

**The Impact of Information and Communications
Technology (ICT) on Inter-Urban Commuting and the
Demand for Commercial Transportation**

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This seminar paper reflects the views of the author and not necessarily those of Transport Canada.

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Abstract

This paper maintains that future labour productivity improvements in the Knowledge Based Society will depend on improved inter-metropolitan “Accessibility” linkages within the Central Canada corridor, primarily Toronto - Ottawa - Montreal - Quebec city. Transportation and telecommunication technologies will compose the basis for this “Accessibility” infrastructure. The two will complement each other to extend the urban labour catchment region for knowledge employers. While telecommunications would reduce the need for daily physical commuting, transportation linkages would increase the opportunity for necessary face to face communications. This complementarity invites a shared undertaking between Transport Canada and Industry Canada.

It is recommended that Transport Canada and Industry Canada join forces to develop a long range **25 Year Accessibility Strategic Plan** to identify the transportation and telecommunications requirements to link the metropolitan regions into a single connected urban network. This will entail a change in orientation from the traditional supply led investigation to a more demand driven exercise that addresses the needs of knowledge employers in the corridor.

The paper defends the recommendation by: describing the relationship between transportation and telecommunications; analyzing the confines of the metropolis in the new economy; reviewing the historical impact of transportation on the emerging industrial economies in England and France and their lessons for the new economy; and ending with an outline of assumed transportation attributes that are required to link metropolitan regions together in the Central Canada corridor.

Introduction

Our generation of transportation experts is not the first to hear of the imminent decline of transportation in response to telecommunications advancements. One hundred years ago, a similar proposition was being promoted with the telephone. Far from replacing the need for transportation, it altered transportation requirements by dispersing urban activities over larger distances thereby expanding the urban form and creating the modern metropolis. While telecommunications dispersed urban activities, transportation consolidated the metropolis. The convergence of accessibility technologies achieved significant improvements in the quality of life and increased labour productivity.

“The densely crowded agglomeration of the 19th Century with its concomitant fantastic skyrocketing of urban land values, was a short-lived passing phenomenon caused by the time lag between the modernization of inter-city and intra-urban traffic; once this time lag was overcome, it was bound to disappear forever, and few will regret its passing.”¹

Today, similar changes are occurring largely as a result of the Knowledge Based economy and the liberating locational effects of telecommunication advancements.

“The death of distance as a determinant of the cost of communicating will probably be the single most important force shaping society in the first half of the next century. Technological change has the power to revolutionize the way people live, and this one will be no exception. It will alter, in ways that are only dimly imaginable, decisions about where people work and what kind of work they do, concepts of national borders and sovereignty, and patterns of international trade. Its effects may well be as pervasive as those of the discovery of electricity, which led in time to the creation of the skyscraper cities of Manhattan and Hong Kong and transformed labor productivity in the home.”²

Transportation has a critical role to determine how our Canadian society will evolve in the Knowledge Based Society. Because of the portability of work, the stakes in the global economy are large. In order to put in place a transportation system that will complement telecommunications advancements to improve labour productivity and the standard of living, it will require a shift in the current thinking of transportation experts. While a supply driven analysis to transportation planning has been the mainstream orientation for some time, this approach may lead to the development of a transportation infrastructure ill-suited for Canada’s needs in the Knowledge Based Society. The more effective approach is to become demand driven and proactive by discerning how transportation system improvements will allow our Canadian industries to become more competitive. Instead of conducting travel surveys on business travellers, we should investigate how changes in the transportation network will improve the competitiveness of firms in the Knowledge Based Society. There is no value creating 10,000 jobs in building and operating a high speed ground transportation system in the corridor, if in the long run, 100,000 jobs in the Knowledge Based economy are lost because greater labour productivity is available elsewhere.

This paper maintains that the metropolitan urban form is too confining for the Knowledge Based Society and that Transport Canada and Industry Canada are well positioned to assemble an

¹ Blumenfeld Hans, Experiments in Transportation - For What?, in the Modern Metropolis: Its Origins, Growth, Characteristics, and Planning, ed. Spreiregen P., Harvest House Ltd., 1971, Montreal, Canada.

² Cairncross Frances, Death of Distance, Harvard Business School Press, Boston, 1997.

“Accessibility” infrastructure linking metropolitan regions to achieve increased urban agglomerations of specialized labour. The direct benefits of this investment would be significant improvements in labour productivity and improved standards of living that would attract investment in the Windsor - Quebec City corridor for all Canadians.

The Relationship Between Transportation and telecommunications

Stephen Graham and Simon Marvin provide an excellent description of the impact on the urban form stemming from the introduction of the telephone in congested urban areas of England in the mid to late 1800's.³

Prior to the telephone, all forms of communications in the city were dependent on physical interactions and written correspondence. Movement was by foot, horse, river and in London, by the horse driven trolley. This required very close proximity for urban dwellers, often limited to a distance of 3 to 5 kilometers. As result, land use in the city was segregated by the type of commerce located in a neighbourhood. Each city had separate clusters for hatters, furriers, financiers and bankers, and advocates, among others. Business was conducted by foot, requiring personal contact to obtain orders, negotiate deals and to meet prospective clients. As these quarters became congested, businessmen would pay higher costs to obtain a central location in close proximity to clients and suppliers.

Once the telephone came into use, contact with clients and suppliers was now possible from greater distances, increasing the locational choices to businesses to more affordable sites. The net effect of the telephone was a reduction in the frequency of trips while the distance of the trips increased. And because movement by foot and horse was no longer time efficient, alternative transportation means were required. Initially it was the telephone that relieved congestion in the cities, but it in turn, created a market for a new form of transportation. It was this complementary effect that expanded and transformed the urban form.

Similarly in the United States, F. Rice Jr, a telephone expert in 1906 was quoted to say that the telephone “was the greatest urbanizer on record.”⁴ This spatial effect was recorded by Mayer in an empirical investigation of the complementary effect of the telephone and urban decentralization in Boston at the turn of the century. The telephone was instrumental in

³ Graham S. & Marvin S., *Telecommunications and the City: Electronic Spaces, Urban Places*, Routledge Press, New York & London, 1996.

dispersing some of the central city activities into the suburbs. At the same time, the increasing spatial influence of Boston soon came to envelope those same suburbs to create the metropolitan region as the transportation infrastructure caught up to the advancements created by the telephone.

Today with growing financial and environmental constraints in metropolitan and inter-metropolitan transportation, the instinct to deploy telecommunications to substitute for physical transportation is tempting, but shortsighted. In the last 20 years telecommunications advancements have occurred at a such rapid pace, that they are creating new markets for transportation in the Knowledge Based Society within clustered metropolitan regions. These new markets do not conform to the traditional notions of inter-city travel markets or intra-city mass travel markets.

The result (from telecommunications) may not necessarily be less travelling - indeed, when people need to meet their electronic contacts, they may actually travel further than before - but travelling will be of a different kind.⁵

1971 Transportation and Communications Report

In 1971, Neal Irwin, Managing Director of the IBI Group in Toronto, prepared a communications report for the Department of Telecommunications recommending that the Government of Canada embark on a series of studies to evaluate whether synergistic advances in transportation and telecommunications can be coordinated to achieve national policy objectives “in the face of rapid growth and urbanization, greater residential mobility and dispersion of family groups, increasing economic internationalism, and rapid technological development.”

“Important decisions are being made and will have to be made during the coming decade about the nature, location, and pricing of these transport and communications applications. If, as seems likely, they will have an impact upon the locations of people and jobs in Canada, it becomes essential that we understand in advance the probable nature of these impacts so that decisions made will be in the best long-term interests of the people of Canada. Recognizing the interaction between transport and telecommunications, and the potential for their combined use to achieve national objectives, the

⁴ Gaspar J. & Glaeser, E., Information Technology and the Future of Cities, Journal of Urban Economics 43, 136-156, Academic Press, 1998.

⁵ Cairncross Frances, Death of Distance, Harvard Business School Press, Boston, 1997.

term “Transcom Systems” has been created to describe the type of interactive systems which include both transportation and communications.”⁶

Based on a longitudinal study of Canadian data bases from the early 1900's to the 1960's, the study concluded that transportation and telecommunications advancements tend to reinforce each other rather than compete for substitution. Neal Irwin recommended a series of studies that would have examined the synergistic advantages of deploying transportation and telecommunications systems in tandem to improve the economic competitiveness of Canadian businesses. Unfortunately rather than examining the complementary effects, future studies concentrated on the substitution effect of telecommunications on transportation.

Contradictions in the Transportation - Telecommunications Substitution Assumption

There is no greater contradiction concerning the exaggerated demise of distance attributed to accelerating advancements in telecommunications than the physical clustering of high technology companies. They cluster in so-called “Technopoles” (technology cities) and are concentrated in metropolitan regions with member firms in close physical proximity to one another. One would expect that the industry devoted to the creation of Marshall McLuhan's “Global Village”, would not limit their location choices to physical proximity. Yet this is exactly what is occurring in Silicon Valley, Route 128, Kanata and elsewhere in the world. ***As a result, it is physical access that determines the limits of our cities and not virtual access.***

John Roth CEO of Nortel in 1997, confirms this when he is reported by Southam News to have said that “The Ottawa region remains a central part of Nortel's \$1.8-billion annual research effort. But even there, Nortel may not be able to increase its staff levels because the company is reaching the limit of its ability to attract the right kinds of skills to the region.” Why is the region to which Mr. Roth refers, limited in scale to the metropolis and why can it not be expanded to include the adjoining metropolitan region of Montreal with a population of 3.4 million people located only 200 kilometers away? He continues to issue a dire warning reflecting the portability of jobs in the global economy by saying, “A shortage of workers and flights, combined with Nortel's increasingly global thrust, could result in the gradual diminution of the importance of the Ottawa region in Nortel's affairs.”⁷

⁶ Irwin Neal, Transport and Communications as Instruments of National Policy, Department of Communications, Kates, Peat, Marwick & Co., August 27, 1971

⁷ Montreal Gazette, Incoming CEO Has Vision of Sleeker, Faster Northern Telecom, March 7, 1997.

Nortel is simply responding to the inevitable risks of global capitalism. The effective management of knowledge, that is, the organizational capability to create, acquire, accumulate and exploit knowledge, is increasingly a source of competitive advantage. Global firms source, produce and distribute their products world-wide, continuously striving to minimize their costs and maximize their profits.⁸

It should be noted that several months after making these statements, Nortel announced a major expansion of its research facilities in the Ottawa/Hull region. These capital investments in land and buildings are not sufficient guarantees of continued Nortel economic activity in the Ottawa/Hull region. In the Knowledge Based Society, firms will be more willing to walk away from fixed assets if a new location will offer improved labour productivity. (see the evolving relationship between labour and land and buildings on page 17)

The Explosion of Inter-City Travel and Commuting Distances

If telecommunications alone can provide inter-metropolitan accessibility, then the organization of knowledge labor should be determined by employee residence rather than departmental function within a cluster of metropolitan regions. The reality is that for the vast majority of knowledge employment centers, labor is still organized by departmental function requiring residential relocation for transferred workers, thereby limiting the urban form to present day limits.

According to a recent joint Conference Board of Canada and American Express survey, travel costs have doubled for Canadian firms in the past 10 years and now account for the second largest operating cost after labour.⁹ This is occurring despite the proliferation of telecommunication devices such as facsimile machines and electronic mail that have enabled work content to be transmitted quickly and affordably. Indeed some products such as cellular telephones, pagers and notebook computers rely on the growing travel demands of knowledge workers to market these new products, as they facilitate rather than supplant travel.

Dan Brand of Charles River Associates of Boston, and Neal Irwin of IBI have foreseen the likelihood of declining opportunity costs of travel that could encourage even more frequent travel, as travellers would still be able to use travel time productively while in transit.

Telecommunications has certainly not satisfied all the requirements for inter-metropolitan interaction. In the United States, the fastest growing commuting market is commuters travelling

⁸ Canadian International Development Agency (CIDA), Unpublished Paper, November 1996, Ottawa, Canada.

between metropolitan regions. Gordon Ewing of McGill University found that commuting between metropolitan regions from 1980 to 1990 was growing at twice the rate of intra-metropolitan commuting. While some of this can be explained by the peculiar boundaries of the metropolitan regions, the pattern is quite clear. Within the Standard Metropolitan Statistical Area (SMSA) the growth rate was 31.2%, while beyond the SMSA, the rate was 72.1%. In 1990, there were .8 million commuters travelling from one central city SMSA to another central city SMSA, a 100% increase. The fastest growth rate was Central City to Other SMSA Suburb where it grew from .5 million to 1.1 million.¹⁰ It is assumed that increasing labour specialization, rising prominence of two income households, and decreasing labour tenure are the driving forces behind this spatial expansion.

The traditional rule of thumb to gauge the radius of cities is to apply a one hour or so commuting time. This time constraint has held since the earliest cities and towns to the present day automobile and mass transit age. Teleworking allowing for fewer weekly but longer commutes has eased this constraint. The evidence provided by Mokhtarian seems to indicate that this is so.¹¹ This will change our traditional understanding of urban commuting sheds, as workers will be more able to separate the location of work and residence between metropolitan regions.

Knowledge Based Society and the Limitations of the Metropolis

To achieve significant productivity gains in the Knowledge Based Society, the urban form will have to be expanded beyond the metropolitan confines of the industrial age. Just as the industrial age gave birth to the metropolis, consolidating villages and towns, the new information age will link clustered metropolitan regions together to create a new urban form. Changing means of production will influence employers to access greater agglomerations of specialized urban labour and technology advancements in transportation and telecommunications will provide this accessibility.

⁹ Barber J, The Road Warriors: How they stay sane, Globe and Mail, November 4, 1998.

¹⁰ Ewing G., Unpublished Paper, McGill University, 1996; A. Pisarski, Commuting in America: A National Report on Commuting Patterns and Trends (1980), 1987; Bureau of Transportation Statistics Annual Report (1990), 1995.

¹¹ Mokhtarian, Now That Travel Can Be Virtual, Will Congestion Disappear?, Scientific American, October 1997, Volume 277, Number 4.

Knowledge Worker and Community

To understand the accessibility requirements of the Knowledge Based Society it is important to first understand the type of work knowledge workers do, how they work, and to describe the community that sustains their talents and provides their work.

The earliest study of this workforce comes from Robert B. Reich's, "The Work of Nations." In it, he categories three different types of workers: Routine producers; In-person servers; and Symbolic analysts. Symbolic analysts are better known in today's nomenclature as Knowledge Workers. While high-technology workers, such as those found in Kanata and Silicon Valley are found in this category, Knowledge Workers also include those possessing and utilizing specialized knowledge bases. Robert Reich, the former Secretary of Labor in the first Clinton administration, estimates that upwards of 20% of the labour force is composed of knowledge workers in the U.S. We can expect a similar proportion of knowledge workers in Canada.

These knowledge workers provide value added services to their clients and employers by: identifying problems; developing solutions; and brokering strategies to implement corrective actions. New business practices, engineering innovations, technical inventions, government policies or even entertainment productions are the tangible outcomes of their efforts. Their incomes reflect the quality, originality, cleverness, acceptance, and timing of their interventions. Knowledge workers, even in the employ of large organizations, work alone and in small working teams whose composition is determined more by the nature of the work problem and right skills mix, than by any rigid organizational structure.

The bulk of their time is spent conceptualizing problems and creating solutions. Conversations are frequent and informal helping to insure that new insights and discoveries are put to best use, always subjected to quick, critical evaluations. They have become in a sense, journey tradesmen.

Telecommunications and the notebook computer have liberated knowledge workers from fixed location and work has become portable and to a large extent, location neutral. But this liberation is tempered by situations requiring physical contact. Knowledge workers remain dependent on physical proximity to employers/clients and working partners. Long hours are already spent travelling to meetings, making presentations, and assembling working teams. The selection of working partners and the pursuit of work is affected by distance and distance determines the range of workers accessible and knowledge skills available.

Knowledge worker labour shortages have been extensively reported by the media in recent years. However Robert Reich argues “Labour shortages rarely means that workers cannot be found at any price. A more accurate meaning is that desired workers cannot be found at the price that employers and customers wish to pay.”¹² The influence of labour costs as a location determinant is clear: knowledge labour industries will locate where expertise is more available and affordable.

This observation underscores the importance for demand driven transportation research rather than supply driven if we are to gain a better understanding of the role of transportation in the Knowledge Based Economy.

Technopole Location Attributes

In September of 1997, the Conference Board of Canada released a study that examined the spatial clustering of knowledge-based industries. They surveyed 12 technopole clusters around the world - including Ottawa/Hull - to learn how they are formed and what factors attracted companies into these areas.¹³

The three most important location factors, listed in order of importance, were:

1. access to a skilled labour force;
2. quality of life;
3. access to a local research and development university

These location factors were consistently shared internationally, inspiring the Conference Board of Canada to recommend that governments focus their efforts and invest in programs that would strengthen these attributes. Interestingly, they also reported that companies in mature clusters complained of high taxes, the high cost of living and expensive real estate.

For readers familiar with the work of Hans Blumenfeld, the first two attributes reflect a fundamental tenet of urban planning that he understood: “Cities are primarily a place to work and a place to live.” While these attributes are forever linked, they are at the same time in conflict. Where the first attribute requires higher concentrations of urban populations, the second attribute is adversely affected by rising urban populations. For government, the collision of these trends

¹² Reich Robert B., The Work of Nations: Preparing ourselves for 21st century capitalism, Alfred A. Knopf Inc., New York, 1991.

¹³ The Conference Board of Canada by Zieminiski J. and Warda, What Makes Technopoles Tick?, Ottawa, September 1997.

will impact on higher infrastructure costs in transportation and the negative environmental externalities that result.

Conflicting Demands of Metropolitan Labour Accessibility

In the Knowledge Based Society, the conflict between quality of life and desirable levels of urban agglomeration skills will be even more pronounced. Silicon Valley and the Ottawa/Hull region represent the opposite ends of this spectrum (Globe and Mail)¹⁴. Where Ottawa/Hull extolls the virtues of quality of life to attract companies already located in Silicon Valley and other congested international centres, these companies must evaluate the cost of locating in a region where an urban population of one million residents may not be large enough to sustain it with a continuing pool of knowledge workers. At the same time, companies evaluating a move to Silicon Valley from Ottawa/Hull know that their operating costs will be greater in Silicon Valley. Not only will land costs for its facilities be greater, but also labour costs will have to be adjusted to offset the cost of higher residential real estate in Silicon Valley, a region that has quickly become congested.

Recognizing the limitations of the metropolis is more evident by observing the problems created by congestion but in the case of Ottawa/Hull where congestion is all but absent, the limitations of the metropolitan labour force are much more difficult to observe. What is observed is the slow migration of high technology activities out of the region and the inability to attract new companies into the region. Whether the linkage is ever made to required agglomerations of a specialized urban force, remains in question.

Manuel Castells and Peter Hall in their review of technopoles, write how Silicon Valley has been transformed from the 1970's, when its famous orchards blanketed the region. Today, traffic jams, growing residential densities, growing crime rates, and chemical pollution have deteriorated the quality of life in the area.¹⁵

While affordable middle class housing was available ten years ago in Silicon Valley, newly arriving workers now find themselves economically disadvantaged to acquire similar suitable housing. Recently, the hi-tech employers of Silicon Valley banded together to develop a long range surface rail transportation service that provides access to affordable housing for hi-tech

¹⁴ Brethour Partrick, [Silicon Valley North Lives Up to Its Name](#), Globe and Mail, October 23, 1997.

¹⁵ Castells M and Hall P, [Technopoles of the World: The making of 21st Industrial Complexes](#), Routledge, London and New York, 1994, page 26 (pbk).

workers in settlements lying along a 110 kilometer line, east of the Bay Area. (See Commuters to Silicon Valley ready to ride rails, in Appendix)

The significance of this public/private sector initiative is two fold.

First, continued economic prosperity for the hi-tech industry in Silicon Valley can only be sustained by attracting hi-tech workers with affordable salary expectations. If salary expectations would continue to escalate, labour productivity would decline and in time, a competitive disadvantage for Silicon Valley would be inflicted. In the industrial age where manufacturing was the dominant industry, while this same relationship between congestion and housing costs existed, rarely were the problems of such magnitude that employers fearing lost earnings, actively persuaded government intervention; the reason, workers were more easily replaced in the industrial era. This demonstrates the second important lesson. In the Knowledge Based Society, knowledge employers will become more active in promoting quality of life concerns to governments, not because of altruism or paternalism, but because of the bottom line. A more telling indication of this distinction will be whether knowledge employers will extend the same concerns for the remaining 80% of the work force: those defined as Routine producers and In-person servers.

The Impact of Transportation on the Industrial Revolution: Why England Surged Ahead of France

Richard Szostak, a University of Calgary economist, has researched the relationship between transportation, technological innovation and economic development, particularly during times of economic transition.

In a paper prepared for the Eno Foundation in the U.S., he describes how transportation infrastructure investments in England and later, in the United States during the early industrial revolution, facilitated the industrialization of their national economies. Szostak demonstrates that industrialization would not have occurred without transportation investments.¹⁶ It wasn't just the fact that transportation technology was available, but more importantly, governments in England and in America recognized the economic promise and established institutional infrastructures conducive to transportation investment.

¹⁶ Szostak R., The Economic Impacts of Road and Waterway Improvements, Transportation Quarterly, Eno Foundation, Volume 50 Number 4, 1996.

While similar opportunities to invest in the inter-city road linkages in France existed, Louis XVI was unwilling to offend noble interests by expropriating land to straighten roads or waterways or by interfering with ancient rights to collect tolls. This reluctance according to Szostak, hampered the development of the industrial economy in France.

In the 1760's, English coaches averaged distances of 80 to 130 kilometers a day, while the French were able to cover 40 to 55 kilometers a day. And the roads in England were passable throughout the year, while bogged down in France during times of inclement weather. By the time the French caught up to the English standard at the eve of the French revolution, inter-city travel in England was averaging 110 to 175 kilometers a day, and the London and Manchester route was averaging 250 kilometers a day. Travel times dropped dramatically after the introduction of turnpikes; the first public/private sector partnerships in transportation. By the mid-1800's, most of England was accessible to entrepreneurs and innovators, while much of France was inaccessible to French industrialists.

Such transportation improvements in England transformed the economy and changed the factors of production that directly led to rapid changes in urbanization. Three significant developments occurred: the creation of factories; regional specialization; and technological innovation.

In the agrarian society, the cost of materials was greater than the cost of labour but as the industrial age emerged, the cost of labour became greater than the cost of raw materials. This single dynamic set in motion a series of events that transformed the urban form.

Once transportation improvements increased the reach of alternate sources and selection of materials, the cost of raw materials declined. At the same time, workers became more specialized as the production process began streamlining to increase efficiency. The ability to perform these tasks required certain specialized skills effecting changes in the division of labour. This change in the economics of production permitted the creation of factories. Previously, people worked in their homes. The economies of scale for both raw materials and labour were now extended beyond the limits of villages to include other villages, creating the early industrial town and city. This process of urbanization was a direct by-product of the changing economy that capitalized on the investments in transportation.

The second related change was the rapid development of regional specializations throughout England during the period of 1760 to 1850. As a direct result of falling transportation costs and

increased reliability, measured both in terms of cost and time, firms were able to locate in regions that offered certain advantages. Productivity improvements were effected as location became less of a determinant to market access. While the shipment of finished goods and the delivery of raw materials became far more decentralized, a concentration or centralization of the production process occurred in certain regions: wool production became centralized in Yorkshire; steel in Sheffield; pottery in Staffordshire; and iron in Birmingham. Average incomes across the country grew, as these new low-cost locations were consuming more goods and services imported from the rest of the country.

The third change is the acceleration of new innovations that were being developed and disseminated. Technological innovation has always been a crucial ingredient in economic development. New improved products or new methods of production that increase cost efficiencies owe their development to innovation. As Szostak argues, “rarely is innovation a solitary achievement.” As a result, innovation is usually a product of shared partnerships where the sum of complementing skills and experience are deployed to achieve common innovation goals. The degree of interaction between such members is determined by the ease, reach and cost of transportation and information flows. Szostak credits technological innovation to the interaction that was facilitated as a result of transportation improvements in England.

The time constant relationship between transportation - telecommunications and economic development can be summarized in this manner:

- ***Economic growth is dependent on innovations***
- ***Innovation requires interaction***
- ***Interaction is therefore the basis of economic development***

Application of the Szostak Analysis: Lessons Learned

The application of the Szostak analysis to the Knowledge Based Society directs us to a major change that is now occurring in the relationship between the capital costs of land, buildings, labour and materials. Until the present economic transformation, the capital cost of fixed assets always exceeded the capital cost of labour. As a result, the location of labour was determined by its proximity to the capital of fixed assets. The major change in the Knowledge Based Society is that the **capital cost of labour**, a portable asset, **now exceeds the capital cost of fixed assets**, an immovable asset.

In *Intellectual Capital*, written by Thomas A. Stewart, the author describes how the stock market is developing means to evaluate the capital value of intellectual capital. Although annual revenues for IBM are 15 times greater than Microsoft's, the stock market capitalization for Microsoft is greater than IBM's. The fixed asset evaluation for IBM is \$16.6 billion compared to \$930 million for Microsoft or put another way, an equal \$100 share would buy \$23 of fixed assets for IBM while \$1 for Microsoft. Clearly, revenue and fixed assets cannot account for the market capitalization of Microsoft shares. According to Stewart, the difference can only be explained by the comparative evaluation of knowledge in both companies. "The market perceives that Microsoft organizes and marshals its creativity better than IBM."¹⁷

The enhanced and market capitalized value of knowledge, will effect fundamental changes in the process of urbanization in the Knowledge Based Society. How that process will unfold is difficult to forecast, unless we understand how knowledge based companies will take advantage of transportation and telecommunications advancements to improve labour productivity, introduce new technological innovations and achieve greater market access. But we do know that greater economies of scale will be needed for urban economies if they are to be successful in attracting knowledge based industry.

Comparison of Two American and Canadian Markets

Professor Robert Cervero of the University of California at Berkeley while surveying airport ground transportation requirements in the Bay Area, came upon data indicating that some air passengers were commuting to work in Silicon Valley from their residences in Southern

¹⁷ Globe and Mail, [Corporate Winners Nurture Knowledge](#), August 7, 1998.

California. These were regular but not daily commutes. They would either work from their homes or at the premises of their employer. The combination of telecommuting and rapid and affordable air transportation, allowed these companies to access specialized expertise far beyond metropolitan borders. In this example, the relationship between telecommunications is complementary since the absence of one would lead to the elimination of the other.

While the Silicon Valley - Southern California market provides for an extended range of over 500 kilometers, there are metropolitan regions in the Canadian central corridor where metropolitan regions are separated by distances of 200 kilometers or so such as, Montreal - Quebec City and Montreal - Ottawa. For frequent travellers, if the cost of flying is onerous, modal competitors such as auto, rail and inter-city bus are adequately positioned. A 2 hour travel time journey falls within reasonable tolerances for frequent commuters. This does not imply that such travel is not difficult but that it is available. For these markets, Canada is not disadvantaged relative to the U.S.

For Toronto - Ottawa and Toronto - Montreal, the comparative situation is quite different. Modal competition for long distance same day travellers is non-existent. The closest competitor to air - Via Rail - has improved service in these markets but low frequency, inconvenient station locations for non-downtown travellers, and long travel time journeys, provide a captive market to the airlines for same day return travel. Compared to similar US corridors, the Canadian air travel market is not well served.

The cost of air travel from Burbank CA to Oakland CA is US\$182 (includes all applicable taxes) to fly a distance of 525 kilometers. An identical same day return flexible and refundable economy fare to fly from Montreal to Toronto costs CDN\$688.57 (including all applicable taxes).

The Economist magazine evaluates the comparative value of international currencies by comparing the cost of a McDonald's Big Mac sandwich. The Big Mac is universal product targeted for the mass market but is produced - using local produce and labour - and marketed locally, as is domestic air travel around the world. Table 1 uses the same Big Mac comparison to gauge the affordability of inter-city travel in the United States where Southwest Airlines flies and in the Montreal-Toronto and Toronto-Ottawa markets.

Table 1
The Big Mac Cost of Air Fare in Selected US and Corridor Markets
All costs are in local currencies
Same Day Return Fully Refundable Flexible Fare

	Dallas-Houston	Ottawa-Toronto	Burbank-Oakland	Montreal-Toronto
Distance (kilometers)	375	357	525	496
Return Air Fare	\$172	\$530	\$172	\$556
Taxes	\$4	\$62.99	\$10	\$112.57
Airport Improvement Fees		\$20		\$20
Total Air Fare	\$176	\$612.99	\$182	\$688.57
Cost of a Big Mac	\$1.99	\$2.79	\$1.99	\$2.79
Big Mac Air Travel Cost	88	220	91	247
Premium Canadian Cost		2.5		2.7

Sources: 1) Southwest Airlines, <http://www.iflyswa.com/cgi-bin/requestFares>
2) Reservation telephone inquiry: Air Canada and Canadian Airlines
Note: Even in winter climate markets such as Chicago Midway to Detroit, Southwest Airlines has a return flexible fare of \$172.

While a Burbank - Oakland flight costs the Silicon Valley same day return traveller 91 Big Mac units, a similar traveller from Montreal - Toronto is faced with a cost of 247 Big Mac units. Similar comparisons for Ottawa - Toronto and Dallas - Houston reveal that Canadian travellers pay an average premium of 260% more in these markets. Even compared to the cost of Via 1 travel from Montreal to Toronto return (\$310 including tax or 111 Big Mac units), rail is more expensive than flying with Southwest Airlines.

“We’re (Southwest Airlines) looking to grow the market when we go into a new city. When we enter, air travel has often dwindled as a result of high prices and poor service. We can often quadruple or quintuple the number of passengers on a particular route. At the very least we can double it. We do it by pricing against ground transportation as much as against existing air service. This results in prices at least 60% below competitive airfares and sometimes 75% or 80% below.”¹⁸

In Canada, while we can intuitively consider the economic repercussions of higher transportation costs in two important corridor markets, we have been unable to quantitatively evaluate the impact of current air operations to the economic development of the corridor. So while we know that the high costs of air travel likely damage the economy in the corridor, we do not know how

bad the damage is. And if we do not know the extent of the comparative disadvantage, then we really do not know whether we should do anything to remedy the situation.

In Southwest Airlines operated corridors, the ability of American knowledge workers to complement telecommunications with transportation to increase accessibility to neighbouring metropolitan regions is at least 2.6 times easier than in Canadian markets. Ironically, if further telecommunication advancements in North America facilitate a greater change in the distribution of labour between adjacent metropolitan regions (decentralization of operations) stimulating more demand for inter-city travel, the Canadian corridor will be more comparatively disadvantaged economically under the current operating scenario in these captive air markets.

Mokhtarian describes the substitution effect between two entities: teleconferencing and air transport. Perfect substitution arises when one alternative is more attractive than the other because of cost or other positive attributes but shares similar properties and utilities.¹⁹

This relationship between transportation and telecommunications demonstrates a fundamental reality for transportation policy makers. If transportation policies make inter-city travel more difficult as the pricing policies of Canada's major airlines have done compared to various US corridors, the effect will be largely one of substitution, not complementarity. The ability to decentralize corporate activities to access a larger market or labour force within the corridor would require the combined advantages of telecommunications and transportation.

Therefore, it is not the telecommunications sector that will determine whether transportation has become redundant in the Knowledge Based Society but the transportation sector that will have failed to match the liberating effects of telecommunications advancements.

Labour Productivity in the Canadian Corridor

Researchers studying the economics of growth turn to Robert Solow's (1956) neo-classical model where output growth is determined by two factors of production (capital and labour) and by exogenous changes in technology. In 1988, Lucas refined the model to incorporate the knowledge and skills of urban residents. Recognizing that workers' skills are augmented through learning on the job, Lucas also determined that the quality of a worker's human capital

¹⁸ Southwest Airlines: Just Plane Smart, Harvard Business Review, December 17, 1993, 9-694-023, page 11.

¹⁹ Mokhtarian P. & Salomon I., Emerging Travel Patterns: Do Telecommunications Make a Difference, Prepared for the Eighth Meeting of the International Association of Travel Behavior Research, Austin, Texas, 1997.

depends on the human capital that one interacts with. The sheer density of human capital improves the quality of human output.²⁰ (See *Cities and Growth*, in Appendix)

This economic interpretation of growth accounts for the results of a study that determined the correlation between labour productivity and city size. Sveikauskas in a 1975 empirical study that examined 14 industries across 212 metropolitan regions found that a doubling of the population resulted in a 6% labour productivity improvement accompanied by a 5% increase in the cost of wages. While Sveikauskas was unable to show causation between city size and labour productivity since it could not be determined whether city size caused productivity gains or whether already productive cities grew, urban historians have always recognized that a growing urban agglomeration is necessary to sustain urban growth.

Perhaps the greatest socio-demographic change in the modern era, is the emergence of two income households. In the Knowledge Based Society, the lost productivity of a spouse resulting from the relocation of a worker in the corridor, will be significant. This factor was not considered in 1975. Every year, about 40,000 Canadians are relocated by their employers throughout the country, and the impact on spousal careers is only increasing.²¹ We do not know how severely labour productivity is affected for firms who lose valuable employees as a result of spousal relocation.

If a combined “Accessibility” infrastructure can be put in place that would allow Canadians in the corridor to access employment opportunities in adjacent metropolitan regions, significant labour productivity gains may be realized. Table 2 gauges the theoretical labour productivity improvements in the Canadian corridor using the relationship between city population and labour productivity using the correlation developed by Sveikauskas.

²⁰ Federal Reserve Bank of San Francisco, *Cities and Growth*, <http://www.frbsf.org/econrsrch/wklyltr/wklyltr98/e198-27.html>

²¹ Globe and Mail, *Job Relocation: Aid for the Trailing Spouse*, April 13, 1996.

Table 2 Labour Productivity and Population Levels (in thousands) Sveikauskas Productivity Estimates				
	TORONTO	OTTAWA/HULL	MONTREAL	QUEBEC CITY
Metropolitan Limited Population ²²	4,444.7	1,030.5	3,359	697.6
Linked Metropolises	Toronto-Ottawa/Hull	Toronto-Ottawa/Hull-Montreal	Ottawa/Hull-Montreal-Quebec City	Montreal-Quebec City
Linked Metropolitan Populations	5,475	8,834	5,087	4,057
Labour Population Increase	23.2%	757.3%	51.4%	481.5%
Theoretical Labour Productivity Increase (100% population increase = 6% labour prod. increase)	1.4%	45.4%	3.1%	28.9%

The above table shows quite a significant theoretical labour productivity gain for knowledge employers in the Ottawa-Hull area, given the accessibility to knowledge workers in both greater Toronto and Montreal. Bear in mind, that a decentralized office would not necessarily require daily commutes or even regularly timed commutes. However, the decision to decentralize work activities would depend on the ease, cost, rapidity, and reliability of transporting an individual within a reasonable time frame to meet with clients, brainstorm with colleagues, attend training sessions, or even to meet with a supervisor. More likely than not, a large number of these trips would not be scheduled but would occur at a moment's notice. The comfort factor for companies to decentralize their activities beyond metropolitan limits at arm's length, would be effected by the confidence of bringing the worker to a desired location in a timely fashion and allowing him/her to return to their principal residence on the same day.

Limitations to Company Decentralization

Not all knowledge workers would be able to enjoy a metropolitan neutral work location. For some, metropolitan access or at least, daily or frequent inter-metropolitan commuting would

²² Statistics Canada, <http://www.statcan.ca/english/Pgdb/People/Population/demo05.htm>

become necessary. In addition, companies would likely have to accept some of the trade-offs of adopting an arm's length relationship with their workers, as some have already done for metropolitan based teleworkers. The benefits of re-engineering work activities for knowledge employers would be rising labour productivity levels that are directly due to increased agglomeration of labour pools. As always, only individual companies will be able to determine whether the benefits will outweigh the complexity of a decentralized operation in the corridor.

Consequently, future Transport Canada studies should focus on knowledge employers as well as knowledge workers to assess the economic returns of transportation investments in the corridor.

Necessary Travel Attributes To Link Metropolitan Regions

Factors that impede travel between metropolitan regions can be compared to the "Friction Resistance" in pipes that carry water from source to receptor. The properties of the pipe determine the speed and efficiency of transmission and its effective capacity. Transportation technologies that can "peel away" as many of these travel inhibitors as possible, offer Canadians far greater mobility.²³

Today in North America, no transportation mode offers the traveling public the service attributes that can provide the necessary urban inter-action to link metropolitan regions together to achieve a shared urban agglomeration of knowledge workers. The air mode does provide increased accessibility but for many reasons in addition to cost and capacity, its service attributes cannot easily serve the "mass-commuter" market, despite the improvements achieved by low-cost commuter airlines. And the automobile for consistent commuters is largely limited to a time duration of 60 minutes; depending on congestion levels, roughly 70 kilometers door to door.

A successful transportation mode will be one that can emulate the airlines' inter-city travel time (for distances up to 400 kilometers) as well as the convenience, ease of use and time-reliability of an intra-urban mass transit service. In such a scenario, and for planning purposes, 'inter-city' and 'intra-urban' can be considered one and the same market.²⁴

²³ Zavergiu R.M., Information Age Urban Form: Maglev Transportation, Telecommunications and Implications for Urban Scale and Design, American Institute of Architects, May 17, 1997, New Orleans.

²⁴ Eggleton P., Zavergiu R.M, Induced Demand: Matching the Attributes of Maglev with the Information Age Inter-Active Megalopolis, Symposium on MAGLEV Train Application in China, Zhejiang University, Hangzhou, China, October 27, 1997.

Assumed Travel Attributes

The following travel attributes for an inter-metropolitan mass transit market are assumed and have not been tested. Some already exist in either developing or mature technologies but may lack complementary but necessary co-attributes. A good example is the speed of certain steel-wheel high speed trains and the air mode, but neither technology offers conveniently located stations or airports to minimize station/airport access and egress times. A further example is the development of the V-22 VTOL aircraft which can operate from numerous metropolitan VTOL ports, but suffers from reduced capacity and an operating cost that commands premium air fares.

There are two developing technologies in the United States that have potential to provide many of the needed attributes but their progression is stalled because their economic feasibility studies ignore the potential ridership benefit of expanding the intra-city market to link adjacent metropolitan regions: Automated Highway System; and Maglev.

In the past twenty years, each of the above mentioned transportation technologies: shared common congestion relief objectives; was technology pushed; considered telecommunications as a substitute technology; found that benefits did not exceed public costs; and as a result, was predictably canceled or scaled back in North America.

Attributes

SPEED: A system capable of sustained operating speeds in excess of 400 kms per hour or more, which for markets up to 400 kilometers is as fast as regional airlines.

STATION LOCATIONS: Should the transportation mode be a collective ground system, the number and location of stations is critical in the development of a long distance commuter service. A commuter service from Montreal to Ottawa or from Ottawa to Toronto would have to serve many stations in order to minimize station access/egress times. For example, the system would have to be able to follow the rights-of-way of the major highways such as the Don Valley and the Trans-Canada in the Toronto region. The location of a single station in downtown Toronto with trains departing for Ottawa/Hull could never be considered an intra-city trip when residents north of the old boundaries of the City of Toronto would be forced to commute to the downtown core to access the service. In this instance the trip journey would be composed of two intra-city trips, limiting the advantage of a Toronto - Ottawa downtown service.

SERVICE CONVENIENCE: The mode must be designed to match several user friendly service attributes from 'intra-urban' transit modes, that is: high frequency, ease of use; ease of access; ease of information provision; ease of ticketing (ideally, no ticketing); ease of passenger processing; and a simplified fare structure.

SECURITY: The system would have to be designed to achieve zero-incident tolerances.

CONFIDENCE: An 'intra-urban' transportation system (whether highway expressways or public transit) to function effectively must inspire total confidence from the traveling public. Travelers must be assured that when they need to travel, they will always have the transportation system available.

CAPACITY: The issue of capacity is directly related to the confidence and convenience level of commuters. Excess capacity is an intra-urban travel attribute in which (in economics terminology) an Available Seat Mile is not considered a perishable good. It is, however, a defining attribute for inter-city travel and subjected to yield management. For example, while airlines are not inconvenienced when passengers are asked to wait for the next available flight, its passengers are. While this may be considered a frivolous attribute, consider the likely impact to the urban scale if commuters had only a 90 percent chance of departing for their destination. Fixed capacity restrains urbanization.

COSTS: The price of Ottawa/Hull - Toronto or a Montreal - Quebec City trip ought to replicate or better the cost of a cross town taxi fare.

ENVIRONMENTALLY BENIGN: To the extent possible, the transportation technology should be environmentally benign.

Automated Highway System

Under the aegis of the United States Intelligent Transportation Systems initiative, a program to develop an automated highway was launched in the early 1990's. A demonstration of the automated highway system was held north of San Diego, California, in August of 1997.

It was designed to alleviate congestion on America's freeways by eliminating differential speeds, and freeway incidents by introducing automated guide-ways to govern vehicular control. While the technology would allow a vehicle to reach a distance of 180 kilometers in 90 minutes (120 kilometers/hour), a committee of land use - transportation experts failed to anticipate the ability of intra-city travellers to travel longer distances, let alone the possibility to link metropolitan regions

together. The economic opportunity to achieve increased agglomerations of urban labour was never considered.²⁵

For both economic and technical reasons, the Automated Highway System has been scaled back and re-launched as the Intelligent Vehicle Initiative consolidating the technical advancements in vehicle controls to improve road - vehicle safety.

National Maglev Initiative in the United States

In 1990, the United States Department of Transportation, the United States Army Corps of Engineers and the Department of Energy were assembled to develop a National Maglev Initiative. Three years later, the team reported that while the technology was feasible, inter-metropolitan maglev service was not economically feasible given the limited amount of traffic currently travelling in these corridors with the exception of the Northeast corridor, and possibly, California.

One of the technologies investigated, was designed to transport a high volume of passengers from numerous off-line stations, at a very low cost. If constructed between Montreal and Ottawa/Hull, it would be able to transport a Montrealer to Kanata in 30 minutes at a cost comparable to an intra-city cab ride (\$20-\$30) and arrive at a conveniently located station. While the operating cost of this system is low, the capital costs are significant, in the range of US \$30 to \$50 million a linear mile, depending on the topography.²⁶ **To justify such a significant public expenditure, the required traffic levels would more closely resemble that of mass transit and not current inter-city transportation markets.**

Ridership projections were used to evaluate the economics of this transportation technology. Projections were solely estimated by applying modal diversionary models to estimate derived market shares from existing air and auto inter-city markets. It was not surprising therefore, that the traffic levels did not materialize. The Federal Railroad Administration restricted itself to current inter-metropolitan traffic in its market assessment and ignored the market potential of diverting intra-metropolitan trips to longer distance inter-metropolitan commuting trips.

²⁵ Unpublished, National Automated Highway System Consortium Land Use Panel, Series of Automated Highway System Reports: How Will AHS Effect Metropolitan Development Patterns? (Landis, John); Implications of Automated Highway Systems on Land Use Patterns, (Beimborn, Edward); A Simple Framework for Evaluating the AHS (Downs, Anthony); Effects of AHS on Urban Land Use and Metropolitan Form, (Giuliano, G.); Land Use and the Automated Highway System (Rutherford, G.S.) 1996.

²⁶ U.S. Dept. of Transport & US Army Corps of Engineers, Final Report on the National Maglev Initiative, Washington D.C., Sept., 1993.

Therefore, the failure of the United States Government to capture the promise of Maglev and the Automated Highway, lies in its misunderstandings of the changing role of inter/intra urban transportation and the expanding urban spatial requirements of the Knowledge Based Society.

Southern California Association of Governments

(all costs in US\$)

This Metropolitan Planning Organization (MPO) of Southern California Association of Governments (SCAG) adopted a transportation plan in 1998, calling for the construction of a regional maglev system to serve long distance commuters. By focusing the ridership investigation on current intra-city traffic data (42 million daily trips), SCAG is forecasting a daily ridership of 600,000 passengers. They estimate the average trip length to be 40 miles, which at a fare of 23 cents per passenger mile, would generate a daily revenue of \$5.5 million. The capital cost of the 273 mile system, including right-of-ways, would be \$12.285 billion or \$45 million per linear mile.

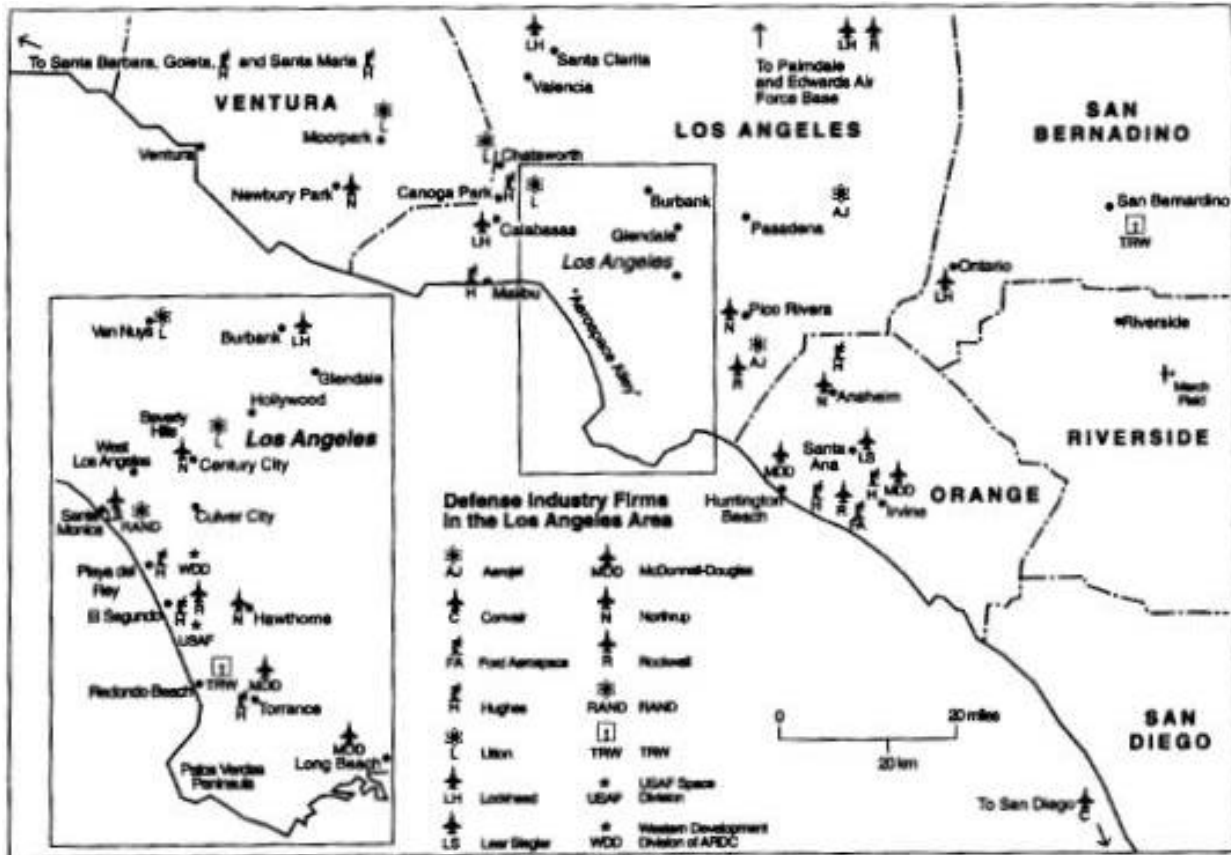
This is the first attempt anywhere in the world, to apply Maglev technology for a mass transit service. And it is unknown whether existing proven maglev technologies in Japan or Germany will be capable of providing all the travel attributes that are required in Southern California. American technology suppliers - among them, General Atomics of San Diego - are also vying for the right to deploy their systems that are designed to more closely match the commuting requirements for Southern California. A potential problem for this regional Maglev system will be capacity constraints. The 600,000 ridership estimate is based on current long-distance commuters in the region and it does not include new ridership from changes in the distribution of labour that will occur as a result of the increased accessibility to a regional employment market.

Should SCAG succeed in promoting such a system, it will extend the urban catchment region beyond the metropolis to cover the entire region of Southern California. If extended beyond the southernmost limits of Orange County to include San Diego, an urban agglomeration of over 20 million people will be accessible to knowledge employers. One of the objectives of the plan is to attract foreign investment by raising labour productivity rates in the region.

“Transportation projects can be more effectively advanced if they promote productivity, economic growth, or improvements in living standards than they can, as instruments of redistribution, trade, or congestion relief. It is not the number of jobs that Maglev creates during construction but the number and quality of jobs that it helps attract once in operation.”

*Southern California Association of Governments 1998*²⁷

Figure 1 shows a regional map of the Los Angeles center of Southern California indicating the location of high technology centers dotted throughout the region. The entire region covers an area that is currently beyond reasonable commuting distances, even for Southern Californians. While California was built to accommodate the automobile, its range is limited; indeed the automobile commuting range is more likely to decline given rising congestion levels.



Los Angeles Defense Industries
 Source: Markusen, Hall, Campbell and Deitrick, 1991

Covering 41,000 square miles, from San Diego to Santa Barbara, Southern California is home to 400,000 high technology workers. Yet this region is unable to provide commuting access to all its resident high technology workers. This failure has been attributed by some, as one of the reasons why Southern California has been so far, unable to match the growth of high-technology jobs in Silicon Valley.²⁸ (See appendix, Tech Coast)

²⁷ Southern California Association of Governments, Intra: Regional Maglev: For the next millennium, June 1998.

²⁸ Los Angeles Times, Technology Coast, http://www.latimes.com/HOME/NEWS/CUTTING/lat_tech0309.htm

Prepare a 25 Year Accessibility Strategic Plan

It is hoped that this paper has demonstrated the need for the Government of Canada to commission a 25 Year Accessibility Strategic Plan that would call for the development of a combined transportation and telecommunications “accessibility” infrastructure in the central corridor, among others in Canada. One of the goals of the strategy would be to provide location neutral employment for knowledge employers in Central Canada.

Just as this paper challenges many of the conventional wisdom's, this author readily accepts the possibility that telecommunications advancements will be so profound, that the future transportation infrastructure in the corridor will be similar to today's, with the exception of more affordable air fares and Intelligent Transportation Systems equipped non-automated highways.

The strategic plan would simply be an interface between the policies as established by the government and the pursuits of the private sector to deliver the infrastructure technologies in keeping with the strategic plan. The plan would not substitute for private sector initiative or partnerships, but would provide the direction and the goal. At present, the corridor in Central Canada has no long term transportation plan. And it's absence may one day lead to the selection of a transportation infrastructure that will not promote the mobility requirements of the Knowledge Based Society but restrict itself to relieving congestion in the industrial economy.

The plan can be used as a benchmark to assess private sector proposals to put in place the desired transportation infrastructure to support the telecommunications network in the corridor. These plans can be prepared in five year stages, preparing the ground for a gradual or rapid transportation technology deployment. The strategic plan may also address any short term comparative disadvantages that may be remedied by means other than infrastructure development.

The elements of the Strategic Plan would be:

Establish a Joint Research Program with Industry Canada

While the Information Highway initiative rests within the domain of Industry Canada, the requirements for physical accessibility between metropolitan regions can only be determined by Transport Canada. These elements provide the basis for a strong partnership with an equal commitment toward the development of an “*Accessibility*” infrastructure plan for Central Canada.

Acknowledge and Correct the Shortcomings of Inter-City Traffic Demand Models

Acknowledge and correct the shortcomings of existing traffic demand models to assess transportation technology improvements that can link metropolitan regions. There are two glaring failures in current models. One, they cannot investigate the spatial effects of new transportation technologies. And two, inter-city traffic models as a matter of course, exclude the daily intra-city commuting market as a potential market for new transportation technologies. This author believes that the performance of these models can be improved by developing a corridor wide land use model that can interface with a transportation demand model. The land use model itself, can only be prepared once we understand how the inter-play between rising requirements for labour accessibility and the “Accessibility” infrastructure will effect changes in the spatial distribution of employment in the corridor²⁹.

Work with Knowledge Employers First, followed by Knowledge Workers

A joint Industry Canada and Transport Canada investigation would have to target knowledge employers to assess any labour productivity improvements that would occur as a result of linked metropolitan regions. These investigations would not limit themselves to high-technology industries, but would also include industries where knowledge workers are found.

This investigation should not entail traditional “what if” scenarios. Such an investigative approach assumes that employers would be cognitive of the possibilities of bridging the barriers separating our metropolitan regions. It should be one that, according to Hamel Prashad in *Competing for the Future*, “leads customers to where they want to go but don’t know it yet.”³⁰ By opening employers to the possibility of accessing a regional labour force, we will have to work with them to understand what type of transportation attributes in combination with telecommunications advancements would be necessary to achieve this goal. The problem of “what if” scenarios assumes that the interview subject is aware of the opportunities created by new technologies.

²⁹ Zavergiu R.M., *Information Age Urban Form: Maglev Transportation, Telecommunications and Implications for Urban Scale and Design*, American Institute of Architects, May 17, 1997, New Orleans.

³⁰ Prashad Hamel, *Competing for the Future*, Harvard Business School Press, 1994, page 100.

Conclusion

This paper maintains that future labour productivity improvements in the Knowledge Based Society will depend on improved inter-metropolitan “Accessibility” linkages in the Central Canada corridor, primarily Toronto - Ottawa - Montreal - Quebec city. Just as the cost of labour exceeding the cost of raw materials gave birth to the factory in the industrial age, the cost of labour in the Knowledge Based Society will exceed the cost of fixed assets which will in turn effect significant changes in the process of urbanization. Urban regions that can best balance the requirements for increased urban populations while preserving the quality of life will succeed in attracting investment in the new economy.

From this author’s perspective, the choice is quite simple. Either we all move to Greater Toronto and endure the effects of rising congestion or we take advantage of an “Accessibility” infrastructure to provide Canadians resident within the corridor with access to employment throughout this region.

Transportation and telecommunication technologies will compose the basis for this “Accessibility” infrastructure. While telecommunications would reduce the need for daily physical commuting by knowledge workers, transportation linkages would increase the opportunity for necessary face to face communications. This complementarity of objectives invites a shared undertaking between Industry Canada and Transport Canada.

The lessons of the industrial revolution and the comparative experiences of France and England demonstrate that the economic stakes in the current transition to the Knowledge Based Society are significant. The Government of Canada has in the past been solicited to participate in the construction of a high speed ground transportation system in the corridor. Promoted as a means to relieve congestion on our roads and in our airports, the growing requirements of inter-metropolitan commuting in the Knowledge Based Society indicate that congestion relief is too modest a goal for a public investment that approaches \$10billion.

Should a future Industry Canada and Transport Canada study indicate that physical interaction is not only required but must be accelerated through the introduction of new transportation technologies, serious debate will be required to decide how best to finance the system.

In our traditional definition of urban regions, we accept the notion that the capital cost for mass transit investments is a sunk-in investment and that fare box revenue recover only operating

costs. For transportation projects that link metropolitan regions together, transportation authorities submit the technology to the discipline of the private marketplace, where not only capital and operating costs are fully recoverable but sufficient internal rates of return are required to attract private sector investment. But what if the linkage of these metropolitan regions results in a new urban form consolidating physical accessibility for workers in the Knowledge Based Society rendering trips within this region as intra-urban? Would the old rule still apply? That is, that the capital cost of an intra-urban transportation system would be incurred by the public sector.

The timing of this debate can only occur after Transport Canada gains a better understanding of the importance of transportation to complement telecommunications to effect greater labour productivity improvements in the Quebec City - Windsor corridor and other corridors across Canada.

Appendix

List of Articles

1. Associated Press, Commuters to Silicon Valley ready to ride rails: Express trains will help end brutal drive for many, October 19, 1998
2. Globe and Mail, Corporate Winners Nurture Knowledge, August 7, 1998.
3. Federal Reserve Bank of San Francisco, Cities and Growth, September 11, 1998.
4. Los Angeles Times, Tech Coast, March 9, 1998.
5. Globe and Mail, Job Relocation: Aid for the trailing spouse, April 13, 1996.
6. Wall Street Journal, To Some Commuters, Going Home Means a Long Plane Ride, March 7, 1995.
7. Washington Post, Two-Way Commuting Couples Blur Line Between D.C., Richmond, July 21, 1996.

Commuters to Silicon Valley ready to ride rails: Express trains will help end brutal drive for many,

By Matthew Yi

ASSOCIATED PRESS

October 19, 1998

FRESNO -- Dave Simpson is so sold on the idea of riding the new commuter train linking distant rural suburbs to Silicon Valley that he's getting rid of his car.

"I'm in my 40s, but I look 20 years older. It's probably because of that commute," said Simpson, who has been getting up at 4:30 a.m. to try to beat the traffic along his 140-mile round-trip commute.

No more. He's joining about 2,800 other technology workers on the Altamont Commuter Express train, which begins service today. The train is expected to be an instant hit with workers who fled the booming housing market closer to work and live in the more affordable San Joaquin Valley.

"I'm gonna give my car to my oldest son," Simpson said. "It's a ploy to make certain that I use the train."

The purple, blue and white Altamont Commuter Express trains traveling from Stockton to San Jose will go rolling across the Altamont Pass, through southern and eastern Alameda County, and into the land of computers, hard drives and the Internet.

"We got the champagne on ice, thousands of employees in line, and we're very excited about this service," said Carl Guardino, Silicon Valley Manufacturing Group president.

The group, which represents about 30 of the largest high-tech companies in the Silicon Valley, has been pushing for the train service for the last five years. Some companies are offering 25 percent to 100 percent subsidies to employees who use the Altamont Commuter Express, or ACE.

"The train service is a third faster, 75 percent cheaper and with laptop computer trays at most seats, people will be a lot less frustrated when they arrive at work," Guardino said.

In addition to pressure from Silicon Valley employers, the flood of people moving to the valley helped get the train, first imagined in 1991, off the drafting board and onto the rails. An estimated 36,000 people drive across the Altamont Pass each day for jobs mostly in the Silicon Valley, an increase of almost 500 percent since 1980.

Skyrocketing housing costs in the San Francisco Bay Area have pushed commuters to live as far as 80 to 100 miles away in northwestern San Joaquin Valley communities like Tracy and Manteca.

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