivity
5	Assume that vehicle technology will remain unchanged over time	Consider technological change (such as use of fuel) that may influence travel pattern
6	Consider land use as a fixed entity	Adopt use of control increase theory; Adopt land use adjustment to define transportation network as a planning strategy
7	Consider how to reduce environment impact as a result	Integrate transportation, sustainable development, ecology,

	of development	societal/health, etc. issues
8	User fee C/B (cost/benefit) analysis	Ability to model complexity (regional, multi-class fees, etc.)
9	Forecast future traffic based on today's conditions (static condition analysis)	Based on today's data, implement policy to control future growth to desired level (controlled growth)
10	Municipal transportation departments solve problems through planning	Solution through consensus; public buy-in important; Encourage & solicit public participation

9. Implementation

Given the complexity of the planning process, the success of an ITMP approach was unlikely to be accomplished by just one single all-encompassing and inclusive study using one theoretical model and one software that hopefully would cover all fronts and address all issues. While the use of a comprehensive transportation model definitely helped to provide future forecast of traffic demand in an explainable manner, caution must be exercised to ensure that the financial and economic analyses, the formulation of sound land use policies and strategies, and the several concurrent studies that were complementary and inter-supportive must all be adequately supported. Care must also be exercised to ensure that the interest of both urban versus rural settings was adequately balanced. As well, the challenge was to coordinate these efforts so that each of the few time separated studies was not being conducted in a vacuum and presented as a stand-alone initiative oblivious to other inter-related work. Working with inter-departmental personnel, inter-disciplinary consultants, different stakeholders and interest groups, and most important of all, with the general public, was vital to the success of a truly integrated growth management strategy. Finally, specific quantitative performance indicators were used by the County to monitor the ITMP implementation. Some of the "big picture" indicators used as measurement yardsticks included: percentage of person trips by low-occupancy motor vehicles; vehicle-km per capita; quality and quantity of interactions with regional partners regarding transportation; population and employment density; mixed land use; mode share for transit; annual transit passenger trips per capita; mode shares for walking and bicycling; km of bicycle facilities; percentage of programmed bicycle and pedestrian facilities that would be constructed; auto ownership; percentage of programmed road improvements that would be constructed; and level of service for all travel modes including automobiles, transit, bicycles and pedestrians.

10. Conclusions

This paper has explained some of the key elements of how to integrate land use with transportation planning to achieve smart growth, using the Strathcona County ITMP process as an illustrative example. It has provided a workable framework that other similar-sized communities could consider following, without being beholden to any one software modeling package.

While the subject ITMP study might not be able to address all of the many complex issues facing the County into the future, and that there was certainly room for further upgrades to more closely integrate the separate realms of land use and transportation planning, the project demonstrated that this type of planning work need not only be the purview of larger metropolitan areas, and that there were opportunities for even relatively small urban centers to take on such planning effort and to benefit from this kind of integrated growth management approach, and to achieve ultimate success. Some of the more important conclusions drawn were as follows:

- Integrated transportation master plan strategy (ITMP) increased the chance of success in planning into the future
- ITMP need not be the purview of large cities with more resources
- Traditional TLUM models were too complicated to use and were often data hungry. There was a need for a simplified model for use by smaller communities
- Models were only tools and means to the end goal
- Sustainability could be achieved only through cooperation between different government departments, with input and buy-in of citizens and stakeholders
- Growth management, land use and transportation planning was a top down initiative. Talks were easy and cheap; planning efforts were useful only if vigorously followed; great visions were but dreams without the support of clear policies and directives from politicians and decision makers.

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