MICHIGAN DEPARTMENT OF TRANSPORTATION

MICHIGAN-ONTARIO RAILROAD BORDER CROSSING INFRASTRUCTURE: AN EVALUATION OF MODERNIZATION PROPOSAL BENEFITS AND RECOMMENDATIONS FOR FUTURE ACTION

A Report For The

MICHIGAN DEPARTMENT OF TRANSPORTATION
BUREAU OF TRANSPORTATION PLANNING
FREIGHT TRANSPORTATION PLANNING SECTION

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This report represents the findings and/or professional opinions of the consultant and is not an official opinion of the Michigan Department of Transportation or the Michigan Transportation Commission.

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EXECUTIVE SUMMARY

The objective of this report is to analyze the limitations of Michigan's current cross-border railroad infrastructure, to develop a preliminary evaluation of the economic benefits which would result from various options for improving that infrastructure, and to develop a recommendation on the approach which the state should encourage. The study objective also includes a review of Detroit highway border crossing roadbed capacity for trucks, and the role that a rail related project could play in reducing truck traffic and in providing additional truck capacity.

While the scope of the study has been increased as additional border rail projects have been suggested, the original questions related to the benefit which would result from partial deepening at Detroit, the additional benefits which would be provided by a double stack tunnel, and the benefits which might be provided by converting the existing twin tube rail tunnel to truck and/or auto use. Since the project began, other approaches have been proposed and these are also reviewed in the report. The Port Huron-Sarnia double stack tunnel being considered by Canadian National is the most important of the new concepts.

It should be noted that the findings in this report are the result of an exploratory research effort. While quantified benefits are suggested for each project, these should be considered general guidelines of the potential benefits. Further research would be necessary to provide detailed estimates of the overall and Michigan benefits.

PROBLEM STATEMENT

The current problem is that the railroad tunnels at both Detroit-Windsor, and Port Huron-Sarnia, are inadequate for passage of several kinds of modern railroad cars. Both tunnels have height limitations that prevent the passage of standard trailer-on-flat-car (TOFC) equipment, high cube boxcars, auto tri-level railcars, and double stack container trains. As a result, the above railcars must be ferried across the river, and double stack container trains simply do not use the Michigan-Ontario crossings.

The ferry trip across the river adds substantial costs, results in service delays of 12-24 hours, and causes the federal harbor maintenance fee of up to $300 per railcar crossing to be imposed.

Because the auto industry is a prime user of high cube boxcars and the auto tri-levels that do not fit, these tunnel limitations impose substantial costs on the industry.

The lack of through double stack service could also threaten Michigan's position as a major rail gateway between Canada and the U.S. With double stack service, Michigan will sit at the rail center of a market with Chicago to the west and Toronto/Montreal to the east. Without double stack service, Michigan will sit at the northern terminus of a rail system which increasingly relies on auto industry volume to absorb costs. The potential diversion of existing through traffic to Buffalo and the loss of potential rail traffic could have significant implications for roadbed and railyard fixed cost absorption, and for the level of rail service provided to Michigan manufacturers. This study will attempt to determine the actual benefits of cross-border double stack service, and the opportunity costs associated with a lack of such service.

INFRASTRUCTURE IMPROVEMENT OPTIONS

There are several options for providing improved and/or new rail border crossing capacity, and for using existing rail tunnels to augment highway truck capacity. The first option involves a partial deepening of the Detroit-Windsor rail tunnel. This option would cost $35 million, and would allow for passage of all but 9'6" domestic double stack trains and 20'2" auto tri-levels Chrysler would need to use to move from truck to rail border crossings. While this option would allow for passage of 8'6" maritime double containers, industry trends are moving towards the higher containers and any future double stack capability should accommodate the higher containers.

The second principal option involves construction of a new double stack tunnel at Detroit-Windsor or Port Huron-Sarnia. Such a tunnel has been estimated to cost $155 million at Port Huron, and $172 million at Detroit. It should be noted that the railroad owners (Canadian National and Canadian Pacific) are about to commit to a partial deepening at Detroit-Windsor, and that the owner at Port Huron-Sarnia (Canadian National) is engaged in a major engineering study of a new double stack tunnel there.

There are two other principal options. The third option is to construct a new double stack tunnel at Detroit and convert the existing twin tube railroad tunnel to truck use. Such a project has an estimated cost of $267 million. In addition to having been considered by the Michigan Department of Transportation (MDOT), the project has also been proposed by a private developer, Beztak, in partnership with the Greater Detroit/Wayne County Port Authority. However, neither of the railroad owners have seriously considered this concept up to now. However, recent speculation about CN approval of a Port Huron double stack project may cause CP to show an increasing interest in a fully capable double stack tunnel at Detroit.

The fourth option involves a combination of the above projects. The most likely involve a partial deepening at Detroit, followed by new double stack tunnels at Detroit or Port Huron, and possible conversion of the rail tunnel to truck at some later date.

BACKGROUND INFORMATION

The Detroit-Windsor rail tunnel is a twin "immersed tube" facility built in 1910 and jointly owned by Canadian Pacific (CP) and Canadian National (CN) with CN management responsibility. Current traffic levels at the tunnel are estimated at 325,000 railcars per year. Approximately 20 trains a day use the tunnel, including eight CP/Soo single level container trains moving between Chicago/Detroit and Montreal. Current charges approximate $40 per railcar.

Ferry service is currently provided by Norfolk Southern (NS) ferries making four round trips per day. The costs of the operation result in a per car charge of $150 at recent volume levels. Traffic is down from 85,000 units in 1988 and is forecast at 23,400 units in 1991-1992. The reduction is due to Buffalo diversions and NS use of the tunnel for regular size traffic.

The Port Huron-Sarnia rail tunnel is a single tube bored facility constructed in 1890 and owned outright by CN. Current traffic levels at the tunnel are estimated at 180,000 railcars based on 1988 data. There are an estimated 12 freight trains per day, and two passenger trains a day. Two ferry services operate at Port Huron-Sarnia, and they are owned by CSX and CN. Ferry volume is estimated at 110,000 units, some 75,000 of which are assumed to be oversize railcars that do not fit through the tunnel.

It should be noted that the U.S. harbor maintenance fee is charged on the value of all cargo crossing the river by railcar ferry. This fee was recently tripled from 4/100ths of one percent to 12/100ths, and is costing up to $300 per railcar. The Corps of Engineers has also been given the authority to raise the fee in the future. The fee is costing the owners of rail cargo, primarily General Motors and Ford, substantial sums of money and is leading to increasing diversion of freight to Buffalo where rail bridges cross to Canada.

There are an estimated eight double stack trains a week using the Buffalo double stack capable bridges. Asia to Eastern Canada traffic which once used the Michigan-Ontario crossings is now diverting to Buffalo because of the ability to utilize double stack trains from the West Coast to the Toronto area. NS recently diverted Detroit-Windsor ferry traffic to Buffalo, and Grand Trunk is concerned about diversions of auto traffic due to the harbor maintenance fee. Some Mexican-Ontario traffic is using this crossing, and Buffalo is being explored as an option in several cases.

Total Michigan-Ontario rail borne trade is estimated at $21.6 billion. Included is $4.8 billion of U.S. overseas trade transshipped through Canadian ports which was recorded by the U.S. Customs District at Detroit.

CHANGES IN THE GLOBAL ECONOMY

The global economy has become increasingly competitive since the end of World War II and this development is forcing the need for improvements in U.S. competitiveness. The increased competition is in part due to the development of once inferior overseas economies, and in part due to the development of low cost transportation, communications and information processing systems which allow for global operations at economical levels.

North American corporations are responding to the challenge by participating in the global market at unprecedented levels, and by specializing production geographically and by product so as to maximize comparative advantage and increase competitiveness. Both approaches demand efficient transportation systems in order to be effective, and are in part driving the need for better rail crossings.

Countries are responding to the trend towards specialization and global production by seeking out nearby partners with complimentary comparative advantages. This hunt for comparative advantage has led to the pursuit of trading block relationships amongst neighboring countries. In Europe the result has been formation of the European Community, and the effort to create a more unified and efficient economy by 1992. In North America, the result has been a movement towards unification of the three countries into one trading area.

However, effective trading block relationships with specialization of production along lines of comparative advantage requires efficient intra-trading block transportation. Without low cost intra-trading block transportation, the manufacturing savings of specialization are consumed in physical movement costs. Participation across trading blocks also requires each block to have efficient inland and ocean transportation systems.

TRANSPORTATION DEVELOPMENTS

The changes in the global economy reviewed above are forcing the need for the most efficient North American transportation system possible, and the rail mode is becoming an increasingly important player in that system. Containerization, intermodal, and now double stack services have helped to make rail more competitive. Double stack technology involves the use of specially designed railcars that can carry various size containers two high. This increases each train's capacity and results in lower line-haul costs. Many observers believe double stack could revolutionize rail services and costs.

Because a fairly inexpensive partial deepening can eliminate all but 9'6" double stack and 20'2" special tri-level problems at the Michigan-Ontario border, it is critical to understand how important this technology is now, and how important it is likely to become. The categories of freight which might move by double stack today and in the future will determine the kinds of freight that need to be evaluated for possible benefits. The current benefits provided by double stack, compared to single stack container services or truck, will be used to determine the savings that a double stack tunnel would provide.

Current literature generally indicates that double stack efficient distances are constrained by service and cost factors. The most comprehensive research indicates that double stack dedicated trains are competitive with truck at distances over 725 miles. However, other literature and rail industry statements have suggested that double stack could be competitive at distances of as low as 200-300 miles. Based on this information it would appear that double stack would be viable on U.S. Midwest to East Coast corridors, and on Chicago to Toronto/Montreal corridors. It would also be viable on longer distance moves through Michigan, and possibly, for intermediate moves between Michigan and Ontario as part of longer distance trains.

It appears that 9'6" domestic double stack containers are about to make major inroads into the domestic truck market. The trend is also towards shorter distance dedicated trains, and towards mixed intermodal trains. There is also increasing use of single well, as opposed to five well unit cars, and this has led to double stack being mixed with general freight trains in some cases. Double stack also may have the potential to replace boxcars for intensive movement corridors such as those in the auto industry. This development could lead to the use of double stack as a replacement for boxcars on short distance Michigan-Ontario rail only movements. Shorter distances would be possible because terminal and drayage costs would be avoided.

A review of the literature indicates that there are two main benefits from double stack. These benefits relate to line-haul savings and better ride quality. Compared to TOFC service, double stack has been estimated to save $100 per container for movements of 800 miles. Double stack costs are generally assumed to be 90-95% of truck costs at distances over 600 miles. The ride benefit relates to slackless couplings and improved suspensions, and while more economical with double stack cargo levels per well, such innovations are not limited to "double stack."

Given the above points, it would appear that double stack capable Michigan-Ontario rail border crossings may be important to Michigan manufacturers. They would, first, appear to be important for providing a competitive route to Europe for Michigan companies. Improvements which would lead to more trains on the corridor could also help minimize unit costs for all traffic on Michigan railroads, and could result in improved service levels and rail freight rates. Improved crossings could also somewhat help to unclog congested highways and border bridges with positive economic results for area manufacturers. Finally, to the extent that auto industry rail movements become double stack viable, improved border crossings will be essential. Given the above points it would seem that further investigation of the possible benefits by category would be justified and the results of this review are presented in the next section.

GENERAL BENEFITS

The following paragraphs summarize the types of benefits that would accrue to partial deepening, double stack, and rail conversion to truck projects.

The partial deepening project has the most significant benefits and these are summarized in Exhibit 10. The benefits relate to elimination of the ferry service and its associated costs, service time improvements and a reduction in auto inventory carrying costs, elimination of harbor maintenance fee expenses, freeing up of the ferry land for economic development, and the possible elimination of 20-40,000 trucks per year from the road.

A double stack tunnel provides a number of incremental benefits over and above those achieved with a partial deepening. These benefits are summarized in Exhibit 11. One major benefit relates to the ability to carry 20'2" tri-levels that Chrysler would need in order to move from truck to rail cross-border auto shipments. A second major benefit relates to gross savings of $75-100 per container, and net savings after construction costs of $49-74 per container, on trade between the U.S. Midwest and Europe moving via the Port of Montreal. Other benefits relate to Mexican-Canadian auto components trade transportation costs, Asia-Eastern Canada transportation costs, and possible Michigan-Ontario benefits. Double stack services could also remove up to 116,000 trucks a year from the roads and bridges in initial years, and more in succeeding years. Other more generic benefits relate to increased local intermodal services and possibly lower rates, the potential for location of rail sensitive manufacturing plants in the area, the absorption of track and yard fixed costs by additional trains, and substantial image enhancement impacts.

It should be noted that the potential for lower freight rates, which almost all the above benefits are predicated on, is subject to considerable debate. Canadian Pacific has stated that lower rates would not be possible. On the other hand, Canadian National and Grand Trunk Western, the Michigan line owned by Canadian National, believe that lower rates would be possible. Given the statements by Canadian National, their commitment to a Port Huron double stack tunnel feasibility study of over $1.0 million dollars, and some support from industry observers, this report assumes rate reductions will be possible.

The final category of improvement project relates to conversion of an existing railroad tunnel to truck (Exhibit 14). This is somewhat feasible at Detroit but not very feasible at Port Huron because of the single tube there. The conclusion of this study is that a conversion would be very expensive for the value received, and that the Ambassador Bridge truck roadbed capacity will be adequate until the year 2005 at the very least. Given secondary yard and primary inspection capacity improvements at the Ambassador it is believed that additional volume can use this facility. As such it would be possible to divert downtown auto tunnel truck traffic to the Ambassador if Customs/INS problems are resolved. Because of these factors no benefit is assumed for a conversion, although, a "what-if" benefit level of $7.8 million per year is assumed for analysis purposes.

CONCLUSIONS BY PROJECT

Analysis of each project was conducted in three ways. First, the pro forma financials for a project were calculated using conservative estimates of volume. Construction costs were assumed to be financed over 30 years at 8%. Secondly, cost benefit net present value paybacks were computed for North America-wide benefits, and for Michigan only benefits. Quantified benefits by freight category were estimated where possible, inflated at 5% per year, and discounted back at 8% to obtain a discounted return which could be compared to construction costs for determination of payback years. Finally, the advantages and disadvantages of each project were reviewed from a quantitative and qualitative vantage point.

The results of this review are summarized for each project in the following parts. Exhibit 1 summarizes the financials for all project options considered, while Exhibit 9 summarizes the cost benefit payback analysis for all project options.

Detroit-Windsor Partial Deepening

The Detroit-Windsor partial deepening project is the most beneficial of all the projects reviewed, and at $35 million has the lowest cost. The project also accomplishes most of what the three auto companies feel needs to be done, although it does not take care of the 20'2" tri-level problem that Chrysler very much wants addressed. The project will allow for all railcars except 20'2" tri-levels and 9'6" domestic double stacks to pass.

From the standpoint of a CP/CN owner, the project has a positive pre-tax cash flow of $.4-13.2 million depending on the volume assumptions. The most likely volume assumption indicates an annual cash flow of 2.7 million. The cost benefit analysis indicates the project has a North America-wide net present value payback of 4.5 years with Detroit only oversize volume. For Michigan only benefits the payback is 11.8 years.

The key advantages relate to the railroad interest, low cost, elimination of the ferries and their associated cost, and avoidance of the harbor maintenance fee. There is also the potential to eliminate 20-40000 trucks per year from the road after several years and a long term potential to eliminate 200,000 trucks per year within five to ten years. The key disadvantages are that the project does not allow for passage of 20'2 tri-levels or 9'6" domestic double stacks, and does not resolve the needs at Port Huron unless traffic is diverted to Detroit.

MDOT/Beztak-Dewin Detroit Project

The MDOT/Beztak-Dewin concept has a minimum cost of $267 million and the cost could go much higher depending on the road access dollars. From the perspective of a third party owner using the MDOT pro formas, the project has a conservative pre-tax positive cash flow of $3.6 million. The project has incremental North America-wide benefits of $21.5-29.3 million per year depending on whether any quantified benefit is assumed for the tunnel conversion. Incremental Michigan benefits total $6.2-14.0 million per year depending on whether a tunnel conversion benefit is assumed. Without the truck conversion benefit the North America payback is 16.5 years, with the conversion to truck benefit it is 11.3 years. From a Michigan only perspective, the relevant paybacks are 100.0 plus years and 30.1 years.

The chief advantage is that the project would provide for Chrysler 20'2" tri-levels with the associated potential to take 60,000 trucks off the road, and would provide for the full range of double stack benefits. Other advantages relate to the provision of future highway capacity needs at relatively low cost, and the immediate potential to eliminate 250,000 trucks from the downtowns of each city. The project also has the interest of a third party developer, Beztak, and would provide direct service to Detroit. The disadvantages relate to the seeming lack of railroad interest, the relatively long payback compared to other options, and the rather minimal benefits obtained for the truck conversion expenditure. The truck conversion also is predicated on drawing truck traffic from the Ambassador Bridge and this presents a number of public policy problems. In terms of the original Beztak-Dewin concept, the main problems relate to the assumptions on auto traffic that are not feasible, and the low cost assumptions for a twin tube.

Detroit Double Stack Only Project

A 9'6" capable double stack only tunnel at Detroit would have a cost of $172 million. From the perspective of a third party owner, such a project would have a positive pre-tax cash flow of $2.5 million assuming no traffic growth. The net present value North America-wide payback, assuming a prior partial deepening, would be 9.8 years. For Michigan only benefits the project would have a payback of 80.0 years.

The chief advantage of such a project would be the lower total project cost, the generation of benefits similar to those indicated for the MDOT concept (except for highway capacity), the access to all railroads, and the flexibility provided for future developments. The chief disadvantages relate to the lack of highway capacity, the lack of Port Huron consideration, and the fact that no railroads are considering this option. Although, as mentioned earlier, CP may show new interest in a Detroit option if it is not feasible for them to cooperate with CN on a Port Huron project.

Port Huron Double Stack Project

The analysis in this report assumed a Port Huron double stack tunnel would have a cost of $155 million, compared to $172 million at Detroit. Based on the lower cost, the financials for this project have a positive pre-tax cash flow of $2.4 million. The payback for North America-wide benefits is 7.3 years if one assumes a previous Detroit deepening has removed all oversize volume. With the current Port Huron oversize volume (no previous partial deepening at Detroit) the payback is 4.5 years. From a Michigan benefits only perspective the payback is 33.0 years with a previous Detroit deepening, and 15.0 years without such a previous deepening.

The chief advantage compared to Detroit is that a major railroad is interested in completing the project, and the Michigan payback is 33.0 years vs. 80.0 years at Detroit. Other advantages relate to the lower cost and the shorter cross-continental and Chicago-Detroit distance. Another benefit relates to immediate elimination of the much more voluminous harbor maintenance fee problem at Port Huron. The project also may provide for shorter and quicker Detroit service, expansion of the Battle Creek intermodal facility, and ready utilization of CN's "Laser" car fleet for double stack. The disadvantages are that other railroads may not receive equitable access, the project does not directly serve Detroit, and the Chrysler needs are not fully served.

RECOMMENDATIONS

The recommendations relate to the overall approach to be pursued, possible state assistance to the rail industry and developers, the need for long term planning and strategy, a possible Port Huron Border Crossing Authority and the possible role for a state border crossing Authority. Each of these recommendations is reviewed in the following parts.

Recommended Development Approach

The recommended approach is for the State of Michigan to help facilitate both the Detroit partial deepening project and the Port Huron double stack project. The Detroit project involves deepening of one tube at the existing Detroit-Windsor rail tunnel. This project accomplishes the principal objectives of most parties, has the lowest costs, and the best payback. The main disadvantage is that Chrysler 20'2" tri-levels would not fit, and this would prevent Chrysler from moving away from cross-border trucking towards rail.

The second project involves facilitation of the construction of a double stack tunnel at Port Huron-Sarnia. Port Huron offers several advantages, not the least of which is the considerable interest of CN in completing a double stack tunnel. Other advantages relate to a potentially lower cost, elimination of harbor maintenance fees on a large volume of oversize cars that might or might not take advantage of a Detroit deepening, the shorter rail distances between major markets using this crossing, and the lack of congestion.

Potential conversion of the Detroit-Windsor railroad tunnel to truck use should await better information on future traffic growth and the potential need for truck highway capacity. This would avoid a premature expenditure of $95 million on a project that would provide marginal truck only capacity at best. Should a need for capacity be demonstrated in future studies this option can be considered in light of other alternatives such as new bridges. In the meantime, various steps being taken or already taken at the Ambassador Bridge will help to alleviate past congestion and should allow for additional volume.

The payback for a combined Detroit-Windsor partial deepening and Port Huron-Sarnia double stack tunnel would be 6.8 years from a North American perspective, and 26.0 years from a Michigan benefits only perspective. The Port Huron project alone, with an assumption of an earlier Detroit partial deepening, has a North American-wide payback of 7.3 years. With just Michigan benefits considered, the Port Huron project has a payback of 33.0 years.

The Michigan benefits only payback of 33.0 years for the Port Huron project alone is acceptable from a transportation infrastructure standpoint. It should also be noted that any state role would be limited to tax-exempt financing, property tax abatements, and other assistance that would have a much lower cost than the full construction dollars assumed in the above payback analysis.

Potential Government Actions

The following sub-parts review the rationale for government involvement, the potential role that state government could play, and the Canadian government role relative to Michigan.

Rationale for State Action

The role to be played by state government, and the Ontario government, should in considerable part be dependent on the needs and wants of the railroad industry. While there may be several public interest reasons for government involvement, if the railroad industry feels assistance is not necessary, and a satisfactory project can be completed without such assistance, there will be no need for a government role.

There are two primary reasons why a government role might be appropriate. First, the costs of rail double stack border crossing infrastructure at the Michigan-Ontario border are very large relative to other projects that have been completed around the country. Given this cost, and given a desire to assure that the state is not bypassed by the rail mainline system, it may be appropriate for the state to play some role. A second reason for government involvement may relate to assuring a competitive rail transportation system. In this case a Port Huron-Sarnia railroad double stack tunnel would provide monopoly benefits to one railroad. A considerable case could be made for state action designed to assure competitive access to other railroads at reasonable costs.

Potential State Actions

There are several roles state government could play in facilitating construction of a new double stack tunnel at Port Huron. These roles relate to financing assistance, tax abatements, federal funding, and permitting. The costs of these options would have to be compared to the benefit levels in order to determine the payback on state government expenses related to such a project.

Aside from paying for part of the construction costs, an option which is not recommended, assistance with financing is the largest role that state government should play. Tax exempt financing could reduce the interest rate on the project by one to two percentage points and save tens of millions of dollars over the life of the project. However, in order to provide such financing it may be necessary for a public Authority to own the asset and lease it back to the railroads, or own and operate the asset with a management contract providing for rail operational management.

A second state role could be in assuring a property tax abatement for the project. Assuming a property tax equal to 3% of the market value, and half of the tunnel property being in Michigan, an abatement would save the owner, and cost government, $2.33 million per year on a $155 million Port Huron project.

The third role for the state could involve assistance with national and state permitting requirements. Such a role, while hard to quantify, could prove critical to obtaining the necessary permits in a timely fashion.

A fourth role could involve assistance in securing funding from federal sources if necessary. Texas has received funding for a Southern Border Capital Improvement Act totaling $357 million dollars, and Michigan should pursue funding for a Northern Border Capital Improvement Act. Such funding could include monies for "intermodal" or possibly even rail freight projects depending on past precedents and new precedents which may be established in the highway bill. It should also be noted that the highway bill includes several provisions requiring studies of U.S.-Canada transportation needs and that these may provide a vehicle for calling attention to rail needs.

Any state role should, however, be contingent on securing competitive access for all railroads. There may also be several other conditions the state would want met in return for assistance.

Canadian vs. Michigan Interests

While there are several cross-border rail improvement benefits that accrue directly to Michigan, a number of the benefits are indirect and require a rather non-parochial perspective in order to understand the value to Michigan. Many of the benefits of double stack will help to make the North American automotive industry more competitive, and will therefore help Michigan in the long term. However, Canada, and Ontario, will receive very direct benefits to their auto assembly plants. Double stack capability will also make it easier for their exporters to reach distant U.S. markets.

Given these conclusions it would seem that the government of Ontario would have a deep interest in assuring double stack capability. Any state involvement should, therefore, be conditioned on financial participation by the governments of Canada and Ontario. To some extent, the Canadian government is already playing this role through the Crown owned CN railroad. Ontario has shown less interest but has access to the U.S. through Buffalo and may not be as concerned with the Michigan gateway given this alternative.

Long Term Strategy and Planning Requirements

Work on this project and several other border crossing issues points out the need for better information and long term planning on regional transportation needs. Regional planning, however, can no longer be conducted on just one side of the border. A comprehensive planning system that takes into account demand and developments on both sides of the border is required if maximum benefits are to be derived from regional interaction.

There are two specific issues that such a planning process should address. First, it is clear that the Ontario and Michigan governments must work more closely to accomplish planning for the region's transportation needs. Secondly, there is a need for a comprehensive regional planning system and data base that includes information on border crossing needs and origin-destination data on domestic as well as cross-border movements.

Port Huron-Sarnia Highway Bridge and Railroad Double Stack Tunnel Authority

A recent announcement by Congressman Bonior of Port Huron and his Canadian Parliament counterpart about their intention to create an Authority for construction of a new highway bridge raises some interesting possibilities. Such an Authority could be used to finance and operate both a new bridge and a railroad tunnel.

A joint highway bridge - rail tunnel Authority, in its simplest form, could provide a vehicle for tax exempt financing of both projects. To the extent that the two projects were allowed to cross guarantee bond payments, the Authority could also serve to reduce concerns about repayment of the rail related bonds. Bond rating agencies would be more receptive to a project tied to a highway toll income stream, even if just as a secondary guarantor of rail revenues derived from a few railroads. A joint Authority might also allow the project to qualify for special "intermodal" border crossing monies contemplated in some versions of the federal highway bill. Alternative federal funding arrangements, such as the idea about a "Northern Border Capital Improvement Act," with funding similar to the $357 million obtained by Senator Bensten for Texas, also might be more viable with a comprehensive highway/rail project.

The State of Michigan should explore this possibility, and the potential benefits, to determine its viability. Such a review should also include an examination of how the current single tube railroad tunnel could be used if a new highway bridge and double stack rail tunnel are built. Finally, while it is assumed that a new highway bridge could not accommodate a rail deck at a sufficiently low grade to allow rail service, the possibility of a joint highway/rail facility should be explored further.

State Border Crossings Authority

A broader approach to the border crossings issue statewide would be to create a State Border Crossings Authority. An Authority could plan, finance, construct, and/or manage various kinds of facilities that provided a state benefit. Examples might include highway border crossing needs such as those developing at the Blue Water Bridge, international airport terminal projects, and even the local share of funds for a new Soo lock. The main criterion would be that such projects provide a transportation infrastructure competitiveness benefit, and be self sufficient in terms of being able to repay revenue bonds.

Such an Authority would be undertaken to provide an organizational entity which could finance projects of international competitiveness significance without using traditional tax sources of infrastructure funding. Non-traditional financing could include private investment coordinated by an Authority or some combination of public and private funds. It should be noted that the new highway bill encourages such concepts, and also provides for several studies of U.S.-Canada transportation needs. The Authority would also focus state and provincial attention on border crossing issues. An Authority could also serve as a focal point for efforts to secure dedicated federal funds for infrastructure and staffing. Finally, an Authority could coordinate cross-border infrastructure requirements planning.

An Authority could possibly be created under Act 237 of 1935, as amended, although this legislation would limit the scope to an international bridge or tunnel.

INTRODUCTION

The purpose of this report is to analyze the limitations of Michigan's current cross-border railroad infrastructure, to develop a preliminary evaluation of the economic development benefits which would accrue from various options for modernizing that infrastructure, and to develop a set of recommendations for possible state action.

REASON FOR STUDY, OBJECTIVES, AND KEY QUESTIONS

The analysis is necessary because of the increasing role of railroad transportation in global trade, and because of the significant limitations in the existing railroad tunnels' ability to handle modern railroad cars. These limitations are thought to impose substantial inefficiencies in the rail transportation system and may negatively affect Michigan's ability to compete in the North American and global economies of the future.

The railroad tunnel limitations relate to height restrictions at both the Port Huron-Sarnia and Detroit-Windsor railroad tunnels. The height limitations make it impossible for standard trailer-on-flat-car (TOFC) platforms, high cube boxcars, tri-level auto railcars, or double stack container cars to use the Michigan-Ontario railroad crossings. These limitations force the railroads to use railroad ferries to move tri-level and high cube boxcars across the border and completely prevent the use of standard TOFC cars and double stack cars. Use of the ferries increases rail costs by approximately $160 per railroad car and results in delays of anywhere from 12 to 24 hours over continuous rail movements. Cargoes moving on the ferry are also subjected to the harbor maintenance fee which can cost up to $300 per railroad car for high value cargo.

The analysis also provides an opportunity to consider the capacity of current highway border crossings and to determine the role that the rail mode can play in alleviating increased traffic levels at highway border crossings. The rail mode can play two potential roles. First, by making the current railroad tunnel available for truck and/or auto use it may be possible to increase highway border crossing capacity at a relatively modest cost relative to other highway options such as a bridge. Secondly, it may be possible for enhanced intermodal rail services to pull volume off congested highway border crossings and roads thereby reducing the pressure on highway border crossings. Both of these potential benefits will be considered in the analysis to determine if they are in fact possible.

The specific objectives of the report are to:

- o Develop an understanding of the impact of railroad tunnel limitations.
- o Develop an understanding of various proposed options for eliminating the tunnel limitations.
- o Develop an overview of the role of double stack trains in North American transportation systems.

- o Analyze the potential benefits which would result from eliminating the height restrictions.
- o Consider the impact that proposed modernization options might have on reducing highway border crossing congestion.
- o Evaluate the feasibility, advantages and disadvantages of proposed modernization options.
- o Develop recommendations for possible state action.

The key question that this study will seek to address is the degree of benefit which will derive from various options for modernizing the railroad border crossing infrastructure. Because a low cost option for deepening the current tunnel sufficiently to allow for high cube boxcars, auto tri-levels, and 8'6" maritime double stack containers exists, it will be important to first determine the benefits for this option. The incremental benefits of a full 9'6" domestic double stack capable tunnel will then be considered. It will also be important to determine the double stack benefits which would accrue to Michigan, as opposed to benefits which accrue to other locales in North America. The key questions are:

- o How much benefit derives from simply deepening the current Detroit-Windsor tunnel to allow for high-cubes, auto tri-levels, and 8'6" maritime double stack containers?
- o What benefits are not provided for by such improvements?
- o What additional benefits would derive from providing for full 9'6" double stack capabilities at the border crossings?
- o The extent to which a double stack capable crossing provides for Michigan benefits, as opposed to North American-wide benefits?

The answers to these questions will form the basis of the report's conclusions and will have a major impact on recommendations for possible state action. It should be noted, however, that the railroad tunnels are owned by the railroads, and that railroad infrastructure has traditionally been paid for by the railroads. As such, the state's objective is to facilitate private sector construction of the infrastructure necessary to assure Michigan's future competitiveness in global markets. Possible state roles could range from facilitating permitting, to providing property tax abatement, to providing tax exempt financing, to ownership and leaseback through a Michigan Border Crossing Authority.

SCOPE AND APPROACH

The original scope of this project was limited to an evaluation of a Michigan Department of Transportation (MDOT) concept for converting the existing Detroit-Windsor railroad tunnel to truck use, and construction of a new double stack capable railroad tunnel. However, the revelation of several alternative private sector proposals for accomplishing varying levels of tunnel construction at both Detroit-Windsor and Port Huron-Sarnia have resulted in expanding the scope of the project to consider these proposals.

The original MDOT guidelines called for an evaluation of the benefits that would derive from a double stack tunnel and conversion of the current tunnel to truck use. The guidelines also indicated that an assessment should consider:

- Freight transportation impacts.
- Economic development and related impacts.
- International trade impacts.
- The benefits associated with provision of additional highway capacity.
- The role of containerization and double stack service in domestic and international trade.
- The competitive position of railroad crossings at Port Huron and Buffalo relative to Detroit.

Since initiation of the project the following guidelines were added:

- Evaluation of the various options for providing improved railroad border crossing clearances including a statement of the relative advantages and disadvantages of each proposed option.
- An assessment of the benefits accruing from partial deepening, and an assessment of the incremental benefits that accrue from a full double stack tunnel.
- Development of recommendations for future state action.

The original MDOT guidelines also suggested that the "scale of efforts will be quite small and is intended to give a preliminary perspective on impacts associated with this type of project." This limited scope was necessitated by the relatively modest project budget. None-the-less, every effort has been made to provide as detailed an analysis of alternatives and relative benefits as possible.

The basic approach has been an attempt to obtain an understanding of each modernization option first, and to develop an understanding of the levels of traffic currently using various crossings. Considerable research was also undertaken on the role of intermodal transportation in both domestic and cross-border rail movements, and into the role of double stack in international and domestic transportation. Finally, an effort was made to categorize and qualitatively describe all of the potential benefits of partial deepening, and of full 9'6" double stack capability. Where possible, rough quantitative estimates of the benefits have been developed.

The research methodology consisted of initially performing considerable secondary research. A number of reports on the subject were reviewed and many articles on the role of railroad transportation, and the value of double stack service in particular, were reviewed. The bibliography summarizes these sources.

Following this preliminary research, interviews were held with a number of railroad, shipper, ocean carrier, third party intermodal providers, railroad equipment lessors, and development officials to obtain an understanding of the benefits which might accrue from the various modernization proposals.

The above information was discussed periodically with MDOT officials and priorities for analysis were revised as information became available. The final analysis focused on determining the benefits of partial deepening as opposed to full double stack/tunnel conversion, and the relative advantages and disadvantages of various proposals.

REPORT OUTLINE

Following this introduction section the report provides detailed background information on the crossings being studied. The following section examines changes in the world economy, developments in rail transportation, and the implications of these developments for Michigan railroad transportation, and specifically, cross-border rail transportation. The next section of the report considers various proposed options for modernizing the crossings. This section also considers some possible approaches not now being considered by railroads or developers.

The report then considers the benefits of a partial deepening, and the incremental benefits of full double stack/tunnel truck conversion, based on the original MDOT proposal. This section considers the general economic development, plant location, competitive rail routing, construction, and related benefits of a new double stack tunnel. It also considers the specific benefits which would accrue to the auto industry under partial deepening and double stack tunnel scenarios. Next, the specific benefits which might accrue for various categories of rail traffic are considered. Finally, the potential benefits for the highway mode are also considered.

The last section of the report considers the relative advantages and disadvantages of each proposed modernization option, draws conclusions on the key questions posed earlier about North American vs. Michigan benefits, and makes a series of recommendations for state consideration.

NOTE: All dollars in this report are stated in U.S. currency.

RAILROAD CROSSINGS BACKGROUND INFORMATION

The cross-border rail facilities being examined in this study are located at Detroit-Windsor and Port Huron-Sarnia. It should be noted that an additional Michigan-Ontario railroad crossing is located at Sault Saint Marie but that this crossing is not a part of this study given the low levels of traffic at that crossing and given its location outside of the main transportation corridors. Railroad border crossings in the Buffalo, New York area are considered in this study in terms of the possible diversion of traffic to those unrestricted facilities. Appendix I provides several overview maps of the region and relevant crossings.

CROSSING OPERATIONS

The following three parts contain information on each border crossing. The last part provides some background information on railcar dimensions.

Detroit-Windsor Railroad and Ferry Operations

The following sub-parts contain information on the railroad and ferry operations, and on traffic levels at Detroit-Windsor. Appendix II includes photographs of the Detroit side of the railroad tunnel, the Detroit side of the right-of-way adjacent to the tunnel, and the ferry and surrounding land.

Tunnel Operations

At Detroit-Windsor the railroad tunnel consists of a twin tube that was constructed in 1910 using "immersed tube" technology. A steel liner tube was constructed on shore and towed to the site where it was sunk. Outer and inner concrete liners were then poured underwater. The steel tube dimensions place a limit on the amount of deepening that can be accomplished at this tunnel.

The tunnel is jointly owned by Canadian National and Canadian Pacific railroads, and is managed by Canadian National. Cost information was not available on the tunnel's total annual costs. However, CN has indicated that the charges for each railroad are approximately $40 per railcar. These charges apply equally to loaded and empty cars.

The Detroit-Windsor tunnel height restrictions allow any railcars whose dimensions are within the "Plate E" template to clear the tunnel. Such cars must be narrower than 10'8".
The cars also must not exceed the following heights from top of rail to top of car at the stipulated width's. Please note that this data is provided for illustrative purposes only and should not be relied upon for operating decisions.

At 10'8" width cars must not exceed 15'1" height

At 10'3" width cars must not exceed 15'3" height

At 5'5" width cars must not exceed 15'9" height

Conventional TOFC, auto tri-level, high cube, and double stack cars cannot use the tunnel at Detroit-Windsor given the above constraints. However, conventional container-on-flat-car (COFC) cars can use the tunnel and Canadian Pacific uses both "spine" cars and conventional TTWX cars.

The most recent information on the number of trains using the various crossings indicates that about 20 trains per day are using the Detroit-Windsor gateway. This data was obtained in September of 1991. Of the total number of trains, 8 are container trains. This includes six per day from Chicago and two per day from Detroit's Oak Yard. There is one CP container train each way per day at Detroit's Oak Yard, and there are three CP container trains each way per day from and to Chicago that utilize the Detroit-Windsor tunnel. Additional non-container trains include those operated by CN, CSX, Conrail, and NS.

Ferry Operations

A railroad ferry operation owned by Norfolk Southern operates at Detroit-Windsor to provide transit for high-cube and tri-level railroad cars. This ferry service is currently operating on one shift per day and is making up to four round trips per day. The use of the ferry can result in delays of up to 24 hours. The ferry operates from an 80 acre complex located between the Ambassador Bridge and the Detroit Free Press printing plant and is just west of Rosa Parks Boulevard. The complex includes both the ferry docks and an associated boat yard.

The costs of the ferry and boat yard are split on a pro rata use basis between CP and NS under a facility cost sharing agreement. Based on 1990 volumes the cost was approximately $150 per railcar according to NS officials. Given that some 34,600 railcars used the ferry in 1990, one could calculate that the estimated cost of the operation is $5.2 million. In addition, the owners of the cargo being loaded or unloaded on the U.S. side must pay the federal harbor maintenance fee. This fee, equal to twelve one hundredth's of 1 percent of the value of the cargo, can be as high as $300 per railcar. While there are administrative and legislative efforts underway to have these crossings exempted from the fee, it is unclear whether these will be successful. It should also be noted that the Corps of Engineers has authority to increase the fee in future years.

Modernization Options

At Detroit-Windsor two modernization options exist. The first option is to cut out the inner concrete liner along the top and bottom of the tunnel so as to deepen the single tube. This option would provide sufficient depth for TOFC, high cube, tri-level and maritime 8'6" double stack railcars. The estimated cost for this option is $35 million. However, the deepening would not accommodate the 20'2" tri-level cars Chrysler would like to use for movement of combinations of minivans, jeeps and autos; 9'6" domestic double stack container cars; or conceptualized extra-high cube boxcars.

The second option at Detroit-Windsor is to construct a new sunken single or double tube construction tunnel capable of hauling all conceptualized railroad cars including domestic 9'6" double stack cars. The cost estimates for this all new tunnel range from $172 million for a single tube to $258 million for a double tube. A variation of the all new railroad tube plan calls for converting the current railroad tunnel to truck and/or automotive use and this option is estimated to cost $65 million for the conversion.

Traffic Levels

At Detroit-Windsor the best current estimate of total crossing volume is 359,600 railcars. This volume consists of an estimated 325,000 railcars using the tunnel during the 1991-1992 year, and an estimated 34,600 railcars using the NS ferry. It should be noted that a review of logs indicates that generally about two thirds of the railcars using the tunnel are loaded.

The rail tunnel volume is up from 290,000 railcars in 1988, while the ferry volume is down from an estimated 85,000 railcars in

1988. The extra tunnel volume includes NS/CP "Roadrailer" volume which previously had crossed the border in highway mode. The decline in ferry volume can be attributed to two factors. First, NS is now diverting about half of the 50,000 railcar decline to Buffalo crossings. Secondly, beginning in late 1990, NS started using the tunnel for railcars that would actually fit through the tunnel. Prior to that time NS carried all of its railroad cars on the ferry regardless of whether or not the cars would fit at the tunnel. NS expects to carry just 23,400 railcars at the ferry in 1991-1992, given a full year's use of the tunnel for railcars that are not restricted by height. NS expects about one third of those cars to be auto tri-levels and about two thirds to be high cube boxcars.

The traffic volume for Detroit-Windsor is summarized below.

Detroit-Windsor	1990
Rail Tunnel	325,000
NS Ferry	34,600
Total	359,600

Port Huron-Sarnia Railroad and Ferry Operations

The following sub-parts contain information on the railroad and ferry operations at Port Huron-Sarnia. Appendix III includes photos of the Port Huron side of the Port Huron-Sarnia tunnel, and a photo of the CN ferry operation at Port Huron-Sarnia.

Tunnel Operations

The railroad tunnel crossing at Port Huron-Sarnia is a single bored tube constructed in 1890 and owned outright by Canadian National railroad. Canadian National owns the Grand Trunk Western railroad which it interchanges with at Port Huron.

The Port Huron-Sarnia tunnel height restrictions allow any railcars whose dimensions are within the "Plate C" template to clear the tunnel. Such cars must be narrower than 10'8". The cars also must not exceed the heights from top of rail to top of car at the stipulated width's indicated below. Please note that these data are provided for illustrative purposes only and should not be relied upon for any operational decisions.

At 10'8" width cars must not exceed 14'2" height
At 10'0" width cars must not exceed 14'8" height
At 7'0" width cars must not exceed 15'6" height

In addition to the above height restrictions, railcars using the Port Huron-Sarnia tunnel also must conform with width restrictions at the bottom of the car. These restrictions are due to the curvature at the bottom of this tunnel.

Given the above constraints the railroad tunnel does not accommodate conventional TOFC/COFC, auto tri-level, high cube, or double stack railroad cars. However, Canadian National does utilize special low slung TOFC/COFC cars for their cross-border "Laser" service. This service allows for transit of trailers and containers through the tunnel.

At Port Huron-Sarnia CN/GTW operate 12 freight trains per day. In addition, two passenger trains traverse the tunnel each day. This consists of one passenger train each direction per day.

Ferry Operations

There are two railroad ferry services at Port Huron-Sarnia for movement of oversized cars. One is owned by Canadian National. The second ferry service is owned by CSX. The ferries are primarily used to move automotive industry components and finished vehicles for General Motors and Ford. The CN car ferry is currently operating on three shifts and makes up to 20 round trips per day. The CSX ferry operates on two shifts and makes up to eight round trip crossings per day. The use of the ferry can result in delays of up to 24 hours.

No cost data was obtained on the ferries themselves, however, it is assumed that the costs would be similar to those incurred in Detroit. If each ferry and boat yard cost $5.0 million to operate as is the case in Detroit, the average cost per railcar would equal $91. The same federal harbor maintenance fees charged at Detroit apply here as well. Grand Trunk has estimated that these fees cost their customers at least $12.4 million per year.

Modernization Options

While the tunnel could potentially be rebored to provide clearances for any type car desired, proposals currently being considered call for providing full double stack capability in a new bored tunnel. It is important to note that boring technology is potentially cheaper than the sunken tube construction which would be required at Detroit-Windsor, and that the current cost estimate is $155 million.

Traffic Levels

At Port Huron-Sarnia the most recent data obtained indicated a total of 290,000 railcars used the crossing in 1988. This total consists of 180,000 railcars using the CN tunnel, and 110,000 railcars using the CN and CSX car ferries. Approximately 80,000 railcars used the CN ferry, while some 30,000 used the CSX float. This is consistent with the fact that the CN ferry operates on three shifts and makes up to 20 round trips a day, while the CSX ferry operates on two shifts and makes only eight round trips per day on average. Based on information provided to Beztak (the partnership of Carl Beznos and Jerry Luptak) it would appear that some 75,000 of the total 110,000 Port Huron-Sarnia ferried cars are in fact dimensional cars that will not fit through the tunnel.

The traffic level for Port Huron-Sarnia is summarized below.

Port Huron-Sarnia	1988
Rail Tunnel	180,000
Rail Ferries	
CN	80,000
CSX	30,000
Ferry Subtotal	110,000
Total	290,000

Buffalo

At Buffalo eight double stack trains per week use the bridges. CN operates three trains each way per week. NS operates one train each way per week. This totals four trains each way per week or a total of eight trains per week.

The double stack service is provided by K-Line, Maersk, APL, and Sea-Land/CSX. In each case the companies are providing service for Asian cargo moving to Eastern Canada through U.S. West Coast ports. In almost every case the companies have indicated they would prefer to serve Eastern Canada through a Detroit-Windsor gateway because of the shorter distance and because of the potential Detroit area volume.

The K-Line operation has three trains per week and services Montreal and Toronto by truck from a ramp located at Welland. APL has a similar service level. Both Maersk and Sea-Land/CSX offer weekly service.

Railcar Dimensional Information

The sub-parts above describe several types of railcars that are restricted from using the tunnels do their height. Following is a summary of the known heights of these various railcars. It should be noted that this information is for illustrative purposes only and should not be relied upon for operational decisions.

Double Stack International Containers (8'6") (Note: Assumes 1'6" rail to container bottom)	18'6"
Double Stack Domestic Containers (9"6") (Note: Assumes 1'6" rail to container bottom)	20'6"
Conventional Tri-level	19'0"
Extra Height Tri-level (Chrysler specifications)	20'2.5"
High Cube Box Cars	19'0"

RAIL BORNE TRADE LEVELS AT MICHIGAN-ONTARIO

The following parts review current and potential rail borne trade levels at the Michigan-Ontario crossings.

Current Rail Borne Trade Levels

Following are the calculations of current rail borne trade levels. The first sub-part is based on published trade data and the percentage of cross-border trade dollars moving by rail mode. The second sub-part is a confirming calculation based on the known number of cross-border railcar movements and an estimate of dollar value of cargo per car for several types of railcars and trade.

Published Trade Data and Estimated Rail Modal Share

Trade between the United States and Canada reached $162 billion dollars in 1989 and trade between Michigan and Ontario alone totaled $31.5 billion (Federal Reserve Bank of Chicago and the Great Lakes Commission 1991). In addition, based on work conducted by the author previously, it can be estimated that an additional $52.0 billion of trade moves through the Michigan-Ontario gateway on its way to other states and provinces (Taylor 1988). In total, therefore, it can be estimated that $83.5 billion of total U.S.-Canada trade crossed at the Michigan-Ontario gateway.

Since 20.1% of the dollar value of Ontario-United States trade moved by rail (Taylor 1988) it can be estimated that $16.8 billion of the 1989 Michigan-Ontario gateway trade moved by rail.

The primary goods carried include transportation equipment, pulp and paper, and manufactured goods.

U.S.-Overseas trade transshipped through Canadian ports totaled $11.1 billion in 1989 and $4.8 billion of that total cleared at the Detroit customs district (U.S. Department of Transportation 1990). If one assumes that the bulk of this trade was European related, and that it moved via CP Rail to the Port of Montreal, an additional $4.8 billion of trade could be assumed to have moved by rail across the Michigan-Ontario gateway.

Unfortunately, no statistical sources were found on the level of Canadian-overseas traffic, however, it is known that a significant amount of such trade uses U.S. ports and that a good deal of Asian traffic for Eastern Canada crosses at Buffalo due to a lack of double stack capability at Detroit.

In total, then, it can be estimated that at least $21.6 billion of global trade crossed the U.S.-Canadian border via rail.

Confirming Calculation

A confirming calculation was used to determine the feasibility of the above rail borne trade dollar estimates being correct. The calculation is based on the number of railcars known to have crossed at the border at the two crossings, and estimates of the cargo value by type of railcar.

The calculation starts with the known figure of 649,600 railcar crossings. Given that tunnel log books show approximately 66% of the cars are loaded we estimate that 432,234 railcars were loaded. We also know that 75,000 cars at Port Huron-Sarnia were dimensional, based on Beztak data, and that 34,600 cars at Detroit-Windsor were dimensional. This totals 109,600 cars. Assuming 66% of the ferry cars are also loaded, we can estimate that 72,993 of these railcars were loaded. We also know that 33% of the ferry cars at Detroit-Windsor are auto tri-levels and that the remainder are high cube boxcars. If we assume this ratio holds at Port Huron-Sarnia as well, it can be estimated that a total of 24,307 auto tri-levels crossed the border loaded and that 48,686 high cube boxcars crossed loaded. This leaves 359,241 loaded cars.

Based on information from CAST indicating that about 75,000 containers per year of export U.S. Midwest traffic is moved through the Port of Montreal, and an assumption that another 25,000 containers are imported, we could assume that 100,000 container movements represent overseas trade with Europe. The import assumption of 25,000 containers is based on the fact that 68% of the port diverted import/exports at Detroit were exports according to Marad data. It is also known that based on the total number of CP intermodal trains (a total of eight between Chicago/Detroit and Montreal) there are about 100,000 loaded containers moving. This leaves 259,241 boxcars of U.S.-Canada trade.

By estimating typical cargo values for each category of railcar we can arrive at the likely total trade dollars borne by rail at the border. With respect to the auto tri-levels it is known from harbor maintenance fee information that the typical car carries about $250,000 dollars of cargo. Estimates provided by Chrysler would also indicate that a typical high cube boxcar might carry approximately $75,000 of cargo. The remaining assumptions are that a standard boxcar in U.S.-Canada trade might carry a cargo valued at $30,000, and that a European container might move cargo with an average value of $50,000.

Given the above assumptions, a total of $17.51 billion in rail borne U.S.-Canada trade is estimated, and a total of $5.0 billion of U.S. Midwest-Europe rail borne trade is assumed. Total trade borne by rail at these crossings would be estimated at $22.51 billion. This estimate compares to an estimated $16.8 billion of U.S.-Canada trade using trade statistics, an estimated $4.8 billion of U.S. Midwest-Europe trade using trade statistics, or a total of $21.6 billion of trade.

Overall, the above calculations would seem to confirm the estimate of $21.6 billion

Potential Rail Borne Trade

There is considerable potential for rail to increase its share of the cross-border transportation movements. The current physical limitations have restricted a good deal of direct U.S.-Canadian rail transportation because of the need for excess height cars to use the rail ferry services. These ferries result in significant cost penalties and service delays. The result is that potential rail traffic moves in the highway mode and contributes to both highway border crossing and road congestion. The fact that TOFC traffic cannot move through either tunnel without special cars restricts the potential to pick up current truck traffic.

There is also the potential for an improved rail border crossing infrastructure to carry some of the Canadian-Mexican trade currently moving by truck across the border. This traffic typically moves by double stack rail or TOFC rail from Mexico to Chicago, or Detroit, and then is trucked across the border because of the tunnel height restrictions. There is also the possibility of additional volumes of U.S.-European trade moving by rail, and for Asian-Canadian traffic to move by rail through Michigan-Ontario rather than through the state of New York.

THE ROLE OF TRANSPORTATION AND MICHIGAN-ONTARIO RAIL BORDER CROSSINGS IN A CHANGING WORLD ECONOMY

A number of developments in the global economy have heightened the need for efficient and effective transportation services. These developments are also realigning trading corridors and increasing the need for transportation services on routes that were not heavily used in the past. At the same time, recent improvements in rail technology and operating systems are making possible substantial improvements in the cost and service levels available in the rail mode. And, as rail becomes more competitive, the costs and operating constraints on trucking are becoming more pronounced.

THE CHANGING WORLD ECONOMY

During the post World War II era the United States faced a competitive environment that it clearly dominated. Given the size of the U.S. market, and its dominance of every technology and process, it was not necessary for American companies to participate in global markets. This was true both in terms of finished product marketing, and in terms of inbound component sourcing requirements.

The Globally Competitive World

Several events, however, have conspired to force a new globally competitive economy. First, the other nations of the world have developed to the point where they are now the leaders in many technologies and processes. This fact has made aggressive competitors out of many European and Japanese companies and has forced U.S. companies to seek competitive parity. The second development has been the advent of low cost transportation, communications, and information processing. This has made it possible for companies to compete in global markets in a cost effective way.

As a result of these developments, U.S. companies cannot simply work to outperform their nearest neighbor. They must compete against companies located throughout the world and many of those companies enjoy competitive advantages related to low wages, lax regulatory standards, excellent technical training and education systems, and strong work ethics. The result is intense competitive pressure to reduce costs, improve quality, and outperform global competitors.

Corporate Competitiveness Strategies and the Role of Transportation

Companies are pursuing several approaches to dealing with the new competitive pressure. First, U.S. competitors are entering global markets at an increasing pace. While overseas markets did not have significant buying power in the years after World War II, this is not true today. In fact, the achievement of competitive parity has boosted buying power significantly in many countries. In order to achieve world class scale today manufacturers must market their products across the globe. Such volumes are often necessary to cover R & D expenses, capital equipment costs, and marketing expenses. It is also important for U.S. competitors to challenge foreign competitors in their home markets to prevent those competitors from subsidizing export operations with excessive home market profits. The result is that U.S. competitors are increasingly finding it necessary to compete beyond their traditional home marketplace in order to remain competitive.

A second approach to improving competitiveness relates to reducing the costs of production. Increasingly, companies are seeking to specialize along lines of comparative advantage in the production process. Such specialization results in considerable outsourcing and often results in suppliers being sought in distant countries offering the greatest level of comparative advantage for a particular component. The need to effectively coordinate such diverse value added chains often leads to the establishment of strategic alliances and partnerships with firms around the world. Such partnerships can reduce coordination costs and can help to defray the risks associated with world scale production and competition in today's highly competitive marketplace.

Both approaches, worldwide marketing and specialization in the value adding production chain, lead to major increases in the need for transportation. However, transportation, while critical, also serves as a barrier to the effective use of specialization and world marketing. Every dollar of transportation cost robs a dollar of savings that may have resulted from seeking the low cost world manufacturer of a given component. The time required to move products across continents also detracts from the savings achieved through the use of global marketing and production specialization. Time is critical because of the costs of money tied up in inventories, and because of the customer's expectations of rapid delivery in today's environment.

Transportation, then, is critical to the effective implementation of global marketing and production specialization strategies. More so then ever before, companies are seeking highly effective and low cost transportation services. They are seeking such services in both domestic and international markets.

The Development of Regional Trading Blocks

In seeking out partners offering comparative advantage for each factor of production, companies have sought out firms which are as physically close as possible. Global producers are seeking the lowest cost and most productive labor for labor intensive components, partners with special advantages in natural resource intensive production, and partners that offer specialized technical knowledge and/or capital advantages for other processes. However, in order to realize the maximum benefits such partners must be nearby in order to reduce coordination and transportation costs. The result has been that countries and their commercial interests have sought to establish special trading relationships with neighboring countries that offer comparative advantages along one factor of production or another.

In Europe, in Asia, and now in North America, the result has been a movement towards economic unions. The 12 EC nations bring together partners that offer low labor costs (Spain), technology (Germany), market buying power (Great Britain and Germany), resources (France, Spain, Portugal), and capital (Germany). In Asia, the Japanese have formed relationships with countries offering both resources and low cost labor. And now, in North America, the United States, Canada, and Mexico are seeking a trading relationship that merges countries with advantages in each of the key factors of production. The integration in manufacturing systems is already evident. For instance, in the automobile industry, one company uses carpet raw materials sourced in Carlisle, PA., ships the product to Hermosillio, Mexico for processing, and returns the processed carpeting to the Northern U.S. and Southern Canada for installation in cars. Such integrated production systems will require major improvements in transportation services and costs in order to assure maximum benefits.

In North America, a new North American Free Trade Agreement (NAFTA) will require significant improvements in north-south transportation. This means improvements in U.S.-Canada transportation, in U.S.-Mexico transportation, and in Canada-Mexico transportation. The types of changes and improvements that will be required are evident from observing the changes taking place in the EC countries. Across Europe, barriers to effective transportation between countries are being reduced. These barriers relate to border crossing infrastructure, and to regulations and procedures.

Conclusions on the Global Economy

In conclusion then, the world economy is undergoing a number of changes that will have an impact on U.S. and Michigan companies. Increasing competitive pressure is forcing firms to become global marketers and is also forcing them to specialize production along lines of comparative advantage. Both developments will require improved transportation services and reduced transportation costs for firms to be successful.

OVERVIEW OF CONTAINERIZATION, INTERMODAL, AND DOUBLE STACK DEVELOPMENTS AND BENEFITS

Intermodalism, and double stack container movements in particular, offer the potential for achieving some of the improvements in transportation that changes in the world economy dictate. The development of containerization, intermodalism, and double stack services, and their existing and potential role in U.S.-Canada cross-border movements are explored in the following sections.

History and Recent Developments

The move to containerization, which began in the late 1950's and early 1960's, has had a dramatic impact on transportation cost and service levels. The modern day container was developed for use in intracoastal trades by Sea-Land and the Matson Navigation Company because of high U.S. port labor costs. The benefit of the container was that, compared to trailers, it could easily be loaded and unloaded from ships. In 1960, the first break-bulk ships in international trades were converted to accommodate containers, and in 1966 the first trans-Atlantic container service began (Manalytics, Inc. 1990). In just a few short years the container revolutionized ocean transportation and became the norm for movements of overseas general cargo as well. Containerization eventually led to the development of single purpose, large scale container ships that have made the St. Lawrence Seaway System uncompetitive for most container traffic.

While intermodal trailer-on-flat-car (TOFC) services have been available since the 1920's, they did not really develop a strong niche position until the 1950's. TOFC services were developed in order to improve service and reduce cost in cross-continental domestic transportation movements. By placing truck trailers on flat cars the line haul advantages of rail were merged with the flexibility advantages of trucking.

At the same time that TOFC services were developing containers also began to be moved via rail. While TOFC services were designed for domestic truck-rail movements, container-on-flat-car (COFC) services were designed to facilitate ship-land transportation interfaces. Rail was used to deliver containers to ports where they could be loaded onto ships with a minimum of port handling and damage.

As these TOFC and COFC services were developed by the railroads they began to merge together into one overall intermodal concept. However, while TOFC service stagnated due to the advantages of the trucking industry over rail in domestic transportation, COFC intermodal service began to grow rapidly. Several developments were responsible for this growth, including, (1) the development of a standard marine container, (2) the development of mini and microlandbridge services between FarEast/U.S. West Coast ports and Eastern U.S. markets, (3) the rise in Far East exports to the U.S. East Coast and Midwest, and (4) the development of efficient rail "hub and spoke" distribution systems (Manalytics, Inc. 1990).

Intermodalism in international trades was given a substantial lift by the early introduction of unit trains designed to assure on-time delivery of traffic at minimum cost. Using such unit trains, the first minilandbridge service was introduced in 1972 by Seatrain Lines for Far East cargoes moving to U.S. East Coast ports via rail movement from California ports. The chief advantage of these services was the shorter transit time compared to an all water service from the Far East to U.S. East Coast ports. Such services proliferated as the economics improved and as the demand for shorter transit times increased.
The minilandbridge service was augmented with the development of microlandbridge services designed to serve U.S. Midwest markets from the Far East via West Coast ports.

In summary, three types of land bridge services have developed using intermodal COFC trains. They are:

- Landbridge - From a foreign origin to a foreign destination via two U.S. ports, with a land rail transport segment connecting the two U.S. ports.
- Minilandbridge - From a foreign origin to a U.S. port area destination, but entering the U.S. at another U.S. port on another coast, with a land rail transport segment connecting the two U.S. ports.
- Microlandbridge - From a foreign origin to an inland U.S. location, but entering the U.S. at a port on a more distant coast closer to the foreign origin.

Double stack intermodal trains were an outgrowth of the above intermodal trains and the desire to improve the economics and ride quality of such rail movements. The first double stack cars were developed in 1977 with a five well articulated unit car being tested in 1981 (Manalytics, Inc. 1990). The first double stack train was operated by American President Lines (APL) in 1983 between Los Angeles and Chicago. Sea-Land introduced service in 1985 and they were soon followed by Maersk, NYK, "K"-Line, and OOCL. Following the exemption of TOFC/COFC from all rate regulation by the Interstate Commerce Commission (ICC) in 1987 the ocean customers began marketing train space to third parties and a number of other shipper agents entered the double stack market.

One final development that should be noted is the advent of "carless," or "Roadrailer," services using the hybrid trailer with rail and highway wheels. These vehicles are only being operated by Norfolk Southern's (NS) Triple Crown Service today but are an important addition to the intermodal concept. NS has 1600 such units in service. Roadrailer service is currently running in dedicated trains but is being considered for use in joint double stack/Roadrailer trains (Kaufman). Roadrailers are designed to compete with truck in movements under 900 miles and do currently operate through the existing railroad tunnel at Detroit-Windsor. The chief advantages of carless technologies such as Roadrailer are the reductions in tare weight compared to TOFC, the elimination of separate chassis, the reduction in investment dollars compared to car technologies, and greatly reduced terminal costs given that lifting capability and labor is not required (Manalytics, Inc. 1990). These advantages give

Roadrailer an advantage over double stack in low volume corridors.

Domestic Double Stack

While there had always been a problem with filling empty containers for the repositioning move westward, the advent of double stack and the growth in its use created a much bigger problem. The first uses of double stack for purely domestic moves were in response to the need to fill empty containers moving westward.

Since that time additional efforts have been made to market double stack as a substitute for truck movements in long haul domestic corridors. These efforts have been quite successful and on freight lanes where the services are offered up to 70% of the traffic previously moving by truck is moving by double stack services (Borzo 1990). Additional efforts to fill empty containers have involved the marketing of space to shippers moving product to Asia (Abramson 1991, Arena 1991).

Intermodal Volume and Mix

In 1957, intermodal accounted for just 250,000 railcar loadings (Harper 1982). By 1988 intermodal containers and trailers moved totaled 5.7 million (Richardson 1989). As of 1988, TOFC movements accounted for 60% of the intermodal traffic, and containers represented 40% of the total. Of the total container movements 60% were double stack and 40% moved single stack. More recent data for 1990 indicates that there were 3,451,953 TOFC shipments (55.6%) in that year and 2,754,829 container shipments (44.4%) (Leonard 1991).

It is estimated that about 750,000 domestic container movements occurred in 1990 (Leonard 1991). This would represent 27% of the total container movements, or 12.1% of the total intermodal traffic. It is further estimated that 500,000 of the domestic movements were made in international dimension boxes and that 250,000 of the domestic movements were made in domestic dimension container boxes. The domestic containers are 9'6" high as opposed to a standard international container height of 8'6". This data would indicate that TOFC still represents about 80% of domestic intermodal market, and that domestic containers represent some 20% of the domestic intermodal market. The data would also mean that just 6% of the domestic intermodal traffic moved in domestic dimension containers.

However, the size of the fleet is still heavily trailer oriented. It is estimated that 100,000 trailers are in the TOFC fleet, while there are still only 20,000 containers

Double Stack Benefits

There are two primary benefits of double stack rail movements compared to truck, TOFC, or COFC. The two benefits relate to lower costs and superior ride quality. However, the extent to which these benefits exist depends on the service to which double stack is being compared.

Compared to TOFC or COFC services, double stack costs are as much 20-25% lower in the longest distance runs (Leonard 1991). Temple, Barker and Sloane (1988) have estimated double stack cost savings at $50 per container for movements of 500 miles, and at $100 for movements of 800 miles. These cost savings are due to the line-haul economies of 20-40% compared to TOFC/COFC on movements of 500-800 miles (Manalytics, Inc. 1990). Other terminal and drayage costs are similar for double stack and TOFC/COFC.

Double stack costs are generally agreed to be approximately 90-95% of truck costs (Mongelluzzo 1991). For instance, on one 559 mile movement, double stack costs were calculated at $.86 per mile, while truck costs totaled $.95 per mile (Manalytics, Inc. 1990). Shipper expectations generally require intermodal rates to not exceed 85% of truck rates.

The other primary benefit of double stack is the improved ride and resulting reduction in damage caused by vibration and shocks.

The better ride is due to two factors (Brown 1990). First, and most important, is the advent of slackless couplings. These couplings reduce the longitudinal stretch that occurs in traditional couplings when the train begins movement. Couplings with slack were required in earlier days so as to allow for less powerful engines to start the train. This was accomplished by "bunching the slack" and then moving forward pulling just one car the first few inches and building momentum in this way. The second feature allowing for better ride has been improved suspensions in double stack cars.

However, it should be noted that slackless couplings are not limited to double stack cars. Single stack spine cars, for instance, are also available with slackless couplings (Manalytics, Inc. 1990).

While debatable, some analysts have also indicated that double stack now offers better ride characteristics than truck (Brown 1990).

Conditions Required for Economical Double Stack Operations

There are two types of double stack operations. Dedicated train double stack operations and single unit double stack operations. While the common perception is that double stack operations only occur with dedicated trains, it is now quite common for double stack cars to be mixed into general intermodal trains, and even into standard mixed equipment trains on occasion (Johnson 1988, Commins 1991, Manalytics, Inc. 1990).

The criteria for economical single unit double stack trains are the same as those that exist for intermodal TOFC/COFC trains. Generally, the minimum competitive distance for such trains is 700 miles (Manalytics, Inc. 1990). For cost reasons, intermodal rail generally cannot compete with truck on movements under 700 miles. For service reasons, intermodal rail cannot compete with truck under 500 miles because of the stem and dwell time handicap that rail operates with, and because of the slower rail average operating speed of 40 miles per hour compared to 57 miles per hour for truck. Trucks using single drivers are limited by the fact that a driver cannot exceed ten hours of straight driving time without legal rest periods. These truck limitations allow rail to catch up with truck's service advantages. Finally, competition with truck generally requires a minimum five day a week service frequency.

While the only quantitative analyses of intermodal competitive distance reviewed indicated distances of 700 miles were necessary, several other sources have indicated that shorter distance moves are feasible. For instance, Temple, Barker & Sloane (1988) indicates that double stack and intermodal are competitive above 500 miles. Similarly, Peat Marwick, Stevenson & Kellogg (1990) indicate in an intermodal options study for the Province of Ontario that they believe intermodal double stack movements under 400 miles are economically feasible. Grand Trunk Western (1991) has also expressed the view that double stack could be competitive in 200-300 mile corridors.

Dedicated stack trains, on the other hand, face several additional constraints. These constraints are related to efficient minimum train lengths, operating costs, and service levels. For purposes of this analysis the minimum feasible train length is assumed to be 15 five car platforms or 150 containers (Manalytics, Inc. 1990). According to Manalytics, Inc. the shortest dedicated trains in operation today are a minimum of 15 platforms.

From a cost standpoint, Manalytics, Inc. has calculated that the minimum truck competitive distance is currently 725 miles. They also calculate that every $.01 per mile increase in the truck operating cost level per mile will reduce the minimum rail competitive distance by 11 miles. Two principal factors could result in near term increases in truck operating costs. First, the Clean Air Act of 1990 could result in fuel cost increases of $.03 -.04 per mile. In addition, based on truck miles per gallon rates, every $.06 per gallon increase in fuel taxes would increase truck operating costs by $.01 per mile.

Manalytics, Inc. also suggests several additional service related criteria that must be met for double stack to be able to compete with truck in domestic markets. First, a minimum of five day a week service is required. This service frequency has an impact on the volumes required given the minimum train size of 150 containers. This minimum volume level amounts to 46,800 containers a year on an ongoing basis. They also calculate that intermediate stops on a through service would not have to provide more than 2600 containers a year to allow for economical service. However, Manalytics, Inc. states that the minimum intermediate distance constraint of 725 miles would still have to be met. Manalytics also estimates, on an admittedly arbitrary basis, that just 28,080 containers a year would be required to initiate service.

From a service level standpoint, Manalytics has also calculated that a minimum distance of 540 miles is required in order to compete with truck. This distance is again related to the ability to match delivery times with truckers who operate at faster speeds and without the handicap of stem and dwell time requirements at terminals. The 540 mile distance serves as a floor below which double stack cannot go regardless of truck operating cost increases. Finally, Manalytics estimates that cost economics requires a maximum drayage distance of 30 miles at each end on a 725 mile movement. Feasible drayage distance increases with line haul distances.

Future Rail Industry and Double Stack Trends

The railroad industry is likely to continue with the rationalization process that began after passage of the Staggers Act. This will mean the continued abandonment of underutilized track and the development of a hub and spoke system similar to those now employed in the airline and trucking industries. Michigan's best interests will be served by a system that includes a hub in Southeast Michigan, with several spokes extending into other sections of the state. New trains and volume which results from a vibrant double stack capable cross-border rail gateway could help to assure that Southeast Michigan obtains full hub status service.

With respect to double stack, it appears that major inroads are about to be made into truck transportation in the United States. Manalytics, Inc. (1990) has forecast that based on the criteria described above, some 5.7 million containers of double stack freight could have been economically moved in 1987. That compares to their estimate of an actual 1.2 million double stack container movements in 1987. The additional volume would have consisted of 3.7 million units moving away from truck, 1.1 million units converting from intermodal rail, and .4 million units of boxcar traffic. They predict a 4% annual growth rate in double stack container traffic through the year 2000.

Interestingly, Manalytics suggests that 1987 U.S.-Canada volumes on the Chicago-Detroit-Toronto-Montreal route, apparently excluding overseas shipments, would have been sufficient to meet their double stack service criteria.

The trend in double stack is clearly towards shorter dedicated trains, and towards single unit (five wells) or single well double stack cars in general freight trains (Johnson 1988, Commins 1991). Firms such as APL are also known to be experimenting with much shorter double stack movements.

There is in fact nothing to prevent double stack cars from moving in the same pattern as boxcar traffic. To the extent that shipments can be made direct to major manufacturer's rail sidings the disadvantages of stem and dwell terminal times will be eliminated. This would allow full competition with truck and/or boxcars in those circumstances where a container handling forklift is available and where large volumes of product are moving to single plant locations. As domestic containerization increases its penetration of the transportation market, it will become more and more likely that major manufacturing plants will have container handling capability.

Auto manufacturing plants are a clear example of such a situation. For instance, the Mazda plant complex in Flat Rock receives double stack containers now. In the future, double stack may become quite feasible for relatively short distance moves from supplier consolidation points to assembly plants. This possibility will be more fully explored in the section on Michigan-Ontario double stack benefits later on in this report.

Michigan and Cross-Border Double Stack and Intermodal Services

Michigan is currently served by a substantial number of intermodal and double stack services. The cross-border market is also served by several intermodal services. Of course, double stack cross-border services are not allowed at the Michigan-Ontario crossings because of height restrictions.

Examples of Michigan-Ontario and U.S. internationally oriented intermodal and double stack services into and out of Michigan are as follows:

- Detroit-Toronto NS Roadrailer - NS, in conjunction with CP, recently began offering five day a week "Triple Crown" Roadrailer service between their Detroit Melvindale Yard and the CP Lambton Yard in Toronto. Initial volume is running at an annual rate of 5000 units, or 20 trailers a day. Expectations are that volume will increase to 60 trailers a day shortly, or 15,000 units a year. This traffic comes directly off the roads and border bridges.

- Chicago/Detroit-Montreal CP/Soo Intermodal - CP/Soo offer service between Chicago and Montreal three times a day each way, five days a week, via the Detroit-Windsor gateway. This service currently does not move through Oak Yard and does not offer local Detroit service. However, CP/Soo offer daily service each way between Detroit and Montreal using the Oak Yard terminal.

- Chicago-Montreal CN/GTW "Laser" - CN/GTW offer their "Laser" service between Chicago and Montreal on a daily basis using their Port Huron-Sarnia tunnel crossing. The "Laser" service uses articulated five well cars that offer the same ride advantages as 1985 generation double stack cars. In fact, the "Laser" cars could accommodate double stacked containers if the tunnel restrictions did not exist. The 845 mile route takes 21 hours. Local Michigan traffic is loaded and unloaded from GTW terminals in Michigan.

- Mexican border-Chicago/Detroit Santa Fe for Ford - Santa Fe/GTW are providing intermodal TOFC service between maquilas on the Mexican border and Ford assembly plants in various U.S. and Ontario cities. The train operates three times per week and moves raw materials southbound to Ford suppliers and finished components northbound. Approximately 70% of the northbound movements go to Ford's St. Thomas, Ontario assembly plant. The train currently terminates at GTW's Ferndale Moterm facility and trailers bound for St. Thomas are drayed the remaining 100 miles.

- Detroit-Hermosillio, Mexico APL Ford - APL is providing double stack service between the Detroit area and Hermosillio for Ford. This service operates three times per week and primarily carries components southbound for assembly in Mexico. Approximately 17,000 containers per year of Ford traffic are moved , including 15 containers per week of northbound carpet for the Ford assembly plant in St. Thomas.

- West Coast-Detroit Mazda service - GTW provides Mazda with access to double stack service at its Flat Rock, Michigan facility. This cargo includes components originating in Japan and being shipped to Detroit via microlandbridge from West Coast U.S. ports.

There are also believed to be several other domestic double stack services into and out of Detroit.

Cross-Border Intermodal and Double Stack Volumes, and Michigan-Ontario Prospects

Intermodal rail movements across the Ontario-U.S. border currently represent 7.9% of total transborder traffic (U.S.-Canada rail and truck, and Canadian import/export through U.S. ports) according to a report completed in 1990 for the Ontario

Ministry of Transportation (Peat Marwick 1990). The great bulk of cross-border intermodal traffic is in fact containers bound to or from Europe via the Port of Montreal. Excluding this traffic, intermodal rail represents only about 1% of total cross-border traffic.

The intermodal rail movements across the Michigan and New York borders totaled 175,419 empty and loaded containers. In addition, 29,154 trailers moved across the border in rail mode. Rail container and trailer intermodal movements across the border totaled 204,578 units in 1989. This intermodal rail traffic totaled 2.8 million tons, or 29% of total rail transborder tonnage. The traffic represented just 7.9% of the 35.4 million tons of rail and truck transborder traffic. Excluding the 175,419 containers which are mostly international in nature, just 1% of the cross-border traffic was moved by intermodal rail.

In terms of the Michigan-Ontario border, it is currently thought that approximately 150,000 of the above containers are crossing in rail mode. This volume is based on the fact that there are some eight container trains a day operating through Detroit-Windsor (four in each direction) between the U.S. Midwest and Montreal. It is estimated that 120,000 of these are Chicago to Montreal trains, while 30,000 containers represent Michigan-Montreal traffic.

The 50,000 some container/trailers making up the balance of the 204,578 containers and trailers described above are thought to be represented by Asian-Eastern Canada traffic crossing the border in rail mode at Buffalo. Interviews with CAST indicate that approximately 50,000 Asia-Eastern Canada containers per year are moving in rail mode through Buffalo. In addition, according to the study done for MTO, there are some 35,000 containers a year moving through Welland and across the border by truck. This Asia-Eastern Canada traffic represents a total of 80,000 containers a year, loaded and unloaded that should be moving through Michigan-Ontario according to most of ocean carriers talked to.

Not included in the above intermodal figures are rail intermodal trailers and containers that cross the border by truck. This traffic includes West Coast containers ramped or deramped at Chicago or Detroit for final truck movement across the border, and piggyback trailers used in Ontario-Canada trading. At the Michigan-Ontario crossings some 30-60,000 containers/trailers per year may be crossing by truck instead of rail. For instance, until the recent introduction of cross-border Roadrailer service, some 30 trailers a day were being deramped in Melvindale, Michigan and trucked across the Ambassador Bridge to final destinations in Ontario. This totaled some 7500 containers per year.

Another part of this traffic represents Mexico-Canada volume. For instance, 70% of the Ford TOFC train from Mexican suppliers is bound for St. Thomas. However, because this train cannot clear the tunnel it is deramped in Ferndale and the trailers are trucked across the bridge. This traffic totals some 12,000 units a year loaded. In total it is believed there are approximately 21,000 loaded and empty containers crossing the Detroit-Windsor border that could cross the border in double stack mode.

A partial deepening of the tunnel would also open the Detroit-Windsor gateway to TOFC traffic between Chicago and Toronto, and between the Upper Midwest and the Northeast U.S.. While CN offers TOFC service between Chicago and Toronto CP does not have any competing service. A competing CP TOFC service might help to bring down truck costs on this corridor and could contribute to reduced highway congestion. Rail executives have estimated that CP might capture 10,000 truckloads of freight a year initially, and that eventually they could pull 200,000 loads a year off the Chicago to Toronto corridor. While it is difficult to quantify the potential benefits that could be achieved with TOFC, it may be that 20-40,000 truckloads a day could be diverted from the Ambassador Bridge. This figure is used for the partial deepening benefits analysis.

A double stack capability would allow additional containers now deramped or ramped in Chicago and Detroit to cross by rail. Based on some rail executives comments on the importance of double stack from a marketing perspective it is assumed an incremental 10,000 units could be captured with double stack.

On the Upper Midwest to U.S. Northeast corridor CP could use the newly acquired D & H to offer a competing service to Conrail through Detroit and Buffalo. The potential on the Upper Midwest to Northeast U.S. corridor is hard to quantify but a 1987 study for the Ontario Ministry of Transportation estimated that 119,000 trucks per year on the 401 were through traffic between Michigan and Ontario. A competing double stack service to the U.S. East Coast via Ontario could take both current truck and rail traffic off the all U.S. route. Because rail executives expressed such strong sentiments on the potential for the route, this report will assume one dedicated double stack train per day each direction is viable. Such a train would typically carry 150 containers per run, or 39,000 per year. Two trains, one each way, could carry 78,000 empty and loaded containers.

Barriers to Cross-Border Double Stack

According to the Ontario intermodal study done by Peat Marwick (1990) truck dominates the cross-border market because of (1) trucking's competitiveness, (2) the short distance that Ontario freight moves, and (3) the railroad tunnel height constraints. They consider the impediments to rail intermodal to be (1) restrictive work practices, (2) tunnel height restrictions, (3) the necessity for interlining in Chicago, (4) slow Canadian customs procedures and hours of operation for rail, and (5) inadequate commercial operations.

Peat Marwick suggests that there are two primary opportunities to increase rail intermodal opportunities in Southern Ontario and these are (1) Roadrailer, and (2) double stack. In order to facilitate development of intermodal/double stack services they suggest beginning with the elimination of restrictive institutional practices, and then proceeding to infrastructure problems relating to tunnel height limitations at Detroit-Windsor and Port Huron-Sarnia.

Peat Marwick specifically suggest that any investigation of a new highway bridge at Detroit-Windsor should include a provision for a double stack railway crossing. A bridge, however, would be a difficult option to implement for a rail crossing given the navigable waterway clearance requirements and grade restrictions that rail must observe. However, this recommendation would seem to support the need for a new railroad double stack tunnel. This would seem to be especially true today now that the institutional practices preventing Roadrailer have been eliminated.

MICHIGAN-ONTARIO CROSS-BORDER RAIL REQUIREMENTS, GEOGRAPHIC RATIONALE, AND BUFFALO COMPETITION

The changes in the global economic and trading system described above dictate the need for efficient rail, and cross-border rail transportation systems. In addition, it is clear from the discussion of new transportation developments that double stack technologies can make a significant contribution to improved rail service and costs.

Good transportation has been a key factor in this region's economic development since the earliest days of exploration. While this can be said about many regions and communities it is especially true in the Michigan case given the state's location on the northern edge of the country, and given the distance to major continental market centers on the two coasts. Over the last 50 years the state responded to its transportation needs by heavily investing in the highway system.

While the highway system will continue to be very important, the need for an efficient rail transportation system may increase as we enter the 21st century. More importantly for the study at hand, is the potential need for an efficient cross-border rail system given some of the changes occurring in the global economy.

<u>**Developments Impacting New Cross-Border Rail Requirements**</u>

Several of the global economic developments discussed earlier have implications for national and Michigan transportation systems. First, while regional and Michigan companies participation in global trade has increased substantially, the ability of the St. Lawrence Seaway to provide low cost, efficient transportation service for general cargo has declined relative to other modes. In today's competitive environment intermodal rail is the most efficient means for moving product to the East Coast and on its way to Europe. And in the case of the upper Midwest, some of the most competitive ports are in Canada. Cross-border rail infrastructure is necessary to reach those ports efficiently.

Secondly, as discussed earlier, the emerging North American trading block is increasing the need for efficient North-South transportation flows between all three countries of the continent. Good transportation is necessary in order to allow each country to specialize along lines of comparative advantage and produce a combined North American product which is world class competitive. <u>Without Canadian trade, Michigan sits on the Northern end of a weak regional sector, outside the mainstream of transportation and distribution networks. With the markets to the North, Michigan sits at the strategic center of a region which stretches from Chicago on the West to Toronto on the East</u>. However, in order to make this regional market a reality, efficient cross-border transportation systems will be critical, and rail crossings will be an important part of any such system.

Finally, both domestic and cross-border rail is likely to become increasingly important because of improvements in rail costs and service levels, coupled with developments which are likely to increase the costs of truck service. As discussed earlier, rail is improving its performance by eliminating wasteful labor practices and taking advantage of the economies and service improvements inherent in intermodal and container technologies. However, maximum utilization of these improvements requires access for intermodal and double stack container cars currently restricted at Michigan rail border crossings.

While rail costs and service are improving, there is a definite tilt in federal policy away from trucks. New clean air standards, emerging congestion problems, and a growing belief that truckers are not paying their fair share for roads are all likely to drive up the costs of trucking transportation.

The degree to which the above developments materialize, and the speed with which they emerge, will determine the level of Michigan's need for modern railroad border-crossings.

Geographic Rationale for Michigan-Ontario Rail Crossings

The above developments point out the need for efficient cross-border rail transportation systems. Both New York-Ontario and Michigan-Ontario crossings are necessary for such a system and both will play their own role. However, overall North American and Michigan interests require an efficient Michigan-Ontario crossing. Efficient Michigan-Ontario crossings are necessary for many rail movements because:

- The Michigan-Ontario crossings provide the shortest distance railroad/ocean route between Asia and Europe.
- The Michigan-Ontario crossings provide the shortest distance route between West Coast U.S. ports and Eastern Canadian markets.
- The Michigan-Ontario crossings provide the shortest route between the U.S. Midwest and the Port of Montreal.
- The Port Huron-Sarnia crossing provides the shortest distance route between Chicago and Toronto.
- The Michigan-Ontario crossings provide the shortest distance route between component suppliers and Mexican and Canadian assembly plants.
- The Michigan-Ontario crossings provide the shortest route between Canadian assembly plants and U.S. component suppliers and auto markets.

While these Michigan-Ontario crossings provide the shortest route for many origin-destination pairs they are not necessarily the lowest cost routings. The costs depend on additional factors such as the ability to use double stack technology.

Potential Rail Diversions to Buffalo

The above information points out why the Michigan-Ontario gateway is the ideal location for many origin-destination movements between the U.S. and Canada, and why it is the only efficient crossing for Michigan and several other states. However, as pointed out in earlier sections, competing railroad crossings at Buffalo, New York do not have height restrictions and may become the crossing of choice for movements that should transit at Michigan-Ontario. While there are limits on the origin-destination combinations that could viably use Buffalo, New York in lieu of shorter distance moves through Michigan-Ontario, there is already some traffic diverting to Buffalo.

There are several examples of traffic being diverted. For instance, much of the U.S. West Coast to Eastern Canada traffic that should use the Michigan-Ontario gateway is currently using Buffalo because of its double stack capability. This traffic represents some 80,000 loaded and empty containers a year. Some automotive tri-level traffic is also diverting to Buffalo to avoid harbor maintenance fees charged when railcars have to be put on the ferries at Michigan-Ontario crossings. Such diversions eliminate profitable railroad traffic which is critical to the viability of the state's principal railroad service providers.

These potential diversions need to be taken into account in considering the need for Michigan-Ontario double stack crossings. The potential for Buffalo to improve its competitive position at Detroit's expense as a gateway city must also be considered.

IMPLICATIONS FOR MICHIGAN MANUFACTURERS

Given the above transportation developments and geographic factors it may well be important for Michigan companies to have access to a state of the art rail transportation system for domestic, cross-border, and overseas shipments. Such a system could be critical for competitive participation in international trade with Europe. Improvements in the cross-border infrastructure, whether partial deepening or double stack oriented, could also result in increased traffic that would help to place Michigan closer to the railroad system mainstream. Such traffic increases could result in spin-off improvements to the domestic Michigan system as well. Increased rail volumes through Michigan could improve railroad car availability, improve service frequency and service levels, and help to absorb system costs thereby allowing for lower pricing to Michigan users of the rail system.

Improved railroad crossings also may allow for additional highway bridge traffic to be diverted to rail. There is considerable potential for additional Chicago-Montreal and Detroit-New York traffic to be diverted to rail. However, it should be noted that a partial deepening would allow some of this traffic to be captured utilizing TOFC services.

As individual unit, mixed train, double stack service becomes more common, it also may become feasible to move Michigan-Ontario automotive plant components by rail. All of these developments could help to reduce truck traffic. The feasibility of such developments will also be influenced by the level of truck congestion, truck taxes, fuel prices, and Clean Air Act requirements.

Because of the transportation developments described above, and because of the potential for Buffalo to pull rail traffic from Michigan freight lanes, it may be quite important for Michigan officials to do everything possible to assure that state railroad crossings are the most competitive on the border. Competitive crossings and a vibrant domestic rail system may well be critical to the competitiveness of the auto industry, and possibly to other industries, in future years.

The purpose of this report is to determine how beneficial various improvements might be. The remaining sections of the report will examine the options for obtaining double stack crossings, the benefits that might result from several options, and the advantages and disadvantages of each option. The final section will make several recommendations for future state consideration.

CROSS-BORDER INFRASTRUCTURE IMPROVEMENT OPTIONS AND FINANCIAL ANALYSIS

The following sub-sections describe the options for improving rail, and in some cases rail and highway, border crossing infrastructure. The descriptions of each option should be useful in considering the generic benefits analysis developed in the next major section of this report.

For each option the pre-tax cash flow financials have been calculated based on current railcar and/or truck volumes and tolls, and estimated construction, operating and lease right costs. A summary of these calculations for each option is shown in Exhibit 1. Oversize railcars are assumed to pay the current ferry rate in the revenue analysis. However, an oversize car rate is also calculated based on the breakeven point assuming regular size railcars and/or trucks return the existing rate levels. The financials are calculated from the perspective of either the likely railroad ownership, or a third party, depending on which is most likely. In order to assure the most conservative analysis only current volumes are considered. The debt service cash outlay calculations for annual principal and interest payments assume 30 year financing at 8% and are displayed in Appendix IV.

At Detroit-Windsor there are basically two options. The first option relates to a partial deepening of the current tunnel, and this project is in the final planning stages at CN/CP. Such a

Exhibit 1
Proposed Concepts Financial Analysis Summary
(U.S. Millions of Dollars)

Concept/Proposal	Annual Revenue[1]	Annual Cash Outlay	Net Pre-tax Cash Flow	Breakeven Oversize Car Rate (Per Car)	Breakeven Savings Per Oversize Car
Detroit-Windsor					
Deepening for Tri-Level, Etc. (Exhibit 2)					
Rail Volume 23,400	$ 3.5	$ 3.1	$ .4	$132.0	$ 18.0
Rail Volume 38,400	5.8	3.1	2.7	81.0	69.0
Rail Volume 113,400	16.3	3.1	13.2	29.0	121.0
Old Tunnel Truck Conversion and/or New DS Tunnel					
MDOT Concept (Exhibit 3)	39.1	35.5	3.6	115.0	35.0
Beztak Proposal (Exhibit 4) (original financing)	50.5	34.5	8.5	N/A	N/A
Beztak Revised[2] (Exhibit 5) (per JCT estimates)					
Single Tube	39.1	35.5	3.6	115.0	35.0
Double Tube	39.1	43.1	(4.0)	177.0	(27.0)
Additional Options (Exhibit 6)					
Rail Only Single Tube	28.5	26.0	2.5	124.0	26.0
Rail Only Double Tube	28.5	33.6	(5.1)	186.0	(36.0)
Rail-Truck New Double Tube	39.1	37.3	1.8	130.0	20.0

[1] Assume current and/or diverted volume levels with no traffic growth.
[2] Original Beztak proposal financials are on P+L basis but count both principal payment and depreciation as expense.

Exhibit 1 (Cont'd.)
Proposed Concepts Financial Analysis Summary
(U.S. Millions of Dollars)

Concept/Proposal	Annual Revenue[1]	Annual Cash Outlay	Net Pre-tax Cash Flow	Breakeven Oversize Car Rate	Breakeven Savings Per Oversize Car
Port Huron-Sarnia (Exhibit 7)					
Rail Only Single Tube DS	$ 17.2	$ 14.8	$ 2.4	$130.0	$ 20.0
Rail Only Single Tube DS/Truck Conversion of Existing Tube	18.9	21.0	(2.1)	169.0	(19.0)
Rail-Truck Multi-Use New DS Tube and Conversion of Existing Tube to Truck One Way	20.6	21.9	(1.3)	162.0	(12.0)
Rail Twin Tube DS Multi Rail-Truck Use	20.6	34.2	(13.6)	269.0	(119.0)
Most Likely Combination of Projects (Exhibit 8)					
Detroit Partial Deepening	5.8	3.1	2.7	81.0	69.0
Port Huron Rail Double Stack	12.3	14.8	(2.6)	183.0	(33.0)

deepening would allow for the passage of auto tri-level, high cube boxcar, TOFC equipment, and maritime 8'6" container double stack cars. Both CN and CP staff have indicated to various people that they will be deepening the tunnel, however the CN/CP Partnership have not formally approved the project.

The summary of the financials shown in Exhibit 1 indicates that the partial deepening at Detroit has the best net cash flow at $13.2 million per year, assuming Port Huron oversize traffic diverts to Detroit as a result of the project. Without this diversion the deepening would be likely to have a positive annual cash flow of $2.7 million. At the breakeven point the most optimistic deepening scenario studied would allow for oversize railcar savings of $121 per car. It should be noted that the financials assume no maritime double stack incremental volume in this option because of a trend toward higher domestic containers.

The second option at Detroit-Windsor, the conversion of the current rail tunnel to truck and/or auto use, and the construction of a new domestic double stack capable rail tunnel partially subsidized by truck tolls, was the initial focal point of this study. Both MDOT, and a private firm, Beztak, have made proposals along these lines, however, it should be pointed out that, as far as is known, no railroad is formally considering a double stack tunnel at Detroit. Each will be explored although they are quite similar in nature.

The third option at Detroit involves construction of a new domestic capable double stack tunnel while maintaining the status quo at the current rail tunnel. A new double stack tunnel could be designed for just rail, or could be designed for dual purpose rail and truck use over the same roadbed. In such a system trucks could use the crossing whenever rail traffic was not present. This latter option is suggested for consideration given the possible $300-400 million cost (with tolls calculated at $13.00 per truck and $3.92 per auto on average assuming a $323 million cost financed over 30 years at 8%) of obtaining highway capacity with a new bridge in the Detroit-Windsor area. However, a number of problems related to rail-truck competition, operational difficulties, liability, and road access costs make this option unlikely.

The double stack concept with the best financials at Detroit is the MDOT/Beztak single tube new tunnel with conversion of the current tubes to truck. This concept has a positive annual pre-tax cash flow of $3.6 million and allows oversize railcar savings of $35 per railcar at breakeven operation. However, this concept would have to overcome a number of obstacles and the road access costs could go much higher then the $30 million assumed. The second best proposal is the single double stack tube concept, which would have a positive cash flow of $2.5 million and which would result in per car savings of $26 per oversize car at the breakeven point assuming current volumes.

At Port Huron-Sarnia the option under serious and formal study by Canadian National and Grand Trunk Western involves construction of a new single tube tunnel. This Port Huron single tube rail only double stack tunnel concept has a positive net pre-tax cash flow of $2.4 million and would result in an oversize car savings of $20 per car at breakeven. This assumes no increase in double stack volume (although such increases would be likely) but does assume diversion of Detroit oversize traffic to Port Huron.

A final option which should be noted involves a plan for implementation of several of these options in tandem or in succession. For instance, one option might call for encouraging the partial deepening at Detroit-Windsor, and the construction of a new double stack tunnel at Port Huron-Sarnia. Alternatively, at some point after the deepening is completed at Detroit-Windsor, consideration could be given to a new double stack tunnel. Such a tunnel would, of course, be more feasible if plans had not proceeded to construction at Port Huron for whatever reason. Any number of variations to the plan described above could be devised.

Should a partial deepening be completed at Detroit, the Port Huron project would lose oversize traffic from Detroit and would be operating at a negative $2.6 million pre-tax cash flow point without other incremental traffic.

The financial analysis summarized above and discussed below assumes that each project is being carried out in the private sector, either with railroad or third party ownership. The analysis relates private benefits to private costs. As such, all costs, including road access costs, are assigned to the project. Analysis in the next major section of this report considers the rail and truck oriented public benefits which could arise.

DETROIT-WINDSOR OPTIONS

The following parts consider the deepening option, the tunnel conversion/new construction option, and the new construction rail/truck multi-purpose crossing option. While the CN/CP Partnership have the deepening option in the final planning stages, it should be pointed out again that, as far as is known, no railroad is now considering a domestic 9'6" double stack capable tunnel at Detroit-Windsor.

Partial Deepening of Current Rail Tunnel

The partial deepening option would allow for the passage of auto tri-level, high cube boxcar, standard TOFC, and maritime 8'6" double stack container equipment. However, the tunnel cannot be deepened sufficiently to allow for passage of the 20'2" auto tri-levels Chrysler would have to use for economical rail border operations, potentially higher high-cube boxcars being talked about in the rail industry, or domestic 9'6" double stack cars.

Frame cars also could not pass through with standard loading patterns. The deepening would, however, be sufficient to allow for elimination of the current ferry operations. This fact has been confirmed by all of the railroads involved.

The current tunnel has been deepened twice before to increase vertical clearances. In each case this deepening was accomplished by lowering the rail tracks. In one case the tracks were lowered by shaving the ties, and in another case, the lowering was accomplished by rerailing with shallower section rail. The additional deepening option now contemplated involves removing some of the inner concrete liner from the ceilings and the floor of the tunnel and increasing the clearances approximately 24". This deepening would be conducted in the north tube alone.

As indicated above, CN and CP personnel have told the author, MDOT officials, and auto industry executives that the tunnel will be deepened shortly. While this does seem to be imminent, the project has been proposed for some time and has apparently never received a high priority. In 1984, when the Partnership acquired the tunnel, the Canadian Transport Commission held a series of hearings at which the proposed partners indicated their intentions. At that time the partners indicated that they had resolved disagreements over deepening costs with outside experts representing competing potential purchasers of the Canada Southern owned tunnel, and that:

"Provided the current estimates are substantiated by the detailed engineering studies and the project is shown to be viable from marketing and financial standpoints, the enlargement of the tunnel would be an attractive investment for CN and CP and we are prepared to recommend to our respective Boards that the work be undertaken."

While the Commission seemed to be left with the impression that the work would be performed, they realized that it was not definite and that the above statement was probably "the most that can be expected in the circumstances."

Since that time the Partnership has been reviewing the feasibility with varying degrees of intensity. In 1986 the Partnership commissioned an engineering feasibility study with Acres International. In 1987 they received a report indicating that the feasible deepening would allow the contemplated traffic to clear, and that the project would cost C$30 million for a single tube. In December of 1989 the author was told that the earliest the project could be tabled would be the Fall of 1990 partnership meeting. On 27 July 1990 CN wrote prospective engineering firms asking for proposals for engineering services including design, drafting, specifications and cost estimates. that request for proposals contemplated a contract award for construction by 30 September 1991. The latest information is that the Partnership will consider a deepening proposal at their November meeting. The latest cost estimate is $35 million. It should be noted that publication of the MDOT concept for conversion of the tunnel to truck, and MDOT's desire to complete feasibility studies before a deepening commenced, could have introduced some pause in the Partnership's plans although CN representatives have never indicated they would hold up their plans on this account.

The only doubt about the Partnership's intentions comes about because of CN's primary use of their Port Huron-Sarnia tunnel, and the fact that they are considering a new double stack tunnel at that location. The Port Huron tunnel also can already accommodate special TOFC cars used by CN, and CN has poor access to the Detroit-Windsor tunnel. CP, on the other hand, would benefit significantly from such capability at Detroit-Windsor and this would allow them to provide TOFC service without the need for special TOFC cars. A deepening at Detroit would also provide a route for auto tri-levels which currently have to pay harbor maintenance fees at Port Huron using CN/GTW, and could potentially result in such traffic shifting from CN/GTW to CP at Detroit. Given these facts, it may not be in CN's competitive interests to participate in a deepening. None-the-less, CP can proceed on their own under the Partnership Agreement and this fact may make it meaningless for CN to object to the project.

The financials for such a project appear quite favorable and are summarized in Exhibit 2. The pre-tax net cash flow under each volume scenario ranges from $.4-13.2 million. At a breakeven rate, the required railcar charge ranges from $132 to $29. This means that the project could break even and save between $18-121

Exhibit 2
Detroit-Windsor Deepening
From CN/CP Ownership Perspective
Annual Cash Flow
(U.S. Millions of Dollars)

Item \ Scenario Annual Incremental Traffic Level	(1) 1991-1992 Forecast 23,400 Oversize Cars	(2) (1) + Diverted Buffalo Volume 23,400 + 15,000 = 38,400 Oversize Cars	(3) (2) + Port Huron Volume 38,400 + 75,000 = 113,400 Oversize Cars
Price Per Car	$ 150.0	$ 150.0	$ 150.0
Total Annual Incremental Revenue	3.5	5.8	16.3
Annual Incremental Cash Outlay ($35 million, 30 years, 8%)	3.1	3.1	3.1
Pre-Tax Net Cash Flow	.4	2.7	13.2
Price Level Per Car Required for Breakeven Operation	132.0	81.0	29.0
Savings Per Car Compared To Ferry	18.0	69.0	121.0

per railcar compared to the ferry cost, depending on incremental volume. It should also be noted that such a ferry would save the costs of the federal harbor maintenance fee, or twelve one hundredths of one percent of the value of the cargo.

These financials are calculated from the perspective of the likely CN/CP facility owner and reflect incremental volume/revenue against incremental costs. Incremental revenue can be calculated under three scenarios. A fourth scenario, assuming use of the tunnel for maritime double stack traffic, was not considered because of the domestic double stack trend. However, the inclusion of such volume would make the project all the more attractive and would reduce the benefits attributable to a double stack capable tunnel. The first scenario assumes just the forecast 1991-1992 fiscal year volume of 23,400 oversize railcars. The second scenario assumes recapturing some 15,000 of the 25,000 oversize cars currently being diverted to Buffalo per NS. The third scenario assumes addition of 75,000 cars of Port Huron-Sarnia oversize traffic and represents the most optimistic forecast. The revenue for each scenario is calculated based on a per car charge of $150, similar to current ferry costs. Total revenue under each scenario ranges from $3.5 million to $16.3 million. Expenses for the above project reflect the $35 million construction cost financed over 30 years at 8% interest. At such a rate the annual cash outflow equals $3.1 million.

Existing Tunnel Conversion and New Double Stack Tunnel Construction

The following sub-pieces discuss two concepts for converting the current rail tunnel to truck use and construction of a new railroad domestic 9'6" double stack tunnel. The first concept reviewed is the one proposed by MDOT. The MDOT concept was conceived before the Department became aware of a similar private sector proposal. The second concept is one which Beztak/Dewin, a partnership of local developers and the Detroit and Windsor port authorities, conceived several years ago. Again, it must be pointed out that no railroad, as far as is known, is seriously considering construction of a double stack tunnel at Detroit-Windsor. As such, all financial calculations assume a third party operator that would be required to reimburse the CN/CP Partnership for their net cash flow from current tunnel operations.

MDOT Conversion/Construction Concept

The original MDOT intent of this report was to evaluate the potential economic benefits of an MDOT concept for conversion of the existing railroad tunnel to truck use, and construction of a new double stack capable tunnel. The concept was designed to alleviate the rail clearance problem while at the same time providing additional capacity for border crossings by truck. Because of the impending CN/CP Partnership decision on a partial deepening, it seemed prudent to study whether the concept was viable, and if so, how likely implementation might be, before $35 million was sunk into a partial solution.

Construction of the new domestic container capable double stack railroad tunnel would in part be financed by tolls on the trucks. Such tolls would be similar to those charged at existing private crossings. The estimated cost of this concept is $237 million according to a study undertaken by Jenny Engineering for MDOT. However, this figure does not include most of the likely costs for access roads. Inclusion of such costs would bring the total concept budget to over $267 million if $30 million is assumed for access costs.

The MDOT concept does not specify what role the state should assume in such a project. However, there is no intent to dedicate substantial state money to such a project. The possible roles, however, range from assistance with permitting, to property tax abatement, to assistance in seeking federal funding, to tax exempt bonding through a state Border Crossing Authority.

The proposed concept was in part developed in response to concerns about highway border crossing capacity at the Ambassador Bridge and Detroit-Windsor Tunnel Corporation auto tunnel, and because of continued growth in traffic levels at all highway crossings. Recent reports for MDOT have indicated that the Ambassador Bridge system could reach capacity in some of its system elements, such as inspection booth numbers, by 1996. In addition, there has been some question about the adequacy of the roadbed capacity depending on the assumptions used in recent MDOT simulation modeling. The Detroit-Windsor Tunnel Corporation is also forecast to reach capacity in 1994 and tunnel officials have indicated there will be a need for additional capacity by the year 2000. These concerns, and the potential benefits that would result from the proposed concept, will be evaluated in the benefits section later in this report.

The tunnel conversion concept envisions use of both tubes of the existing railroad tunnel for truck traffic. In order to implement the plan considerable construction work would be required at the tunnel. The estimated cost of this construction work is $65 million according to the Jenny Engineering estimates. The cost includes $8.9 million for toll/customs plazas and structures. In addition, access roads to the expressways or primary roads on each side would be necessary. The above $65 million cost figure includes $4.0 million for two three lane roadway sections. One fifth mile would be provided on the U.S. side and two kilometers on the Canadian side, however much greater additional costs are likely for expressway interchanges as discussed below.

The tunnel conversion for truck use must overcome a number of serious problems. Perhaps the most important problem is the issue of access roads. While the existing rail right-of-way would prove almost completely sufficient for the truck access on the U.S. side, entry and egress from I-96 would be extremely complicated. The second picture in Appendix II shows the right-of-way up to and over I-96. A cursory review by MDOT personnel resulted in an estimate that the access road and ingress/egress cost would be well over $20 million if a way could be found to introduce additional entry/exit points on that heavily accessed section of the expressway. On the Canadian side, the concept also envisions use of the rail right-of-way to reach the 401 expressway system. However, the several mile distance would result in major investment requirements. Access roads to even the nearby primary roads would probably also cost at least $10 million additional dollars. In total a minimum of $30 million would be required for access roads and this figure is probably on the low side.

A second problem with the truck conversion involves the issue of Customs, and Immigration and Naturalization Service (INS) staffing of the facility. It is unlikely that these agencies would agree to provide separate staffing at a facility within six or seven blocks of the Ambassador Bridge plaza. As a result, it might be necessary to route trucks to the already congested Ambassador Bridge, and to establish primary inspection booths that would allow for access to the secondary plaza as necessary. Truck traffic on the area's city streets would encounter significant neighborhood resistance in addition to a number of security concerns on the part of Customs Services on both sides of the border. While these issues will have to be dealt with some day when a new auto/truck bridge is constructed, it might be difficult to resolve them at a truck only facility.

A third problem with the tunnel conversion concept relates to the width of the one-way tunnel lane in each of the tubes. These lanes would be 11'6" and could possibly be extended one foot by removal of a sidewalk on one side of the tunnel. None-the-less, an American Association of Highway and Transportation Officials waiver would be required and the single one-way lane would not provide much margin for error by drivers. Removal of burning trucks, or other incapacitated vehicles could also pose serious difficulties.

At the heart of the MDOT concept is the construction of a new double stack capable tunnel. While the conversion of the existing railroad tunnel to truck could provide some benefits in its own right, it also provides for toll revenues which could assist in the financing of a new rail tunnel. Such a railroad tunnel has an estimated cost of $172 millions according to Jenny Engineering.

A double stack railroad would allow for passage of all types of railroad cars now on the drawing boards or contemplated. In addition, the tunnel would have sufficient space for installation of catenary power systems which might be necessary for some future high speed passenger rail service. The tunnel would be a single tube as envisioned by MDOT and would be built just north of the existing railroad tunnel. The railroads would share right-of-way with the trucks using the converted tunnel for the first several hundred yards on each side of the tunnel with possible joint right-of-ways for several miles on the Canadian side.

The new tunnel would be built in compliance with American Railroad Engineering Association criteria according to Jenny Engineering. The tunnel section would be 12 feet wide and would offer 23 feet vertical clearance from the top of rail.

The tunnel would be built using immersed tube construction similar to that which was used for the existing railroad tunnel according to Jenny Engineering. A bored method was not selected because of the depth that would be required to achieve sufficient cover for this diameter bore, and the resulting increase in project length that would be required to achieve current grade levels. This deeper invert would also increase the probability of having to bore through soil/rock at higher construction cost.

Exhibit 3 summarizes the likely financials on a cash flow basis from the perspective of a third party operator. Such a project would have a positive net cash flow of $3.6 million. At breakeven operations, and assuming existing truck and rail tolls, the project could charge $115 per oversize railcar. Such a charge would represent a $35 per oversize railcar savings compared to current ferry costs. Depending on the desired profit

Exhibit 3
Detroit-Windsor MDOT Conversion/Construction Concept
Third Party Ownership Perspective
Annual Cash Flow
(U.S. Millions of Dollars)

<u>Annual Project Revenue</u>

■ Truck Traffic - 50% of Existing 1990 Truck Traffic at Ambassador (777,000) at Average Toll of $13.60 Per Truck	$ 10.6
■ Railroad Traffic	
• Existing regular size cars at Detroit (325,000) at $33 per car[1]	10.7
• Detroit-Windsor oversize cars assuming forecast 91-92 volume (23,400) plus recapture of a portion of Buffalo traffic (15,000) plus Chrysler 20'2" tri-levels (10,000) for total of 48,400 cars priced at $150 per car (current ferry cost)	7.3
• Port Huron-Sarnia oversize cars (75,000) at $150 per car	10.5
Railroad Sub-Total	28.5
■ Total Annual Revenue	$ 39.1

[1] Assumes no increse in traffic for conservative analysis purposes.

Exhibit 3 (Cont'd.)
Detroit-Windsor MDOT Conversion/Construction Concept
Third Party Ownership Perspective
Annual Cash Flow
(U.S. Millions of Dollars)

<u>Annual Project Expenses</u>	
■ Debt Service	
• Debt service principal and interest for $237 million direct construction costs at 8% for 30 years	$ 21.1
• Debt service principal and interest for access road costs of $30 million assuming private entity must repay over life of project at 8% for 30 years	2.7
Total Debt Service	23.8
■ Operations for Both Tunnels Based on Assumption of Maintenance and Toll Collection	2.0
■ Lease Payment to CN/CP Partnership for Foregone Cash Flow Per JCT Services Estimates (current 325,000 cars X $33/car less $1.0 M/year costs)	9.7
■ Assumes Property Tax Abated	-0-
■ Total Annual Cash Expenses	35.5
<u>Annual Net Pre-Tax Cash Flow</u>	$ 3.6
Oversize Railcar Price Level Required for Breakeven Operation Assuming Truck Rate of $13.60 and Tunnel Size Railcar Rate of $33.00	$115.0
Savings Compared to Ferry	$ 35.0

level, savings would therefore range between zero and $35. Additional double stack or other intermodal traffic could also result in increased savings per railcar.

Combined truck and rail revenue on the project would total $39.1 million per year if one assumes half the current truck traffic could be captured at current rates, and that current and diverted Detroit-Windsor rail and ferry traffic plus Port Huron oversize ferry traffic is captured. The annual cash outflow on such a project totals $35.5 million assuming it is necessary to make a lease payment of $9.7 million per year to CN/CP to compensate their loss of current tunnel operations cash flow.

Beztak-Dewin Conversion New Construction Concept

The Beztak-Dewin Partnership proposal was developed during 1990 in response to interest by the Detroit and Windsor port authorities. The Partnership was made up of Beztak and Dewin. Beztak (as mentioned previously) is the development firm of two prominent Detroit area developers - Mr. Jerry Luptak and Mr. Carl Beznos. Members of the Beztak management team were involved in the 1984 efforts of the Stroh family to buy the Detroit-Windsor railroad tunnel and are therefore very familiar with the issues.

Dewin is a Partnership of the Greater Detroit/Wayne County Port Authority and the Windsor Harbor Commission. The Partnership exists primarily on paper and has not had any substantial operating activity. For purposes of the tunnel proposal, Dewin would be 51% owned by the Detroit Port Authority and 49% owned by the Windsor Harbor Commission. The port authorities are thought to be interested because of the potential income stream that could be used in port development, and because of the benefits that increased intermodal activity would have for the city and port operations.

The Partnership between Beztak and Dewin is not currently in effect because of several possible legal problems. However, should the legal issues be resolved, the intent is for Dewin to own the new tunnel assets and to hold the lease on the converted railroad tunnel.

The Beztak-Dewin proposal is virtually identical to the MDOT concept but is based on the assumption that auto traffic could also use the tunnel. The plan envisions a total cost of $265 million for a new double stack, twin tube tunnel and conversion of the existing railroad tunnel for auto/truck use. The Partnership would invest $25 million in equity provided by Beztak and would finance up to $250 million in debt from overseas sources. The Partnership would seek state and provincial financing and construction of the access roads, and would also seek federal funding to the extent possible.

The Detroit Port Authority would issue tax exempt bonds and would make a payment in lieu of property taxes. This assumes that Port

Authority ownership would exempt the project from property taxes and this may or may not be the case. Michigan law does provide a tax credit for a railroad's maintenance and track capital expenditures each year but the railroad would have to own the tunnel in order to use this credit to offset major property taxes on a new tunnel.

CN and CP would be asked to provide construction management assistance, and would be required to commit to use of the tunnels to the maximum extent possible. They would also be required to sell right-of-way necessary for roadbed construction at the converted rail tunnel.

The financials for the Beztak-Dewin Partnership are in some ways more fully developed than the MDOT concept, and in other ways not as fully developed. The original Beztak financials are displayed in Exhibit 4. On the revenue side the proposal assumes capture of 50% of the existing Ambassador Bridge and Detroit-Windsor Tunnel Corporation traffic. This traffic would amount to 875,000 trucks and 5,525,000 autos per year. Based on competitive tolls this traffic is estimated to raise $22.5 million. The proposal also assumes capture of regular sized railcars at Detroit-Windsor, or 325,000 cars; plus 40,000 Detroit-Windsor oversize cars; plus 75,000 oversize cars from Port Huron-Sarnia. Based on tolls of $33 per regular size car and $150 per oversize car (similar to current tunnel and ferry respective costs), the rail traffic would generate $28.0 million per year. It should be

Exhibit 4
Detroit-Windsor Beztak Conversion/Construction Concept
Third Party Ownership Perspective
Project Economics as Proposed by Beztak
(U.S. Millions of Dollars)

<u>Annual Project Revenue</u>

■ Detroit River Tunnel Converted to Highway Vehicles	
• 50% of existing, or 1,040,000 trucks at $13.60 each	$ 14.2
• 50% of existing, or 5,525,000 cars at $1.50 each	8.3
Subtotal Highway	22.4
■ New Railroad Tunnel	
• All existing regular sized railcars 325,000 at $33 each	10.7
• Detroit-Windsor oversized railcars 40,000 at $150 each	6.0
• Port Huron-Sarnia oversized railcars 75,000 at $150 each	11.3
Subtotal Rail	28.0
Total Revenue	50.5

Exhibit 4 (Cont'd.)
Detroit-Windsor Beztak Conversion/Construction Concept
Third Party Ownership Perspective
Project Economics as Proposed by Beztak
(U.S. Millions of Dollars)

Annual Project Expenses

■ Debt Service: $240 Million at 9% for 30 Years (Twin Tubes)	$ 23.4
■ Depreciation and Amoritization: $250 Million, 50 Years; $15 Million, 10 years	6.5
■ Operations, Both Tunnels	1.0
■ Lease Payment to CN/CP Partnership for Detroit River Tunnel (what they paid) and Low per JCT Services	3.6
Total Expenses	34.5
Net Income (pre-tax)	16.0

noted that the proposal assumes the 75,000 oversize cars at Port Huron-Sarnia would be routed to Detroit-Windsor by CN and CSX, and while likely, this cannot be assured. In total revenue is estimated at $50.5 million per year.

On the cost side the Partnership has less extensive data in their proposal. They simply state that the total cost including project management would be $265 million. There is no breakdown between conversion costs and new tunnel costs, however, the engineering firm that conducted feasibility and cost estimates for the Partnership, BEI Engineering in Detroit, estimated that the tunnel conversion costs would be in the vicinity of $30 million. BEI's costs do not contemplate the ventilation work assumed in Jenny Engineering's work for MDOT. Based on Jenny's concept costing, and the fact that their estimate included some $12.9 million in access, plaza, and structure costs not in the BEI proposal, it would still appear that the BEI estimates are approximately $22 million lower than the full $65 million cost envisioned by Jenny.

The $235 million which would be left in the Partnership costs for construction of the new double stack tunnel itself are $63 million more than estimated by Jenny. However, the Jenny estimate of $172 million is for a single tube, while BEI confirmed their estimates were for a twin tube tunnel. While there would be substantial economies to be gained in construction of a second tube Jenny has indicated that they believe a second tube might cost and additional 50% over a single tube. If correct, a two tube tunnel should cost $258 million, some $23 million more than proposed by the Partnership for total costs.

All told, the Partnership's cost construction estimates appear to be about $45 million below the Jenny estimates when compared on an equal footing, and given a twin tube tunnel project. In addition, the Beztak proposal assumes public financing of the $30 million in access costs assumed here. Given the nature of the project these construction cost differences may not be that great and it is difficult to tell which is closer to correct. However, Jenny provided considerable costing detail in their report to MDOT, and given the absence of any detail in the Beztak proposal it is assumed here that the Jenny costs are more accurate.

Based on the above costs, the Partnership has estimated annual debt service expenses of $23.4 million based on total debt of $265 million, 30 year financing, and a 9% interest rate. They also estimate annual depreciation and amortization costs of $6.5 million based on $250 million in construction costs and $15 million in management costs spread over 50 and 10 years respectively. Operating costs are assumed at $1 million per year. A lease payment to the CP/CN Partnership designed to recoup their current cash flow from ownership, is estimated at $3.6 million despite CP/CN initial demands for a $10 million per year payment.

The total annual cost is therefore estimated at $34.5 million. Based on the Partnership financials a $8.5 million profit per year would result. Again, the original Beztak financials are summarized in Exhibit 4.

Analysis of the Partnership financials raises a number of questions. First, is it realistic that the project would capture half of all auto and truck traffic? This would seem to be highly unlikely. There is no advantage for most autos and trucks to use the crossing, and there may be a disadvantage to using the crossing if traffic must detour to the Ambassador Bridge to use the Customs and INS plazas on each side of the river. Furthermore, Jenny Engineering has stated that it is extremely unlikely that auto traffic would be allowed given the narrow single lane configuration. Without autos the project would suffer a loss of $8.3 million in revenue.

Revised financials have been prepared on a pre-tax cash flow basis and are presented in Exhibit 5. The revised revenue equals $39.1 million and the revised cash outlay totals $35.5 million. At current tolls and traffic levels the project would have positive pre-tax cash flow of $3.6 million. A toll as low as $115 could be charged before the breakeven point would be reached. Savings could range to as high as $35 per oversize railcar assuming current toll levies on regular size railcars and trucks. If one were to assume a double tube was necessary, the

Exhibit 5
Detroit-Windsor Beztak Conversion/Construction Concept
Third Party Ownership Perspective
Revised Annual Cash Flow - JCT Services Revisions
(U.S. Millions of Dollars)

Annual Project Revenue	Single Tube	Twin Tube
■ Detroit River Tunnel Converted to Highway Vehicles		
• 50% of existing 1990 or 770,000 trucks at $13.60	$ 10.6	$ 10.6
• Auto	-0-	-0-
Subtotal Highway	10.6	10.6
■ New Railroad Tunnel		
• Existing regular sized cars at Detroit (325,000) at $33 per car or the current tunnel cost[1]	10.7	10.7
• Detroit-Windsor oversized cars assuming forecast 91-92 volume (23,400) plus recapture of a portion of Buffalo traffic (15,000) plus Chrysler 20'2" tri-levels (10,000) for total of 48,400 cars at $150 per car or the current ferry cost	7.3	7.3
• Port Huron-Sarnia oversized cars (75,000) at $150 per car or the current ferry cost	10.5	10.5
Subtotal Rail	28.5	28.5
Annual Project Revenue	39.1	39.1

[1] Assumes no increase in traffic for conservative revenue analysis.

Exhibit 5 (Cont'd.)
Detroit-Windsor Beztak Conversion/Construction Concept
Third Party Ownership Perspective
Revised Annual Cash Flow - JCT Services Revisions
(U.S. Millions of Dollars)

Annual Project Cash Expenses	Single Tube	Twin Tube
■ Debt Service		
• Debt service principal and interst for construction and conversion costs at 8% for 30 years		
- Single tube at $237 million per Jenny ($65 million conversion and $172 million new tube)	$ 121.1	--
- Double tube at $323 million per estimate ($65 million conversion and $258 million new tube)	--	$ 28.7
• Debt service principal and interest for access road costs of $30 million assuming private entity must repay over life of project at 8% for 30 years	2.7	2.7
Total Debt Service	23.8	31.4
■ Operations for Both Tunnels Per Toll and Maintenance Estimates	2.0	2.0
■ Lease Payment to CN/CP Partnership for Foregone Cash Flow Per JCT Services (325,000 cars X $33/car - $1.0 million)	9.7	9.7
■ Assumes Property Tax Abated	-0-	-0-
Total Annual Cash Expense	35.5	43.1
Annual Net Pre-Tax Cash Flow	3.6	(4.0)
Oversize Railcar Price Levels Required for Breakeven Operation Assuming Truck Rate of $13.60 and Regular Size Railcar Rate of $33.00	115.0	177.0
Savings Per Car Compared to Ferry	$ 35.0	$ (27.0)

annual cash outlay would equal $43.1 million, and a negative cash outlay of ($4.0 million) would result.

Cash outlays are based on an estimate of $237 million for single tube tunnel construction/tunnel conversion, and $30 million for access. At this level the total annual debt service at 8% over 30 years equals $23.8 million. The debt service covers principal and interest, and in order to place the financials on a pre-tax cash flow basis depreciation and amortization are not considered. While Beztak assumes a lease payment to CN/CP for maintenance of their lost tunnel cash flow would equal just $3.6 million, JCT Services believes this charge should approximate $9.7 million to fully cover the Partnership's lost cash flow.

Both the single and double tube scenarios assume all rail traffic materializes, that the rates are acceptable, and that half of the truck traffic can be captured at current toll levels. This latter assumption is somewhat questionable given the likely competitive response from the Ambassador Bridge. However, on the positive side, it is likely that additional volume would actually be attracted.

In conclusion, the Beztak proposal is similar to the MDOT concept. However, the original assumptions on revenue are suspect, principally because of the auto traffic assumptions. The twin tube construction costs also seem to be understated by $45 million given the more detailed estimates prepared by Jenny

Engineering for MDOT. In addition, the lease payment does not seem to be high enough in the original financials presented by Beztak.

New Double Stack Tunnel With and Without Truck Access

A third option at Detroit involves construction of a single tube rail only tunnel. Such a tunnel would avoid the costs associated with conversion of the existing tunnel, and the substantial road access costs. Of course, the disadvantage is that there is no cross-subsidization from truck, and no benefit for the highway mode.

A variation of the new construction only approach would involve construction of a twin tube tunnel capable of providing both rail and truck service through the same tubes. Discussions with some railroad executives have suggested that a single tube is not feasible anyway given the number of trains and potential growth in traffic. In such a tunnel the rail tracks would be built into the roadbed.

While the technical feasibility of this latter approach has not been explored, there are currently locations where trains run over such track. Trucks would be allowed to use the tunnels whenever trains were not present and an electronic signing system would be used to divert trucks to the nearby Ambassador Bridge as necessary. The problem with this approach is that construction costs are higher, and the road access costs are again a factor. However, to the extent that a twin tube is necessary for rail anyway, the extra construction costs must be borne by rail.

If a new double tube is necessary for rail, the truck mode must only absorb the access costs. Such costs, at $30 million, would be minimal compared to likely new bridge construction costs in the vicinity of $300-400 million. The other benefit of this approach over conversion of the existing tube is that an all new facility is obtained, and less riverfront is required for plaza and right-of-way. The new tubes would be of sufficient width for truck use and would not require regulatory waivers. Such an option should also assume use of the Ambassador Bridge customs plaza in order to reduce plaza costs, and whatever security costs are necessary to convince the customs services of the system's integrity. The intermodal nature of the project also might qualify the project for special federal funding under the new highway bill.

However, it is unlikely that the rail/tuck interface could be worked out. Railroads will not be receptive to the idea given rail-truck competition, operational problems, and liability problems. The frequency of train passage would also be likely to preclude any significant use by trucks. Finally, the road access costs would be an even greater problem than in the original MDOT concept.

The financials for each of these variations are shown in Exhibit 6. The financials indicate that a single rail only tube would have a positive pre-tax cash flow of $2.5 million and would allow for an oversize railcar rate of as low as $124 while still breaking even. Savings could therefore be as high as $26 per oversize car. A double rail only tube would, however, have a negative pre-tax cash flow of ($5.1 million). A double tube rail and truck multi-use facility would have a positive pre-tax cash flow of $1.8 million because of the incremental truck revenue. At breakeven operations such a tunnel would save $20 per oversize railcar.

PORT HURON-SARNIA DOUBLE STACK TUNNEL AND CURRENT TUNNEL TRUCK CONVERSION

There are two basic options at Port Huron-Sarnia. The more likely one, and the only one being formally evaluated by the railroads, involves a new double stack tunnel. There is, however, the possibility of obtaining rail related truck capacity at this crossing as well. Unfortunately, the same problems that make this option difficult at Detroit-Windsor make it unlikely at Port Huron-Sarnia as well. The financials for each of these options are explored in Exhibit 7. The two major options are explored in the next two sub-parts.

Exhibit 6
Detroit-Windsor New Double Stack Tunnel With And Without Truck Access
Third Party Ownership Perspective
Annual Cash Flow
(U.S. Millions of Dollars)

Annual Project Revenue	Single Tube Rail	Double Tube Rail	Double Tube Rail & Truck
■ Highway Traffic - 50% of existing 1990 or 770,000 trucks at $13.60 each	-0-	-0-	$ 10.6
■ Rail Traffic			
• Existing regular sized railcars at Detroit (325,000) at $33 per car or the current tunnel cost[1]	10.7	10.7	10.7
• Detroit-Windsor oversized cars assuming forecast 91-92 volume (23,400) plus recapture of a portion of Buffalo traffic (15,000) plus Chrysler 20'2" tri-levels (10,000) for total of 48,400 cars at $150 per car or the current ferry cost	7.3	7.3	7.3
• Port Huron-Sarnia oversized cars (75,000) at $150 per car or the current ferry cost	10.5	10.5	10.5
Subtotal Rail	28.5	28.5	28.5
Annual Project Revenue	$ 28.5	$ 28.5	$ 39.1

[1] Assumes no increase in traffic for conservative revenue analysis.

Exhibit 6 (Cont'd.)
Detroit-Windsor New Double Stack Tunnel With And Without Truck Access
Third Party Ownership Perspective
Annual Cash Flow
(U.S. Millions of Dollars)

Annual Project Cash Expenses	Single Tube Rail	Double Tube Rail	Double Tube Rail & Truck
■ Debt Service			
• Debt service principal and interest for construction costs at 8% for 30 years			
– Single tube at $172 million per Jenny	$ 15.3	--	--
– Double tube at $258 million per estimate by JCT Services	--	$ 22.9	$ 22.9
• Debt service principal and interest for access road costs of $30 million assuming private entity must repay over life of project at 8% for 30 years	--	--	2.7
Total Debt Service	15.3	22.9	25.6
■ Operations for Tunnel (Estimate)	1.0	1.0	2.0
■ Lease Payment to CP/CN Partnership for Foregone Cash Flow Per JCT Services (325,000 cars X $33/car - $1.0 million)	9.7	9.7	9.7
■ Assumes Property Tax Abated	-0-	-0-	-0-
Total Annual Cash Expense	26.0	33.6	37.3
Annual Net Pre-Tax Cash Flow	2.5	(5.1)	1.8
Oversize Railcar Price Levels Required for Breakeven Operation Assuming Truck Rate of $13.60 and Regular Size Railcar Rate of $33.00	124.0	186.0	130.0
Savings Per Car Compared to Ferry	26.0	36.0	20.0

Railroad Only Single Tube Double Stack Tunnel

Unlike the situation at Detroit-Windsor, a major railroad is seriously considering construction of a new, fully capable double stack single tube tunnel at Port Huron-Sarnia and has made a tentative decision to proceed. Canadian National railroad has issued a million dollar plus contract for an engineering feasibility study of such a tunnel at Port Huron. Canadian National and their Grand Trunk Western subsidiary are primarily interested in a rail tunnel. Such a bored tunnel at Port Huron-Sarnia may be easier to construct than at Detroit-Windsor. Construction costs have been estimated at $155 million for a single tube.

The CN/GTW interest relates to the evolving North American economic system and their desire to be a major participant in the expected increase in north-south transportation activity. Grand Trunk has indicated that they believe Michigan must be positioned for increased European trade, and for increased U.S.-Canadian and U.S.-Canadian-Mexican trade. It would seem that a double stack facility, if cost effective, could help them compete for European CAST container traffic. Such a facility would also help there relationship with BN. All of the above thoughts are consistent with the earlier comments in this report about global trade and transportation developments. Finally, they believe the Port Huron route is the best crossing location because it is the shortest route between Chicago and Toronto, and the least congested one.

Canadian National and Grand Trunk Western also seem to believe that domestic containerization will be increasingly important, and that the auto industry will need efficient cross-border rail transportation services between Ontario and Michigan. They have suggested that double stack services may be feasible and necessary for Ontario-Michigan automotive movements.

The other driving force for CN/GTW, and perhaps the most important one, is concern over the possible diversion of oversize railroad cars to Buffalo, or Detroit-Windsor, if that crossing is able to obtain a deepened tunnel. The ferry system currently in use at Port Huron-Sarnia is an increasing problem for rapid, reliable delivery cycles, and is quite costly. More importantly, the federal harbor maintenance fee is now costing CN/GTW customers as much as $300 a railroad car and this is already leading to traffic diversions to Buffalo.

In order to allow for passage of auto tri-levels and high cube boxcars at Port Huron-Sarnia a new tunnel is in effect needed. This is because unlike at Detroit, a tri-level capable tunnel cannot be obtained by simply removing concrete from the floor. At Port Huron-Sarnia the current tunnel would have to be rebored at a cost not dissimilar from that required for full double stack services. As such, a partial deepening is not thought to be a realistic option.

Given the fact that a partial deepening is not thought to be viable, all of the railroad car category benefits of deepening accrue to a new tunnel and it may be much easier to justify a full double stack tunnel as a result. This is quite different than at Detroit-Windsor where the benefits associated with auto tri-levels and high cubes can be obtained with a rather inexpensive partial deepening of the current tunnel. At Detroit, only the benefits of double stack service itself, and of Chrysler 20'2" tri-levels, can be attributed to the double stack tunnel. This makes it very difficult to justify the Detroit double stack facility.

There are a number of issues that must be considered in terms of whether a Port Huron-Sarnia or Detroit-Windsor tunnel is more beneficial for the State of Michigan's business climate. While these will be explored more fully in the section on advantages and disadvantages of each option later in this report, it is worth summarizing these here. First, is the question of whether a crossing using Grand Trunk benefits the state more than a Detroit-Windsor one because of its mid-state track route and commitment to Michigan. A second issue relates to whether a Port Huron crossing can effectively serve the primary demand in the Detroit area. The concern is that service times to Detroit area shippers would be lengthened. However, Grand Trunk has pointed out that a Detroit to Toronto route through Sarnia is actually three miles shorter than a route through Windsor. A third issue relates to the CN monopoly position at Port Huron-Sarnia compared to the multiple railroad access which exists at Detroit-Windsor. The main concern is that Canadian Pacific does not currently have access to Port Huron-Sarnia and is not likely to be able to negotiate cost effective access.

The financials displayed in Exhibit 7 for a single tube rail tunnel assume revenue of $17.2 million. Annual cash outlays for a $155 million tunnel are $14.8 million including operations. Such a tunnel would have a pre-tax net cash flow of $2.4 million. Oversize tolls could go as low as $130 while maintaining breakeven operations. The above savings levels do not account for potential incremental double stack volume which would reduce the costs per car further. At breakeven, savings over current ferry costs would equal $20 per car.

The Port Huron financials assume CN ownership of the tunnel and hence are based on incremental revenue and costs only. Incremental revenue is assumed to be based on oversize Port Huron-Sarnia railcars, and current and diverted Detroit-Windsor oversize cars. A portion of potential Chrysler tri-level traffic is also assumed to be captured. It should be noted, however, that the Detroit area traffic would not develop if a deepened tunnel is built at Detroit-Windsor. On the other hand, the Port Huron analysis should also take into account double stack

Exhibit 7
Port Huron-Sarnia Double Stack Tunnel
From a CN Ownership Perspective
Annual Cash Flow
(U.S. Millions of Dollars)

Annual Project Revenue	New Rail Only Single Tube	New Rail Only Single Tube and Conversion of Existing Tube To Truck Use	Rail Multi-Use Tube and Conversion of Existing Tube to Truck	New Twin Tube Multi-Use for Rail/Truck
■ Highway Traffic				
• Conversion of existing tube and 1/4 of 1990 volume or 167,520 units at $10.00 each	-0-	$ 1.7	--	--
• Single multi-use rail/truck tube and conversion of current tube and 1/2 of 1990 volume or 335,014 units at $10.00 each	-0-	-0-	$ 3.4	--
• New twin tube multi-purpose rail/truck and 1/2 of 1990 volume or 335,014 units at $10.00 each	-0-	-0-	-0-	$ 3.4
Subtotal Highway	-0-	$ 1.7	$ 3.4	$ 3.4
■ Rail Traffic[1]				
• Existing Port Huron-Sarnia oversize cars (75,000) at $150 per car or current ferry cost at Detroit	$ 11.3	11.3	11.3	11.3
• Detroit-Windsor oversized cars including 91-92 fiscal year forecast (23,400) plus recapture of a portion of Buffalo diverted traffic (10,000) plus a portion of Chrysler's 20'2" tri-level traffic potential (6,000) for total of 39,400 cars at $150 per car or the Detroit Ferry cost	5.9	5.9	5.9	5.9
Subtotal Rail	$ 17.2	$ 17.2	$ 17.2	$ 17.2
Annual Project Revenue	$ 17.2	$ 18.9	$ 20.6	$ 20.6

[1] Assumes no traffic growth in total (does not include potential double stack traffic).

Exhibit 7 (Cont'd.)
Port Huron-Sarnia Double Stack Tunnel
From a CN Ownership Perspective
Annual Cash Flow
(U.S. Millions of Dollars)

Annual Project Cash Expense	New Rail Only Single Tube	New Rail Only Single Tube and Conversion of Existing Tube To Truck Use	Rail Multi-Use Tube and Conversion of Existing Tube to Truck	New Twin Tube Multi-Use for Rail/Truck
■ Debt Service				
• Debt service principal and interest for construction costs at 8% for 30 years				
– New rail only single tube at assumed $155 million	$ 13.8	--	--	--
– New rail only single tube at construction cost of $155 million and conversion of existing tube to truck at cost of $30 million or half the two tube conversion costs at Detroit for a total of $185 million	--	$ 16.3	--	--
– New multi-use tube at assumed construction cost of $155 million plus $10 million for multi-use features, or $165 million total tube, plus $30 million for conversion of existing tube to truck for a total project cost of $195 million	--	--	$ 17.2	--
– New twin tube multi-use tunnel at single tube cost of $165 million times two, or $330 million total cost	--	--	--	$ 29.5
• Debt service principal and interest for road access at 8% for 30 years for $30 million	--	2.7	2.7	2.7
Total Debt Service	$ 13.8	$ 19.0	$ 19.9	$ 32.2

Exhibit 7 (Cont'd.)
Port Huron-Sarnia Double Stack Tunnel
From a CN Ownership Perspective
Annual Cash Flow
(U.S. Millions of Dollars)

Annual Project Cash Expense (Cont'd.)	New Rail Only Single Tube	New Rail Only Single Tube and Conversion of Existing Tube To Truck Use	Rail Multi-Use Tube and Conversion of Existing Tube to Truck	New Twin Tube Multi-Use for Rail/Truck
■ Operations for Tunnel	$ 1.0	$ 2.0	$ 2.0	$ 2.0
■ Assumes Property Tax Abated	-0-	-0-	-0-	-0-
Total Annual Cash Expense	$ 14.8	$ 21.0	$ 21.9	$ 34.2
Annual Net Pre-Tax Cash Flow	$ 2.4	$(2.1)	$(1.3)	$(13.6)
Oversize Railcar Price Levels Required for Breakeven Assuming No Incremental Double Stack Volume	$130.0	$169.0	$162.0	$ 269.0
Savings Per Car Compared to Ferry	$ 20.0	$(19.0)	$(12.0)	$(119.0)

incremental traffic and per car savings, as well as ferry operations savings to reflect the full benefits. Such an analysis is beyond the scope of this project.

Rail/Truck Tunnel Options

While Canadian National and Grand Trunk are primarily interested in a rail tunnel, Grand Trunk has raised the possibility of converting the current tunnel to truck use in a concept briefing book prepared for interested parties. There are several options which could be explored for providing additional rail related truck capacity at this crossing. However, it should be noted that the rail industry is generally not going to support improvements which benefit their trucking competitors.
One approach given the lower volume of truck traffic compared to Detroit, and the one noted by Grand Trunk, would be to use the current tunnel for one way truck traffic in alternating directions for several minutes at a time. The problem with this approach is the limited benefit of an alternating single lane facility given the likely costs of access roads. However, considerable money could be spent if it would delay the need for a new $200 million span at the Blue Water.

A more complicated approach, which the railroads would have serious concerns about, would be the approach suggested at Detroit for dual rail-truck operation. Such an approach could possibly make use of the existing tube for one direction of truck traffic and the new tube for the other direction of truck traffic. As in the Detroit case, electronic signage would be used to advise truckers of the availability of the rail tube for truck operation. If for some reason, a twin tube was necessary at Port Huron, whether for rail or truck reasons, such a facility could perhaps be considered. This new twin tube option might be necessary for truck operations because of problems in bringing road access to the current tunnel.

The need for truck capacity may be greater at Port Huron-Sarnia then at Detroit-Windsor given the effective two-lane nature of the Blue Water Bridge, and given the current roadbed capacity margin, and the rapid growth in truck traffic over the last few years. None-the-less, any dual rail-truck concept would present a number of operational, liability, and simple rail traffic volume problems that would probably preclude this as a realistic option.

The estimated pro forma financials in Exhibit 7 indicate that the two truck options involving just a single new tube have negative pre-tax cash flows. A new single rail tube with conversion of the existing tube to truck one way alternating direction use would have a negative cash flow of $2.1 million per year. A new multi-use single rail/truck tube along with conversion of the existing tube to truck use would have a negative pre-tax cash flow of $1.3 million. A new multi-use rail and truck double tube would have a negative pre-tax cash flow of $16.6 million per year. These three approaches are therefore not likely to be pursued.

PROJECT COMBINATIONS

It is quite possible that several of the project options will be pursued in unison or in succession. Two major options seem most feasible. One option is that the Detroit deepening takes place and that the Port Huron double stack project also proceeds. The other option is that the Detroit deepening takes place and is eventually followed by a new double stack tunnel at Detroit. This latter option would be much less feasible once a Port Huron project is started.

The financials for a Detroit deepening and new Port Huron double stack tunnel are not as favorable for Port Huron because of the loss of oversize traffic from Detroit. The financials in Exhibit 8 indicate that this combination of projects would reduce the Port Huron only net pre-tax cash flow to a negative $2.6 million. Given this scenario a Port Huron double stack tunnel would have to count on likely additional rail double stack volume to be viable.

Exhibit 8
Combined Detroit Partial Rail Deepening and Port Huron Rail Only Double Stack
From a Railroad Ownership Perspective
Annual Cash Flow
(U.S. Millions of Dollars)

Annual Incremental Project Revenue	Detroit-Windsor Partial Deepening	Port Huron Rail DS Tunnel
■ Detroit-Windsor		
• Overside railcar volume of 23,400 current 91/92 forecast units plus recapture of 15,000 units diverted to Buffalo equals total railcars of 38,400 at $150/car	$ 5.8	--
■ Port Huron-Sarnia		
• Existing Port Huron-Sarnia oversize cars of 75,000 at $150 per car or current Detroit Ferry cost	--	$ 11.3
• Chrysler tri-level 20'2" traffic portion from Bramale of 6000 units at $150 per car	--	.9
Subtotal Port Huron-Sarnia	--	12.2
Total Annual Revenue	$ 5.8	$ 12.2

Exhibit 8 (Cont'd.)
Combined Detroit Partial Rail Deepening and Port Huron Rail Only Double Stack
From a Railroad Ownership Perspective
Annual Cash Flow
(U.S. Millions of Dollars)

Annual Project Cash Outlay	Detroit-Windsor Partial Deepening	Port Huron Rail DS Tunnel
■ Detroit-Windsor (see detail in Exhibit 2)	$ 3.1	--
■ Port Huron-Sarnia (see detail in Exhibit 7)	--	$ 14.8
Total Project Cash Outlay	3.1	14.8
Annual Net Pre-Tax Cash Flow	2.7	(2.6)
Breakeven Oversize Railcar Rate	81.0	183.0
Savings Per Car at Breakeven Rate Compared to Ferry	$ 69.0	($ 33.0)

INFRASTRUCTURE IMPROVEMENT
COST-BENEFITS ANALYSIS

This benefits analysis examines both public and private benefits for the rail and truck mode, and compares the net present value of the benefits level to the investment costs in a payback calculation. The net present value calculations assume a 5% inflation rate in the benefits, and an 8% discount rate. Where possible, the level of expected benefits has been quantified, however, in many cases it is not possible to quantify the benefits. In other cases, it may be possible to quantify benefits, but not within the limited scope of this project.

The cost benefit payback analyses should be considered a preliminary effort to quantify the benefits and payback. As this project was designed to be an exploratory effort, the level of benefits represent rough estimates. Additional analysis should be conducted using the framework of benefits categories developed here, and using alternative dollar savings, before any final actions are taken.

The analysis is not related to any specific proposal but instead examines the generic benefits that would result from the two basic infrastructure options that this study was originally intended to address. These options relate first, to a partial deepening at Detroit-Windsor, and secondly, to any option which results in a double stack rail capability along with additional truck capacity. Both rail and truck benefits are reviewed, and the truck benefits are examined in light of current congestion and the possible need for additional capacity. The second option relating to double stack could be achieved with any of several specific proposals but most closely relates to the original MDOT concept which was to be the focal point of this study. The Port Huron approach could accomplish similar results if extended to include truck.

An incremental benefits approach is used for most of this analysis. First, the benefits related to partial deepening are identified and examined in terms of the likely costs. Following that review, the incremental benefits that would accrue to a double stack only tunnel, with a previous deepening, are considered in light of double stack only incremental costs that would have to be borne by the shipping public. While a partial deepening would allow for passage of 8'6" maritime double stack containers, it would not allow for passage of 9'6" domestic maritime containers. Because of a trend towards domestic double stack containers, the analysis assumes that both maritime and domestic double stack benefits will accrue to the double stack project only. No maritime double stack benefits are assigned to the partial deepening project.

Next, the benefits analysis also reviews the benefits vs. costs that would accrue to a double stack tunnel assuming a partial deepening does not occur. The benefits of obtaining additional truck capacity are then examined in light of the incremental costs for truck capacity.

The original MDOT new tunnel/converted tunnel concept is then analyzed, first assuming no partial deepening, and then assuming a partial deepening has taken place. Finally, two combination project approaches are evaluated. The first involves a Detroit partial deepening with a new Port Huron double stack tunnel, and the second assumes a Detroit partial deepening with a new Detroit double stack tunnel.

The analysis also makes an effort to discriminate between Michigan benefits and North America wide benefits. While several categories of benefits do accrue to Michigan, a number of the benefits related to double stack accrue to more distant locales, or only tangentially relate to Michigan. For instance, double stack trains from the Midwest to Montreal benefit other non-Michigan areas of the United States primarily, but also have some Michigan impact in that railroad track and yard fixed costs are absorbed.

Again, the level of Michigan benefits relative to North America wide benefits, should be considered a preliminary analysis. Because of the exploratory nature of this research, more emphasis was attached to identifying the potential Michigan benefit categories. The Michigan savings are subject to a wide range of interpretation and additional work needs to be done in this area.

Because the Port Huron double stack tunnel can be built more cheaply, and because the incremental volume at Port Huron includes tri-levels, the cost per incremental car to absorb construction costs is lower at Port Huron. As such, the savings which would result from double stack on various routes are analyzed in terms of both a Detroit and Port Huron option.

SUMMARY OF COST BENEFITS ANALYSIS BY PROJECT

Exhibit 9 presents a summary of the cost benefits net present value payback analysis for each type of project. It should be noted that the Exhibit includes only quantifiable benefits. Other key benefits may exist but were not quantifiable. The first page summarizes the benefit analysis for each project assuming North America-wide benefits. The second page shows the benefits analysis for the same projects, but assumes only those benefits that accrue to Michigan are to be included in the savings. The net present value payback figure shown in the last column assumes that annual savings are inflated 5% per year, and that savings are discounted back at a rate of 8%. The payback represents the number of years required for the discounted annual benefits to equal the project construction cost.

The Detroit partial deepening project has the best payback of any project considered, and the payback is calculated in Exhibit 10. When just current Detroit traffic is considered, and North

Exhibit 9
Summary of Cost Benefits Payback Analysis[1]
(U.S. Millions of Dollars)

Project Type \ Item North America-Wide Benefits	Annual Benefit	Project Costs	NPV Payback Period	Rank
Detroit Partial Deepening (Exhibit 10)				
Partial Deepening Detroit Volume	9.2	35.0	4.5	2
Partial Deepening Detroit and Port Huron Volume	19.3	35.0	2.0	1
Double Stack Tunnel With Previous Detroit Partial Deepening (Exhibit 11)				
Detroit-Windsor	21.5	172.0	9.8	11
Port Huron-Sarnia	25.1	155.0	7.3	7
Double Stack Tunnel With No Previous Detroit Deepening (Exhibit 13)				
Detroit-Windsor	40.8	172.0	4.8	4
Port Huron-Sarnia	39.4	155.0	4.5	3
Tunnel Conversion Only (Exhibit 14)				
Zero Benefit Before 2005	-0-	95.0	NA	16
"What-if" $3.9 Million Truck Capacity Benefit	3.9	95.0	46.5	15
"What-if" $7.8 Million Truck Capacity Benefit	7.8	95.0	16.2	13
MDOT Concept for Detroit-Windsor (With No Previous Deepening) (Exhibit 16)				
Double Stack With No Tunnel Conversion Benefit to 2005	40.8	267.0	7.7	8
Double Stack With $7.8 Million Truck Capacity Benefit	48.6	267.0	6.5	5

[1] All payback periods are based on net present value and assume benefits are inflated 5% per year and discounted back at an 8% rate.

Exhibit 9 (Cont'd.)
Summary of Cost Benefits Payback Analysis[1]
(U.S. Millions of Dollars)

Project Type \ Item North America-Wide Benefits (Cont'd.)	Annual Benefit	Project Costs	NPV Payback Period	Rank
MDOT Concept for Detroit-Windsor (With Previous Deepening) (Exhibit 17)				
Double Stack With No Tunnel Conversion Benefit to 2005	21.5	267.0	16.5	14
Double Stack With $7.8 Million Truck Capacity Benefit	29.3	267.0	11.3	12
Combination Projects (Exhibit 18)				
Detroit-Windsor Partial Deepening and Port Huron-Sarnia Double Stack	34.3	190.0	6.8	6
Detroit Windsor Partial Deepening and Detroit-Windsor Double Stack	30.7	207.0	8.0	9
Detroit-Windsor Partial Deepening and Double Stack and Converted Tunnel	38.5	302.0	9.5	10

[1] All payback periods are based on net present value and assume benefits are inflated 5% per year and discounted back at an 8% rate.

Exhibit 9 (Cont'd.)
Summary of Cost Benefits Payback Analysis[1]
(U.S. Millions of Dollars)

Project Type \ Item Michigan-Wide Benefits	Annual Benefit	Project Costs	NPV Payback Period	Rank
Detroit Partial Deepening (Exhibit 10)				
Partial Deepening Detroit Volume	3.7	35.0	11.8	2
Partial Deepening Detroit and Port Huron Volume	7.8	35.0	5.2	1
Double Stack Tunnel With Previous Detroit Partial Deepening (Exhibit 11)				
Detroit-Windsor	6.2	172.0	80.0	14
Port Huron-Sarnia	7.7	155.0	33.0	11
Double Stack Tunnel With No Previous Detroit Deepening (Exhibit 13)				
Detroit-Windsor	14.0	172.0	16.4	5
Port Huron-Sarnia	13.5	155.0	15.0	3
Tunnel Conversion Only (Exhibit 14)				
Zero Benefit Before 2005	-0-	95.0	NA	16
"What-if" $3.9 Million Truck Capacity Benefit	3.9	95.0	46.5	13
"What-if" $7.8 Million Truck Capacity Benefit	7.8	95.0	16.2	4
MDOT Concept for Detroit-Windsor (With No Previous Deepening) (Exhibit 16)				
Double Stack With No Tunnel Conversion Benefit to 2005	14.0	267.0	30.5	10
Double Stack With $7.8 Million Truck Capacity Benefit	21.8	267.0	16.5	6

[1] All payback periods are based on net present value and assume benefits are inflated 5% per year and discounted back at an 8% rate.

Exhibit 9 (Cont'd.)
Summary of Cost Benefits Payback Analysis[1]
(U.S. Millions of Dollars)

Project Type \ Item Michigan-Wide Benefits (Cont'd.)	Annual Benefit	Project Costs	NPV Payback Period	Rank
MDOT Concept for Detroit-Windsor (With Previous Deepening) (Exhibit 17)				
Double Stack With No Tunnel Conversion Benefit to 2005	6.2	267.0	>100.0	15
Double Stack With $7.8 Million Truck Capacity Benefit	14.0	267.0	30.1	9
Combination Projects (Exhibit 18)				
Detroit-Windsor Partial Deepening and Port Huron-Sarnia Double Stack	11.0	190.0	26.0	8
Detroit Windsor Partial Deepening and Detroit-Windsor Double Stack	9.9	207.0	35.2	12
Detroit-Windsor Partial Deepening and Double Stack and Converted Tunnel	17.7	302.0	25.5	7

[1] All payback periods are based on net present value and assume benefits are inflated 5% per year and discounted back at an 8% rate.

America wide benefits are counted, the project has a payback of 4.5 years, and ranks number two among all options. When just Michigan benefits are counted the project has a payback of 11.8 years and ranks number two. An assumption that Port Huron oversize cars would move to Detroit if a deepening occurred there improves the payback substantially, and the project then ranks number one for both North America wide and Michigan only benefits. It should be noted that a partial deepening is not believed to be economically feasible at Port Huron. The Detroit partial deepening project also accomplishes the great bulk of the auto industry objectives and has the lowest total project cost.

There are two ways of looking at the double stack project options at Detroit and Port Huron. In the first case the two locations are compared assuming the Detroit partial deepening has occurred. See Exhibit 11. This is the most likely option but penalizes the Detroit case severely because the benefits that accrue to partial deepening cannot be claimed by the double stack project. At Port Huron, where no partial deepening is thought to be economically feasible, all the benefits accrue to the double stack project. On this basis, the Port Huron project comes out looking substantially better than a Detroit double stack tunnel, with a North American payback of 7.3 years compared to a Detroit payback of 9.8 years. This Port Huron project ranks number seven, while the Detroit project ranks number eleven for North America wide benefits. The Port Huron advantage is in large part due to the far lower construction costs assumed, $155 million, compared to

$172 million at Detroit. If one examines Michigan only benefits the Detroit project requires 80.0 years to payback, and ranks fourteenth, while a Port Huron project requires 33.0 years and ranks eleventh.

Because it does not seem fair to compare the Detroit project to the Port Huron project when a partial deepening has already occurred at Detroit, a second comparison was made assuming no previous deepening at Detroit (See Exhibit 13). This allowed for a head to head comparison of the two projects. In this scenario all of the benefits of deepening, even if they really should be assigned to a partial deepening project, are assigned to the double stack project. In the North America wide case the payback is 4.8 years at Detroit (ranks fourth), and 4.5 years at Port Huron (ranks third), reflecting the lower construction costs. For Michigan benefits only, this project requires 16.4 years at Detroit (ranks fifth) and 15.0 at Port Huron (ranks third).

The tunnel conversion to truck project (see Exhibit 15) assumes all truck savings, to the extent that there would be any before 2005, accrue to Michigan. As such, the North America and the Michigan paybacks are identical. It should be noted that the conclusion of the report is that a conversion truck capacity benefit would not accrue until 2005 because the Ambassador Bridge has adequate roadbed capacity for truck until that point. However, if one wanted to assume benefits would occur sooner, a payback would occur. For instance, the payback is 46.5 years (ranks fifteenth) if one assumes on a "what-if" basis that benefits would occur immediately at a level of $7.8 million in crossing savings.

Finally, the original MDOT concept of a tunnel conversion/new double stack tunnel is reviewed from the North American wide, and the Michigan only perspective. The review is first conducted assuming no previous deepening (Exhibit 16), and then with an assumption of a previous Detroit deepening project (Exhibit 17).

With no previous deepening, the assumption originally made by MDOT, this project has a North American payback of 7.7 years (ranks eighth) if one assumes no immediate truck conversion benefit, and 6.5 years (ranks fifth) if a $7.8 million truck conversion benefit is taken into account. From a Michigan perspective, the payback is 30.5 years (tenth) and 16.5 years (sixth), respectively.

If one assumes a previous deepening, the more likely scenario, the MDOT concept, for North America wide benefits, has a payback of 16.5 years (ranks fourteenth), and a payback of 11.3 years (ranks twelfth) if one assumes a $7.8 million benefit for truck capacity. For Michigan only benefits this scenario results in a payback of over 100.0 years (ranks fifteenth) when no truck capacity benefits are assumed, and a payback of 30.1 years (ranks ninth) if a $7.8 million benefit for truck capacity is assumed.

The most likely combination of projects involves a Detroit-Windsor partial deepening followed by a new double stack tunnel at Port Huron, or at Detroit (Exhibit 18). In the latter Detroit case, the current tunnel could eventually be converted to truck use. The Detroit partial deepening, Port Huron double stack scenario has a North America payback of 6.8 years (ranks sixth), and a Michigan only payback of 26.0 years (ranks eighth). A Detroit only scenario, without the tunnel conversion, has a North America payback of 8.0 years (ranks ninth), and a Michigan only payback of 35.2 years (ranks twelfth). The Detroit scenario with an eventual tunnel conversion has a North America payback of 9.5 years (ranks tenth), and a Michigan only payback of 25.5 years (ranks seventh).

The remaining sections review each project in detail.

DETROIT-WINDSOR PARTIAL DEEPENING BENEFITS

A partial deepening of the existing tunnel offers a number of benefits for North American commerce, and would be especially helpful in improving auto industry competitiveness. However, while the project would benefit Michigan based companies, and would offer several direct and indirect benefits for Michigan, at least half of the direct benefits would accrue to Canadian auto assembly plants and more distant U.S. based suppliers shipping to Ontario. In the most parochial sense, direct benefits only accrue to the extent that Michigan produced goods are shipped through the deepened tunnel on their way to Canadian, U.S. Northeast, or European markets. However, in a broader sense, anything that improves the competitiveness of North American industry will in the long term benefit Michigan.

Given the Michigan origin-destination of many of the benefits categories, and given the fact that auto industry benefits indirectly accrue to Michigan, 40% of the quantified benefits will be assumed to accrue to Michigan. While this is an arbitrary figure it would seem to be reasonable.

The deepening of the current tunnel will allow auto tri-level, high cube, standard TOFC, and 8'6" maritime double stack equipment to utilize the tunnel. Currently, auto tri-levels and high cubes must use the ferry service or be diverted through Buffalo. In lieu of the TOFC service, truck traffic that might otherwise travel in the rail mode must now move over the highways. This project will not, however, allow for the passage of 20'2'" auto tri-levels that Chrysler requires for consideration of cross-border rail movements in lieu of current all truck transportation, or the passage of domestic 9'6" double stack cars. Nor would the deepening allow for higher high cube boxcars now being contemplated, or for the passage of frame cars with standard loading patterns.

The potential benefits that would result from a partial deepening include reduced operating cost, improved rail delivery cycle times, avoidance of the federal harbor maintenance fee, the freeing up of ferry/railyard land for alternative economic development purposes, and the potential for standard TOFC service to take truck traffic off the roads. These benefits, including any quantifiable estimates of savings, are related to project costs and summarized in Exhibit 10. A 5% inflation rate and an 8% discount rate have been applied to the benefits stream. The payback period is the time required for the discounted benefits to equal the project construction cost. It should be noted that no benefits are quantified for the maritime double stack capability provided by this option. All double stack benefits are shown accruing to the fully capable domestic double stack project.

The cost benefit analysis indicates that with just Detroit traffic the quantifiable North American benefits total $9.2 million per year. The Michigan related benefits are assumed to equal 40% of the total, or $3.7 million after rounding. Given the $35 million construction cost the project has a payback period of 4.5 years for all North American benefits, and 11.8 years for Michigan benefits. If all of the possible Port Huron oversize traffic were to shift to Detroit, and the ferry was to close at Port Huron, the annual North America-wide benefits would total $19.3 million, and the Michigan benefits would total $7.8 million. The payback for North America-wide benefits is then just 2.0 years, while the payback for Michigan benefits is 5.2 years.

Exhibit 10
Detroit-Windsor Partial Deepening
Cost Benefit Analysis
(U.S. Millions of Dollars)

Annual Benefits	North America-Wide Benefits Detroit Only Volume (Annual)	Michigan Benefits Detroit Only Volume[1] (Annual)	North America-Wide Benefits Detroit & Port Huron Volume (Annual)	Michigan Benefits Detroit & Port Huron Volume[1] (Annual)
■ Quantifiable				
• Decreased rail operating cost	$ 5.2	$ 2.1	$ 10.2	$ 4.1
• Improved service times	.3	.1	.9	.4
• Elimination of federal harbor maintenance fee	3.7	1.5	8.2	3.3
Quantifiable Subtotal	9.2	3.7	19.3	7.8
■ Non-quantifiable				
• Ferry land for development	Commercial Development	Commercial Development	Commercial Development	All Commercial Development
• TOFC reduction in highway traffic	20-40,000 Trucks/Year Initially with Potential for 200,000/Year	40% of North America-Wide Benefit	20-40,000 Trucks/Year Initially with Potential for 200,000/Year	40% of North America-Wide Benefit
Project Costs				
■ Deepening Construction Cost	35.0	35.0	35.0	35.0
NPV Payback				
■ Years for Payback Potential Negatives	4.5	11.8	2.0	5.2
Potential Negatives				
■ Loss of Ferry Jobs/Payroll	Several Million Dollars Payroll Loss	Several Million Dollars Payroll Loss	Doubling of Payroll Loss Compared to Detroit Only	Doubling of Payroll Loss Compared to Detroit Only

[1] Assumes Michigan benefits equal 40% of North America-wide benefits.

Discussions with auto industry logistics executives during the course of this study indicate that this project accomplishes the bulk of what these companies want done by the railroads. While all three U.S. auto companies are supportive of a double stack tunnel, none of them want to see a deepening project postponed in order to study the potential for a double stack tunnel. The deepening will significantly reduce railroad costs, and will therefore allow the railroads to charge lower rates to auto companies. The project will also eliminate the need for auto companies and others to pay the federal harbor maintenance fee. While this fee may be eliminated administratively or legislatively, the tunnel project would make the issue moot.

The following parts describe the specific benefits which would accrue from a partial deepening.

Decreased Rail Operating Cost

Interviews with the management of Norfolk Southern's Detroit ferry operations confirm that deepening of the current tunnel would result in elimination of the ferry service. Elimination of the ferry service would mean an end to all expenses related to the operation of the ferries themselves, and elimination of expenses related to the boatyard and adjoining railyard. At the same time there should not be any significant increases in expenses relating to use of the current tunnel.

While the management could not provide detailed cost figures for the ferry operation, they have indicated that the ferry costs are approximately $150-160. By multiplying the 1990 volume of 34,600 railcars times $150 per railcar an estimate of total cost equal to $5.2 million per year is obtained. While it is impossible to say how much of this savings would be passed on to shippers, the $5.2 million can be used as an estimate of the savings which would result. If the Detroit deepening led to the diversion of Port Huron dimensional traffic to Detroit, and this resulted in elimination of the ferry services there, an additional $5.0 million per year could be saved.

Improved Service Times

Use of the ferry can result in delays of anywhere from several hours to as many as 24 hours. Most estimates are that railcars encounter a half day of delays typically. The length of delay depends on whether a train arrives while a ferry shift is in operation, and on whether customs staff are available to clear the cars. Such delays are a problem in and of themselves, but they also contribute to a lack of reliability in the system. Surveys of shippers indicate that reliability is one of their chief concerns in rail operations.

The delays also impose a quantifiable inventory carrying cost (ICC) burden on the auto companies. Chrysler uses a figure of

$5.00/day/auto for in-transit inventory carrying cost. Based on the 1990 ferry volume of 34,600, and assumptions in the previous trade data section, it can be estimated that 7,536 loaded tri-levels used the ferry that year. At 15 cars per tri-level the total number of automobiles equals 113,038. If a half day delay is assumed, or $2.50 per auto, the total Detroit tri-level ICC delay cost can be estimated at $.3 million per year. If Port Huron tri-level delays are taken into account it can be assumed that total ICC delay costs on tri-levels alone total $.9 million per year.

Federal Harbor Maintenance Fee

The U.S. federal harbor maintenance fee is currently being charged on all cargo loaded or unloaded from the ferries operating at Detroit and Port Huron. The fee equals 12/100ths of one percent of the value of the cargo. While there is some chance that these rail ferry movements will be exempted from the fee, this is not a certainty. As such, the fee savings which would result from use of the tunnel are considered in this benefits analysis. It should be noted that the Corps of Engineers has the authority to increase the fee in the future and that such increases are likely.

The amount of the fee can be estimated by splitting the 1990 ferry volume of 34,600 units into loaded tri-level and high cube segments, estimating cargo value per car type, and multiplying by the fee. Based on information provided in the trade data section the above calculations have been made and it can be estimated that the harbor maintenance fee totaled $3.7 million at Detroit in 1990. At Port Huron, similar calculations result in a fee estimate of $8.2 million. This estimate is believed to be quite conservative given what Grand Trunk has confidentially estimated the fee to be costing their customers. Diversion of this cargo to Detroit would result in elimination of the fee.

Ferry Land Value

Partial deepening of the tunnel would eliminate the ferry service and the need for a good deal of the riverfront land currently occupied on both sides of the river. Norfolk Southern has indicated that they might be interested in cooperating in the conversion of this land to other uses. The land in question totals 80 acres on the Detroit side and is partly owned by CSX, and partly owned by Penn Central's successor. Norfolk Southern has a 999 year lease on the Penn Central portion, and rents the remaining land from CSX.

The City of Detroit, according to Norfolk Southern, is interested in clearing the land from the Detroit Newspaper Agency on the East to the Ambassador Bridge on the West. They propose using this riverfront for commercial/residential condominium buildings. In 1984, Mayor Young wrote to the Canadian Transportation

Commission expressing the city's interest in having this land freed up for development.

While it is difficult to estimate the value of the land, Norfolk Southern indicated that it had been estimated at $50,000 per acre, or $4.0 million. When the land was considered a potential site for gambling casinos an offer for $230,000 an acre was considered, or $18.4 million. The development value of the land, and return in terms of jobs, wages, and income and property taxes would be substantially greater. On the downside, the land may be badly polluted with toxins and may not be suitable for development.

Despite the previous estimates of costs per acre, it is not possible to conclusively estimate the value of this land on the Detroit or Windsor sides. On the Windsor side it quite likely would be used for additions to the riverfront park system. Given the difficulty in estimating the development value this benefit category will be shown only in qualitative terms.

TOFC Capture of Highway Traffic, and Analysis of Double Stack Potential

As indicated in the earlier section on intermodal and double stack prospects, a partial deepening would also open the Detroit-Windsor gateway to standard TOFC traffic between Chicago and Toronto, and between the Upper Midwest and the Northeast U.S.

While CN offers TOFC service between Chicago and Toronto CP does not have any competing service. While CP could offer this service now at Detroit-Windsor, it would require the purchase of special low slung cars like CN uses at Port Huron, and they have not chosen to do so. A deepened tunnel would make a competing CP TOFC service more likely and could contribute to reduced highway congestion. Rail executives have estimated that CP might capture 10,000 truckloads of freight a year initially, and that eventually they could pull 200,000 loads a year off the Chicago to Toronto corridor. While it is difficult to quantify the potential benefits that could be achieved with TOFC, it may be that 20-40,000 truckloads a year could be diverted from the Ambassador Bridge. This figure is used for the partial deepening benefits analysis.

Ferry/Railyard Job Loss

One potential negative that results from deepening is the loss of direct jobs and taxes related to the ferry operation. While there is the potential to actually lose these jobs there is a strong chance that competitive improvements will result in more rail traffic and the absorption of these jobs in other dimensions of the rail operation. The other possibility is that the resulting improvements in Michigan's competitiveness will lead to alternative job growth in the manufacturing sector.

Despite the theoretical possibilities the deepening could result in a loss of jobs related to the ferry. Such a potential job loss is shown in the cost benefits summary exhibit in non-quantified terms.

NEW DOUBLE STACK TUNNEL BENEFITS

The benefits of a fully capable 9'6" domestic container double stack tunnel are somewhat more difficult to quantify. It is also difficult to determine the degree to which benefits accrue to Michigan, as opposed to other locales. The primary quantifiable benefits relate to Michigan exports to Europe via Montreal, and to the opportunity for Chrysler to take advantage of cross-border rail borne auto transportation using 20'2" tri-levels. This latter benefit would help to improve a major Michigan company's competitiveness, and would remove truck traffic from the highway and border infrastructure. However, the largest auto beneficiary would be Chrysler's Canadian assembly plants, and not Michigan assembly plants.

Because the Port Huron double stack tunnel can be built for less cost, and because the incremental volume at Port Huron includes tri-levels, the cost per incremental car to absorb construction costs is much lower at Port Huron. As such, the savings which would result from double stack on various routes are analyzed in terms of both a Detroit and Port Huron option.

The cost benefit analysis for a double stack tunnel has been conducted first, with the assumption of a previous partial deepening at Detroit, and secondly, with the assumption that no such previous deepening has taken place. The cost benefit analysis for each scenario considers a Detroit-Windsor and a Port Huron-Sarnia tunnel.

The cost benefits net present value payback analysis for the projects, assuming a previous partial deepening, is shown in Exhibit 11. Both quantitative and qualitative benefits are listed. For a Detroit-Windsor tunnel the net present value payback on a construction cost of $172 million is 9.8 years if all North American benefits are taken into account. The quantifiable benefits total $21.5-22.8 million. For Michigan benefits alone, the payback is estimated to be 80.0 years, with benefits estimated at $6.2-6.8 million.

At Port Huron-Sarnia the net present value payback on a construction cost of $155 million is 7.3 years if all North American benefits are taken into account. The benefits total $25.1-25.7 million. If just Michigan benefits are taken into account, the net present value payback is 33.0 years and the actual Michigan related benefits total $7.7-7.9 million.

The Port Huron-Sarnia project has a shorter payback period than the Detroit-Windsor project. The shorter payback is due to the $155 million construction cost being assumed, compared to $172

Exhibit 11
Detroit-Windsor or Port Huron Double Stack Tunnel
Previous Deepening At Detroit
Cost Benefit Analysis
(U.S. Millions of Dollars)

Annual Benefits

■ Route Specific	North America-Wide Detroit-Windsor	Michigan Only Detroit-Windsor	North America-Wide Port Huron-Sarnia	Michigan Only Port Huron-Sarnia
• Tri-level 20'2" benefits after absorption of construction costs				
– Rail mode	$ 2.6 - 3.9	$ 1.0 - 1.6	$ 1.2 - 1.8	$ .5 - .7
– Highway mode	60,000 Less Trucks	60,000 Less Trucks	30,000 Less Trucks	30,000 Less Trucks
• Port Huron oversize cars	--	--	5.0	2.0
• Michigan-Europe trade	2.3	1.2	2.3	1.2
• U.S. Midwest-Europe trade (excluding Michigan)	8.7	2.2	8.7	2.2
• Mexico-Ontario trade				
– Rail mode	.6	.2	.6	.2
– Highway mode	21,000 Less Trucks	21,000 Less Trucks	21,000 Less Trucks	21,000 Less Trucks
• Asia-Eastern Canada	.8	--	.8	--
• Asia-Europe Land Bridge	--	--	--	--
• Michigan-Ontario				
– Rail mode	Through train and box car replacement benefits possible	Through train and box car replacement benefits possible	Through train and box car replacement benefits possible	Through train and box car replacement benefits possible
– Highway mode	Potential significant reductions in highway traffic	Potential significant reductions in highway traffic	Potential significant reductions in highway traffic	Potential significant reductions in highway traffic

Exhibit 11 (Cont'd.)
Detroit-Windsor or Port Huron Double Stack Tunnel
Previous Deepening At Detroit
Cost Benefit Analysis
(U.S. Millions of Dollars)

	North America-Wide Detroit-Windsor	Michigan Only Detroit-Windsor	North America-Wide Port Huron-Sarnia	Michigan Only Port Huron-Sarnia
Annual Benefits (Cont'd.)				
■ Route Specific (Cont'd.)				
• Chicago-Toronto				
– Rail mode	1.0	.2	1.0	.2
– Highway mode	10,000 Less Trucks First Year	10,000 Less Trucks First Year	10,000 Less Trucks First Year	10,000 Less Trucks First Year
• U.S. Upper Midwest to Northeast U.S.	5.5	1.4	5.5	1.4
General Benefits				
■ Through Trains and Local Service	- Some increased fixed cost absorption - Some local service/rate improvements - Increased rail "hub" potential	- Some increased fixed cost absorption - Some local service/rate improvements - Increased rail "hub" potential	- Some increased fixed cost absorption - Some local service/rate improvements - Increased rail "hub" potential	- Some increased fixed cost absorption - Some local service/rate improvements - Increased rail "hub" potential
■ Manufacturing Plants and Distribution Center Location Impact	- Actual industry attraction benefits - Dramatic "image" benefits	- Actual industry attraction benefits - Dramatic "image" benefits	- Actual industry attraction benefits - Dramatic "image" benefits	- Actual industry attraction benefits - Dramatic "image" benefits
■ Reduced Highway Traffic	- Delay new highway construction by one year	- Delay new highway construction by one year	- Delay new highway construction by one year	- Delay new highway construction by one year

Exhibit 11 (Cont'd.)
Detroit-Windsor or Port Huron Double Stack Tunnel
Previous Deepening At Detroit
Cost Benefit Analysis
(U.S. Millions of Dollars)

	North America-Wide Detroit-Windsor	Michigan Only Detroit-Windsor	North America-Wide Port Huron-Sarnia	Michigan Only Port Huron-Sarnia
General Benefits (Cont'd.)				
■ Facilitation of Competititve Transportation Routes	- Maintain Montreal viability and increase Michigan to east coast transportation options	- Maintain Montreal viability and increase Michigan to east coast transportation options	- Maintain Montreal viability and increase Michigan to east coast transportation options	- Maintain Montreal viability and increase Michigan to east coast transportation options
■ High Speed Passenger Rail	- Capability for catenary power systems	- Capability for catenary power systems	- Capability for catenary power systems	- Capability for catenary power systems
■ SBT Tax Collection	- Rough estimate of $.4 million	- Rough estimate of $.4 million	- Rough estimate of $.4 million	- Rough estimate of $.4 million
Auto Benefits				
■ Inbound Component Movements	- Incremental efficiency gains Canadian benefits greatest	- Some benefits for Michigan suppliers to Europe and Canada	- Incremental efficiency gains Canadian benefits greatest	- Some benefits for Michigan supplies to Europe and Canada
■ Tri-level 20'2"	- $2.6 - 3.9 rail savings 60,000 less trucks	- $2.6 - 3.9 rail savings 60,000 less trucks	- $2.6 - 3.9 rail savings 60,000 less trucks	- $2.6 - 3.9 rail savings 60,000 less trucks

Exhibit 11 (Cont'd.)
Detroit-Windsor or Port Huron Double Stack Tunnel
Previous Deepening At Detroit
Cost Benefit Analysis
(U.S. Millions of Dollars)

	North America-Wide Detroit-Windsor	Michigan Only Detroit-Windsor	North America-Wide Port Huron-Sarnia	Michigan Only Port Huron-Sarnia
Auto Benefits (Cont'd.)				
■ Autos in Container	- Substantial need if develops, greatest benefit for Canada	- Substantial need if develops, Michigan assembly plants would need to reach US Upper East Coast	- Substantial need if develops, greatest benefit for Canada	- Substantial need if develops, Michigan assembly plants would need to reach US Upper East Coast
Quantitative Rail Benefits Subtotal	$21.5 - 22.8	$6.2 - 6.8	$25.1 - 25.7	$7.7 - 7.9
Non-Quantifiable Highway Benefits Subtotal	116,000 trucks off road	116,000 trucks off road	86,000 trucks off road	86,000 trucks off road
Project Costs				
■ Double Stack Tunnel	$172.0	$172.0	$155.0	$155.0
NPV Payback				
■ Years for Payback[1]	9.8	80.0	7.3	33.0

Potential Negatives

- Loss of truck drayage and yard activities related to transporting to Canada goods now deramped/ramped in Chicago and/or Detroit

[1] Payback calculation uses the lowest value in the benefits range and assumes 5% inflation and 8% discount rate.

million at Detroit-Windsor. The improved payback also occurs because oversize railcar benefits accrue to a Port Huron-Sarnia double stack tunnel, but do not accrue to the Detroit-Windsor project because these benefits can be obtained with a less expensive deepening at Detroit-Windsor.

The primary benefits for North American competitiveness relate to U.S. Midwest to Europe trade transportation cost savings, to intermodal rail savings compared to truck in moving goods from the U.S. Upper Midwest to the U.S. East Coast, to rail savings compared to truck in moving 20'2" auto tri-levels, to movement of regular sized containers by rail rather than ferry (Port Huron tunnel only), and to Michigan to Europe trade transportation cost savings. For Michigan, the primary benefits relate to Michigan and neighboring state trade transportation cost savings with Europe, savings on movement of goods to the U.S. East Coast via alternative routes, and savings related to 20'2" tri-levels moving by rail. In the case of a Detroit-Windsor tunnel, some 116,000 trucks could be removed from the roads, while this number would fall to 86,000 less trucks in the case of a Port Huron-Sarnia tunnel.

The following parts describe the potential for lower rates as a result of double stack, potential benefits on specific routes, the generic rail related benefits, the likely auto industry-specific benefits, and the highway benefits that could result from a double stack capable railroad tunnel.

Potential for Lower Freight Rates

The potential for lower freight rates is the main benefit associated with double stack service. This part examines the potential net after construction cost savings per container that could be passed on to shippers in specific traffic corridors. The following part on route and category specific benefits will discuss these potential savings in each specific benefits sub-part. However, the specific sub-parts will also indicate the gross savings per container or unit, and the annual level of those savings, for use in the cost benefits payback calculations.

While there are other benefits besides lower price, the other benefits that have been associated with double stack, such as better ride and better service, can for the most part be obtained using new single stack equipment. For instance, the new "spine cars" offer similar slackless couplings and improved ride.

The question for this study, then, is one of when can double stack be viable, and one of how much shipper rates can be lowered when double stack service is provided. Most formal studies indicate that intermodal, dedicated train double stack service requires 700 mile minimums to be competitive. However, some studies have suggested that double stack could be competitive on runs of 400 miles or more when traffic volumes are heavy and highways are heavily congested. There is already increasing use of single well double stack on mixed trains and there is the potential for this type of movement to operate in shorter and shorter corridors.

Double stack may also become a feasible alternative to boxcars at fairly short distances. In industries where frequent, high volume movements take place, and where manufacturing plants have sidings and container handling equipment available, double stack could emerge as a replacement for the boxcar. This situation may soon exist in the Michigan-Ontario auto industry and this potential benefit will be discussed in the Ontario-Michigan benefits section.

Several of the studies which have been reviewed in this report indicate that double stack can save considerable amounts compared to existing single stack intermodal service. These studies also indicate that even greater amounts can be saved when comparing to truck costs. For instance a U.S. Industrial Outlook (1990) report indicates that double stack can save 30% compared to truck in distances over 1500 miles. The specific benefits analysis by category which follows later in this section will assume that double stack can save the following amounts before absorption of construction costs. These gross amounts will be used in the actual cost-benefit payback calculations, and are extrapolated from information contained in Temple, Barker & Sloane's 1988 report for the Pennsylvania Department of Transportation:

Length of Haul	Savings/Container to Single Stack
500 Miles	$ 50
650 Miles	75
800 Miles	100
1000 Miles	125
1500 Miles	200
2000 Miles	300
3000 Miles	450

While the cost benefit payback calculations will use the gross savings compared to construction costs, a determination of whether actual savings can be passed onto customers requires an evaluation of the construction costs per container which must be borne by the shipper, and the resulting net savings which would result. How much of these savings would be eaten up by construction costs is a matter of considerable disagreement. Canadian Pacific believes the construction costs would absorb all savings. Canadian National indicates that while some costs may have to be absorbed in order to enter the business, that they believe lower rates will be possible.

The positions of CP and CN, and some rationale for their differing views, are discussed in the next two sub-parts. In the third sub-part, the likely incremental volume, and the construction costs per incremental container that should be absorbed by shippers is calculated. These calculations are based on previously discussed information on annual debt service and incremental volume, and on the railroad positions as described in the next two sub-parts. Finally, the last sub-part estimates the savings per length of haul after application of the construction cost factors.

CP Position on Lower Rates

Canadian Pacific has stated that the costs of a double stack tunnel would preclude them from being able to offer any lower rates than they are currently offering using single stack spine cars between Chicago/Detroit and Montreal. As such they have indicated little interest in a 9'6" domestic capable double stack tunnel or double stack service between Ontario and Michigan.

CN Position on Lower Rates

While CP says lower rates would not be likely compared to their current intermodal single stack container service, CN has stated that they would, if necessary, be able to offer lower rates than they currently offer for single stack service. Canadian National executives have indicated that they see the tunnel investment as a strategic one which is necessary for them to compete in expanding north-south trade between the three countries of North America. As such, Canadian National has indicated that they would in effect "eat" some of the investment cost necessary to obtain a double stack capability. Because of these statements, it is assumed in the following construction cost per container sub-part that shippers will only have to absorb two thirds of the double stack construction cost debt service at Port Huron. In addition, because of CN's role at Detroit, it is also assumed that shippers would only have to absorb two thirds of the cost at this location.

There are several reasons why CN may look at the feasibility of double stack more favorably than CP. First, the construction cost of $155 million at Port Huron is considerably lower than the cost of $172 million at Detroit. Secondly, CN already has double stack capable equipment in the "Laser" cars, and would not have to make as heavy an investment as CP would. Third, CN is moving towards double stack in Canada at a faster pace than CP, and this could be driving their interest.

Canadian National also may have more incentive to pursue double stack than CP. First, CP has the CAST and other Montreal business locked up and double stack might give CN an opportunity to recapture this substantial volume. Secondly, CN has made several plans with Burlington Northern that would be facilitated if they had a double stack capability in place. Third, a Port Huron double stack capability could offer CN a monopoly position on cross-border Michigan-Ontario gateway double stack business. Fourth, if a deepening occurs at Detroit-Windsor, and CN does not have any capability at Port Huron, they are likely to lose some auto traffic to CP and others at Detroit. Finally, at Port Huron CN has no real option for a partial deepening like at Detroit.

Costs for boring a double stack capable tunnel are not likely to be significantly higher than those for a tri-level capable tunnel. As such, the double stack benefits are, in effect, a "free rider."

Based on what CN has said one would have to assume that they believe they can offer lower rates. Some of the above points may clarify why they can offer lower rates, and why they have more incentive to offer lower rates.

Construction Cost Per Railcar

Any potential savings estimates based on typical double stack benefits need to be adjusted down by a factor representing the costs per container required to recover annual double stack construction cost debt service. The cost factor to be used is calculated in this section for both Port Huron and Detroit projects, and is based on incremental project volume. For Port Huron the calculations assume current oversize traffic will stay at Port Huron and not shift to Detroit as the result of a partial deepening project there.

The incremental costs of a single tube double stack tunnel at Port Huron-Sarnia are $155 million, or $13.8 million in annual debt service. At Detroit-Windsor the incremental costs of a single tube double stack tunnel are $172 million, or $15.3 million per year in principal and interest payments. However, given CN's comments on their intent to absorb some of the cost of a double stack tunnel for strategic reasons, and given their role both at Port Huron and Detroit, it is assumed that one third of the cost at each location would be absorbed by the railroads. As such, the annual debt service at Port Huron is assumed to drop to $7.3 million for purposes of determining costs per traffic unit. At Detroit, the annual debt service is assumed to drop to $10.1 million.

The cost per container equivalents calculations are shown in Exhibit 12. The Exhibit indicates that the per container charge necessary to recover annual debt service which is to be absorbed by shippers equals $26 at Detroit, and $17 at Port Huron. The per container costs are based on the annual construction cost debt service to be absorbed by shippers, and on the incremental project traffic volumes.

The current and prospective container volumes shown in the Exhibit are based on the discussion in the "Cross-Border Intermodal and Double Stack Volumes, and Michigan-Ontario Prospects" part of the section on transportation industry developments. Based on the information in that part, the incremental project volumes are based on current loaded and empty rail traffic levels, and on assumptions about which traffic would use these corridors if double stack were available. The calculations also assume some gain in rail traffic resulting from the anticipated capture of truck traffic on the Chicago-Toronto

Exhibit 12
Construction Cost Recovery Factors Per Container
Incremental Volume Per Project

	Detroit	Port Huron
Double Stack Annual Debt Service (Millions)		
Total Annual Debt Service	$15.3	$13.8
Shipper Absorbed Annual Debt Service (two/thirds of Total)	10.1	9.2
Incremental Volume		
Traffic Category:		
Tri-level 20'2" (assumes 1 car=2 containers, and 20000 entries Detroit, 8000 P.H.)	46000	20000
Oversize Port Huron Traffic (No deepening option at P.H.)	-0-	75000
U.S. Midwest-Europe CP	120000	120000
Michigan-Europe Trains	30000	30000
Asia-East Canada	80000	80000
Mexico-Ontario (Mainly TOFC to Ferndale for Ford St. Thom.)	21000	21000
Chicago-Toronto truck to rail incremental double stack potential first year	10000	10000
Upper U.S. Midwest-U.S. East Coast truck to rail incremental double stack potential first year	78000	78000
Total	385000	434000
Construction Cost Debt Service Per Container	$26	$21

corridor, and a gain from the capture of rail and truck traffic currently moving in the U.S. Upper Midwest to U.S. East Coast corridor. These possibilities are discussed in the referenced section and part earlier in the report.

<u>Conclusion on Lower Rates</u>

While CP seems to have reasonably good reason for stating that lower rates would not be possible, CN seems to have an equally good rationale for stating that lower rates would be possible if they are necessary. In fact the economics at Port Huron compared to Detroit-Windsor help to make CN's case.

Given CN's comments, this analysis will proceed on the basis that somewhat lower customer rates will be possible depending on the distance involved. After application of the construction costs per container calculated in Exhibit 12 the savings per container compared to single stack intermodal are as follows:

Length of Haul	Detroit Savings/Container Compared to Single Stack After Construction Costs	Port Huron Savings/Container Compared to Single Stack After Construction Costs
500 Miles	$ 24	$ 29
650 Miles	49	54
800 Miles	74	79
1000 Miles	99	104
1500 Miles	174	179

2000 Miles	274	278
3000 Miles	374	378

The overall conclusion is that the double stack project would allow for the actual net savings shown above to be passed on to customers. This is an important finding of this report. However, one of the key assumptions is that the railroads will indeed absorb some of the construction costs as CN has indicated.

The above net savings per container will be used to discuss potential per unit and annual savings that could accrue to shippers in each of the specific benefits analyses being conducted in the following sections of this report. However, for purposes of the cost-benefits analysis, the gross pre-construction cost savings figures per container will be applied to annual volumes to determine benefits. These benefits will then be compared to construction costs to determine a payback.

Potential Specific Route/Freight Category Benefits

Several categories of freight, and specific routes, have been identified as offering potential benefits for shippers. Some of these benefits accrue to North America as a whole, or to Canada, while others provide more specific gains for Michigan. Each of the following parts reviews the potential benefit and discusses its level, and the degree to which Michigan vs. other locales derive the benefit. In a few cases it has been possible to provide a quantified estimate of the size of the benefit.

Chrysler 20'2" Tri-levels

Chrysler Corporation currently moves all of its finished vehicles at the Michigan-Ontario gateway by truck. In total, Chrysler moves over 800 trucks a day across the Michigan-Ontario border. This traffic contributes to congestion on the highways, and results in increased costs to Chrysler relative to likely rail costs. It is estimated that 240 loaded and empty auto hauler trucks per day cross the Michigan-Ontario border for Chrysler.

Based on discussions with a number of sources it is estimated that a Detroit-Windsor double stack capability could entice Chrysler into use of the rail mode. Chrysler requires the new tunnel because they would be using 20'2" tri-levels that would not fit through a deepened tunnel. These higher tri-levels are required for efficient hauling of mixed minivan and passenger car loads.

The potential loaded volume which could move by rail through the Michigan-Ontario gateway includes 10,000 Toronto area tri-levels, and 3000 Windsor area tri-levels, or a total of 13,000 units. These forecasts assume a Windsor tunnel. If a Port Huron tunnel were built the potential volume would drop to 6000 units. Interviews with auto industry executives also suggest that $200-

300 per tri-level could be saved on average when the rail mode is used in place of truck transportation. However, when adjusted for absorption of a portion of construction costs the savings which could be passed on to automotive customers are reduced to $148-248 in the Detroit scenario, and $158-258 in the Port Huron case. Because the tri-levels were weighted as equal to two containers in the construction absorption per container calculations, double the Detroit and Port Huron charges of $26 and $21 respectively are subtracted from the savings.

Based on these estimates, a total of $1.9-3.2 million per year could be saved by automotive customers if 20'2" tri-levels were able to cross at a Detroit-Windsor double stack tunnel. At Port Huron-Sarnia the automotive industry savings would amount to $1.0-1.6 million per year. The other benefit would be, in the case of Detroit, the expected 240 truck per day, or 60,000 per year, reduction in truck traffic at the bridges. For a Port Huron tunnel the truck reduction would equal 120 trucks per day, or 30,000 trucks per year.

Because of the potential savings Chrysler executives have expressed strong support for a double stack capable tunnel. However, given that they currently operate their own fleet of trucks and do not use rail for cross-border movements, it is not possible for them to "guarantee" that the new tunnel would be used for 20'2" tri-levels. None-the-less, there seems to be fairly strong support from Chrysler logistics executives for a double stack tunnel, and a belief that this would benefit their operations.

The question of whether Michigan, Canada, or all of North America are the beneficiaries of the above benefits depends on the breadth of one's outlook. From a direct standpoint, Canada is the main beneficiary of this benefit category because it reduces the costs of transporting Canadian made products to the United States. However, a large volume of Michigan components are exported to Canada for production of those vehicles and these sales provide significant Michigan benefits. Finally, while Michigan or Ontario may benefit more or less in any specific category, the important point is that North American manufacturing competitiveness must be improved if we are to compete as a region against off-shore manufacturers. This project would contribute to competitiveness by reducing transportation costs.

While not stated by anyone in the auto industry, there also may be some question about the degree of benefit that would accrue to Japanese and Asian transplants in Canada if a double stack capable tunnel was available. Such a tunnel would lower the costs of moving Asian components to Canadian assembly plants via double stack container, and would reduce the cost of moving finished vehicles to the U.S. market.

Given all of the above points, it would appear that Michigan is a significant beneficiary of the identified benefits, however, the Ontario assembly plants receive a somewhat greater direct benefit. In order to present a summary of North American vs. Michigan benefits the above savings will be split so as to reflect Michigan receiving 40% of the total benefit.

For purposes of the cost-benefits analysis the gross savings are estimated to be $2.6-3.9 million for a Detroit-Windsor tunnel, and $1.2-1.8 million for a Port Huron tunnel. The Michigan portion of these savings would equal $1.0-1.6 million for a Detroit-Windsor tunnel, and, $.5-.7 million for a Port Huron-Sarnia tunnel.

Port Huron Oversize Cars

Because a partial deepening at Port Huron is not a viable alternative, all railcar type benefits would accrue to the double stack project at Port Huron. This is not true at Detroit-Windsor where oversize cars can be accommodated with a much cheaper partial deepening project. Because of this, only incremental benefits over and above those that accrue to the partial deepening are considered in the Detroit-Windsor double stack project.

Allowing oversize cars to pass at Port Huron would eliminate the need for ferry services and would conservatively save $5.0

million per year. The Michigan share of such a savings, at the 40% rate used in other sections, would equal $2.0 million per year. This assumes that the ferries are not previously eliminated by virtue of Detroit obtaining a partial deepening that diverts this traffic there.

Michigan Trade With Europe

One of the most direct Michigan benefits of double stack capability would relate to trade with Europe. The shortest and most efficient route to Europe for Michigan traders is via the Port of Montreal. This route may become more important in providing a competitive advantage to Michigan exporters if U.S. port harbor related fees continue to grow. These fees are already thought to be putting exporters that must use them at a competitive disadvantage. For instance, a container ship calling at a U.S. port must now pay approximately $80,000 per ship, while the same ship calling at a Canadian port would only pay $2500 per ship.

Michigan exporters to Europe have a distinct advantage in being able to efficiently use the Port of Montreal as an alternative to New York. Any developments that would reduce the land costs of the Montreal-Detroit segment would make this even more beneficial. This land segment is currently served by one CP single stack container train a day in each direction. This train allows Michigan shippers to move product directly from CP's

Detroit Oak Yard to Montreal. If this option or a similar one allowing direct access to Montreal were not available, Michigan exporters would have to interface with Conrail at Toledo or Chicago for service through New York.

The importance of having double stack on this Detroit-Montreal route is made more evident by the fact that competitors to Michigan exporters, located in the Chicago area, now have double stack service to the Port of New York via Conrail. Whatever advantage this provides these manufacturers will have to be offset by Michigan manufacturers.

The current single stack train carries 80 eastbound containers per day for five days a week on average. This volume totals 20,000 containers a year and on average CP indicates that 85% are loaded, or a total of 15,000 loaded containers. Of these loaded containers, CP estimates that 85% have a Michigan origin while the remainder are from Ohio and Indiana. In total, then, some 12,750 loaded Michigan containers travel to Europe each year. Another 12,750 loaded containers per year move from Europe to Michigan destinations on the westbound train. The total Michigan-Europe traffic amounts to 25,500 loaded containers per year. An additional 4,500 loaded containers per of Ohio and Indiana traffic also move on this train. The total figure of 30,000 loaded containers is fairly similar to the 27,000 loaded container figure that CAST indicated move between Michigan and Montreal.

Based on the net after construction cost savings data per container described earlier in this section a shipper should save between $49-54 per container compared to single stack depending on whether a Detroit or Port Huron scenario is assumed. Given the total two-way loaded volume on this train of 30,000 containers, the estimated potential customer savings are $1.5-1.7 million per year. Michigan shippers or receivers have combined volume of 26,500 containers and would incur between $1.3-1.5 million of the above savings per year. Finally, because MARAD data indicates 75% of this traffic represents Michigan exports, the Michigan customer's export portion of these savings would equal $1.0-1.1 million per year.

For purposes of the cost-benefits payback analysis, it is necessary to use the gross savings per container, and for the year as a whole. This allows comparison to the construction cost. Because the gross savings of $75 per container are the same for both locations, and because the volumes would be similar regardless of the crossing location, the gross annual savings are the same for both locations. For North America-wide benefits, the savings are estimated at $2.3 million. The Michigan portion of benefits, accruing to exporters and importers alike, is assumed to be 50%. This is quite conservative given the export dominance, but assumes that benefits are split between shippers and receivers. At a 50% level, the Michigan benefits equal $1.2 million.

U.S. Midwest Trade With Europe

While the U.S. Midwest-Europe trade does not provide any direct benefit to Michigan, there are very important quasi-direct benefits relating to Michigan suppliers of other manufacturing plants in the Midwest. In addition, because the auto companies are headquartered in Michigan, and employ large staffs unrelated to specific production plants in Michigan, there are significant benefits to Michigan any time the auto industry's competitiveness is improved. Logistics executives in the auto industry felt quite strongly that double stack service was important in this corridor and that Michigan would in fact benefit.

One dimension of the auto industry benefit relates to their ability to better move components from distant auto plants to Montreal for export. What makes this important for Michigan is the secondary effects caused by the integrated nature of the auto industry. It may well be that a components plant or assembly plant in St. Louis. MO that can benefit from a more efficient transportation corridor with Europe, is being supplied sub-components by Michigan companies. As such, many Michigan companies will have a very strong interest in making sure that the automotive industry's transportation system is efficient.

There are also some important spin-off benefits the rail traffic that moves through Michigan provides. These benefits relate to absorption of track costs in Michigan, absorption of rail yard costs in Michigan, and the potential for increased local service through addition and deletion of railcars on these quasi-through trains. While it is difficult to quantify these benefits, it is clear that the Michigan rail system would be hurt if the CP/Soo Chicago-Montreal trains were to be rerouted through Buffalo on double stack services of competitors. In fact, the CSX track across Southern Michigan is perhaps only viable with this Chicago-Montreal traffic. A later section in this report will further examine these indirect spin-off benefits.

It is estimated that there are currently 79,200 loaded containers moving in U.S. Midwest-Europe trade per year. This assumes a 66% load factor and may be somewhat conservative. The principal trains in this service are the three CP/Soo trains per day in each direction between Chicago and Montreal. Some sources have estimated that CP has 90% of this European traffic.

Based on the gross container savings data by distance discussed in the earlier rate reduction section, it can be assumed that a $110 per container gross savings is possible. This savings is based on a Chicago-Montreal distance of 845 miles. After application of the construction cost absorption factors, the net savings to customers would equal $84 per container at a Detroit-Windsor tunnel, and $89 per container at a Port Huron-Sarnia tunnel. Annual net customer savings could reach $6.7-7.4 million depending on whether a Detroit-Windsor or Port Huron-Sarnia crossing is assumed.

For purposes of cost benefits payback analysis, the gross savings at either potential tunnel location would equal $8.7 million per year. This direct benefit would accrue to North America-wide interests but specifically excludes Michigan because Michigan volume is not included in the numbers. None-the-less, there is a very good case that can be made about the Michigan benefits which could result. These benefits primarily relate to the auto industry and Michigan supplier interests described above. While completely arbitrary, this report will assume that a conservative 25% of the benefits eventually accrue to Michigan's economy because of the auto industry role. At this level, the Michigan portion of the gross benefits would equal $2.2 million. The indirect spin-off benefits related to absorption of rail fixed costs, and to the potential for increased local service, will be discussed in separate sections in more detail.

The importance of obtaining these double stack savings is underscored by the fact that competitors in the Midwest now have double stack service to the Port of New York via Conrail. If the volume currently moving to Montreal from outside Michigan were diverted, this would seriously harm the viability of Montreal as a port and would eliminate an excellent route to Europe for Michigan competitors. Without the Chicago-Montreal traffic, it also is unlikely that the CP/Soo Detroit-Montreal train would continue to run. As such, this traffic is of considerable importance to Michigan.

Mexico-Michigan-Ontario Trade

Mexico is currently Michigan's number two export market, with 1989 exports of $1.7 billion. It is also a fast growing export market for the state, with growth of 60% in two years (Richardt 1991). As Mexico embarks on its development plan it will become an increasingly strong buyer of the kinds of industrial equipment and manufacturing technology that Michigan is best at producing. Mexico has already become an important source of low cost labor for U.S. auto manufacturers who must compete in a global market. While this has the potential to eliminate the most labor intensive and least attractive Michigan jobs, these jobs would have moved anyway in due time. By using Mexican labor for these tasks, the U.S. auto industry secures a relatively nearby source, and Michigan companies have an opportunity to participate in the supply of sub-components to those Mexican component and assembly plant operations. The alternative is for this production to shift to Asia where U.S. suppliers are likely to be locked out of the business.

Currently, a great deal of the auto industry trade relating to the U.S., Canada, and Mexico relates to auto fuel economy standards. While parts costs from different sources play a substantial role, the desire to manipulate domestic vs. import average fuel performance in order to avoid penalty taxes is also an important factor in trade decisions of auto companies. For instance, a company wishing to increase production of "imported" cars can do so by changing the sourcing so that U.S./Canada parts represent less then 50% of the total. Alternatively, a company wishing to increase the domestic fleet average can build small cars in Mexico with U.S./Canada components so that it is considered a "domestic.

This fuel economy driven trade is responsible for the high degree of Mexican components going to Ford's St. Thomas plant, and is responsible for Ford sending Michigan and Ontario components to its Hermosillio, Mexico assembly plant. One auto company logistics executive indicated that fleet fuel standards are the only real factor in the increased U.S.-Canada-Mexico components trade, and that there would not be a significant increase in Mexico-Canada parts trade.

However, despite the above prediction, it would appear that the auto industry will increasingly turn to Mexican components sources for North American assembly plants. This trend is likely to be heightened by increasing auto industry competition, and by the impending North America Free Trade Area (NAFTA) talks. Once duties and non-tariff barriers to trade, such as transportation regulations, are eliminated there will be a substantial increase in the trade of components in both directions.

Assembly plants and sub-components suppliers wishing to remain competitive will be well served by being located on main rail gateways between Mexico and Northern U.S. states and Canadian provinces. Equipment manufacturers and others with markets in Mexico unrelated to auto components will also be well served to be located on high service double stack lines between Mexico and the North. Michigan's location on such major routes would be enhanced by the availability of through double stack service to Ontario. Such a through double stack route would allow additional trains to consider this corridor, and could result in additional opportunities for local traffic to be added on and dropped out of quasi-through trains. In addition, such through trains could help increase the prospects for short distance single well double stack movements between Michigan and Ontario.

While several Mexican related trains currently terminate or originate at Chicago and Detroit there is no through service. In the earlier section on cross-border double stack prospects, it was estimated that some 12,560 Mexican related loaded containers are currently being moved across the border in truck mode, and that additional containers are moving between Chicago, Detroit and Mexico.

Other volume is currently moving between Ontario and Mexico via Buffalo. For instance, Chrysler moves Ontario components for Mexico in high cube boxcars via Buffalo but would prefer a double stack service from Ontario to Mexico with stops in Detroit.

Buffalo is also competing for some traffic currently moving from Mexico to Chicago via double stack, and then by truck across the border. APL has advised that a double stack route through Detroit would be better, however, they are examining Buffalo as an option to the current situation. Any loss of existing or potential Detroit-Mexico rail double stack service would hurt Michigan companies trying to develop Mexican markets, whether for end product use in Mexico, or for components which will return to the U.S. for further processing.

Mexico-Ontario trade obviously is more beneficial for Mexico and Ontario then it is for Michigan. However, as pointed out earlier, there is some benefit for Michigan suppliers. Just as in the case of Michigan suppliers to other Midwest plants exporting to Europe, Michigan suppliers are providing sub-components to operations in Mexico. As such, and given that low skill, high labor cost jobs are going to move regardless, it is in Michigan's interest to facilitate transportation between the state and Mexico. This service can be improved by having cross-border double stack service with Michigan sitting at the center of a major corridor rather than at the terminus. In addition, any through service will provide the option for these trains to enhance local service with pickup and drop off of Michigan-Ontario/Quebec traffic.

Such through service would be beneficial to the auto industry and they have expressed an interest in this concept. For instance, it would be much better if the TOFC train from Ferndale to Mexico could move right through to the St. Thomas plant in double stack rail mode. However, the rail carriers have indicated they would not find this an attractive alternative. In fact Santa Fe indicated they had explored moving this train through Buffalo but found it was not competitive because of distance and problems with backhauling of empty containers. As such they would prefer to operate deramping out of a Detroit hub, and use truck drayage to Ontario points within 200 miles. This probably provides additional rail yard jobs in Detroit, but does not offer the best service for the auto companies. Whether or not such double stack services would develop if the capability was present at Detroit is somewhat unclear given these comments by several rail industry executives.

The potential benefits of double stack service will be more relevant if and when the expected increases in trade with Mexico materialize. At current Mexico-Ontario traffic levels, the question of whether or not containers travel the extra 200-400 miles by rail double stack to Ontario destinations, or from Ontario origins, is not particularly significant. The standard double stack savings are already being applied on the movement between Detroit/Chicago and Mexico.

The incremental savings that would accrue from completing the move by double stack would probably amount to no more than $50 per container of line haul savings, or $24-29 per container on a net after construction cost basis. Net savings of $.3-.4 million per year could be expected by the automotive companies. The gross savings of $50 per container would translate into $.6 million per year. While there are a number of indirect and secondary trade transportation benefits that could accrue to Michigan, it is unlikely that the Michigan direct benefits would exceed 25%, or $.2 million.

Perhaps more relevant are the 21,000 empty and loaded containers a year which could be taken out of the highway and bridge system if double stack was available. The other benefit is the contribution to system rail, yard and other fixed costs, and the contribution to potential local service improvements that additional volume and trains could bring. From this latter standpoint, the biggest concern would be the loss of potential volume to Buffalo, much as has happened with Asia-Eastern Canada volume.

Asia-Eastern Canada Trade

Asian exports to Eastern Canada have grown considerably over recent years, and now total some 50,000 loaded containers a year. It is estimated that a total of 80,000 loaded and empty containers move through the border by truck or rail on this route. While much of this business once passed through the Michigan-Ontario gateway, this is no longer the case. Instead, this traffic has switched to Buffalo where it can cross into

Canada in double stack configuration, although a substantial part of this traffic is deramped in Welland and trucked to major Canadian markets.

As indicated, most of this traffic traveled through Detroit or Port Huron at one time. For instance, APL initially routed its Asian volume through the Port Huron gateway on CN's "Laser" service but switched to Buffalo to get double stack capability. Norfolk Southern also used to route Maersk traffic through Detroit but has switched to Buffalo.

All but a few rail executives indicated that Asia to Eastern Canada service should naturally move through the Michigan gateway. Both APL and NS indicated this traffic should move via Detroit because of the shorter distances, and because of the incremental pickup and drop-off volume in the Detroit area.

The major beneficiary of Michigan gateway double stack service for Eastern Canada is Eastern Canada. Again, because much of this traffic moves over the long haul from the Coast to the Midwest, and even right into Ontario by double stack via Buffalo, it is hard to estimate any dollar benefits that would be provided by Michigan-Ontario service. In fact the gross savings per container would not be sufficient to absorb the construction cost per container surcharge. However, for the cost benefits payback calculations purpose, an estimate of $15 per container will be assumed. Such a savings would result in an annual benefit of $.8

million per year. Any actual use of this service would have to occur on a "free rider" basis once the project has been built because the incremental benefits could not support the construction costs per container.

For Michigan, the benefits of this traffic flowing through the state are again indirect, but significant. As discussed in the other traffic lanes, the additional trains, even if nothing more than through services, would help to absorb track, railyard, and other fixed costs of the Michigan system. And, again, the passage of these trains would provide the opportunity for local pickup and drop off of containers, thereby increasing local service. Perhaps most importantly, a flow of these containers back to the West Coast through Michigan could create a number of excess capacity containers that the railroads would heavily discount for westbound loads. Low cost transportation of goods to the West Coast could benefit Michigan exporters, and especially, agricultural exporters to Asia.

The loss of this traffic to Buffalo helps to point out some of the opportunity costs. For instance, the APL traffic previously moved on the CN "Laser" through Toronto. Given the high fixed cost nature of this traffic, elimination of the volume results in higher unit costs for the remaining traffic. That means that "Laser" traffic picked up or dropped at Michigan terminals must absorb somewhat higher costs in the final analysis, because of the loss of traffic to Buffalo.

Asia to Europe Landbridge

A full landbridge route from Asia to Europe through the U.S. West Coast and the Ontario-Michigan gateway has long been thought to be the potentially most efficient route. This route is thought to be ideal because it is the shortest ocean and land route between the two continents. As such, the land movement is said to be the most economical. In addition, the distance from Halifax to Europe, compared to the distance from New York, is considerably shorter and allows for considerably shorter sailing times to Europe. Finally, port costs and congestion are much lower in Halifax/Montreal than in the U.S. East Coast ports, and federal user fees in the U.S. could begin to dampen U.S. ports' business. These points do make a strong argument for the route's potential.

Should such a transportation pattern ever substantially develop it would position the Michigan-Ontario gateway at the center of a major trade corridor and would potentially lead to an increased "hub" status for Southeastern Michigan. Such a development would be extremely beneficial to the Michigan economy. However, such a corridor could never develop without double stack capability, and this fact has been advanced as an argument in favor of building a double stack tunnel.

Unfortunately, even with a double stack capability, it does not appear that this landbridge will develop substantially in the foreseeable service. There are several problems. First, the Port of Halifax is experiencing severe problems and is only viable because of substantial Canadian and provincial government subsidies. Because of consolidations in port call schedules of the major liner services, there are insufficient sailings from Halifax. At this time it is unclear what Halifax's future will be, however it is still somewhat competitive and may yet emerge as a major competitor. While there are more frequent sailings from Montreal, the St. Lawrence Seaway dimensional limitations are a major problem for the new generation, large scale container ships. Finally, the domestic East Coast U.S. volumes help to make the entire landbridge via these ports much more attractive. Use of Montreal or Halifax, in effect, means that the service must survive on Asia-Europe volume alone.

The proponents of the Beztak-Dewin Detroit-Windsor double stack proposal have made a strong case about the benefits of an Asian-European landbridge through Detroit. However, conversations with a wide variety of rail and marine carrier executives suggests that the concept is not viable at this time.

However, a number of developments could lead to the concept becoming more viable in the future. Should the U.S. government continue to charge U.S. ports with higher and higher user fees there could be a significant diversion of traffic. However, to date, the diversion has primarily been from Canadian West Coast ports to U.S. West Coast ports. The other possibility is that Halifax regains its competitive edge because of several developments. For instance, CN is starting double stack service between Toronto and Halifax and this could help. If Halifax were to become highly competitive there is a chance that the landbridge concept could become viable.

Michigan-Ontario Rail Transportation

The potential for Michigan-Ontario double stack transportation is a key issue in determining the importance of a cross-border double stack tunnel in Michigan's economic future. While Michigan-Ontario double stack movements would never be viable as a part of customized double stack trains, they may be viable as part of through double stack trains where several cars are dropped or added to the train. Double stack may also be viable as a replacement for boxcar movements in some high density automotive plant environments where rail sidings exist.

As a part of through train services, the various industry executives interviewed had differing opinions. Manalytics, Inc. and Trailer Train executives thought such movements might be feasible and that the auto industry had the power to force them initially. CN and Grand Trunk Western have also indicated such movements may be feasible. For instance, they pointed out that tremendous volumes move between Flint consolidation points and Ontario assembly plants. This latter concept may entail the double stack boxcar movement discussed in the paragraph below. The concept is certainly more viable as double stack begins to run in more and more mixed trains. It should also be noted that auto industry executives at two of the three companies believed Ontario-Michigan double stack may be feasible in some cases. Beztak executives and consultants also indicated they believed double stack would be feasible for Ontario-Michigan traffic in some cases.

However, other executives expressed extreme doubt about Michigan-Ontario movements as part of through trains and indicated that railroads and the major customers would want through services with the service characteristics this entails. Stopping for local traffic defeats the whole purpose of the dedicated double stack service they claim.

For Michigan-Ontario rail movements, the most feasible use of double stack may be as a replacement for the boxcar.
In industries where frequent, high volume movements take place, and where manufacturing plants have sidings and container handling equipment available, double stack could emerge as a replacement for the boxcar or truck. This situation certainly

exists in the auto industry and there is no reason why single well double stack cars could not be used in rail only movements. Containers also offer the advantage of being able to be moved directly to assembly plant bays near the point of use for the components, unlike boxcars. The main constraint right now would be the availability of container handling equipment. While not inexpensive, many major assembly plants have such forklifts, and the advent of domestic containerization would increase their presence at major assembly plants.

As indicated in the transportation developments section, there are an increasing number of single well double stack cars, and these cars are sometimes seen moving in mixed freight trains today. Should this trend continue it is quite possible that double stack could replace the boxcar in certain high density cross-border moves.

If one considers that there are 14 automobile assembly plants in Ontario and Quebec, and that each assembly plant typically requires 240 trailers a day of supply, the volumes become obvious (AASHTO 1990). The location of these assembly plants can be seen on the auto industry manufacturing plant maps shown in Appendix V. In total, these plants require over 3360 trailers a day of supplies. If only 6.0% of this volume moved by double stack from U.S. sources it would amount to 200 trailer equivalents a day, or some 100 double stack wells per day. This volume would exceed the minimum volume requirements for a dedicated double stack train. For a full year this volume would represent 25,000 containers. Such a movement, of [illegible] of the total [illegible], [illegible] single consolidation point to a cluster of three or four assembly plants, would be quite feasible given that several assembly plants are located in close proximity, and that these plants have rail sidings.

While it is difficult to quantify the potential savings per container equivalent, the elimination of all drayage costs and the added flexibility of direct rail delivery in this type of move, should make rail competitive even in short distance movements of 200-500 miles. Even if just $50 a container equivalent were saved in gross terms, this would amount to $1.3 million per year. If 50% of the benefits accrued to Michigan this would equal $.7 million. After application of the construction cost factors, savings would equal $.6-.8 million for North America as a whole.

It is the author's belief that double stack will be viable on the Michigan-Ontario route as part of through train movements to and from Toronto/Montreal. In addition, it is quite possible that double stack will replace the boxcar in certain high volume lanes and the author believes this will be the case in the relatively near future on cross-border movements if the capability exists. As highway congestion and costs increase the likelihood will be even greater. However, because of the speculative nature of the potential, no quantified savings will be assumed in the cost benefits payback analysis.

Competing Chicago-Toronto Intermodal Service

A partial deepening of the tunnel at Detroit-Windsor would allow CP to offer a standard TOFC service which would compete with CN's "Laser" service for Chicago-Toronto traffic. Such a deepening benefit would only accrue to Detroit-Windsor since it is the ability to offer a service in competition with CN's Port Huron service which offers the benefit to shippers. The partial deepening analysis assumed that 20-40,000 containers a year could be taken off the roads with this service.

However, while a deepening would provide some benefit, it is believed that a double stack capability at either Port Huron or Detroit-Windsor would offer an even greater opportunity to pull truck traffic off this corridor. Rail executives have speculated that as many as 200,000 truckloads a year of traffic could be pulled off the Chicago-Toronto roadways if an appropriate double stack service were available. This would represent just 10% of the total annual truck traffic at the principal Michigan-Ontario truck crossings.

Given this potential it is assumed that a double stack service on this corridor could initially pull 10,000 containers a year of incremental traffic off the roads, over and above that obtained with a TOFC service allowed by partial deepening. Based on Manalytics, Inc.'s domestic containerization study, this corridor is of sufficient distance for double stack and offers sufficient volume as well. Combined with the TOFC volume there would be adequate containers for the five day a week schedule Manalytics suggests is critical. In fact, the Manalytics, Inc. report lists this as a potential double stack corridor based on 1987 volumes.

If one simply assumes a gross per container savings of $100 per container compared to truck, this would result in annual savings at the first year volume of $1.0 million. This figure is used in the cost benefits payback analysis. After application of the construction surcharges shippers could expect to save $74-83 per container, or $.74-.83 million per year. While it is difficult to estimate the Michigan benefit, if one assumes this train added and dropped containers in Detroit or Port Huron, and that 20% of the traffic was Michigan based, one could expect gross savings of $.2 million the first year.

Competing U.S. Upper Midwest-Northeast U.S. Intermodal Service

A number of rail industry executives have speculated on the effect that CP's purchase of the D & H could have on rail service between the Upper Midwest and U.S. East Coast. One option is for CP to use the newly acquired D & H to offer a competing service to Conrail through Detroit and Buffalo. A number of rail experts have indicated that this would be a very competitive route if double stack was available.

The route would require double stack capability in order to compete with Conrail's new double stack services. With a double stack capability at Detroit-Windsor this route could take both current truck and rail traffic off the all U.S. route. The route would also provide a competitive climate that could force down truck and rail rates on the U.S. routes.

Such a route could prove especially important for Michigan shippers because it is clearly the shortest and most efficient route to New England, and to the U.S. Northeast. Should domestic containerization ever become the dominant shipment method it would be critical for Michigan shippers to have double stack capability on this route. If, for instance, autos began to be shipped in containers as a matter of course, this route would be critical for competitive double stack distribution to the Upper Northeast.

Because rail executives expressed such strong sentiments on the potential for the route, this report will assume one dedicated double stack train per day each direction is viable. Such a train would typically carry 150 containers per run, or 39,000 per year. Two trains, one each way, could carry 78,000 empty and loaded containers. With a 70% load factor two such trains would carry 54,600 loaded containers a year.

If one again assumed a gross savings of $100 per loaded container, the annual North America-wide savings would equal $5.5 million. If one were to assume that 25% of this traffic was of Michigan origin-destination and benefited Michigan, the total Michigan savings would equal $1.4 million per year. After application of the necessary estimated construction surcharges, shippers could expect to save between $4.0-4.5 million annually North America-wide. The Michigan share of this benefit, at 25%, would equal $1.0-1.1 million per year. Because these trucks would have previously moved primarily over non-Michigan roads, and would not have used the border bridges, there is no highway mode benefit.

General Benefits

The following sub-parts consider various benefits categories that cut across specific route related benefits. Many of these benefits have been alluded to in the earlier route specific discussions.

Through Train Benefits

In several of the route specific, potential benefits categories discussed above, the possibility of "through" trains stopping in Detroit and providing local benefits was addressed. The potential traffic categories that might lead to such trains include those related to U.S. Midwest-Europe trade, Mexico-Ontario trade, Asia-Eastern Canada trade, and Chicago-Toronto intermodal service.

The potential benefits of such trains are three-fold. First, they may provide spin-off benefits in that they help to absorb operating costs associated with current rail roadbeds and rail yards. Secondly, they may result in some increases in local service, and possibly lower rail rates for local shippers when and if such trains stop and pickup of drop off cars locally. Third, the additional trains and traffic could help assure that Southeast Michigan develops into a major rail "hub" as the rail infrastructure system continues its consolidation and evolution.

As for the spin-off benefits, while there is some benefit from increased volume it is doubtful that the railroads employ detailed enough accounting systems to recognize the benefits and affect pricing. On the other hand, a substantial drop-off in volume, such as might occur if CP/Soo stopped using the CSX track, would be noticed, and would have an effect on the fixed costs that would have to be absorbed by other shippers. Railroad executives generally agreed that this was a factor but hardly would justify construction of a double stack tunnel so as to maintain volume. For purposes of this report, the conclusion is that minor benefits could result from incremental gains in traffic. More important, however, are the opportunity costs that would come from losses of major chunks of volume, such as has been the case with Asia-Eastern Canada trade that now bypasses Southeastern Michigan.

As for improvements in local service, the question is whether trains designed for through service are likely to want and stop to obtain incremental volume gains. While the original dedicated unit train double stack services were on tight ship oriented schedules, this is fast changing. As double stack becomes more of a domestic phenomena, and as it is integrated into general freight trains with single well cars, there are likely to be more intermediate stops.

Manalytics, Inc. has suggested that volumes as low as several thousand containers a year will justify intermediate stops on dedicated trains, but that minimum distances of 725 miles will still be required in order to compete with truck. While this may be the case for dedicated trains, the conclusion of this report is that through trains operating via Southeast Michigan will make stops, and will provide service for shorter distances than 725 miles. One factor that will force this is the power of auto industry customers. The majority of rail executives interviewed also indicated that some local service benefits would accrue from trains being routed on this corridor. One fact that is certain, is that Southeast Michigan will never have the opportunity to test this benefit if through trains are routed elsewhere.

Should normally through trains make local stops, the benefits are likely to relate to both frequency of service, and price levels. Service frequency will increase because more trains are moving through the corridor. Prices might improve significantly for westward traffic because a large volume of empty containers being repositioned to the West Coast would be available as they passed through Southeast Michigan on the return trip. Currently, empty Asian containers are routed back through Buffalo to the West Coast. While it is hard to judge the potential for, and the level of such benefits, they could in fact materialize.

Finally, the increased through trains and rail traffic that a double stack tunnel might help bring about would contribute to the area's potential as a major rail "hub." The railroad industry is continuing to consolidate and evolve towards a new infrastructure system that will be much like the "hub and spoke" systems now prevalent in the airline and trucking industries.

It is critical that one of the hub areas be located in Southeast Michigan, and a double stack tunnel capability could help to position Southeast Michigan as the natural location of such a hub. Hub facilities tend to be located at centers of travel with spokes extending 360 degrees. Without modern access to Canada, Southeast Michigan is located at the terminus of a U.S. system, with full Canadian access, Michigan is at the center of a major rail corridor and would be a natural location for "hub" operations.

Plant/Distribution Center Location Impact

The impact of a double stack tunnel on plant location decisions relates both to the reality of transportation services in Southeast Michigan, and to the perception. In fact, the perception is often not fully related to the reality, and may well be more important than the reality.

In considering the impact that a double stack tunnel could have, it must first be noted that double stack services are already available in Southeast Michigan. For instance, the Mazda plant is currently served by double stack. The question is one of whether a double stack tunnel would lead to more double stack in the area, and whether this development of double stack services might be sped up by the construction of cross-border double stack services. Based on the analysis conducted on specific routes, it does appear that a double stack tunnel would contribute to more double stack services.

If double stack develops to a greater degree, and faster than it otherwise would in Southeast Michigan because of a tunnel, this could have a positive impact on location decisions. A recent survey on the importance of site selection factors conducted by Transportation and Distribution (1991) magazine concluded that "transportation access" was the most important site selection factor for manufacturers and distributors.

While transportation access is important, it is unclear how important rail is. For many companies it is not a factor. A recent article on the importance of rail and port facilities in corporate location decisions is titled "Shippers Prefer Highway Access (1991)." However, FHH Fantus Corporation, the premier location consultant, stated in that article that it is a consideration about half the time for Fantus clients. While the importance of rail may, in fact be increasing, the ability to obtain rail services via multimodal operations has decreased the importance of being located on a siding. However, the drayage distance is important and the closer a manufacturing plant is to a rail intermodal yard the better.

Local development officials understand the importance of rail in attracting industrial and consumer durables manufacturing plants. This general view was conveyed in interviews with the Michigan Department of Transportation. They indicated that it is especially important for many of the industrial durable goods manufacturers that often are located in Michigan or that want to locate here because of the supply base. The importance of rail service is also clear when reading some of the economic development trade press. For instance, in a recent article a Dauphin County, Pa. development official indicated that his county's growth was dependent on highway and rail infrastructure (Palermo 1990). The official pointed out that freight classification yards that had been located in the county, and the development of new intermodal yards in the city, had been critical factors in the attraction of several new manufacturing plants.

It is also clear that rail is becoming more important to planners and location executives than was the case until recently. For instance, interviews with logistics executives at all three Detroit headquartered auto companies indicated that rail service was critical in the location of auto assembly plants. This interest in rail service is somewhat newfound. During the 70's and 80's there was little interest in rail access as an issue in plant location decisions. The trend seems to be towards increasing importance being attached to rail service, and this trend could be strengthened if and when additional tax and environmental burdens are imposed on the trucking industry.

The conclusion then is that a double stack tunnel would contribute to improved service, and that this service would have an impact on manufacturing plant and distribution center location decisions. However, the perception about rail service levels in Southeast Michigan will be more important than the reality.

Michigan has a reputation in transportation and logistics circles as being outside of the economic and transportation mainstream because of its location on the northern edge of the country, and because of its peninsular nature. A double stack tunnel would call popular and trade press attention to the fact that Michigan is at the center of a major gateway transportation corridor between Chicago and Montreal. It would also allow Michigan location officials to tout the benefits of double stack service, and to indicate that Michigan is on a growing and important rail line. One CP Rail marketing executive pointed out that even if there are no double stack advantages on a route, in order to compete today, it must be double stack. While strictly an image issue, this points out the industry attraction problems a community may face in the future if it is not perceived to be on a major double stack corridor.

In conclusion, it would appear that rail is of increasing importance in manufacturing plant location decisions, and that proximity to intermodal yards is the critical question. Such intermodal yards are more likely to exist in a city, and are more likely to offer attractive services and rates if a major double stack corridor passes through the city. As such, a double stack tunnel could facilitate an increasing intermodal yard presence. The tunnel, and the resulting increase in the importance of rail lines using the tunnel, could be a very positive factor in improving the image of the region's transportation services. And, it is the image that may be the most important factor in plant location decisions.

Reduced Highway Traffic

One of the benefits of a double stack tunnel that has been discussed in each specific route sub-part has been the impact on reducing highway traffic. Based on the conservative estimates of first year traffic that could be pulled off the highways, it would appear that some 116,000 trucks per year could be removed from the international bridges and highway system.

It would be almost impossible to quantify the benefit of this statistic should it prove true. However, this traffic level represents approximately 5% of the truck volume at the two principal highway crossings. At current growth rates for the two crossings in combination, this represents approximately one years traffic growth. As such, the construction of any new highway capacity could be delayed by one year if this forecast were to hold true.

Facilitation of Competitive Transportation Routes

A double stack tunnel would help to facilitate a competitive Port of Montreal, and a competitive rail transportation corridor between the U.S. Upper Midwest and the U.S. East Coast. The degree of facilitation depends on the extent of double stack benefits that are in fact able to be passed on after absorption of the construction costs.

Montreal is quite important in providing Michigan exporters to Europe a competitive route to U.S. East Coast ports. Given development of Conrail double stack services from the U.S. Midwest to New York, it may be all the more important for Montreal to have double stack access to the U.S. Midwest. While Montreal itself would be the main beneficiary, if Montreal were to become non-viable Michigan shippers would lose a valuable competitive advantage in exporting to Europe.

A double stack tunnel could also facilitate development of a new rail route from the Upper Midwest to the U.S. East Coast markets using the CP Rail System. Such a system would offer Michigan shippers a competitive option to Conrail services, and could take truck traffic off the roads as indicated earlier. The competition at the very least might reduce rail and trucking rates on the all U.S. corridor.

High Speed Rail Capability

The current tunnel is not deep enough to accommodate the installation of special power equipment necessary for high speed passenger rail systems now being contemplated. A new double stack tunnel would allow for installation of the catenary power systems necessary for such trains. This benefit would accrue to tunnels built at either Detroit-Windsor or Port Huron-Sarnia, although current passenger trains operate through Port Huron-Sarnia only.

Single Business Tax Benefits

The State of Michigan collects the Single Business Tax for every revenue carload of traffic passing through Michigan. Last year the state collected $3.9 million from 14 railroads. This revenue was based on 1.1 million revenue carloads of traffic, and averaged out to $3.54 per revenue carload.

Incremental rail traffic using a new double stack tunnel would also be subject to the tax. However, while converted truck traffic would pay the tax, there would be no net gain because there would be some loss of motor carrier fuel tax revenues.

The incremental traffic not now using Michigan rail and/or highway crossings totals 104,600 units. Asia-Canada represent 50,000 of the total, and Upper Midwest-East Coast converted trucks represents 54,600 units. This latter traffic is assumed to have bypassed Michigan in truck movements previously. Based on an average tax of $3.54 per car last year, it could be assumed that a Michigan SBT benefit of $.4 million would result.

Automotive Industry Benefits

The great bulk of the auto industry interest in rail border crossings relates to obtaining a facility that will accommodate tri-levels, high cube boxcars, and TOFC. As has been discussed previously, these objectives can be achieved by a partial deepening at Detroit-Windsor. All three auto companies have made it clear that they do not want a potential new double stack tunnel to delay accomplishment of this principal objective. As such, they would like a partial deepening project to proceed as soon as possible.

The automotive industry interest in cross-border double stack is less pronounced but relates to the need for an integrated North American transportation system that can provide world class competitive costs and service. The specific interests are in the areas of double stack parts movements between U.S., Canada and Mexico, the efficient movement of 20'2" tri-levels and possible higher cube boxcars, and in the possible future movement of autos in containers.

The auto industry logistics executives interviewed were all interested in obtaining double stack cross-border capability if it would allow for lower rates, regardless of whether it benefited Michigan assembly plants per se. All three companies indicated fairly strong support for the need, however, one firm indicated they did not think they would be a significant user of such a capability. This firm indicated that double stack would "incrementally improve efficiency but not by a substantial amount."

A second company was strongly interested in the capability from the standpoint of serving Ontario assembly plants with U.S. and Mexican components, and from the standpoint of moving goods between the U.S. Upper Midwest and Europe via Montreal. This company's interest was at a conceptual level but was fairly strongly stated in terms of desire for the project to advance.

A third company's interest was more strongly related to 20'2" tri-levels, and to some extent, was also related to the potential to move U.S. and Mexican components to Ontario assembly plants. This company is also increasingly interested in the potential of shipping autos in containers. The company expressed the strongest support for the concept but could not say for certain that the capability would change their cross-border transportation operations. None-the-less, senior executives indicated a very definite desire to see the project advance.

As indicated above, there are three categories of benefit that are of interest to the auto companies. These categories are discussed in the following sub-parts.

Inbound Component Movements

The first benefit category relates to use of double stack for improving the efficiency of inbound component movements. This interest relates to movements from the U.S. Midwest to Europe via Montreal, to movements from Mexico and the U.S. South to Canadian assembly plants, and to movements from Michigan/Ohio to Ontario and Quebec assembly plants. In the case of movements to Europe, one company currently moves 7000 containers a year via Montreal and expects the volume to increase substantially. A double stack capability would lower the land costs according to this company.

Two of the three auto companies had a strong interest in the ability to move Mexican components directly to Canadian assembly plants. In terms of Michigan/Ohio movements to Canada, one firm thought the distances were too short, while the other two felt double stack would be feasible. This latter view suggested that double stack movements could occur as part of normally through trains that would in fact provide intermediate service, and as single well movements using existing general freight trains. Assembly plants in St. Therese and Bramalee were most frequently mentioned as potential recipients of double stack inbound service.

<u>20'2" Tri-levels</u>

The second benefit category relates to the need for moving automobiles, small pickups and mini-vans in tri-levels that will accommodate a mix of these vehicle types. Standard tri-levels do not have sufficient height to allow this, and the new 20'2" tri-levels cannot fit through the tunnel even after deepening. The interest in the 20'2" tri-level relates to just one company, Chrysler. The other two companies expressed little or no interest in the 20'2" tri-levels. However, if the 20'2" capability was available Chrysler has indicated that this might allow them to switch from cross-border truck movements to rail. It is estimated that Chrysler could save $2.3-3.2 million after absorption of construction surcharges. Such a development could also move 60,000 trucks a year off the bridges. The greatest level of benefit would be achieved if the capability was available at Detroit-Windsor.

Autos in Container

The third potential benefit relates to the shipment of autos in containers. None of the three companies indicated strong support for the concept, although Ford has been testing the AutoStack system of one manufacturer on shipments from Chicago to the U.S. Northwest. In addition, Chrysler has stated that their interest is growing. If the concept were to develop, Chrysler indicates that a double stack tunnel would be critical to the competitiveness of assembly plants in both Canada and the U.S. Upper Midwest. Canadian plants would need the double stack tunnel capability to competitively reach all U.S. markets. U.S. Upper Midwest plants would need the capability to reach New England and Upper East Coast markets via the Ontario routes.

There are three advantages to the system. First, it allows for double stack movements thereby reducing line-haul costs. Secondly, one system being developed allows the racks to be folded and stored in one container, thereby freeing up the other four containers for loaded backhaul movements. This would provide significant advantages compared to current tri-level equipment which can only be used to carry vehicles. Third, the system allows vehicles to take advantage of the ride quality features that double stack offers. However, the disadvantages relate to loading/unloading time, special equipment needs, and the equipment weight.

Two developments could lead to auto in double stack becoming an important technology, and to the need for cross-border rail crossings that would accommodate double stack. First, if domestic containerization becomes widespread, the preferred route to New England and the Upper East Coast will be through Michigan and Buffalo. Secondly, if a trend towards smaller dealer orders of customized vehicles develops, it may be appropriate to ship those orders in small container lots. The system is also likely to be used for high priced cars, and could be important for the export of U.S. cars to Europe at some future date.

Auto Industry Conclusions

In conclusion, all three auto companies have expressed varying degrees of support for the double stack tunnel need. However, all three have also indicated that the greatest benefit will come from deepening the current tunnel, and that this project should go forward first. In terms of a double stack tunnel, the greatest support relates to Chrysler's 20'2" needs. The remaining support is at a more conceptual level, while the 20'2" tri-level interest seems to be at an operational level. It should also be noted that interest in a double stack tunnel by domestic auto companies may turn in part on the relative benefits to the Big Three, compared to the potential benefits for Asian transplants.

DETROIT-WINDSOR AND PORT HURON-SARNIA DOUBLE STACK TUNNEL COMPARISON ASSUMING NO PRIOR DEEPENING AT DETROIT-WINDSOR

This section summarizes the cost benefit payback data for both the Detroit-Windsor and Port Huron-Sarnia projects assuming the Detroit-Windsor partial deepening project does not take place. In this case, all of the benefits associated with both partial deepening and double stack accrue to the double stack project. This allows for a more even comparison between the Detroit and Port Huron projects because there is no partial deepening option at Port Huron, and consequently, the project there already assumes all oversize traffic benefits accrue to the double stack project. The main difference that exists between the two projects is then the construction cost, and the benefits related to 20'2" tri-levels.

Exhibit 13 summarizes the first year savings and net present value payback years for both the projects. Each option shows the savings and payback for North America wide benefits and for

Exhibit 13
Detroit-Windsor and Port Huron-Sarnia Double Stack Tunnel
Detroit-Windsor Assumes No Previous Partial Deepening
Cost Benefits Analysis
(U.S. Millions of Dollars)

Annual Benefits	North America-Wide Detroit-Windsor Double Stack Only Tunnel	Michigan-Wide Detroit-Windsor Double Stack Only Tunnel	North America-Wide Port Huron-Sarnia Double Stack Only Tunnel	Michigan-Wide Port Huron-Sarnia Double Stack Only Tunnel
■ Current Oversize Car Benefit				
• Decreased rail ferry operating cost[1]	$ 10.2	$ 4.1	$ 10.2	$ 4.1
• Improved service times	.9	.4	.9	.4
• Elimination of federal harbor maintenance fee	8.2	3.3	8.2	3.3
Subtotal	$ 19.3	$ 7.8	$ 19.3	$ 7.8
■ 20'2" Tri-Levels[2]	2.6	1.0	1.2	.5
■ Other Benefits for Current Rail traffic	12.4	3.6	12.4	3.6
■ Truck Traffic Converted to Double Stack Rail Benefits	6.5	1.6	6.5	1.6
Total Quantifiable Benefits	$ 40.8	$ 14.0	$ 39.4	$ 13.5

[1] Assumes project built results in elimination of all ferry services at both locations and that all oversize traffic uses the project built.
[2] Assumes lowest savings in range identified earlier.

Exhibit 13 (Cont'd.)
Detroit-Windsor and Port Huron-Sarnia Double Stack Tunnel
Detroit-Windsor Assumes No Previous Partial Deepening
Cost Benefits Analysis
(U.S. Millions of Dollars)

	North America-Wide Detroit-Windsor Double Stack Only Tunnel	Michigan-Wide Detroit-Windsor Double Stack Only Tunnel	North America-Wide Port Huron-Sarnia Double Stack Only Tunnel	Michigan-Wide Port Huron-Sarnia Double Stack Only Tunnel
Project Costs				
■ Double Stack Tunnel	$172.0	$172.0	$155.0	$155.0
NPV Payback[3]				
■ Years for Payback	4.8	16.4	4.5	15.0

Potential Negatives

- Loss of truck drayage and rail yard activities related to transporting to Canada goods now deramped/ramped in Chicago and/or Detroit
- Loss of ferry jobs at Detroit-Windsor and Port Huron-Sarnia

[3] Payback years are based on annual earnings inflated 5.0% per year and discounted back to present value at 8%. Payback years equals the number of years required for discounted earnings stream to equal construction costs.

benefits assumed to accrue to Michigan alone. For the Detroit-Windsor project the annual benefits for all types of traffic, both current oversize cars and new double stack ones, totals $40.8 million. The net present value payback period equals 4.8 years. Michigan benefits alone total $14.0 million per year and the net present value payback is 16.4 years. For the Port Huron project, the North America wide benefits total $39.4 million per year, and the net present value payback is 4.5 years. The Michigan benefits total $13.5 million per year, and the net present value payback is 15.0 years.

CONVERSION OF EXISTING DETROIT-WINDSOR TUNNEL TO TRUCK

The conversion of the existing twin tube Detroit-Windsor railroad tunnel to truck would increase highway capacity at the border crossing. However, this project would cost an estimated $65 million for the conversion of the tunnel and immediate plaza, plus a conservatively estimated $30 million for full access costs. In total the project would cost $95 million, before financing.

In studying the benefits of this option the key questions relate to 1) the cause of congestion and the point at which the Ambassador Bridge roadbed will reach capacity, and 2) the benefits which would derive from tunnel truck conversion. The following two parts examine the above questions. The final two parts examine the cost benefits on a "what-if" level.

The basic conclusion is that a converted truck tunnel does not address the proper needs and therefore does not provide any significant benefits until the year 2005 when a need for truck roadbed capacity develops. Analysis of Ambassador Bridge truck capacity and likely future truck peak hourly volumes indicates that sufficient roadbed capacity will exist there until 2005. And, while the Detroit-Windsor auto tunnel will reach its capacity shortly, the need that this presents is auto capacity, and not truck capacity. As such, there is no benefit based on the most likely outcome, until the year 2005.

While there does not seem to be a truck roadbed capacity problem until 2005, a "what-if" analysis of plausible benefit ranges was conducted to determine the payback period that would be required at those levels. This analysis is shown in Exhibit 14. The benefits range assumed that half the Detroit truck traffic was available and that each truck crossing experienced delays of 10, 20, or 30 minutes costing $5, 10, or 15 dollars. At these levels annual benefits of $3.9, 7.8, and 11.7 million were obtained with payback periods of 46.5, 16.2, and 9.8 years. The $11.7 million delay cost would be equivalent to the entire 1989 calculated delay cost at the Ambassador Bridge. And the causes of those delays, secondary capacity and booth staffing, have been addressed and/or would not be resolved by this proposal. As such, the conclusion is that the savings range is unrealistic.

Exhibit 14
Detroit-Windsor Tunnel Conversion to Truck
Michigan Benefits Equivalent to North America-Wide
Cost Benefits Analysis
(U.S. Millions of Dollars)

	"What-If" Benefits Alternatives		
Annual Benefits "What-If" Analysis	$5.00/Truck or $3.9 million/yr	$10.00/Truck or $7.8 million/yr	$15.00/Truck or $11.7 million/yr
■ Conversion of Railroad Tunnel to Truck [1]	$ 3.9	$ 7.8	$ 11.7
■ Crossing Backup and Elimination of Downtown Truck Traffic at Auto Tunnel	City Street Congestion Reduced	City Street Congestion Reduced	City Street Congestion Reduced
Project Costs			
■ Total Costs	$ 95.0	$ 95.0	$ 95.0
NPV Payback [2]			
■ Total	46.5	16.2	9.8

Potential Negatives

■ Diversion of Ambassador customs staff to new plaza or use of city streets to reach Ambassador Plaza.

[1] Assumes all benefits accrue to Michigan as well as North America.
[2] Assumes 5% inflation per year in first year benefits and 8% discount rate.

Current Congestion Problems and Causes

A review of the current problems requires an examination of the current traffic levels, an understanding of the previously estimated capacity and volume levels and forecasts at the Ambassador, an understanding of the most recent information on capacity following improvements, and information on the latest estimates of roadbed capacity and peak hourly volume forecasts. Each of these issues is discussed in the following sub-parts.

Current Traffic Levels

Exhibit 15 contains a summary of the most recent traffic volume information for the main truck crossings. The Exhibit indicates that total auto traffic grew at a 4.9% per year average rate during the period 1984-1990, and that truck traffic grew at a 4.2% rate during the same period.

At the Ambassador Bridge auto traffic is up an average 4.0% per year, while truck traffic grew 1.1% per year. However, auto traffic grew 7.2% in 1989 and 6.2% in 1990. Truck traffic was down 6.1% in 1990 reflecting the recession.

At the Detroit-Windsor auto tunnel the auto traffic grew 3.3% per year during the period. Truck traffic volumes are not large. However, auto growth totaled 4.2% in 1989 and 8.1% in 1990. By

Exhibit 15
Border Crossing Traffic Levels
(Millions of Vehicles)

	1984	1985	1986	1987	1988	1989	1990	Annual Average Growth
■ Ambassador Bridge	6.1	6.3 (+3.3%)	6.4 (+1.6%)	6.4 (—)	6.6 (+3.1%)	6.9 (+5.7%)	7.3 (+3.3%)	(+3.3%)
■ Detroit-Windsor Tunnel								
• Auto	5.6	5.7 (+1.8%)	5.8 (+1.8%)	6.0 (+3.4%)	5.9 (-1.7%)	6.2 (+4.2%)	6.7 (+8.1%)	(+3.3%)
• Truck	.2	.2 (—)	.2 (—)	.2 (—)	.3 (+50.0%)	.3 (—)	.2 (—)	(—)
Subtotal	5.8	5.9 (+1.7%)	6.0 (+1.7%)	6.2 (+3.3%)	6.2 (—)	6.4 (+3.6%)	6.9 (+7.8%)	(+3.2%)
■ Detroit-Windsor Subtotal								
• Auto	10.2	10.4 (+2.0%)	10.6 (+1.9%)	10.9 (+2.8%)	10.9 (—)	11.5 (+5.6%)	12.3 (+7.2%)	(+3.4%)
• Truck	1.7	1.8 (+5.9%)	1.8 (—)	1.7 (-5.5%)	1.9 (+11.8%)	1.9 (—)	1.8 (—)	(+.9%)
Subtotal	11.9	12.2 (+2.5%)	12.4 (+1.6%)	12.6 (+1.6%)	12.8 (+1.6%)	13.4 (+4.7%)	14.1 (+5.5%)	(+3.1%)
■ Blue Water Bridge								
• Auto	2.8	2.9 (+3.6%)	3.1 (+6.9%)	3.4 (+9.7%)	3.3 (-2.9%)	3.6 (+9.0%)	4.5 (+23.1%)	(+10.1%)
• Truck	.3	.4 (+.3%)	.5 (+25.0%)	.5 (—)	.6 (+20.0%)	.6 (+5.7%)	.7 (+4.1%)	(+16.7%)
Subtotal	3.1	3.3 (+6.5%)	3.6 (+9.1%)	3.9 (+8.3%)	3.9 (—)	4.2 (+8.5%)	5.2 (+20.4%)	(+11.3%)
■ Totals								
• Auto	13.0	13.3 (+2.3%)	13.7 (+3.0%)	14.3 (+4.4%)	14.2 (-.1%)	15.1 (+6.3%)	16.8 (+11.3%)	(+4.9%)
• Truck	2.0	2.2 (+10.0%)	2.3 (+4.5%)	2.2 (-4.3%)	2.5 (+13.6%)	2.5 (—)	2.5 (—)	(+4.2%)
Total	15.0	15.5 (+3.3%)	16.0 (+3.2%)	16.5 (+3.1%)	16.7 (+1.2%)	17.6 (+5.4%)	19.3 (+9.7%)	(+4.8%)

1990 auto traffic had reached 6.7 million and truck traffic had reached an estimated .28 million.

At the Blue Water Bridge, auto traffic grew an average 10.1% per year during the period, while truck traffic grew 22.0% during the same time period. Auto traffic was up 9.0% in 1989, and 23.1% in 1990. By 1990 auto traffic had reached 4.5 million and truck traffic had climbed to .7 million, for a total of 5.2 million vehicles.

While the Blue Water Bridge truck traffic averaged 4.2% growth during this period, it is interesting to note that total Detroit area truck traffic was up just .9% per year during the six year time frame. In fact, truck traffic is down 4.9% since 1988 at the Ambassador Bridge. The conclusion is that truck traffic growth has been much more moderate than auto growth. And, given the shortage of auto capacity at the tunnel, it would seem that auto capacity needs are the greatest.

A.T. Kearney Current and Forecast Capacity and Volumes for Ambassador Bridge

For the Ambassador Bridge the A.T. Kearney study concluded that truck capacities for the toll facilities totalled 154 trucks per hour and 160 trucks per hour, respectively, for the U.S. and Canadian sides. Primary booth capacity was estimated at 280 trucks per hour on the U.S. side, and 328 trucks per hour on the

Canadian side. Secondary inspection plaza capacity was estimated at 67 per hour on the U.S. side, and at 100 trucks per hour on the Canadian side. it should be noted that only two thirds of the trucks crossing are routed into secondary. Finally, the roadbed capacity at the Ambassador Bridge was estimated at 1534 per hour each way for autos and 383 per hour each way for trucks, for a total roadbed capacity of 1917.

For entry to the U.S. and to Canada peak truck volumes did not exceed 200 trucks per hour at any time during a sample month of truck volumes per hour. Calculated peak truck volumes were assumed to equal 190 trucks in each direction. Based on these volumes it was concluded that the capacity problems at the Ambassador Bridge on entry to the U.S. related to toll booths and truck secondary yard space. For entry to Canada the major bridge problems relate again to toll and secondary plaza capacity. At times the capacity of the primary inspection booths is also reached. For auto traffic the primary capacity problem relates to the number of auto inspection booths, assuming provisions are not made to use truck booths. While capacity problems were not a significant factor for truck delays, the staffing of primary and secondary booths was a factor. The general conclusion was that inadequate staffing of inspection booths caused the great majority of recorded delays.

Looking to the future, the A.T. Kearney report indicated that planned improvements to the Ambassador Bridge would lead to an increase in truck toll capacity to over 300 per hour, and an increase in truck primary inspection capacity to 336 trucks per hour on each side. The secondary inspection capacity was forecast to increase to 157 on the Canadian side, and to 100 on the U.S. side. Based on forecast 1994 volumes, and a calculation of hourly peak truck demand, A.T. Kearney concluded that truck capacity would be adequate at least until the forecast year of 1994.

This conclusion was based on a truck roadbed capacity of 383 units an hour and forecast hourly peak truck volumes of 337 units under the most optimistic scenario. However, it should be noted that the hourly peak traffic was assumed to equal 12% of calculated ADT volume. This level of 337 trucks an hour exceeded the 1989 actual peak hour volumes by 68%, far more than the forecast growth in annual traffic. As such the 337 unit hourly peak truck forecast in the Kearney study would seem to be suspect. While this excessive hourly truck forecast was still within the capacity constraints for all crossing elements it must be used with caution.

The conclusion from the A.T. Kearney study is that volumes through the 1994 forecast will be within the roadbed capacity of the bridge, and that improvements planned at the time would allow for sufficient capacity in other elements.

Additional Information on Capacity Following Planned and Completed Improvements

More recent information on the Ambassador Bridge improvements indicates that on the U.S. side they will have the anticipated six truck booths with the assumed capacity of 336 trucks per hour. The improvement plan being constructed by GSA at this time will allow for three additional truck booths to be added if necessary. This would increase truck capacity to 500 plus trucks an hour at standard processing times. Auto booths on the U.S. side will be increased to 14-15, eliminating potential problems with auto capacity at booths. Plans are also being made to allow for auto use of truck booths at peak auto-average truck demand periods. The secondary yard construction anticipated in the study is underway and will lead to the planned increase in yard capacity. Toll capacity has not yet been addressed but can be easily dealt with.

On the Canadian side the contemplated off-site secondary yard is now a reality. This substantially increases the capacity on the Canadian side. While truck primary inspection capacity is not a problem on the Canadian side given the potential to use six booths (four truck only and two auto/truck capable), the primary inspection booth capacity on the Canadian side can now be increased because of the movement of secondary off-site.

With the changes which have been made, and with the construction underway, each of the non-roadway elements should be capable of handling traffic into the foreseeable future. In terms of roadway, the ingress problems on the Detroit side which were to be corrected with construction of the Welcome Center are on hold. It is unclear when this project will resume but as volume grows there will be an increasing need to resolve the street access to the bridge.

Additional Information on Roadbed Capacity and Peak Hourly Volume

The remaining issue is the roadbed capacity of the bridge itself. The A.T. Kearney study calculated the roadbed capacity at 383 units per hour. However, previous studies have calculated the capacity at anywhere from 220-390 trucks per lane per hour with an assumption that one is available for trucks. In estimates prepared for the Border Station Environmental Impact Statement (EIS), Barton-Aschman, Inc. estimated the truck roadbed capacity at 390 trucks per hour. The Michigan Department of Transportation (MDOT) estimated the capacity at between 220 and 390 trucks per hour. For purposes of a uniform position in the EIS, MDOT and other parties agreed to a truck roadbed capacity of 300 trucks per hour.

The latest simulations by MDOT indicate that the one way roadbed capacity for trucks is between 239-300 trucks per lane per hour. Conversations with MDOT indicate that they believe the actual capacity is closer to the higher end number of 300 trucks.

In terms of future volume levels, the A.T. Kearney study found actual truck peak volume levels did not exceed 200 per hour in 1989. The Kearney annual volume forecasts assumed growth of 3% per year through 1994. Actual growth to date at the Ambassador Bridge is a negative 4.9% through 1990, and it appears that 1991 volume will not exceed 1990s. If this is the case, it would take until 1998 for truck volume to reach the originally forecast 1.9 million units. If the 1989 hourly peak volume were to grow at the same rate as total annual volume forecast, the hourly peak volume in 1998 would equal 231 units.

The peak hourly volume in 1994 would have been 205 using the 1991 actual annual growth to date from 1988, and the forecast 3% annual growth until 1994. This calculated peak of 205 would exceed the A.T. Kearney calculated peak (based on 12% of ADT) by 64%. The conclusion here is that the 1994 peak of 205, and the 1998 peak of 231 is a more reasonable number. However, MDOT calculates the theoretical design hour volume value to be 264 given current average daily traffic.

While it is difficult to draw any conclusions it will be assumed here that the roadbed capacity is 300 trucks per hour. Given that 1989 actual truck traffic did not exceed 200 units an hour it is hard to understand how hourly peaks could exceed 200 units an hour today, given the decline in annual volume. It would seem very unlikely that peak hour truck traffic would grow as fast as annual demand forecasts of 3%. However, if it did grow at that rate, it would take until 2005 to reach the roadbed capacity of 300. By the year 2010, when the EIS predicted peak hourly volumes of 366 trucks, the 3% growth rate would result in 350 trucks per hour. However, if the MDOT theoretical estimate of a current 264 unit design hour volume were used, along with a 3% growth rate in traffic, the 300 unit capacity would be reached in 1995. This 264 unit current level seems extremely high given the actual figure of 200 in 1989. As a result this study will assume that the 300 truck per hour capacity will be reached in the year 2005. It should also be noted that the increases in truck volume reduce the auto capacity at a disproportionate rate, however, there is considerable auto roadbed capacity available.

Detroit-Windsor Auto Tunnel

The Detroit-Windsor auto tunnel is, unlike the Ambassador, much closer to its physical capacity. The A.T. Kearney study forecast that the auto tunnel would reach its roadbed capacity by 1994. The study also indicated that the tunnel would approach or exceed the planned capacity of primary and secondary auto and truck inspection booths at that time. Since the completion of the A.T. Kearney study the General Manager of the tunnel has indicated that additional auto roadbed capacity will be needed before the year 2000 in the Detroit area.

Blue Water Bridge

The Blue Water Bridge has experienced rapid traffic growth since 1988. Auto traffic is up 32% between 1988 and 1990. Truck traffic is up 10.3%. Based on 1991 YTD March 31 data, the Blue Water auto traffic will be up an additional 20% in 1991 for a total three year increase of 52%. Given that the bi-directional design hour volume was 1478 vehicles in 1989, and that previous plans called for commencement of final engineering design for a second span at that point, it would appear that congestion will be up considerably at the Blue Water. While it would not be appropriate to factor up the 1989 DHV figure by the traffic growth, it is clear that a new span will be needed in the not too distant future.

Benefits Related to Tunnel Conversion

The benefits of a new tunnel depend on the current and forecast costs of congestion, on the level of service such a tunnel would offer, and on the costs of a new tunnel. Other benefits relate to emergency backup crossings and elimination of downtown truck traffic. Costs could be expressed in terms of the overall project costs, or in terms of the likely tolls required for breakeven operation. These issues are explored in the following sub-parts.

Current Costs of Delays

Based on earlier 1989-1990 research conducted by A.T. Kearney, Inc. it is clear that truck congestion is a problem at selected times at the Ambassador Bridge. However, recent reports indicate that there has been substantial improvement in both truck and auto processing at the Bridge. The existing delays are estimated to have cost $10.3 million in 1989. An estimated $3.8 million of these delays occurred at primary inspection booths, while $6.5 million of the delays occurred at secondary inspection facilities. Data on the length of specific backups at the Detroit-Windsor Auto tunnel was not available, however, anecdotal reports indicate that backups are often a problem at this crossing as well. The delays at the tunnel relate more to automobiles then to trucks given the modest truck volumes at the tunnel compared to the bridge.

Based on information presented earlier it would appear that the Ambassador Bridge crossing elements, including roadbed, will be adequate for truck traffic at least through the year 2005. This is the case because of improvements underway or completed in non-roadbed capacity, and because an earlier forecast of 1994 peak hourly truck demand has been found to be excessive. It also appears that the Ambassador Bridge will have adequate auto capacity through at least the year 2000 because of improvements underway or in the final design stages. As a result, the delay costs discussed above will no longer exist assuming the government agencies properly staff the facility.

However, auto delays are likely to become excessive at the Detroit-Windsor auto tunnel, and truck volume using this crossing will increasingly divert to the Ambassador, somewhat speeding the day when Ambassador capacity will be reached. The costs of these delays would be difficult to measure.

Level of Service at Converted Tunnel

The converted railroad tunnel would provide one lane, one way truck only capability. It does not appear that autos could use the tunnel due to width restrictions and regulator guidelines. While this capacity would eventually be needed for truck in the future, the roadbed estimates at the Ambassador would not justify this need until the year 2005. However, auto capacity will be needed by 1994 according to A.T. Kearney's study, and by the year 2000 according to the General Manager of the auto tunnel.

Even if the tunnel could be used for autos, or was currently needed for truck, it is likely that customs and immigration staffing problems on both sides of the border would dictate use of the Ambassador Bridge plazas for inspection. The alternative would require construction of new plazas included in the project cost estimate, and staffing of the facility by the regulatory agencies. This could be a major problem given staff shortages.

The converted tunnel would also provide a poor level of service given the single narrow lane in each direction, and would require very careful driving.

Cost of New Tunnel

As indicated above, a new tunnel would cost $95 million, including road access. Financed at 8% over 30 years, the tunnel would have a total cost of approximately $480 million. Assuming truck only traffic, and capture of half the available first year traffic, or 777,000 trucks a year for 30 years, the total traffic volume over the project life would equal 23.3 million units. In order to recover the full cost, a toll of $20.60 per truck would be required. This compares to a current competitive average truck toll of $13.60.

Backup Crossing and Elimination of Downtown Truck Traffic

One of the soft benefits of converting the railroad tubes to truck use relates to the provision of emergency capacity. If for some reason, the Ambassador Bridge were to be blocked, traffic would now have to divert to Port Huron or Buffalo. Additional truck capacity would provide an emergency backup crossing.

Such a crossing would also be valuable during times of peak auto use of the Ambassador Bridge. While these time periods are generally on weekends when truck traffic is very low, there are drive-time weekday hours when it would be beneficial to be able to divert truck traffic to another crossing.

The other major soft benefit would involve the elimination of truck traffic now using the Detroit-Windsor auto tunnel. The tunnel was not really designed to accommodate truck traffic and the plazas do not have sufficient room to accommodate trucks. Most importantly, trucks using the auto tunnel must drive through the absolute centers of Detroit-Windsor and are an eyesore at the heart of the convention and tourist districts on each side of the border. The converted tunnel would allow the city to consider a ban on trucks using the auto tunnel now that both sides are owned by the cities, although, the management contract/lease with the private operator might not allow such a ban.

Cost Benefits Analysis

While there does not appear to be any short term advantage to the project, a "what-if" cost benefit analysis can be useful in determining the range of benefit that would be necessary to make the project reasonable. A "what-if" benefits analysis is necessary because it is not possible to estimate any actual benefits. This analysis is conducted in Exhibit 14 and is summarized earlier in this section. The analysis indicates that if the tunnel carried half the current truck volume at Detroit, and each of these trucks saved $5 in delay costs (or 10 minutes), that a net present value payback of 46.5 years would result. At this level the benefits would equal $3.9 million. At $10 and $15 per truck of savings per crossing, the benefits would equal $7.8 and $11.7 million per year, and the payback would be 16.2 and 9.8 years respectively. A $11.7 million annual benefit would be similar to the 1989 estimate of $10.3 million in Ambassador Bridge truck delay costs. These delays were mostly caused by secondary capacity problems which have been corrected, and by a lack of primary inspection booth staffing.

__Tunnel Conversion Conclusions__

The conclusion is that the tunnel conversion does not address the most critical capacity need, which is for auto traffic. And, because there is considerable spare roadbed capacity for auto at the Ambassador, there would be little value in freeing up truck space there for autos. The analysis indicates that the Ambassador roadbed can accommodate truck traffic to the year 2005. As a result, there is not an immediate need for truck capacity. Although, from a planning perspective, it is not a long distance out.

The level of service would also be quite poor given the one way, single lane construction. It is likely that many truckers would prefer to use other crossings.

Finally, the costs of the tunnel conversion are excessive, both in terms of the "what-if" payback analysis conducted above, and when compared to what the money would buy in alternative projects. First, it should be noted that the $95.0 million is a conservative estimate in that the road access costs could easily be higher. However, even if the project could be done for this amount, the result would be a truck only, extremely restricted, century old facility. This sum of money would pay for half the estimated costs of a new span at the Blue Water Bridge, or for 58% of the cost of the proposed railroad double stack tunnel.

As a result of the above points it does not appear that the conversion is viable, at least not until the year 2005, when the Ambassador roadbed capacity is forecast to be exceeded.

ORIGINAL MDOT NEW DOUBLE STACK/TUNNEL TRUCK CONVERSION CONCEPT

This section combines the analysis for the new Detroit double stack tunnel, and for the tunnel conversion to truck, and provides an estimate of the cost benefits of the original MDOT concept. The analysis first assumes that no prior partial deepening occurs, and that all possible benefit categories accrue to the project. The analysis then considers the benefits and payback on an incremental basis assuming a prior partial deepening does occur. The truck tunnel benefits are folded into the analysis assuming no benefit, which is the conclusion of the report, and at several "what-if" benefits levels.

Exhibit 16 summarizes the results of the analysis assuming no prior partial deepening, the original MDOT concept. The analysis combines parts of Exhibit 13 and 14 and shows the results for the combined MDOT concept assuming North America wide benefits, and for just Michigan benefits. The tunnel conversion benefit is shown at a "zero" benefit level, and at the "what-if" $7.8 million benefit level. A tunnel conversion benefit would begin to occur in 2005 according to discussion in the last section. It is important to note that the "what-if" contemplated tunnel conversion benefit is assumed to accrue equally to both North America, and to Michigan.

The results suggest that, on a North America wide basis, the MDOT original concept would offer $40.8-48.6 million in benefits depending on whether any benefit is assumed for the tunnel conversion. Without the tunnel benefit the net present value payback is 7.7 years. With an assumed tunnel conversion benefit at the midpoint of the "what-if" range, the net present value payback period is 6.5 years. When taking into the Michigan portion of the double stack benefits, and assuming no tunnel conversion benefit, the total savings equal $14.0 million, and the payback is completed in 30.5 years. If one assumes there is a tunnel conversion benefit at the "what-if" mid range, and that all this benefit accrues to Michigan, the total savings are $21.8 million per year, and the net present value payback is 16.5 years.

Exhibit 16

MDOT Concept for New Double Stack and Conversion of Existing Tunnel To Truck
Assumes No Previous Partial Deepening
Cost Benefits Analysis
(U.S. Millions of Dollars)

	North America Double Stack		Michigan Double Stack	
	Zero Conversion Benefit	$7.8 Million Conversion Benefit	Zero Conversion Benefit	$7.8 Million Conversion Benefit
Annual Benefits				
■ Double Stack Tunnel Benefits	$ 40.8	$ 40.8	$ 14.0	$ 14.0
■ Converted Tunnel Benefits Based on "What-if" Assumptions[1]	-0-	7.8	-0-	7.8
Subtotal Benefits	40.8	48.6	14.0	21.8
Project Costs				
■ Double Stack Tunnel	172.0	172.0	172.0	172.0
■ Converted Tunnel	95.0	95.0	95.0	95.0
Subtotal Costs	267.0	267.0	267.0	267.0
NPV Payback				
■ Total Payback[2]	7.7	6.5	30.5	16.5

Potential Negatives

- Loss of truck drayage and rail yard activities related to transporting to Canada goods now deramped/ramped in Chicago and/or Detroit
- Loss of ferry jobs at Detroit-Windsor and Port Huron-Sarnia

[1] Assumes all converted truck tunnel benefits accrue to Michigan.
[2] Assumes 5% inflation rate in benefits per year and 8% discount rate.

While the MDOT concept is based on the assumption that no prior partial deepening would take place, it is likely that such a project would occur first. If a prior deepening were to occur, the incremental benefits and payback of the MDOT concept would be substantially reduced. Exhibit 17 summarizes the cost benefits payback analysis for the MDOT concept assuming a prior deepening. The results indicate that the North America wide benefits would total $21.5 million with no truck capacity value, and $29.3 million with a $7.8 million truck capacity savings. At these benefit levels the payback would equal 16.5 an 11.3 years, respectively. The payback for Michigan only benefits would be an exorbitant 100.0 plus years if no truck capacity savings are assumed , and 30.1 years if a $7.8 million truck capacity savings is assumed. A truck roadbed capacity need is not envisioned until 2005.

In conclusion, the most appropriate scenario for review is believed to be the last one. This scenario assumes a prior partial deepening, the Michigan benefits of double stack, and no immediate benefit for the truck conversion. This scenario has a payback of over 100 years. It should be noted, however, that a truck conversion benefit would become realistic in the year 2005, and that some might consider this soon enough to fold in those benefits. However, the discounted value of a benefit that begins 15 years out would be minimal.

Exhibit 17

MDOT Concept for New Double Stack and Conversion of Existing Tunnel To Truck

Assumes Prior Partial Deepening

Cost Benefits Analysis

(U.S. Millions of Dollars)

	North America Double Stack		Michigan Double Stack	
	Zero Conversion Benefit	$7.8 Million Conversion Benefit	Zero Conversion Benefit	$7.8 Million Conversion Benefit
Annual Benefits				
■ Double Stack Tunnel Benefits	$ 21.5	$ 21.5	$ 6.2	$ 6.2
■ Converted Tunnel Benefits Based on "What-if" Assumptions[1]	-0-	7.8	-0-	7.8
Subtotal Benefits	21.5	29.3	6.2	14.0
Project Costs				
■ Double Stack Tunnel	172.0	172.0	172.0	172.0
■ Converted Tunnel	95.0	95.0	95.0	95.0
Subtotal Costs	267.0	267.0	267.0	267.0
NPV Payback				
■ Total Payback[2]	16.5	11.3	>100.0	30.1

Potential Negatives

- Loss of truck drayage and rail yard activities related to transporting to Canada goods now deramped/ramped in Chicago and/or Detroit
- Loss of ferry jobs at Detroit-Windsor and Port Huron-Sarnia

[1] Assumes all converted truck tunnel benefits accrue to Michigan.
[2] Assumes 5% inflation rate in benefits per year and 8% discount rate.

COMBINATION OF PROJECTS

There are two combinations of the above projects that are the most likely. The first combination would involve an initial partial deepening at Detroit, followed by a double stack tunnel at Port Huron. The other possible option would involve a partial deepening at Detroit, followed by a double stack tunnel there. In this case the existing Detroit rail tunnel could be converted to truck use at some later date.

Exhibit 18 summarizes the cost benefit payback analysis for the possible combinations. The results indicate that a Detroit partial deepening and Port Huron double stack tunnel would have a payback of 6.8 years from a North America wide perspective. The Michigan only payback increases to 26.0 years. For a Detroit partial deepening and Detroit double stack project the payback is 8.0 years for North America and 35.2 years from a Michigan perspective.

Finally, if a later tunnel conversion is folded into the all Detroit scenario, the North American payback, assuming first year conversion benefits at $7.8 million, is 9.5 years. The Michigan only benefits payback is 25.5 years. However, it should be noted that the tunnel conversion is not necessary from a truck roadbed standpoint until at least 2005.

Exhibit 18
Possible Combinations of Projects
Cost Benefits Analysis
(U.S. Millions of Dollars)

	North America Detroit Deepening and Port Huron Double Stack	Michigan Only Detroit Deepening and Port Huron Double Stack	North America Detroit Deepening and Double Stack	Michigan Only Detroit Deepening and Double Stack	North America Detroit Deepening, Double Stack, Tunnel Conversion	Michigan Only Detroit Deepening, Double Stack, Tunnel Conversion
Annual Benefits						
■ Partial Deepening at Detroit (Detroit traffic only)	$ 9.2	$ 3.7	$ 9.2	$ 3.7	$ 9.2	$ 3.7
■ Double Stack (assuming all Port Huron oversize cars go to Detroit Tunnel)	25.1	7.7	21.5	6.2	21.5	6.2
■ Tunnel Conversion with $7.8 Million Capacity Benefit	--	--	--	--	7.8	7.8
Total	34.3	11.0	30.7	9.9	38.5	17.7
Project Costs						
■ Partial Deepening at Detroit	35.0	35.0	35.0	35.0	35.0	35.0
■ Double Stack Tunnel	155.0	155.0	172.0	172.0	172.0	172.0
■ Tunnel Conversion	--	--	--	--	95.0	95.0
Total	190.0	190.0	207.0	207.0	302.0	302.0

Exhibit 18 (Cont'd.)
Possible Combinations of Projects
Cost Benefits Analysis
(U.S. Millions of Dollars)

NPV Payback	North America Detroit Deepening and Port Huron Double Stack	Michigan Only Detroit Deepening and Port Huron Double Stack	North America Detroit Deepening and Double Stack	Michigan Only Detroit Deepening and Double Stack	North America Detroit Deepening, Double Stack, Tunnel Conversion	Michigan Only Detroit Deepening, Double Stack, Tunnel Conversion
■ Years for Payback	6.8	26.0	8.0	35.2	9.5	25.5

Potential Negatives

- Loss of truck drayage and rail yard activities related to transporting to Canada goods now deramped/ramped in Chicago and/or Detroit
- Loss of ferry jobs at Detroit-Windsor and Port Huron-Sarnia

CROSS-BORDER IMPROVEMENT OPTION ADVANTAGES/DISADVANTAGES, CONCLUSIONS, AND RECOMMENDATIONS

The following sections first review the advantages and disadvantages of the various options. Following this review, several conclusions about the cross-border rail transportation issue are developed. The last section makes a number of recommendations for further state consideration.

CROSS-BORDER IMPROVEMENT OPTION ADVANTAGES AND DISADVANTAGES

The following sections briefly summarize the advantages and disadvantages of each infrastructure improvement option. The options relate to specific projects and not so much to generic concepts for improvement. Detroit-Windsor options are reviewed first, followed by Port Huron-Sarnia options. The last part reviews the advantages and disadvantages of several combinations of options that are most likely to develop.

Detroit-Windsor Options

The three principal Detroit-Windsor options relate to partial deepening, the MDOT concept, and the Beztak proposal. In reviewing these options it should be noted that CP/CN have a specific proposal in mind for Detroit-Windsor partial deepening, but that as far as is known, no railroad is actively considering a Detroit-Windsor 9'6" domestic capable double stack tunnel. The following sub-parts review each proposal.

Partial Deepening Option

The Detroit-Windsor partial deepening option is the most beneficial of all the proposals reviewed, has the lowest cost, and is the most viable option from a financial standpoint. The project will allow for all current oversize cars to pass, except for 20'2" tri-levels and 9'6" domestic double stack. From an auto company perspective this option takes care of the great bulk of concerns. The project would also allow CP to begin a competitive TOFC service, using standard equipment, from Chicago to Toronto, and a TOFC service from the U.S. Upper Midwest to the U.S. Upper East Coast.

From the financial standpoint of an owner, the project (Exhibit 2) would have a positive pre-tax cash flow assuming just the current volume, and financing over 30 years at 8%. Recapture of Buffalo diverted traffic, and capture of current Port Huron volume, would make the project considerably more attractive. From a public interest cost-benefit standpoint the project (Exhibit 9) has a net present value payback ranging from 4.5 to 11.8 years depending on the scope of benefits. Because of the short payback, this project could be completed and paid back almost before a full double stack tunnel project was ready to begin at Detroit.

The specific benefits of the project include:

- The project is being seriously considered by owners and plans are to proceed at this time.
- It is the number one or two ranked payback depending on volume assumptions (Exhibit 9).
- Depending on oversize traffic captured, it would allow for oversize railcar rate savings of $18-121 at breakeven operations.
- Would provide for the elimination of the ferry service and frees the related land for economic development options.
- Would eliminates the costs associated with the ferry.
- Would improve service times and reduces inventory carrying cost on automobiles.
- Would eliminate the federal harbor maintenance fee problem at this crossing.
- Would provide for a standard equipment TOFC service which should begin to allow for a competitive intermodal service.
- Would allow the potential for removing 20-40000 trucks a year from the roads after several years with the eventual possibility of removing up to 200,000 trucks from the roads each year.

There are, however, some disadvantages to this option. Perhaps most importantly, it does not address 9'6" domestic double stack requirements and sinks $35 million into a partial solution. Some of the other major problems relate to:

- Not allowing for passage of Chrysler's 20'2" tri-levels, and a potential gross savings of $2.6-3.9 million per year.

- Not allowing for the potential elimination from the roads of some 60,000 trucks a year involved in moving Chrysler product.
- Not providing for additional highway roadbed capacity.
- Not providing clearances for contemplated new generation high cube boxcars.
- Not resolving clearance problems at Port Huron where a great deal of oversize traffic crosses the border compared to Detroit.

Despite the above disadvantages, the partial deepening proposal offers the most economic advantages for the least amount of cost.

MDOT Concept

The MDOT concept involves construction of a new single tube 9'6" capable double stack tunnel and conversion of the current railroad twin tube tunnel to truck use. The intent of the concept was to avoid the costs of a partial deepening solution, given that a double stack facility might be needed now or in the immediate future. The concept also envisioned conversion of the existing railroad tunnel to truck so as to provide additional truck roadbed capacity at far less cost then would be possible with a new bridge. Finally, the concept envisioned use of truck tolls for partial subsidization of the new rail tunnel construction costs.

The pro forma financials for this project (Exhibit 3), from the standpoint of a third party owner, indicate that an annual pre-tax cash flow of $3.6 million would result. The financials assume no Port Huron project, that half of all Detroit crossing truck traffic would be captured at current tolls, and that oversize railcars would be charged the current ferry cost. At this rate the only oversize railcar benefit relates to avoidance of the harbor maintenance fee. The financials also assume a total construction/road access cost of $267 million financed for 30 years at 8%, and payment of a $9.7 million per year lease fee to CP/CN for their loss of cash flow. Finally, the financials assume only current traffic levels in order to provide a conservative estimate of potential cash flow implications and bonding viability.

From a public cost benefit payback standpoint, this project (Exhibit 16), and the Beztak version of this project, have a net present value payback period of 7.7 years from a North American perspective, and 30.5 years from a Michigan perspective. The payback assumes no previous deepening project. This payback also assumes that there are no truck benefits, as was concluded in analysis of the conversion option. However, if one assumes a $7.8 million per year benefit for truck (20 minute wait for each truck crossing due to roadbed over capacity), the payback is reduced to 6.5 years for North America, and 16.5 years for Michigan. Finally, the cost benefit analysis assumes some incremental traffic related to attraction of rail and truck mode traffic using other crossings currently.

While not envisioned in the MDOT concept, if a partial deepening were to occur first (Exhibit 17), the payback would be increased to 16.5 years for North America wide benefits assuming no truck capacity benefit, and to 11.3 years if the $7.8 million truck benefit is assumed. From a Michigan only benefit perspective, the payback would be increased to over 100 years without the benefit of any truck capacity savings, and to 30.1 years if a $7.8 million savings for truck capacity is assumed.

The advantages of the concept are as follows:

- Would allow for oversize railcar rate reductions of $35 at breakeven operations.
- Would allow for rate reductions to customers of $19-69 per container on U.S. Midwest (including Michigan) shipments to Europe and East Coast.
- Would facilitate Michigan exports to Europe via Montreal.
- Would address future highway capacity needs in a limited way for less cost then a new bridge would require.
- Would offer potential to remove 116,000 incremental trucks from road via capture by rail mode.
- Would provide for a backup truck crossing in emergencies, and would allow truck traffic currently using the downtown Detroit-Windsor auto tunnel to be rerouted out of the immediate downtowns on both sides of the border.
- Would provide domestic 9'6" double stack, and more importantly, 20'2" tri-level capability.
- Would allow for avoidance of $35 million partial deepening costs.
- Would provide for increased number of through, and potentially local service trains, and resulting benefits associated with absorption of system fixed costs and improved service/rate levels.

- Would provide a dramatic image building project that calls attention to both the reality and the perception of Detroit as a major North American gateway where industry should locate.

- Would facilitate competitiveness of Michigan based auto companies and improves current and future access to auto industry components and markets.

- Would provide competitive rail services that can help maintain viability of Port of Montreal as an advantageous route for Michigan exports to Europe. Also allow for competitive rail services between Chicago and Toronto, and Detroit-New York, which should help reduce rail and truck rates.

- Would offer competition advantages relative to a Port Huron project because multiple railroads would have access, whereas CN could have close to a monopoly position at Port Huron.

- Would provide for Detroit to be served from Detroit, rather than from an alternative Port Huron project. Although, the conclusion of this study is that Detroit can be adequately served from Port Huron.

The projects disadvantages are as follows:

- No railroad is known to be seriously considering it.

- The payback is much longer compared to other alternatives. The MDOT concept ranks 5 or 8 out of 16 for North America if no previous deepening is assumed, and 12 or 14 out of 16 if a previous deepening is assumed. For instance, this concept has a North America wide payback of 7.7 years, and a Michigan benefits only payback of 30.5 years assuming no conversion benefit and no previous deepening. If a partial deepening occurs previously, the payback increases to 16.5 years for North America wide benefits, and to 100 plus years for Michigan only benefits if no truck capacity benefits are assumed.

- The project benefits relate primarily to the double stack mode, but a good deal of the cost relates to the tunnel conversion.

- The roadbed capacity is not required until 2005, and the capacity provided at a cost of $95 million is substandard, and will not accommodate automobiles.

- The costs of access roads would be excessive, and may exceed the $30 million assumed.
- The project presents a number of problems related to customs and immigration services and would require additional staff for plazas at this location, or movement of trucks down city streets to customs plazas at the Ambassador Bridge.
- The lack of contribution at Port Huron.

While the double stack portion of the project offers a number of benefits, the truck portion does not offer sufficient benefits to justify its portion of the cost.

Beztak Proposal

The Beztak proposal is virtually identical to the MDOT concept in terms of the infrastructure changes planned, with the exception that a double stack twin tube is envisioned. However, there are several traffic volume, revenue, and cost assumptions in the Beztak proposal that differ from the assumptions contained in the MDOT proposal. The cost benefits analysis for the concept is the same as the MDOT concept one reported on in the previous sub-part.

The Beztak financials provided for this research indicated a positive "income" of $16.0 million per year assuming current rail traffic levels and capture of half of all truck and auto traffic at Detroit. Revenue is based on current area tolls and ferry charges. However, a number of assumptions are believed to be inappropriate based on more detailed information available to the author.

The revised financials for a twin tube tunnel project (Exhibit 5) indicate a $4.0 million negative pre-tax cash flow. A single tube would have the same $3.6 million positive pre-tax cash flow indicated for the MDOT proposal. The revisions to the Beztak financials include a reduction in the assumed truck traffic level, elimination of $8.3 million in assumed auto revenue, an increase in the construction cost for a twin tube from the estimated $250 million to $323 million, and several other major changes. The payback calculations are the same as those shown for the MDOT concept (Exhibit 16).

The advantages of the Beztak proposal are as follows:

- The same as those stated for the MDOT concept.
- The complete private sector role envisioned. Although, the Beztak proposal assumed state and provincial financing of the access roads. The financials and cost benefit analysis have been completed assuming private financing of the road, however, with a tax exempt financing package.
- The generation of outside capital that neither the railroads or state have to raise.
- The indication that the Beztak-Dewin Partnership planned to make a payment in lieu of property taxes. However, no such payment was included in the Beztak financials summary made available.

The disadvantages of the Beztak proposal are as follows:

- The same disadvantages stated for the MDOT concept.
- The overly optimistic assumptions on revenue, and the understatement of construction costs for a twin tube.
- The belief that auto traffic is necessary to the viability when such traffic is not thought to be feasible from a regulatory and practical standpoint.
- The profits that a third party would require, and the increase in user costs that would result.
- The fairly modest reductions in oversize car rates that would be allowed at breakeven operation.
- The lack of contribution to Port Huron needs.

As restated, the Beztak proposal is similar to the MDOT concept. However, the Beztak proposal specifically envisions a primarily private operation. The MDOT concept does not stipulate ownership but could be either private or government owned, with private operation.

Double Stack Tunnel At Detroit

A domestic container capable double stack only tunnel at Detroit could be single tube, double tube, or double tube with provision for joint rail/truck use on a rail priority basis. The latter project would involve a truly intermodal infrastructure concept. However, the payback for such a project would be slightly worse than the MDOT concept because of the extra costs associated with a twin double stack tube. Two tubes would be necessary in order to allow trucks to flow both directions at the same time.

The financials for these options (Exhibit 6) indicate that both a single tube double stack rail only tunnel, and a mixed rail/truck double stack twin tube tunnel, would have positive pre-tax cash flows. However, a twin tube rail only tunnel would lose $5.1 million.

The single tube rail and multi-use twin tube financials assume that there is no previous partial deepening at Detroit, and that there is no double stack tunnel at Port Huron. The rail only tunnel would have a $2.5 million positive cash flow, while the mixed use tunnel would have a $1.8 million positive cash flow. However, these financials assume current rates, and breakeven operation would allow only a small savings in oversize car rates. On the other hand, the financials do not assume any incremental rail traffic beyond that which would come from Port Huron oversize cars.

The cost benefit payback analysis for the single tube double stack only tunnel includes the same rail benefits as shown in the MDOT concept advantages and disadvantages. The payback on the single tube double stack, assuming no previous deepening, is 4.8 years from a North American perspective, and 16.4 years from a Michigan perspective (Exhibit 13). However, this analysis assumes no previous deepening. When a previous deepening has occurred, only the incremental benefits of double stack can be counted, and the payback is stretched to 9.8 years from a North

American perspective, and 80.0 years from a Michigan only perspective (Exhibit 11).

The advantages of the double stack rail only tunnel are:

- The same rail related benefits and truck volume reduction benefits as outlined in the MDOT concept advantages and disadvantages sub-part.
- Net (after absorption of construction costs) savings to customers of $24-74 per container for U.S. Midwest shipments, somewhat more than the MDOT concept allows, because of lower construction costs.
- The elimination of truck related costs from the project.
- The total 4.8 and Michigan 16.4 year payback for the project assuming no previous deepening. This ranks fourth or fifth in payback depending on the benefits perspective (Exhibit 9). With a previous deepening this project ranks eleventh for North America benefits and fourteenth for Michigan only benefits.

The disadvantages of a double stack rail only tunnel are:

- The lack of any potential highway truck capacity benefits in the near or long term.
- The lack of any contribution to Port Huron needs.
- No railroads currently considering it.

The cost benefit payback for a multi-use twin tube was not shown in an Exhibit. However, the construction and road access cost could be estimated at $288 million, while the North America wide benefits would equal $40.8 million with no previous partial deepening and the assumption of no truck capacity immediate benefit, and $48.6 million if one assumed a benefit of $7.8

million for the truck capacity. The Michigan portion of such benefits would be $14.0 million, or $21.8 million if a truck capacity benefit is assumed. The assumption of a previous deepening reduces the North America benefits to $21.5 million or $29.3 million with truck capacity benefit, and $6.2 million or $14.0 million with truck capacity benefit from a Michigan perspective. This payback would be worse than the MDOT concept payback because of the higher construction costs.

The advantages of a multi-use tunnel are:

- o Similar to those for the MDOT concept.
- o A more clear cut intermodal construction project that might more easily qualify for special federal funding.

The disadvantages are:

- o The need for twin double stack tubes compared to the MDOT concept.
- o The reduced payback compared to the MDOT concept because of the higher construction costs for a twin tube, as compared to converting the current tunnel to truck.
- o The inability to phase in projects inherent in the one dimension projects such as a partial deepening, followed by a double stack rail only tube, followed by a conversion of the original rail tunnel as needed.
- o No railroads seriously considering it.

Port Huron Options

A Port Huron option is the only double stack tunnel being seriously considered by a railroad as far as is known. This project involves a basic single tube however several variations would be possible in order to obtain truck use of the existing railroad tunnel. However, because the current tunnel is a single tube it is much less viable as a truck crossing because traffic would have to be alternating one way. On the other hand, because the Blue Water Bridge traffic is growing rapidly and approaching capacity, there is more need for truck capacity at Port Huron. None-the-less, it is unlikely that provision of truck capacity would be possible.

The financials for this project have a positive net cash flow of $2.4 million. This is primarily because of the assumed lower construction cost of $155 million compared to $172 million at Detroit, and because there is no partial deepening option at Port Huron. As a result all benefits for all railcar types accrue to this project.

From a cost benefit payback standpoint, the Port Huron single tube double stack project has a North America wide benefit of $39.4 million. This leads to a payback of 4.5 years, or the number three ranking, with no previous Detroit deepening. With a previous Detroit deepening, the payback rank drops to number seven. For Michigan only benefits, the project has a 15.0 year payback and a number three payback rank with no previous Detroit deepening. With a previous Detroit deepening, the Port Huron double stack payback ranks eleventh.

The advantages of the Port Huron project are that:

- It has the same rail and truck traffic reduction benefits as described in the MDOT concept advantages and disadvantages section.

- It has a payback of 4.5 years taking into account all North American benefits, and 15.0 years taking into account just Michigan benefits, when no previous Detroit partial deepening has occurred. This payback results in the number three ranking from amongst all proposals. However, with a partial deepening at Detroit, the likely case, the incremental benefits payback falls to number seven for North America, and to number eleven for Michigan.

- For net customer savings, the dollar amount is $29-79 per container for distances of 500-800 miles at Port Huron, compared to $24-74 per container at Detroit for a double stack only project.

- It is assumed to be cheaper than a Detroit tunnel. The most recent estimate was $155 million compared to $172 million at Detroit.

- The distances from Chicago to Montreal are somewhat shorter on this route than on the Detroit route.

- The project immediately takes care of a much bigger harbor maintenance fee problem than exists at Detroit because oversize tri-level volume at Port Huron is triple the Detroit volume.

- It may be possible to serve Detroit better from Port Huron-Sarnia than by crossing at Detroit-Windsor. This is because the CN/GTW distance is three miles shorter than via Windsor.

- It provides benefits for the Battle Creek intermodal yard not present in the Detroit options.

- The CN "Laser" cars which are used on the Chicago to Toronto run now can accommodate double stack.

- There is far less congestion than in Detroit.

The Port Huron disadvantages are that:

- Canadian National could obtain a monopoly border crossing position because of a lack of access for CP and others.

- If CN maintains a monopoly position less volume may use the project initially, increasing the costs for customers.

- It does not directly serve Detroit.

- The project only provides Chrysler with one third of the benefit which they would obtain from a Detroit double stack tunnel because Windsor plants would not use it.

- Due to the reduced Chrysler benefit only 20,000 trucks related to their finished vehicle cross-border transportation would be eliminated from roads and cross-border bridges. With a Detroit project, 60,000 trucks would be taken off the roads and cross-border bridges.

- The Detroit oversize volume is not addressed. However, the Detroit volume is much smaller than at Port Huron.

Combination of Projects

Several combinations of projects are possible. Two are most likely. The first, and the most likely, involves a partial deepening at Detroit, followed by a double stack tunnel at Port Huron. The second involves a partial deepening at Detroit, followed by a new double stack tunnel at Detroit. This later option would allow for conversion of the existing Detroit-Windsor railroad tunnel to truck at some future date.

The financials and cost benefit analysis for the Detroit partial deepening and Port Huron double stack tunnel are summarized first because it seems to be the most viable project from the standpoint of railroad interest. The financials for this project, which are very conservative in that they assume no net gain in double stack traffic, indicate that the combined annual pre-tax cash flow would equal $.1 million. However, a positive $2.7 million would be derived from the Detroit deepening project, and a negative $2.6 million would derive from the Port Huron double stack tunnel. Again, this is based on very conservative traffic assumptions.

The cost benefit payback for the combined project would be 6.8 years with North America wide benefits, and 26.0 years for Michigan only benefits. This payback is based on an assumption of $34.3 million of North America wide benefits, and $11.0 million of Michigan only benefits.

The advantages of this combination of projects are that:

- The most significant benefits, related to partial deepening, are obtained immediately.
- The double stack investment can proceed at Port Huron with an interested railroad leading the way.
- All of the benefits of each project are obtained.
- The lower costs associated with the Port Huron project, if they prove true, can be obtained.
- Shares other advantages as stated for the individual projects.

The disadvantages are that:

- There is no direct construction and employment benefit to the Detroit economy.
- There is no CP access to Port Huron.
- Has the same disadvantages as stated for the individual projects.

A Detroit partial deepening and double stack tunnel would have a North America payback of eight years, and a Michigan only payback of 35.2 years. Adding in the tunnel conversion at $7.8 million in annual benefit from year one, a benefit which is not assumed to exist until 2005, would result in a North American payback of 9.5 years, and a Michigan payback of 25.5 years.

Should the double stack tunnel be built in Detroit, the construction and employment benefits would accrue to Detroit, and not to Port Huron. In addition, the access problems would be eliminated since all railroads can reach the Detroit-Windsor tunnel. Such a project would also allow for full utilization of rail by Chrysler. However, the Detroit double stack tunnel conversion is currently considered to cost $17 million more than the Port Huron version.

The addition of the tunnel conversion project at Detroit worsens the payback for North America wide benefits, because the additional $7.8 million savings is only an approximate 25%

improvement while the cost goes up by some 50%. However, from a Michigan only perspective, the same $7.8 million benefit (all of the truck capacity benefit is assumed to accrue to Michigan because Michigan will have to pay the cost of new capacity) represents a doubling of benefits while project costs continue to go up by about 50%. The result is that from a Michigan perspective the truck capacity conversion improves the payback. However, again, it should be noted that the truck capacity is not needed until 2005, and only then if truck volume grows 3% per year. Truck volume has in fact grown only 1% per year for the last six years at Detroit.

CONCLUSIONS

This section summarizes the findings on various background topics, addresses the questions posed in the introduction section, draws conclusions on the possible benefits, and draws conclusions on the best approach to pursue. The parts which follow address background information, changes in the global economy, transportation developments, general benefits by project type, conclusions by principal project, the overall conclusion as to the best development approach, and finally, the key sensitivity factors.

Background Information

The research effort developed information on a number of topics that were relevant to the study. The key background information is summarized below:

- The Detroit-Windsor rail tunnel is a twin "immersed tube" facility built in 1910 and jointly owned by CP/CN with CN management responsibility.

- The Detroit-Windsor height restrictions allow any railcars within "Plate E" dimensions to clear. This generally excludes conventional TOFC, auto tri-level, high cube, double stack, and standard pack frame cars.

- Current traffic levels at the tunnel are estimated at 325,000 railcars per year. Currently, approximately 20 trains a day use the tunnel, including eight CP/Soo single level container trains moving between Chicago/Detroit and Montreal. Current charges approximate $40 per rail car.

- The NS ferry for oversize cars is currently operating on one shift per day and making four round trips per day. The costs of the operation result in a per car value of $150 at recent volume levels. Traffic is down from 85,000 units in 1988 and is forecast at 23,400 units in 1991-1992. The reduction is due to Buffalo diversions and NS use of the tunnel for regular size traffic.

- The Port Huron-Sarnia rail tunnel is a single tube bored facility constructed in 1890 and owned outright by CN.

- The Port Huron-Sarnia restrictions allow any railcars within "Plate C" dimensions to clear. This generally excludes conventional TOFC, auto tri-level, high cube, double stack, and standard pack frame cars. However, CN uses specially designed cars to allow for TOFC service.

- Current traffic levels at the tunnel are estimated at 180,000 railcars based on 1988 data. There are an estimated 12 freight trains per day, and two passenger trains a day.

- Two ferries operate at Port Huron-Sarnia, and they are owned by CSX and CN. Ferry volume is estimated at 110,000 units, some 75,000 of which are assumed to be oversize.

- The U.S. harbor maintenance fee being charged on the value of cargo crossing by ferry, recently tripled from 4/100ths of one percent to 12/100ths, is costing up to $300 per railcar. The Corps of Engineers is authorized to increase the fee in future years.

- There are an estimated eight double stack trains a week using the Buffalo bridges. Asia to Eastern Canada traffic which once used the Michigan-Ontario crossings is now diverting to Buffalo. NS recently diverted Detroit-Windsor ferry traffic to Buffalo, and Grand Trunk is concerned about diversions of auto traffic due to the harbor maintenance fee. Some Mexican-Ontario traffic is using this crossing, and Buffalo is being explored as an option in several cases.

- Total Michigan-Ontario rail borne trade is estimated at $21.6 billion. Included is $4.8 billion of U.S. overseas trade transshipped through Canadian ports which was recorded by the U.S. Customs District at Detroit.

- The key options for eliminating height restrictions vary between Detroit and Port Huron. At Detroit, the options include a partial deepening which would allow conventional TOFC, auto tri-level (except the 20'2" tri-levels Chrysler would use), high cubes, and 8'6" maritime double stack containers to use the tunnel. The cost of this option is $35 million. Additional options include construction of a new 9'6" capable domestic double stack tunnel ($172 million), and possible conversion of the existing tunnel to truck use ($95 million with access roads). At Port Huron there is no realistic option for partial deepening given the bored nature of the tunnel. The principal option is for a new double stack tunnel (estimated $155 million). Conversion of the existing single tube tunnel for truck use is less viable because of the alternating one way traffic that would be required.

Changes in the Global Economy

Changes in the global economy and the reactions of government and corporations are increasing the need for efficient transportation systems. The key developments in the global economy are summarized below:

- The global economy has become increasingly competitive since the end of World War II. This is in part due to the development of once inferior overseas economies, and in part due to the development of low cost transportation, communications and information processing systems which allow for global operations at economical levels.

- North American corporations are responding by participating in the global market at unprecedented levels, and by specializing production geographically and by product so as to maximize comparative advantage and increase competitiveness. Both approaches demand efficient transportation systems in order to be effective.

- In order to maximize competitiveness, countries are seeking out nearby partners with complimentary comparative advantages. The hunt for comparative advantage has led to the pursuit of trading block relationships amongst neighboring countries.

- Effective trading block relationships with specialization of production along lines of comparative advantage requires efficient intra-trading block transportation. Without low cost intra-trading block transportation, the manufacturing savings of specialization are consumed in physical movement costs. Participation across trading blocks also requires each block to have efficient inland and ocean transportation systems.

Transportation Developments

The changes in the global economy reviewed above are forcing the need for the most efficient North American transportation system possible. Conclusions on the role of rail in such a system, and on the role of double stack in general, and of Michigan-Ontario crossings in particular, are reviewed below:

- Rail is becoming increasingly important in the nation's transportation system. While not yet reflected in modal share statistics, there is a clear policy shift in favor of rail. This shift is due to fuel and environmental concerns, and due to concerns with highway congestion. Coupled with the increasing efficiency of the rail industry, and the trend towards increased use taxes on truck, rail will become increasingly viable and necessary to national competitiveness.

- The role of containerization, intermodal, and double stack services in the rail system has been evolving since the late 1950's. The container developed in order to reduce U.S. port costs. Soon thereafter COFC services developed to reduce inland transportation costs. At the same time intermodal TOFC services were developing to provide efficient and effective domestic rail service. Unit trains developed to reduce the costs for COFC service and were first used in 1972 for minilandbridge services from California ports. Double stack was an outgrowth of the minilandbridge unit trains and commenced in 1983 in order to reduce costs and improve ride.

- Domestic double stack developed in order to fill empty containers on backhauls from the Eastern U.S. to the U.S. West Coast. However, since that time, double stack has developed as an effective means for rail to compete with truck for long distance movements. Double stack is evolving to fill long distance North American transportation requirements between the U.S., Canada, and Mexico as well.

- Intermodal traffic totaled 6.2 million units in 1990 with 3.5 million TOFC shipments and 2.7 million container shipments. Of that total, .75 million containers were estimated to have been moved in domestic trade. This domestic container volume represents 27% of total container traffic, and 12% of total intermodal traffic.

- Double stack benefits relate to line-haul savings and better ride quality. Compared to TOFC service, double stack has been estimated to save $100 per container for movements of 800 miles. Double stack costs are generally assumed to be 90-95% of truck costs at distances over 600 miles. The ride benefit relates to slackless couplings and improved suspensions, and while more economical with double stack cargo levels per well, such innovations are not limited to "double stack."

- Current literature (Manalytics, Inc. 1990) generally indicates that double stack efficient distances are constrained by service and cost factors. From a service standpoint, double stack is assumed to be competitive with truck at distances over 540 miles. The literature also suggests that five day a week frequency is required and that a minimum of 46,800 containers a year of volume are required. From a cost standpoint, double stack is assumed to be competitive with truck at distances over 725 miles. Intermediate service is thought to be competitive at distances over 725 miles with a minimum of

2600 containers per year. However, other literature and rail industry statements have suggested that double stack could be competitive at distances of as low as 200-300 miles. The main limiting factor for intermodal service is the cost of yard operations and drayage.

- It appears that double stack is about to make major inroads into the domestic truck market. Manalytics, Inc. (1990) estimates that 1990 feasible double stack volume totaled 5.7 million containers in 1987. The trend is also towards shorter distance dedicated trains, and towards mixed intermodal trains. There is also increasing use of single well, as opposed to five well unit cars, and this has led to double stack being mixed with general freight trains in some cases. Double stack may have the potential to replace boxcars for intensive movement corridors such as those in the auto industry. This development would require plant rail sidings and container handling equipment which could be used to position containers at assembly line usage slots.

- Current double stack intermodal cross border services at the Michigan-Ontario border include NS/CP "Triple Crown" roadrailer service between Detroit and Toronto, CP/Soo COFC Chicago/Detroit-Montreal service, CN/GTW "Laser" intermodal TOFC/COFC service between Chicago and Montreal, Santa Fe/GTW intermodal service between Mexican maquilas and Michigan/Ontario via GTW's Ferndale Terminal with truck service to Ontario, APL double stack service between Detroit and Hermosillo, Mexico including Canadian volume moving by truck across the border, and several Chicago-Mexico double stack services which connect with Detroit/Ontario plants via truck.

- Barriers to increased cross-border intermodal double stack service in the rail mode include institutional practices in Canada, truck competitiveness, slow Canadian and U.S. customs, the short distance of Ontario-Michigan border freight movements, and border tunnel height restrictions (Peat Marwick 1990). Peat Marwick suggests that any new Detroit-Windsor highway bridges should be considered for double stack rail service, however, this concept is not engineering feasible given clearance requirements and land availability.

- Efficient cross-border rail is important at the Michigan-Ontario border for several reasons. First, intermodal rail is the most efficient means of moving export cargo for Europe to the East Coast, and is important to overall competitiveness. The St. Lawrence Seaway cannot fulfill this need. Secondly, the North American trading block is increasing the need for efficient north-south transportation that will allow for the maximum savings from specialization to be realized. Third, rail service in general is likely to become more important in North America because of rail industry improvements and increasing cost and environmental pressures in trucking.

- The Michigan-Ontario rail border crossings are the most desirable for several reasons, including the fact that they offer the shortest distance rail/ocean route between Asia and Europe, offer the shortest distance between the U.S. West Coast and Eastern Canada, offer the shortest distance between the U.S. Midwest and Montreal, offer the shortest distance between Chicago and Toronto, offer the shortest distances between Mexican suppliers and assembly plants in Ontario and Michigan, and offer the shortest distance between U.S. midwest supplier and assembly plants and Ontario suppliers and assembly plants.

- Given the above points, efficient Michigan-Ontario rail border crossings are important to Michigan manufacturers. They are, first, important for providing a competitive route to Europe for Michigan companies. Improvements which would lead to more trains on the corridor can also help minimize unit costs for all traffic on Michigan railroads, and could result in improved service levels and rail freight rates. Empty containers flowing through this corridor could be especially valuable in obtaining reduced rates for westward moves. These containers now move through Buffalo. Improved crossings could also somewhat help to unclog congested highways and border bridges with positive economic results for area manufacturers. Finally, to the extent that Michigan-Ontario auto industry rail movements become double stack viable, improved border crossings will be essential.

General Benefits

This part reviews the methodology and accuracy of the general benefit findings, the actual key benefits for each category of improvement (partial deepening, double stack, and truck capacity), North America vs. Michigan benefits, and highway vs. rail benefits.

Benefit Methodology and Accuracy

- o The findings in this study are intended to reflect the results of an exploratory preliminary research effort and are not conclusive. Instead, the various benefit categories, and quantified benefit estimates which have been identified, offer general guidelines as to the potential value of the improvements. Additional research should be undertaken to determine whether the level of benefit is realistic. In some cases the benefit level may be considered excessive, although in other cases, potential benefits have been left out of the quantified estimates.

- o The level of benefits estimated for Michigan, as opposed to the rest of North America, are especially arbitrary, and require additional research to confirm whether they are realistic. In all but a few cases, the Michigan benefits are assumed to be a percentage of the North American total. For instance, it is assumed that 40% of the partial deepening benefits will accrue to Michigan.

General Benefits by Project

Following are conclusions on the benefits by project type. The three projects are for partial deepening, double stack construction, and tunnel conversion.

Partial Deepening

The partial deepening benefits are the most significant of all the possible projects (See Exhibit 10). These benefits are summarized next, and assume that Michigan would receive 40% of total benefits:

- o The principal benefit of partial deepening is related to reduced operating cost resulting from elimination of the ferry service. At Detroit-Windsor volume this is estimated to save $5.2 million. If all Port Huron volume were to shift to Detroit, allowing shut-down of the ferries there, savings would be $10.2 million.

- o This option also improves service times by up to 24 hours a crossing. Estimated savings in auto industry inventory carrying cost are $.3 million for Detroit volume, and $.9 million if Port Huron volume also is included.

- o At current reduced volumes, elimination of the ferry service would save $3.7 million in harbor maintenance fee per year for Detroit volume, and $8.2 million if Port Huron oversize volume is included.

- o Partial deepening would also allow for elimination of the ferry and boatyard operations and free the land for commercial development.

- o The improvements would allow for standard equipment TOFC services that could take 20-40,000 trucks a year off the roads and cross-border bridges.

Incremental Double Stack Benefits

Following are the incremental benefits that accrue to a double stack capable tunnel (See Exhibit 11). These are over and above the benefits described above because it is assumed that a prior deepening project has already resulted in those benefits being realized. If one were to assume that a prior partial deepening had not occurred, the benefits for double stack would include the partial deepening savings. The benefits are as follows:

- o All of the quantifiable benefits which follow require an estimate of the savings per container, or per carload, which would result from double stack. These estimates assume that gross savings per container compared to existing COFC service will equal $75 for a 650 mile trip, and $100 for an 800 mile trip. These estimates are used in payback calculations to compare against construction costs. However, in terms of actual customer savings, the gross savings must be deflated by a construction cost factor per container. For Detroit, the cost factor is estimated at $26 per container as shown in Exhibit 12. This factor assumes the railroads absorb one third of the construction costs based on comments which have been made by CN. The net savings to customers of a Detroit crossing are then assumed to equal $49 for a 650 mile trip, and $74 for an 800 mile trip. Because of lower assumed costs for a Port Huron project, the estimated savings to customers of a crossing there are $54 for 650 miles and $79 for 800 miles.

- It should be noted that CP does not believe any savings are possible compared to their current COFC service from Chicago/Detroit to Montreal. CN, on the other hand, believes that savings would be possible and that some of the investment cost would be absorbed for "strategic reasons." While one would have to express some doubt about this "strategic" absorption of cost, those statements have been used in the analysis. The analysis also assumes some traffic increases from double stack in determining the per container construction charge.

- The first specific savings category relates to 20'2" tri-levels. While Chrysler does not now use rail for cross-border movements, availability of a double stack tunnel would allow for minivan capable 20'2" tri-levels to cross, and may result in Chrysler switching from truck to rail for cross-border movements. The partially deepened tunnel would not accommodate these 20'2" tri-levels. Savings at Detroit would total $2.6-3.9 million, depending on the savings estimate compared to truck, and would also include elimination of 60,000 trucks from the bridge. With a Port Huron project, less Chrysler volume would use the facility and savings would equal $1.2-1.8 million and 30,000 less trucks on the road. The Michigan benefit is assumed to equal 40% of the total.

- Assuming Port Huron oversize traffic did not shift to Detroit as a result of partial deepening there, a Port Huron project would also result in savings related to elimination of the ferry there. These savings would total $5.0 million.

- Aside from the Chrysler benefit, one of the most direct Michigan benefits includes the savings on trade with Europe. For 25,500 estimated loaded container loads a year, at a gross savings of $75 each, the total savings are estimated at $2.3 million. Michigan's share of the benefit is assumed to be 50%.

- U.S. Midwest-Europe volume (excluding Michigan) is assumed to equal 79,200 loaded containers. At a distance of 800 miles from Chicago to Montreal these containers are estimated to incur a gross savings of $110 each. The result is estimated savings of $8.7 million. The Michigan share is assumed to equal 25% on grounds that this benefits Michigan suppliers of components to U.S.

Midwest exporters, and on grounds that this benefits the auto industry based in Michigan even if actual shipments and imports are with other Midwest U.S. states.

- Ontario and Michigan industry is increasingly dependent on Mexican sub-components in order to be able to compete with off-shore sources. Based on an estimate of 12,560 Mexican loaded containers a year, and a savings of $50 per container for the incremental rail distance from Chicago to Ontario plants, estimated savings total $.6 million. The Michigan benefits are assumed to equal 25%, or when rounded - $.2 million. This benefit is based on auto industry competitiveness, and on the fact that Michigan suppliers provide componentry for Mexican operations, as well as finished product, and would benefit from additional service. Cross-border double stack service would not guarantee that this traffic would move by rail, given advantages to ramping at Detroit, however, it could, and might eliminate up to 21,000 trucks a year from cross-border bridges. Obviously, the primary benefit is for Ontario assembly plants.

- Asia-Eastern Canada traffic is estimated to total 50,000 loaded containers a year. If this traffic saved $15 per container by moving through Michigan there would be North American benefits of $.8 million. While there could be spin-off benefits from the trains, no Michigan benefits are quantified.

- The Asia to Europe landbridge potential was found to be lacking following investigation. This was primarily due to comments from ocean carriers about the need for East Coast U.S. local traffic. However, future developments could make this an important route at some point.

- Michigan-Ontario rail potential would be dependent on double stack becoming viable on short distance movements as part of longer distance trains, or as a substitute for boxcars in rail only movements between suppliers and assembly plants. While potential benefits were quantified in the discussion of the topic, they were not included in the quantitative benefits analysis because of their speculative nature. However, GTW and the auto companies have indicated there may be potential.

- Double stack capability would allow for additional capture of highway traffic from trucks. The benefits analysis assumes an additional 10,000 trucks a year could be taken off the Chicago-Toronto corridor compared to TOFC. At $100 per truck this would save $1.0 million per year, and 20% of the savings are assumed to accrue to Michigan. For the Upper Midwest of the U.S.-East Coast corridor, it is assumed that double stack service would result in two additional trains using the Ontario route to compete with Conrail. Such a service would carry 54,600 loaded containers a year, and at a savings of $100 per container, would result in total benefits of $5.5 million. The Michigan benefit is assumed to equal 25% based on the potential for a good deal of this traffic to be Michigan origin or destination.

- General benefits of the double stack capability relate to additional trains that might use the crossing. Such trains could help to provide additional local service, and could result in lower rates. They could also absorb some fixed costs related to track and yard operations. In addition, this increase in service could help to attract manufacturing plant and distribution center sitings. Besides the actual service improvements there could also be a considerable "image enhancement" factor related to a new tunnel. Finally, a double stack capability would also facilitate the competitiveness of Montreal as a port, would allow for future high speed rail operation, and would result in an estimated $.4 million a year in incremental Michigan single business tax collection on rail traffic.

- Auto industry benefits would relate to European trade, and to use of a tunnel for Mexican-Canadian direct rail shipments. Any future Ontario-Michigan double stack movements would also be related to the auto industry. Other auto industry benefits would relate to 20'2" tri-levels, and to potential future use of containers to ship automobiles.

Highway Capacity

The third type of project contemplated involves conversion of an existing rail tunnel to truck use (Exhibit 14). The benefits which would result depend on the need for such truck capacity, and on the quality of service that would be provided for a given cost. The general conclusion is that the capacity provided would be sub-par, and that the cost ($95 million) would be excessive for the benefits. While it would be beneficial to provide an alternative route for trucks currently using the auto tunnel, there is ample roadbed capacity at the Ambassador Bridge until at least the year 2005, and trucks could use this facility given current and planned improvements to yard size and staffing. At a later date it would, however, be worthwhile to compare the cost benefits of a tunnel conversion to other approaches for obtaining highway capacity. The following points provide additional detail:

- Ambassador Bridge truck roadbed capacity is 300 units per hour each way and hourly peak traffic in 1989 did not exceed 200 trucks an hour each way. Roadbed truck capacity would only be reached in the year 2005 if truck traffic grew 3% per year. As such, the roadbed capacity for truck at the Ambassador is assumed to be adequate at least until 2005, although it is not to soon to begin planning for needs. Other past problems at the Ambassador related to secondary and primary inspection capacity are being or have been addressed by improvements.

- The Detroit-Windsor auto tunnel is reaching roadbed capacity and auto traffic is up 800,000 units in two years. The 250,000 estimated trucks using the crossing would be more welcome outside the downtown of both cities and an alternative crossing would allow for through trucks to be removed from the tourist and convention districts of both cities. The Blue Water Bridge is also experiencing rapid truck and auto traffic growth and will not be a viable alternative to Detroit by the year 2000.

- Based on tunnel construction and access costs of $95 million, and on the narrow single lane each direction that would be available, the project is not thought to offer a good value. It would not allow for automobile use, and the money might be better spent on a new bridge. The best option for additional highway capacity should be determined after completion of a comprehensive study of the regions needs.

- Given the Ambassador roadbed capacity available, and given the poor value received for a tunnel conversion, it is concluded that this project does not have any substantial benefit at this time. However, future traffic growth might cause it to become necessary. As such, the cost benefit payback analyses includes a "what-if" option in which the converted tunnel has a benefit of $7.8 million assuming a 20 minute delay savings per truck.

- Various alternative options for obtaining joint rail/highway capacity at both Port Huron and Detroit did not have positive cash flows, and/or did not have short enough paybacks. These options included potential double tubes capable of carrying trucks when rail traffic was not present, and various combinations of new and existing tubes at both crossings.

Total North America vs. Michigan vs. Canada Benefits

The benefits for North America, Michigan, and Canada are summarized below:

- For partial deepening, the total quantifiable benefits are $9.2 million per year at Detroit-Windsor, and $19.3 million per year if Port Huron volume is assumed to move to Detroit-Windsor. The Michigan share of this benefit is assumed to be 40%, or $3.7 million per year at Detroit-Windsor only volume, and $7.8 million per year if Port Huron volume moves to Detroit. However, it should be noted that the primary beneficiary relates to Canadian auto assembly plants that must access U.S. markets. While it is true that Michigan suppliers are dependent on these plants it is also true that these suppliers could supply alternative production points in the U.S. without a double stack cross-border capability.

- For a double stack tunnel, the incremental North America benefits total $21.5 million per year for a Detroit project, and $25.1 million per year for a Port Huron project. The relative Port Huron benefit relates to an assumption that the ferry service at Port Huron would not end with construction of a Detroit deepened tunnel, but would end with construction of a double stack tunnel at Port Huron. The Michigan benefit of a Detroit project is assumed to total $6.2 million per year, while the benefit at Port Huron is $7.7 million per year. Again, Canada is the primary beneficiary of a tunnel, and the Port of Montreal is a significant beneficiary.

- For a truck conversion project, the conclusion is that benefits would be zero prior to at least 2005. However, if one were to assume a 20 minute delay per truck due to roadbed capacity congestion, a converted tunnel would have a value of $7.8 million per year. This benefit is assumed to accrue entirely to Michigan given the opportunity costs of a new bridge.

Highway Benefits

A Detroit double stack project would have the potential to take 116,000 trucks a year off the road, over and above that obtained from a partial deepening. A Port Huron project would have the potential to remove 86,000 trucks from the road. These figures include 25,000 trucks related to Ontario-Michigan trade not shown in Exhibit 11.

Conclusions by Project

Following are key conclusions about each proposed or conceptualized project, assuming the most likely volume and prior condition scenarios:

- Detroit-Windsor Partial Deepening - The Detroit-Windsor partial deepening project is the most beneficial of all the projects reviewed, and at $35 million has the lowest cost. The project also accomplishes most of what the three auto companies feel needs to be done, although it does not take care of the 20'2" tri-level problem that Chrysler very much wants addressed. The project will allow for all railcars except 20'2" tri-levels and double stacks to pass. From the standpoint of a CP/CN owner, the project has a positive pre-tax cash flow of $.4-13.2 million depending on the volume assumptions. The cost benefit analysis indicates the project has a North America wide net present value payback of 4.5 years with Detroit only oversize volume. For Michigan only benefits the payback is 11.8 years. The key advantages relate to the railroad interest, low cost, elimination of the ferries and their associated cost, and avoidance of the harbor maintenance fee. There is also the potential to eliminate 20-40,000 trucks per year from the road after several years and a long term potential to eliminate 200,000 trucks within five to ten years. The key disadvantages are that the project does not allow for passage of 20'2 tri-levels, and does not resolve the needs at Port Huron unless traffic is diverted to Detroit.

- MDOT/Beztak-Dewin Tunnel Conversion/Double Stack Tunnel - The MDOT/Beztak-Dewin concept has a minimum cost of $267 million and the cost could go much higher depending on the road access dollars. From the perspective of a third party owner using the MDOT pro formas, the project has a conservative pre-tax positive cash flow of $3.6 million. The project has incremental North America wide benefits of $21.5-29.3 million per year depending on whether any quantified benefit is assumed for the tunnel conversion. Incremental Michigan benefits total $6.2-14.0 million per year depending on whether a tunnel conversion benefit is assumed. Without the truck conversion benefit the North America payback is 16.5 years, with the conversion to truck benefit it is 11.3 years. From a Michigan only perspective, the relevant paybacks are 100.0 plus years and 30.1 years. The chief advantage is that the project would provide for Chrysler 20'2" tri-levels with the associated potential to take 60,000 trucks off the road, and would provide for the range of double stack benefits. Other advantages relate to the provision of future highway capacity needs at relatively low cost, and the immediate potential to eliminate 250,000 trucks from the downtowns of each city. The project also has the interest of a third party developer, Beztak, and would provide direct service to Detroit. The disadvantages relate to the complete lack of railroad interest, the relatively long payback compared to other options, and the rather minimal benefits obtained for the truck conversion expenditure. In terms of the original Beztak-Dewin concept, the main problems relate to the assumptions on auto traffic that are not feasible, and the low cost assumptions for a twin tube.

- Detroit Double Stack Only Tunnel - A double stack only tunnel would have a cost of $172 million. From the perspective of a third party owner, such a project would have a positive pre-tax cash flow of $2.5 million assuming no traffic growth. The net present value North America wide payback, assuming a prior partial deepening, would be 9.8 years. For Michigan only benefits the project would have a payback of 80.0 years. The chief advantage of such a project would be the lower total project cost, the generation of benefits similar to those indicated for the MDOT concept (except for highway capacity), the access to all railroads, and the flexibility provided for future developments. The chief disadvantages relate to the lack of highway capacity, the lack of Port Huron consideration, and the fact that no railroads are considering this option.

- Port Huron Double Stack Tunnel - The analysis in this report assumed a Port Huron double stack tunnel would have a lower cost of $155 million, compared to $172 million at Detroit. Based on the lower cost, the financials for this project have a positive pre-tax cash flow of $2.4 million. The payback for North America wide benefits is 7.3 years if one assumes a previous Detroit deepening has removed all oversize volume. With the current Port Huron oversize volume (no previous partial deepening at Detroit) the payback is 4.5 years. From a Michigan benefits only perspective the payback is 33.0 years with a previous Detroit deepening, and 15.0 years without such a previous deepening. The chief advantage compared to Detroit is that a major railroad is interested in completing the project, and the Michigan payback is 33.0 years vs. 80.0 years at Detroit. Other advantages relate to the lower cost and the shorter cross-continental and Chicago-Detroit distance. Another benefit relates to immediate elimination of the much more voluminous harbor maintenance fee problem at Port Huron. The project also may provide for shorter and quicker Detroit service, expansion of the Battle Creek intermodal facility, and ready utilization of CN's "Laser" car fleet for double stack. The disadvantages are that other railroads may not receive equitable access, the project does not directly serve Detroit, and the Chrysler needs are not fully served.

Conclusions on Best Approach

The conclusion of this report is that the best approach to encourage amongst the railroads is an incremental one involving a progression of projects. The preferred approach would involve immediate completion of the tunnel deepening at Detroit-Windsor, followed by construction of a double stack tunnel, and some future evaluation of a tunnel conversion at Detroit.

The partial deepening at Detroit can be completed first without concern about future double stack plans because the financials will allow for early recovery of the investment, even if based strictly on harbor maintenance fee costs. From a cost benefits analysis standpoint the project also has a very short payback at 4.5 years for North American wide benefits and Detroit only volume. This payback is 11.8 years for Michigan only benefits.

The conclusion of this report is that a double stack project is more viable, and may be more beneficial at, Port Huron.
First, the fact that CN and GTW are seriously interested lends tremendous weight to the credibility of this option. Secondly, because the Port Huron double stack project is assumed to have a lower cost, the payback is better. Third, the Port Huron crossing provides the shortest distance cross-continental and Chicago-Toronto movements. Fourth, the Port Huron tunnel will eliminate harbor maintenance fees for oversize cars that might not switch to Detroit for competitive reasons. Fifth, a Port Huron tunnel will assist the state's most important railroad, Grand Trunk, and should allow Grand Trunk to continue expanding its intermodal services across the state, including those at its Battle Creek yard.

The biggest disadvantages relate to the potential lack of access for other railroads and the location outside of the city center. However, this uncongested location may in fact be an advantage, and might result in easier use of the Ferndale intermodal terminal.

With respect to the tunnel conversion to truck, such a project could occur at Detroit if a double stack tunnel were built there first, and could also occur if current Detroit tunnel volume moved to Port Huron. The advantages of a tunnel conversion could also be considered in light of a comprehensive study of border crossing highway capacity improvement alternatives at a later date. At the present time the truck roadbed capacity does not require new lanes. Past delay costs, and potential future delay costs that are or would be related to secondary and primary inspection booth problems have also been corrected, or are being corrected. While there is a capacity problem developing at the Detroit-Windsor auto tunnel, it relates more to auto capacity then truck. And, the problems with downtown trucks could be eliminated by mandating their use of the Ambassador Bridge, while forcing Customs and INS staffing and procedural improvements. In fact, elimination of separate Customs primary and secondary inspection facilities for trucks could be beneficial.

A separate Port Huron only project, assuming a prior Detroit deepening, has a total North American payback of 7.3 years. The Michigan payback of such a project is 33.0 years. The payback for the combined Detroit-Windsor partial deepening and Port Huron-Sarnia double stack tunnel would be 6.8 years from a North American perspective, and 26.0 years from a Michigan benefits only perspective. A Detroit-Windsor double stack tunnel would have a combined payback of 8.0 years from a North American perspective, and 35.2 years from a Michigan benefits perspective.

Finally, inclusion of the tunnel conversion to truck at a $7.8 million benefit level increases the North American payback to 9.5 years but shortens the Michigan only payback to 25.5 years. The opposite reactions in payback years are due to the higher relative value of $7.8 million in the Michigan only benefits. However, it is not recommended that the tunnel conversion be considered at this time.

While only an estimate at this point, the Michigan benefits only payback of 26.0 years for a partial deepening and Port Huron double stack project is quite acceptable from a transportation infrastructure standpoint. The Port Huron only Michigan payback of 33.0 years with a previous Detroit deepening is also acceptable. It should also be noted that any state role would be limited to tax-exempt financing, property tax abatements, and other assistance that would have a much lower cost than the full construction dollars assumed in the above payback analysis.

Conclusion Sensitivity

The conclusions reviewed above are sensitive to several key factors. First, any increases in the actual costs of construction will have a significant impact on the payback and cash flow. This effect will be exponential given the financing, and the relatively small benefits relative to costs. Any higher cost for a Port Huron tunnel, relative to a Detroit one, will also have a significant effect on the advantage currently shown for Port Huron.

On the benefit side, the level of total benefit, and the amount assigned to Michigan, for several key categories, will have major impact. First, the partial deepening payback is very sensitive to the ferry elimination cost savings, and to the harbor maintenance fee savings. Secondly, the amount of benefit shown for Chrysler 20'2" tri-levels in the double stack projects is very significant and any reduction would significantly increase the payback. Third, the benefit shown for Michigan and U.S. Midwest trade with Europe is also critical to the payback and any reductions would significantly increase the payback years. Finally, the benefit related to double stack intermodal services on U.S. Upper Midwest-East Coast traffic lanes is significant. This benefit is based on double stack rail capturing some 50,000 containers a year of highway traffic, or an equivalent number of Conrail loads, at an average $100 per container savings.

RECOMMENDATIONS

The recommendations relate to the overall approach to be pursued, possible state assistance to the rail industry and developers, the need for long term planning and strategy, and the possible role for a state border crossing authority. Each of these recommendations is reviewed in the following parts.

Recommended Development Approach

As indicated in the conclusions, the recommended approach is for the State of Michigan to help facilitate the Detroit partial deepening project and Port Huron double stack project at this time. The Detroit project involves deepening of one tube at the existing Detroit-Windsor rail tunnel. This project accomplishes the principal objectives of most parties, has the lowest costs, and the best payback. The main disadvantage is that Chrysler 20'2" tri-levels would not fit, and this would prevent Chrysler from moving away from cross-border trucking towards rail.

The second project involves facilitation of the construction of a double stack tunnel at Port Huron-Sarnia. Port Huron offers several advantages, not the least of which is the considerable interest of CN in completing a double stack tunnel. Other advantages relate to a potentially lower cost, elimination of harbor maintenance fees on a large volume of oversize cars that might or might not take advantage of a Detroit deepening, the shorter rail distances between major markets using this crossing, and the lack of congestion.

The third phase, potential conversion of the Detroit-Windsor railroad tunnel to truck use, should await better information on future traffic growth and the potential need for truck highway capacity. This would avoid a premature expenditure of $95 million on a project that would provide marginal truck only capacity at the best. Should a need for capacity be demonstrated in future studies this option can be considered in light of other alternatives such as new bridges. In the meantime, various steps being taken or already taken at the Ambassador Bridge will help to alleviate past congestion and should allow for additional volume. If necessary, efforts could be made to route auto tunnel truck traffic to the Ambassador, and to improve Customs/INS/and operator processing so as to avoid the need for truck use of the congested auto tunnel.

Potential Government Actions

The following sub-parts review the rationale for government involvement, the potential role that state government could play, and the Canadian government role relative to Michigan.

Rationale for State Action

The role to be played by state government, and the Ontario government, should in considerable part be dependent on the needs and wants of the railroad industry. While there are several public interest reasons for government involvement, if the railroad industry feels assistance is not necessary, and a satisfactory project can be completed without such assistance, there will hopefully be no need for a government role.

There are two primary reasons why a government role may be appropriate. First, the costs of rail double stack border crossing infrastructure at the Michigan-Ontario border are very large relative to other projects that have been completed around the country. Several reports have indicated that a government role may be necessary in some parts of the country so as to obtain the necessary clearances. Governments have played such a role in double stack clearance projects in California, New York, Pennsylvania, Vancouver, and Nova Scotia. Given the size of the investment here, which is four or five times the size of any other known double stack clearance project, a government role to help minimize costs may be reasonable depending on the potential benefits.

Governments have desired a role in order to assure their region is not bypassed by modern rail infrastructure leaving them off the main line. There is also a government interest in financing rail improvements which will lead to congestion improvements and a reduction in environmental degradation.

A more important reason for government involvement may relate to assuring a competitive rail transportation system. In this case a Port Huron-Sarnia railroad double stack tunnel would provide monopoly benefits to one railroad. A considerable case could be made for state action designed to assure competitive access to other railroads at reasonable costs. On the other hand, a government role could also be useful in getting competing railroads to cooperate in a venture that would reduce total infrastructure needs. Such a rationale is used in the hospital field to minimize unnecessary duplication.

Potential State Actions

There are several roles state government could play in facilitating construction of a new double stack tunnel. These roles relate to financing assistance, tax abatements, federal funding, and permitting. The costs of these options would have to be compared to the benefit levels in order to determine the payback on state government investment in such a project.

Aside from paying for part of the construction costs, assistance with financing is the largest role that state government could play. Tax exempt financing could reduce the interest rate on the project by one to two percentage points and save tens of millions of dollars over the life of the project. However, in order to provide such financing it may be necessary for a public Authority to own the asset and lease it back to the railroads, or own and operate the asset with a management contract providing for rail operational management. In the latter case tolls would be collected on traffic and used to pay construction bonds. Such an approach might be complicated by the difficulty that a bond rating agency would have in evaluating the soundness of an income stream dependent on a small number of railroads. This issue would also raise the question of guarantees on rail use of the facility.

A second state role could be in assuring a property tax abatement for the project. While a Michigan based owner of such a rail facility already receives a credit on property taxes based on the level of track capital investment and maintenance expenditures, the size of the investment might exceed the credit, or a non rail entity might own the facility. In this case a property tax abatement would be beneficial. Assuming a property tax equal to 3% of the market value, and half of the tunnel property being in Michigan, an abatement would save the owner, and cost government, $2.33 million per year on a $155 million Port Huron project.

The third role for the state could involve assistance with national and state permitting requirements. Such a role, while hard to quantify, could prove critical to obtaining the necessary permits in a timely fashion.

A fourth role could involve assistance in securing funding from federal sources. Texas has received funding for a Southern Border Capital Improvement Act totaling $357 million dollars, and Michigan should pursue funding for a Northern Border Capitol Improvement Act. Such funding could include monies for "intermodal" or possibly even rail freight projects depending on past precedents and new precedents which may be established in the new highway bill. It should also be noted that the highway bill includes several provisions requiring studies of U.S.-Canada transportation needs.

Any state role should, however, be contingent on securing competitive access for all railroads. There may also be several other conditions the state would want met in return for assistance.

Canadian vs. Michigan Interests

While there are several cross-border rail improvement benefits that accrue directly to Michigan, a number of the benefits are indirect and require a rather non-parochial perspective in order to see the value to Michigan. Many of the benefits of double stack will help to make the North American automotive industry more competitive, and will therefore help Michigan in the long term. However, Canada, and Ontario, will receive very direct benefits to their auto assembly plants. Double stack capability will also make it easier for their exporters to reach distant U.S. markets.

Given these conclusions it would seem that the government of Ontario would have a deep interest in assuring double stack capability. In fact, a consultant's report to the Ontario Ministry of Transportation suggests that once institutional barriers are addressed (such as those that had until recently prevented roadrailer service), an effort should be made to obtain double stack clearance at more border crossings. The report goes on to suggest that such efforts should be made at Detroit-Windsor if a new bridge is being considered.

Given these comments it would seem that any state involvement should be conditioned on financial participation by the governments of Canada and Ontario. To some extent, the Canadian government is already playing this role through the Crown owned CN railroad. Their interest in a Port Huron project, and statements concerning absorption of some costs, reflect a Canadian national interest. Ontario has shown less interest but has access to the U.S. through Buffalo and may not be as concerned with the Michigan gateway given this alternative.

Long Term Strategy and Planning Requirements

Work on this project and several other border crossing issues points out the need for better information and long term planning on regional transportation needs. Regional planning, however, can no longer be conducted on just one side of the border. A comprehensive planning system that takes into account demand and developments on both sides of the border is required if maximum benefits are to be derived from regional interaction.

There are two specific issues that such a planning process should address. First, it is clear that the Ontario and Michigan governments must work more closely to accomplish planning for the region's transportation needs. There is little in the way of formal planning relationships currently, and there have been only informal contacts in the past. However, the joint Michigan-Ontario border crossing committees are a step in the right direction.

Secondly, there is a need for a comprehensive regional planning system and data base that includes information on border crossing needs and origin-destination data on domestic as well as cross-border movements. Such an origin-destination study has not been conducted for many years in Detroit as far as is known, and has never been conducted for the Ontario-Michigan region at an integrated level. Current intermodal rail/truck movements and future demand would be important elements of any such data base. The role of rail passenger and freight systems in the overall regional cross-border transportation system would be critical elements of such a long term strategy.

Port Huron-Sarnia Highway Bridge and Railroad Double Stack Tunnel Authority

A recent announcement by Congressman Bonior of Port Huron and his Canadian Parliament counterpart about their intention to create an Authority for construction of a new highway bridge raises some interesting possibilities. Such an Authority could be used to finance and operate both a new bridge and a railroad tunnel.

Such an approach, in its simplest form, would provide a vehicle for tax exempt financing of both projects. To the extent that the two projects were allowed to cross guarantee bond payments, the Authority could also serve to reduce concerns about repayment of the rail related bonds. Bond rating agencies would be more receptive to a project tied to a highway toll income stream, even if just as a secondary guarantor. A joint Authority might also allow the project to qualify for special "intermodal" border crossing monies contemplated in some versions of the federal highway bill. Alternative federal funding arrangements, such as the idea about a "Northern Border Capital Improvement Act," with funding similar to the $357 million obtained by Senator Bensten for Texas, also might be more viable with a comprehensive highway/rail project.

The State of Michigan should explore this possibility, and the potential benefits, to determine its viability. Such a review should also include an examination of how the current single tube railroad tunnel could be used if a new highway bridge and double stack rail tunnel are built. Finally, while it is assumed that a new highway bridge could not accommodate a rail deck at a sufficiently low grade to allow rail service, the possibility of a joint highway/rail facility should be explored further.

State Border Crossings Authority

A broader approach to the border crossings issue statewide would be to create a State Border Crossings Authority. Such an Authority could plan, finance, construct, and/or manage various kinds of facilities that provided a state benefit. Examples might include highway and rail border crossing needs, international airport terminal projects, and even the local share of funds for a new Soo lock. The main criterion would be that such projects provide a transportation infrastructure competitiveness benefit, and be self sufficient in terms of being able to repay revenue bonds.

Such an Authority would be undertaken to provide an organizational entity which could finance projects of international competitiveness significance without using traditional tax sources of infrastructure funding. The Authority would also focus state and provincial attention on border crossing issues. An Authority could also serve as a focal point for efforts to secure dedicated federal funds for infrastructure and staffing. Finally, an Authority could coordinate cross-border infrastructure requirements planning. In the final analysis, the purpose would be to provide an entity that offers the financial advantages of public ownership to the traveling public. The primary such advantages would be tax free financing, and perhaps, technical resources and competence in the design and management of transportation infrastructure projects.

Such an Authority could be created under Act 237 of 1935, as amended, although this legislation would limit the scope to an international bridge or tunnel.

LIMITATIONS AND FUTURE RESEARCH

This research project was intended to produce a preliminary review of the benefits that would result from a double stack tunnel and possible conversion of the existing tunnel to truck. While a number of potential benefits have been quantified, the reader should understand that these are still extremely rough estimates of potential benefit levels. The benefits for Michigan, as opposed to the rest of North America, are even more preliminary.

What has been provided is a sense of the magnitude of benefits which would result from different aspects of the project. The research also provides a good framework for assessing the cash flow position of various alternatives, and a framework for evaluating the cost benefits net present value payback of various alternatives.

Future research needs to be conducted to assess the actual North America benefits level for several categories of freight. It is most important that the overall benefit level for Michigan and U.S. Midwest European trade be evaluated, and that the Michigan benefit of transportation savings on these corridors be further researched. The same is true of potential incremental traffic resulting from capture of highway traffic in the Chicago-Toronto corridor, and in the U.S. Upper Midwest-Eastern U.S. corridor. Last, the potential for Michigan-Ontario double stack traffic, and especially boxcar replacement traffic, should be further assessed.

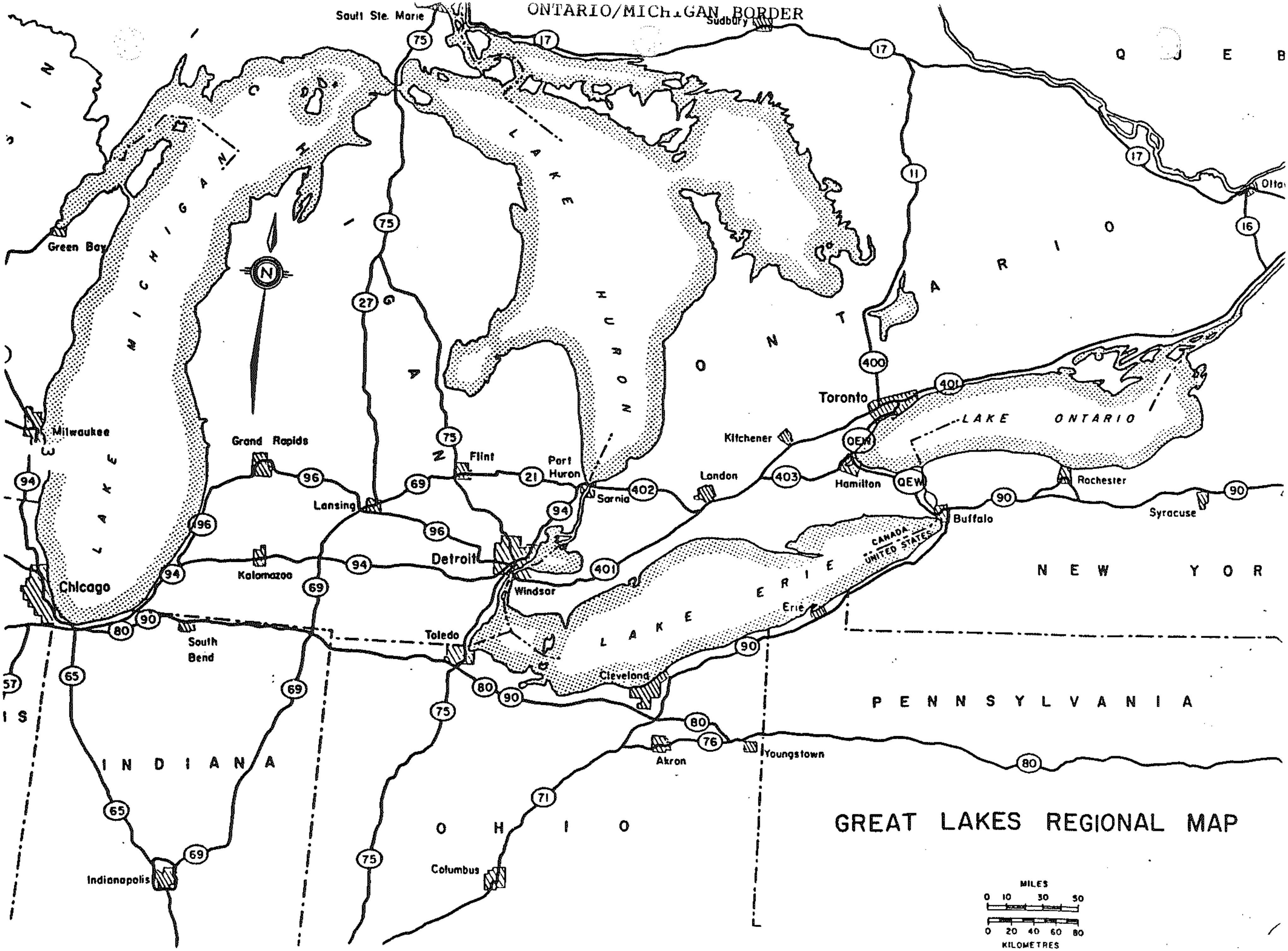
Finally, additional research is required on highway capacity needs and on the options for fulfilling any such needs. This latter research should include increased focus on highway border crossing needs at both Detroit and Port Huron.

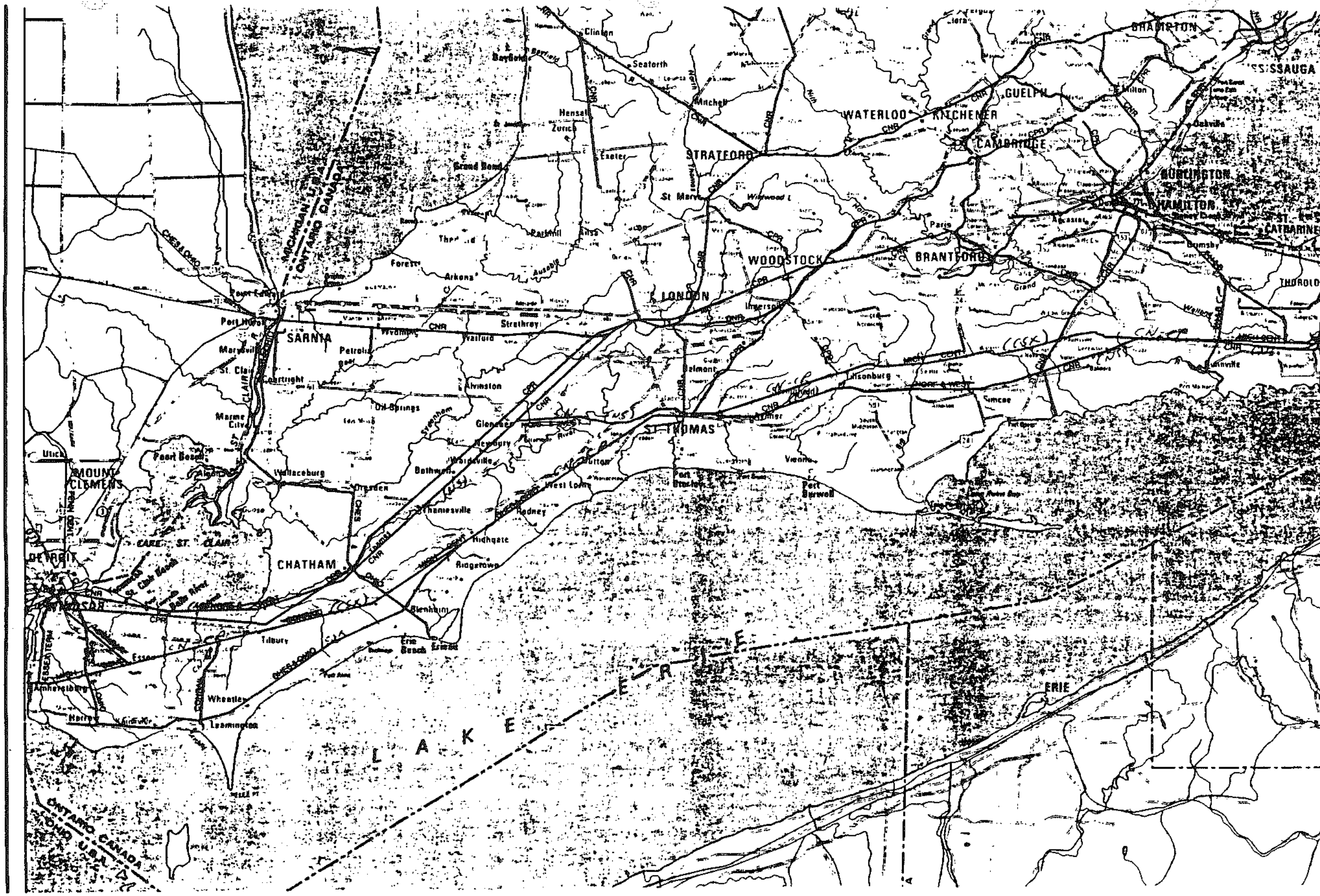
APPENDICES

APPENDIX I

Regional And System Maps

ONTARIO/MICHIGAN BORDER





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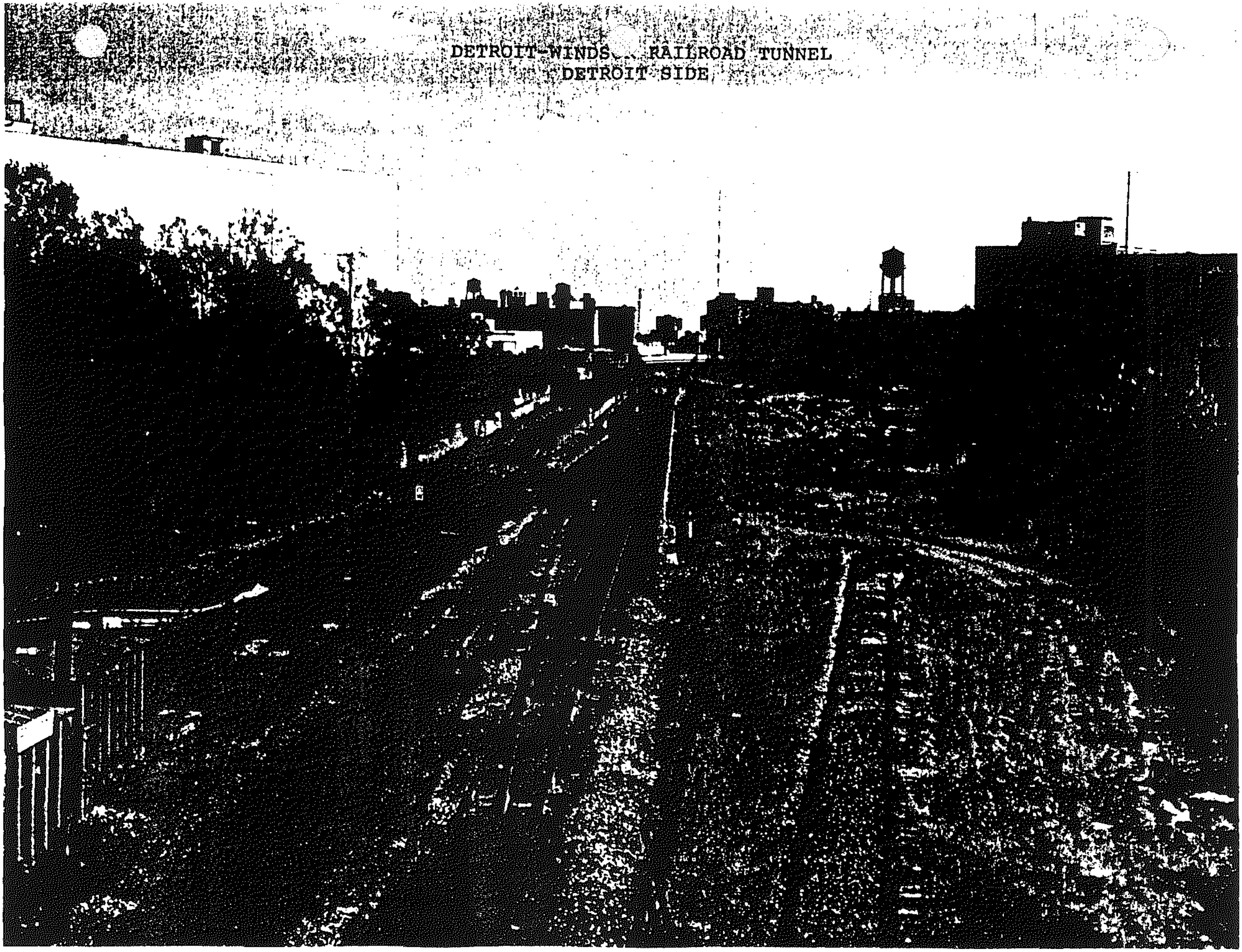
Milton
Oakville
BURLINGTON
HAMILTON
Grimsby
THOROLD
St Marys
WOODSTOCK
BRANTFORD
Paris
LONDON
Ingersoll
Forest
Arkona
Parkhill
Strathroy
Watford
Wyoming
SARNIA
Port Huron
Petrolia
Courtright
St. Clair
Marine City
Wallaceburg
Dresden
Oil Springs
Alvinston
Glencoe
Newbury
Wardsville
Bothwell
Thamesville
West Lorne
Dutton
Rodney
Highgate
Ridgetown
Belmont
ST. THOMAS
Aylmer
Tillsonburg
Simcoe
Port Stanley
Port Burwell
Vienna
Dunnville
MOUNT CLEMENS
LAKE ST. CLAIR
DETROIT
WINDSOR
CHATHAM
Blenheim
Tilbury
Erie Beach
Essex
Amherstburg
Harrow
Wheatley
Leamington
CNR
CPR
L A K E E R I E
ERIE
ONTARIO CANADA
OHIO U.S.A.

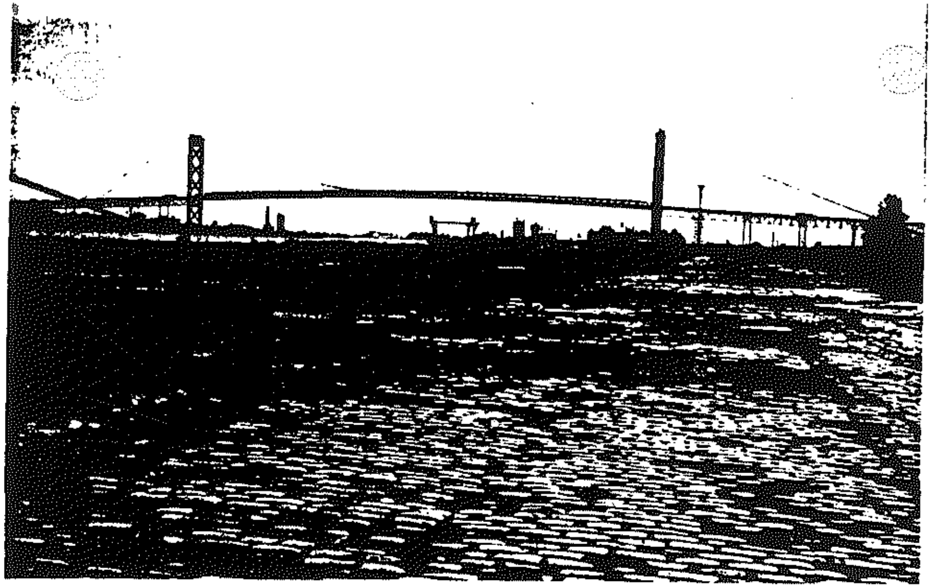
APPENDIX II

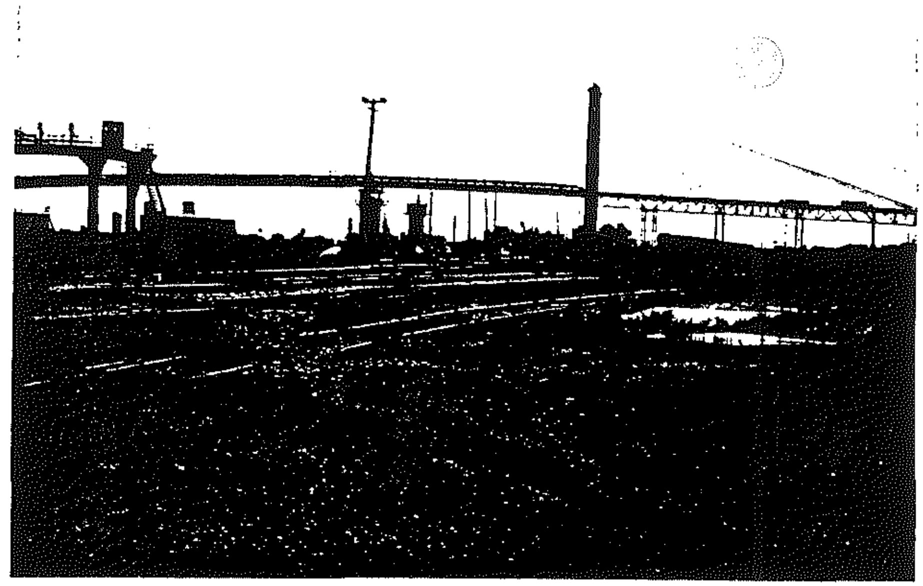
Detroit-Windsor Rail Crossing Photography

DETROIT-WINDS... RAILROAD TUNNEL
DETROIT SIDE

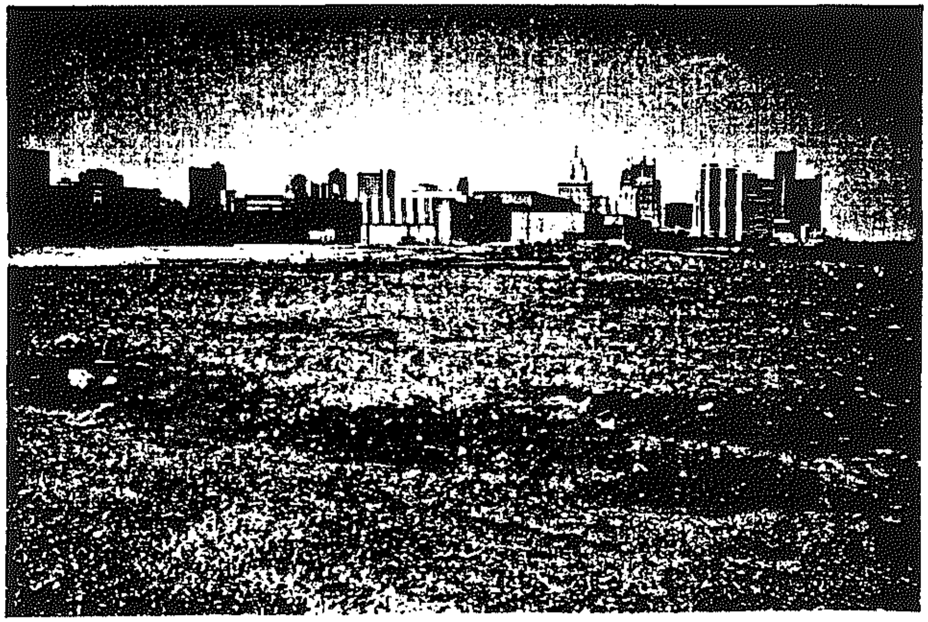


DETROIT-WINDSOR RAILROAD TUNNEL
DETROIT SIDE
RAIL RIGHT OF WAY





DETROIT-WINDSOR RAILROAD FERRY

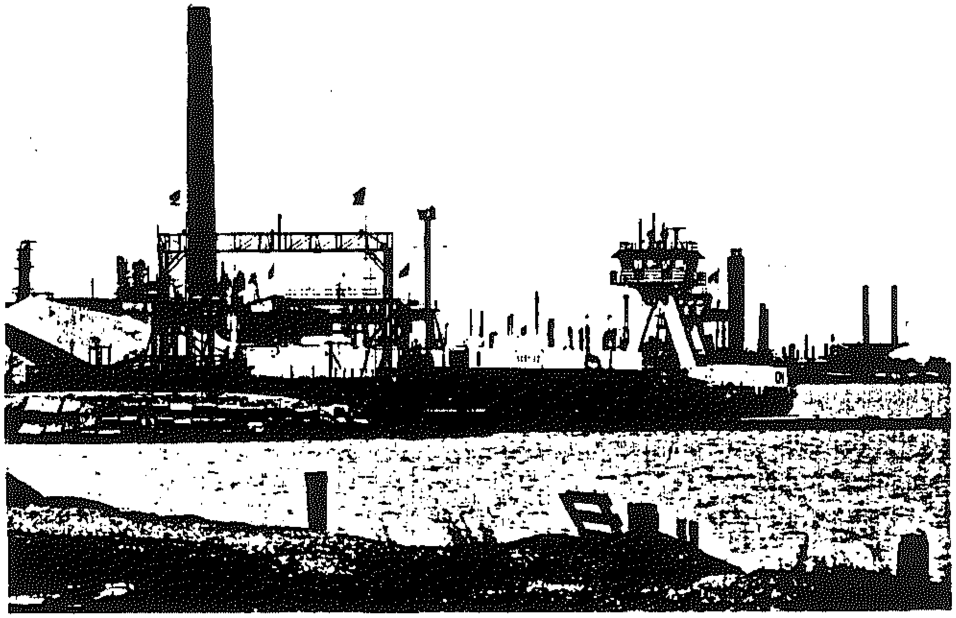


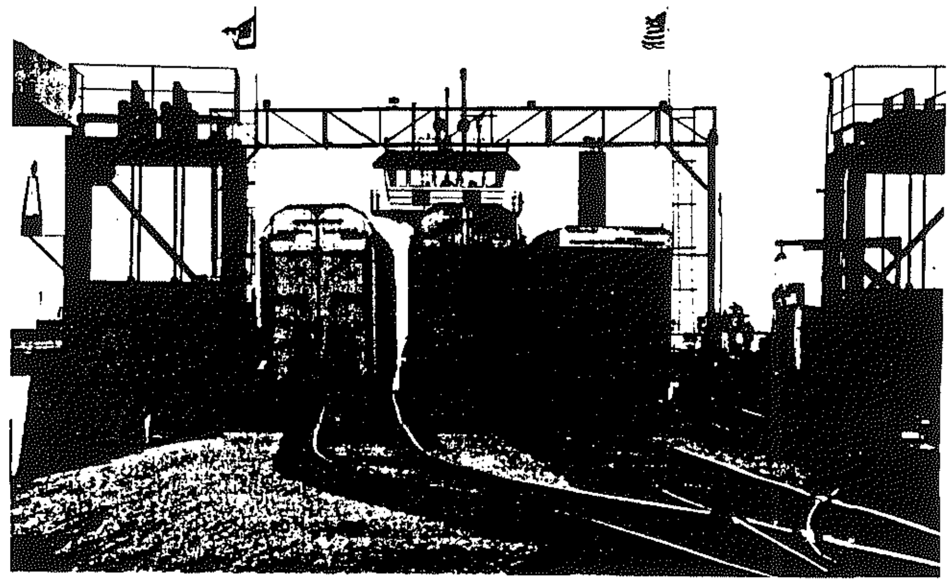
APPENDIX III

Port Huron-Sarnia Rail Crossing Photography

PORT HURON-SARNIA RAILROAD TUNNEL
PORT HURON SIDE

PORT HURON-SARNIA RAILROAD FERRY
CANADIAN NATIONAL





APPENDIX IV

Principal And Interest Calculations For Construction Cost Financing

itial loan amount $323000000.00
nnual interest rate 8.00 %
eriods per year 12
ime period of 30 years 0 months and 0 days or 360 periods.
eriodic payment $2370059.00

ayment umber	Remaining Principal	Principal Payment	Principal Loan to date	Interest Payment	Interest Page to date
1	$322783300.00	$216736.00	$216736.00	$2153323.00	$2153323.00
2	$322565100.00	$218144.00	$434880.00	$2151915.00	$4305239.00
3	$322345500.00	$219648.00	$654528.00	$2150411.00	$6455650.00
4	$322124400.00	$221088.00	$875616.00	$2148971.00	$8604621.00
5	$321901800.00	$222560.00	$1098176.00	$2147499.00	$10752120.00
6	$321677800.00	$224064.00	$1322240.00	$2145995.00	$12898120.00
7	$321452200.00	$225536.00	$1547776.00	$2144523.00	$15042640.00
8	$321225200.00	$227008.00	$1774784.00	$2143051.00	$17185690.00
9	$320996700.00	$228576.00	$2003360.00	$2141483.00	$19327170.00
10	$320766600.00	$230080.00	$2233440.00	$2139979.00	$21467160.00
11	$320534900.00	$231648.00	$2465088.00	$2138411.00	$23605570.00
12	$320301800.00	$233152.00	$2698240.00	$2136907.00	$25742480.00

ess ENTER to continue with next 12 periods. Enter a beginning
yment number if desired or enter 0 to quit.

itial loan amount $323000000.00 28.7M/YEAR PRINC/INTEREST = 861M TOTAL
nual interest rate 8.00 %
riods per year 1
me period of 30 years 0 months and 0 days or 30 periods.
riodic payment $28691260.00

yment mber	Remaining Principal	Principal Payment	Principal Loan to date	Interest Payment	Interest Page to date
1	$320148700.00	$2851264.00	$2851264.00	$25840000.00	$25840000.00
2	$317069400.00	$3079360.00	$5930624.00	$25611900.00	$51451890.00
3	$313743700.00	$3325696.00	$9256320.00	$25365560.00	$76817460.00
4	$310151900.00	$3591776.00	$12848100.00	$25099480.00	$101916900.00
5	$306272800.00	$3879104.00	$16727200.00	$24812160.00	$126729100.00
6	$302083300.00	$4189472.00	$20916670.00	$24501790.00	$151230900.00
7	$297558800.00	$4524576.00	$25441250.00	$24166680.00	$175397600.00
8	$292672200.00	$4886560.00	$30327810.00	$23804700.00	$199202300.00
9	$287394700.00	$5277472.00	$35605280.00	$23413790.00	$222616100.00
10	$281695000.00	$5699712.00	$41304990.00	$22991550.00	$245607600.00
11	$275539400.00	$6155616.00	$47460610.00	$22535640.00	$268143300.00
12	$268891300.00	$6648064.00	$54108670.00	$22043200.00	$290186500.00

ess ENTER to continue with next 12 periods. Enter a beginning
yment number if desired or enter 0 to quit.

...itial loan amount $270000000.00
nnual interest rate 8.00 %
eriods per year 12
ime period of 30 years 0 months and 0 days or 360 periods.
eriodic payment $1981164.00

ay...nt um. r	Remaining Principal	Principal Payment	Principal Loan to date	Interest Payment	Interest Page to date
1	$269818900.00	$181152.00	$181152.00	$1800012.00	$1800012.00
2	$269636500.00	$182368.00	$363520.00	$1798796.00	$3598808.00
3	$269452900.00	$183616.00	$547136.00	$1797548.00	$5396356.00
4	$269268100.00	$184800.00	$731936.00	$1796364.00	$7192720.00
5	$269082000.00	$186080.00	$918016.00	$1795084.00	$8987804.00
6	$268894700.00	$187264.00	$1105280.00	$1793900.00	$10781700.00
7	$268706200.00	$188512.00	$1293792.00	$1792652.00	$12574360.00
8	$268516400.00	$189792.00	$1483584.00	$1791372.00	$14365730.00
9	$268325400.00	$191040.00	$1674624.00	$1790124.00	$16155850.00
10	$268133100.00	$192336.00	$1866960.00	$1788828.00	$17944680.00
11	$267939400.00	$193616.00	$2060576.00	$1787548.00	$19732230.00
12	$267744500.00	$194912.00	$2255488.00	$1786252.00	$21518480.00

-ess ENTER to continue with next 12 periods. Enter a beginning
yment number if desired or enter 0 to quit.

itial loan amount $270000000.00 24.0M/YEAR INT+PRINC.
nual interest rate 8.00 %
riods per year 1
me period of 30 years 0 months and 0 days or 30 periods.
riodic payment $23983410.00

yment mb	Remaining Principal	Principal Payment	Principal Loan to date	Interest Payment	Interest Page to date
1	$267616600.00	$2383408.00	$2383408.00	$21600000.00	$21600000.00
2	$265042500.00	$2574064.00	$4957472.00	$21409340.00	$43009340.00
3	$262262500.00	$2780032.00	$7737504.00	$21203370.00	$64212710.00
4	$259260100.00	$3002400.00	$10739900.00	$20981010.00	$85193710.00
5	$256017500.00	$3242576.00	$13982480.00	$20740830.00	$105934600.00
6	$252515500.00	$3502000.00	$17484480.00	$20481400.00	$126416000.00
7	$248733300.00	$3782208.00	$21266690.00	$20201200.00	$146617200.00
8	$244648600.00	$4084704.00	$25351390.00	$19898700.00	$166515900.00
9	$240237100.00	$4411536.00	$29762930.00	$19571870.00	$186087700.00
10	$235472600.00	$4764464.00	$34527390.00	$19218940.00	$205306700.00
11	$230327100.00	$5145552.00	$39672950.00	$18837850.00	$224144500.00
12	$224769800.00	$5557248.00	$45230190.00	$18426160.00	$242570700.00

ess ENTER to continue with next 12 periods. Enter a beginning
yment number if desired or enter 0 to quit.

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A··ual interest rate 8.00 %
I riods per year 12
ime period of 30 years 0 months and 0 days or 360 periods.
Periodic payment $1893112.00

Payment Number	Remaining Principal	Principal Payment	Principal Loan to date	Interest Payment	Interest Page to date
1	$257826900.00	$173120.00	$173120.00	$1719992.00	$1719992.00
2	$257652600.00	$174272.00	$347392.00	$1718840.00	$3438833.00
3	$257477200.00	$175408.00	$522800.00	$1717704.00	$5156537.00
4	$257300600.00	$176608.00	$699408.00	$1716504.00	$6873042.00
5	$257122800.00	$177776.00	$877184.00	$1715336.00	$8588378.00
6	$256943900.00	$178976.00	$1056160.00	$1714136.00	$10302510.00
7	$256763700.00	$180144.00	$1236304.00	$1712968.00	$12015480.00
8	$256582400.00	$181344.00	$1417648.00	$1711768.00	$13727250.00
9	$256399800.00	$182560.00	$1600208.00	$1710552.00	$15437800.00
10	$256216000.00	$183776.00	$1783984.00	$1709336.00	$17147140.00
11	$256031000.00	$185008.00	$1968992.00	$1708104.00	$18855240.00
12	$255844800.00	$186240.00	$2155232.00	$1706872.00	$20562110.00

Press ENTER to continue with next 12 periods. Enter a beginning
payment number if desired or enter 0 to quit.

Initial loan amount $258000000.00 22.9M/YEAR INT+PRIN
Annual interest rate 8.00 %
Periods per year 1
Time period of 30 years 0 months and 0 days or 30 periods.
Periodic payment $22917480.00

Payment Number	Remaining Principal	Principal Payment	Principal Loan to date	Interest Payment	Interest Page to date
1	$255722500.00	$2277472.00	$2277472.00	$20640000.00	$20640000.00
2	$253262900.00	$2459680.00	$4737152.00	$20457800.00	$41097800.00
3	$250606400.00	$2656448.00	$7393600.00	$20261030.00	$61358830.00
4	$247737400.00	$2868976.00	$10262580.00	$20048500.00	$81407330.00
5	$244639000.00	$3098448.00	$13361020.00	$19819030.00	$101226400.00
6	$241292600.00	$3346384.00	$16707410.00	$19571090.00	$120797400.00
7	$237678500.00	$3614080.00	$20321490.00	$19303400.00	$140100800.00
8	$233775300.00	$3903184.00	$24224670.00	$19014290.00	$159115100.00
9	$229559900.00	$4215472.00	$28440150.00	$18702000.00	$177817100.00
10	$225007200.00	$4552704.00	$32992850.00	$18364770.00	$196181900.00
11	$220090300.00	$4916848.00	$37909700.00	$18000630.00	$214182500.00
12	$214780000.00	$5310304.00	$43220000.00	$17607170.00	$231789700.00

Press ENTER to continue with next 12 periods. Enter a beginning
payment number if desired or enter 0 to quit.

nitial loan amount $237000000.00
nnual interest rate 8.00 %
eriods per year 12
ime period of 30 years 0 months and 0 days or 360 periods.
eriodic payment $1739022.00

ay t umber	Remaining Principal	Principal Payment	Principal Loan to date	Interest Payment	Interest Page to date
1	$236841000.00	$159024.00	$159024.00	$1579998.00	$1579998.00
2	$236680900.00	$160080.00	$319104.00	$1578942.00	$3158940.00
3	$236519800.00	$161136.00	$480240.00	$1577886.00	$4736825.00
4	$236357500.00	$162240.00	$642480.00	$1576782.00	$6313607.00
5	$236194200.00	$163312.00	$805792.00	$1575710.00	$7889317.00
6	$236029800.00	$164384.00	$970176.00	$1574638.00	$9463955.00
7	$235864300.00	$165488.00	$1135664.00	$1573534.00	$11037490.00
8	$235697800.00	$166592.00	$1302256.00	$1572430.00	$12609920.00
9	$235530100.00	$167696.00	$1469952.00	$1571326.00	$14181250.00
10	$235361200.00	$168832.00	$1638784.00	$1570190.00	$15751440.00
11	$235191300.00	$169952.00	$1808736.00	$1569070.00	$17320500.00
12	$235020200.00	$171072.00	$1979808.00	$1567950.00	$18888450.00

ess ENTER to continue with next 12 periods. Enter a beginning
yment number if desired or enter 0 to quit.

itial loan amount $237000000.00 21.1 M/YEAR INT+PRIN
nual interest rate 8.00 %
riods per year 1
me period of 30 years 0 months and 0 days or 30 periods.
riodic payment $21052100.00

ym t mbe	Remaining Principal	Principal Payment	Principal Loan to date	Interest Payment	Interest Page to date
1	$234907900.00	$2092096.00	$2092096.00	$18960000.00	$18960000.00
2	$232648500.00	$2259456.00	$4351552.00	$18792640.00	$37752650.00
3	$230208200.00	$2440240.00	$6791792.00	$18611860.00	$56364510.00
4	$227572800.00	$2635440.00	$9427232.00	$18416660.00	$74781170.00
5	$224726500.00	$2846272.00	$12273500.00	$18205830.00	$92986990.00
6	$221652500.00	$3074016.00	$15347520.00	$17978080.00	$110965100.00
7	$218332600.00	$3319904.00	$18667420.00	$17732200.00	$128697300.00
8	$214747100.00	$3585488.00	$22252910.00	$17466610.00	$146163900.00
9	$210874800.00	$3872336.00	$26125250.00	$17179760.00	$163343600.00
10	$206692600.00	$4182144.00	$30307390.00	$16869960.00	$180213600.00
11	$202176000.00	$4516640.00	$34824030.00	$16535460.00	$196749000.00
12	$197297900.00	$4878032.00	$39702070.00	$16174070.00	$212923100.00

ess ENTER to continue with next 12 periods. Enter a beginning
yment number if desired or enter 0 to quit.

nual interest rate 8.00 %
riods per year 12
me period of 30 years 0 months and 0 days or 360 periods.
riodic payment $1262075.00

yment mr r	Remaining Principal	Principal Payment	Principal Loan to date	Interest Payment	Interest Page to date
1	$171884600.00	$115408.00	$115408.00	$1146667.00	$1146667.00
2	$171768400.00	$116176.00	$231584.00	$1145899.00	$2292566.00
3	$171651500.00	$116944.00	$348528.00	$1145131.00	$3437697.00
4	$171533700.00	$117744.00	$466272.00	$1144331.00	$4582028.00
5	$171415200.00	$118512.00	$584784.00	$1143563.00	$5725591.00
6	$171295900.00	$119312.00	$704096.00	$1142763.00	$6868354.00
7	$171175800.00	$120096.00	$824192.00	$1141979.00	$8010333.00
8	$171054900.00	$120896.00	$945088.00	$1141179.00	$9151511.00
9	$170933200.00	$121712.00	$1066800.00	$1140363.00	$10291870.00
10	$170810700.00	$122528.00	$1189328.00	$1139547.00	$11431420.00
11	$170687300.00	$123344.00	$1312672.00	$1138731.00	$12570150.00
12	$170563200.00	$124144.00	$1436816.00	$1137931.00	$13708080.00

ess ENTER to continue with next 12 periods. Enter a beginning
yment number if desired or enter 0 to quit.

itial loan amount $172000000.00 15.3M/YEAR PRIN + INT.
nual interest rate 8.00 %
riods per year 1
ne period of 30 years 0 months and 0 days or 30 periods.
riodic payment $15278320.00

yment nbr	Remaining Principal	Principal Payment	Principal Loan to date	Interest Payment	Interest Page to date
1	170481700.00	$1518320.00	$1518320.00	$13760000.00	$13760000.00
2	$168841900.00	$1639792.00	$3158112.00	$13638530.00	$27398520.00
3	$167071000.00	$1770944.00	$4929056.00	$13507370.00	$40905900.00
4	$165158300.00	$1912656.00	$6841712.00	$13365660.00	$54271560.00
5	$163092600.00	$2065648.00	$8907360.00	$13212670.00	$67484230.00
6	$160861700.00	$2230928.00	$11138290.00	$13047390.00	$80531620.00
7	$158452300.00	$2409376.00	$13547660.00	$12868940.00	$93400560.00
8	$155850200.00	$2602112.00	$16149780.00	$12676210.00	$106076800.00
9	$153039900.00	$2810320.00	$18960100.00	$12468000.00	$118544800.00
0	$150004800.00	$3035136.00	$21995230.00	$12243180.00	$130788000.00
1	$146726900.00	$3277920.00	$25273150.00	$12000400.00	$142788400.00
2	$143186700.00	$3540160.00	$28813310.00	$11738160.00	$154526500.00

ss ENTER to continue with next 12 periods. Enter a beginning
ment number if desired or enter 0 to quit.

.itial loan amount $165000000.00
nnual interest rate 8.00 %
eriods per year 12
.me period of 30 years 0 months and 0 days or 360 periods.
eriodic payment $1210711.00

aym..t umber	Remaining Principal	Principal Payment	Principal Loan to date	Interest Payment	Interest Page to date
1	$164889300.00	$110704.00	$110704.00	$1100007.00	$1100007.00
2	$164777800.00	$111456.00	$222160.00	$1099255.00	$2199263.00
3	$164665700.00	$112176.00	$334336.00	$1098535.00	$3297798.00
4	$164552700.00	$112960.00	$447296.00	$1097751.00	$4395550.00
5	$164439000.00	$113696.00	$560992.00	$1097015.00	$5492565.00
6	$164324600.00	$114448.00	$675440.00	$1096263.00	$6588829.00
7	$164209400.00	$115216.00	$790656.00	$1095495.00	$7684324.00
8	$164093400.00	$115968.00	$906624.00	$1094743.00	$8779067.00
9	$163976600.00	$116768.00	$1023392.00	$1093943.00	$9873010.00
10	$163859100.00	$117536.00	$1140928.00	$1093175.00	$10966190.00
11	$163740800.00	$118320.00	$1259248.00	$1092391.00	$12058580.00
12	$163621700.00	$119088.00	$1378336.00	$1091623.00	$13150200.00

ess ENTER to continue with next 12 periods. Enter a beginning
yment number if desired or enter 0 to quit.

.itial loan amount $165000000.00 14.7 M/YEAR INT+PRINC.
nnual interest rate 8.00 %
eriods per year 1
.me period of 30 years 0 months and 0 days or 30 periods.
eriodic payment $14656530.00

aym..t umber	Remaining Principal	Principal Payment	Principal Loan to date	Interest Payment	Interest Page to date
1	$163543500.00	$1456528.00	$1456528.00	$13200000.00	$13200000.00
2	$161970400.00	$1573040.00	$3029568.00	$13083490.00	$26283480.00
3	$160271500.00	$1698896.00	$4728464.00	$12957630.00	$39241110.00
4	$158436700.00	$1834800.00	$6563264.00	$12821730.00	$52062840.00
5	$156455100.00	$1981600.00	$8544864.00	$12674930.00	$64737760.00
6	$154315000.00	$2140112.00	$10684980.00	$12516410.00	$77254180.00
7	$152003700.00	$2311328.00	$12996300.00	$12345200.00	$89599380.00
8	$149507500.00	$2496224.00	$15492530.00	$12160300.00	$101759700.00
9	$146811600.00	$2695920.00	$18188450.00	$11960610.00	$113720300.00
10	$143899900.00	$2911616.00	$21100070.00	$11744910.00	$125465200.00
11	$140755400.00	$3144512.00	$24244580.00	$11512010.00	$136977200.00
12	$137359400.00	$3396080.00	$27640660.00	$11260450.00	$148237700.00

ess ENTER to continue with next 12 periods. Enter a beginning
yment number if desired or enter 0 to quit.

itial loan amount $125000000.00
nual interest rate 8.00 %
riods per year 12
me period of 30 years 0 months and 0 days or 360 periods.
riodic payment $917205.60

y nt mber	Remaining Principal	Principal Payment	Principal Loan to date	Interest Payment	Interest Page to date
1	$124916100.00	$83872.00	$83872.00	$833333.60	$833333.60
2	$124831700.00	$84432.00	$168304.00	$832773.60	$1666107.00
3	$124746700.00	$84992.00	$253296.00	$832213.60	$2498321.00
4	$124661100.00	$85568.00	$338864.00	$831637.60	$3329958.00
5	$124575000.00	$86128.00	$424992.00	$831077.60	$4161036.00
6	$124488300.00	$86704.00	$511696.00	$830501.60	$4991538.00
7	$124401000.00	$87288.00	$598984.00	$829917.60	$5821455.00
8	$124313200.00	$87864.00	$686848.00	$829341.60	$6650797.00
9	$124224700.00	$88448.00	$775296.00	$828757.60	$7479554.00
10	$124135700.00	$89040.00	$864336.00	$828165.60	$8307720.00
11	$124046000.00	$89640.00	$953976.00	$827565.60	$9135285.00
12	$123955800.00	$90232.00	$1044208.00	$826973.60	$9962259.00

ess ENTER to continue with next 12 periods. Enter a beginning
yment number if desired or enter 0 to quit.

itial loan amount $125000000.00
nual interest rate 8.00 %
riods per year 1
ne period of 30 years 0 months and 0 days or 30 periods.
riodic payment $11103430.00 11.1 M/YEAR INT+PRIN

me be	Remaining Principal	Principal Payment	Principal Loan to date	Interest Payment	Interest Page to date
1	$123896600.00	$1103424.00	$1103424.00	$10000000.00	$10000000.00
2	$122704900.00	$1191696.00	$2295120.00	$9911732.00	$19911740.00
3	$121417800.00	$1287056.00	$3582176.00	$9816372.00	$29728110.00
4	$120027800.00	$1390000.00	$4972176.00	$9713428.00	$39441540.00
5	$118526600.00	$1501200.00	$6473376.00	$9602228.00	$49043770.00
6	$116905300.00	$1621296.00	$8094672.00	$9482132.00	$58525900.00
7	$115154300.00	$1751008.00	$9845680.00	$9352420.00	$67878320.00
8	$113263300.00	$1891072.00	$11736750.00	$9212356.00	$77090680.00
9	$111220900.00	$2042384.00	$13779140.00	$9061044.00	$86151710.00
0	$109015100.00	$2205768.00	$15984900.00	$8897660.00	$95049380.00
1	$106632900.00	$2382200.00	$18367100.00	$8721228.00	$103770600.00
2	$104060100.00	$2572800.00	$20939900.00	$8530628.00	$112301200.00

ss ENTER to continue with next 12 periods. Enter a beginning
nent number if desired or enter 0 to quit.

Initial loan amount $35000000.00
Annual interest rate 8.00 %
Periods per year 12
Time period of 30 years 0 months and 0 days or 360 periods.
Periodic payment $256817.60

Payment Number	Remaining Principal	Principal Payment	Principal Loan to date	Interest Payment	Interest Page to date
1	$34976520.00	$23484.00	$23484.00	$233333.60	$233333.60
2	$34952880.00	$23640.00	$47124.00	$233177.60	$466511.20
3	$34929080.00	$23800.00	$70924.00	$233017.60	$699528.70
4	$34905120.00	$23960.00	$94884.00	$232857.60	$932386.20
5	$34881000.00	$24116.00	$119000.00	$232701.60	$1165088.00
6	$34856730.00	$24276.00	$143276.00	$232541.60	$1397629.00
7	$34832290.00	$24440.00	$167716.00	$232377.60	$1630007.00
8	$34807690.00	$24600.00	$192316.00	$232217.60	$1862224.00
9	$34782920.00	$24768.00	$217084.00	$232049.60	$2094274.00
10	$34757990.00	$24932.00	$242016.00	$231885.60	$2326159.00
11	$34732890.00	$25096.00	$267112.00	$231721.60	$2557881.00
12	$34707630.00	$25264.00	$292376.00	$231553.60	$2789434.00

Press ENTER to continue with next 12 periods. Enter a beginning payment number if desired or enter 0 to quit.

Initial loan amount $35000000.00
Annual interest rate 8.00 %
Periods per year 1
Time period of 30 years 0 months and 0 days or 30 periods.
Periodic payment $3108960.00 3.1M/YEAR INT + PRIN

Payment Number	Remaining Principal	Principal Payment	Principal Loan to date	Interest Payment	Interest Page to date
1	$34691040.00	$308960.00	$308960.00	$2800000.00	$2800000.00
2	$34357370.00	$333676.00	$642636.00	$2775284.00	$5575284.00
3	$33996990.00	$360372.00	$1003008.00	$2748588.00	$8323871.00
4	$33607790.00	$389200.00	$1392208.00	$2719760.00	$11043630.00
5	$33187460.00	$420336.00	$1812544.00	$2688624.00	$13732260.00
6	$32733490.00	$453966.00	$2266510.00	$2654994.00	$16387250.00
7	$32243210.00	$490278.00	$2756788.00	$2618682.00	$19005930.00
8	$31713710.00	$529504.00	$3286292.00	$2579456.00	$21585390.00
9	$31141850.00	$571864.00	$3858156.00	$2537096.00	$24122480.00
10	$30524230.00	$617612.00	$4475768.00	$2491348.00	$26613830.00
11	$29857210.00	$667020.00	$5142788.00	$2441940.00	$29055770.00
12	$29136830.00	$720386.00	$5863174.00	$2388574.00	$31444350.00

Press ENTER to continue with next 12 periods. Enter a beginning payment number if desired or enter 0 to quit.

Initial loan amount $30000000.00
Annual interest rate 8.00 %
Periods per year 12
Time period of 30 years 0 months and 0 days or 360 periods.
Periodic payment $220129.40

Payment Number	Remaining Principal	Principal Payment	Principal Loan to date	Interest Payment	Interest Page to date
1	$29979870.00	$20128.00	$20128.00	$200001.40	$200001.40
2	$29959610.00	$20266.00	$40394.00	$199863.40	$399864.70
3	$29939210.00	$20396.00	$60790.00	$199733.40	$599598.00
4	$29918670.00	$20538.00	$81328.00	$199591.40	$799189.40
5	$29898000.00	$20672.00	$102000.00	$199457.40	$998646.80
6	$29877190.00	$20808.00	$122808.00	$199321.40	$1197968.00
7	$29856250.00	$20948.00	$143756.00	$199181.40	$1397150.00
8	$29835160.00	$21086.00	$164842.00	$199043.40	$1596193.00
9	$29813930.00	$21228.00	$186070.00	$198901.40	$1795094.00
10	$29792560.00	$21370.00	$207440.00	$198759.40	$1993854.00
11	$29771050.00	$21514.00	$228954.00	$198615.40	$2192469.00
12	$29749390.00	$21654.00	$250608.00	$198475.40	$2390944.00

ress ENTER to continue with next 12 periods. Enter a beginning
ayment number if desired or enter 0 to quit.

nitial loan amount $30000000.00
nnual interest rate 8.00 %
eriods per year 1
ime period of 30 years 0 months and 0 days or 30 periods.
eriodic payment $2664823.00 2.7M/YEAR PRIN + INT

ayment umber	Remaining Principal	Principal Payment	Principal Loan to date	Interest Payment	Interest Page to date
1	$29735180.00	$264822.00	$264822.00	$2400001.00	$2400001.00
2	$29449170.00	$286010.00	$550832.00	$2378813.00	$4778814.00
3	$29140280.00	$308888.00	$859720.00	$2355935.00	$7134748.00
4	$28806680.00	$333604.00	$1193324.00	$2331219.00	$9465967.00
5	$28446390.00	$360286.00	$1553610.00	$2304537.00	$11770500.00
6	$28057280.00	$389114.00	$1942724.00	$2275709.00	$14046210.00
7	$27637040.00	$420240.00	$2362964.00	$2244583.00	$16290800.00
8	$27183180.00	$453860.00	$2816824.00	$2210963.00	$18501760.00
9	$26693010.00	$490168.00	$3306992.00	$2174655.00	$20676410.00
10	$26163630.00	$529384.00	$3836376.00	$2135439.00	$22811850.00
11	$25591900.00	$571728.00	$4408104.00	$2093095.00	$24904950.00
12	$24974420.00	$617476.00	$5025580.00	$2047347.00	$26952290.00

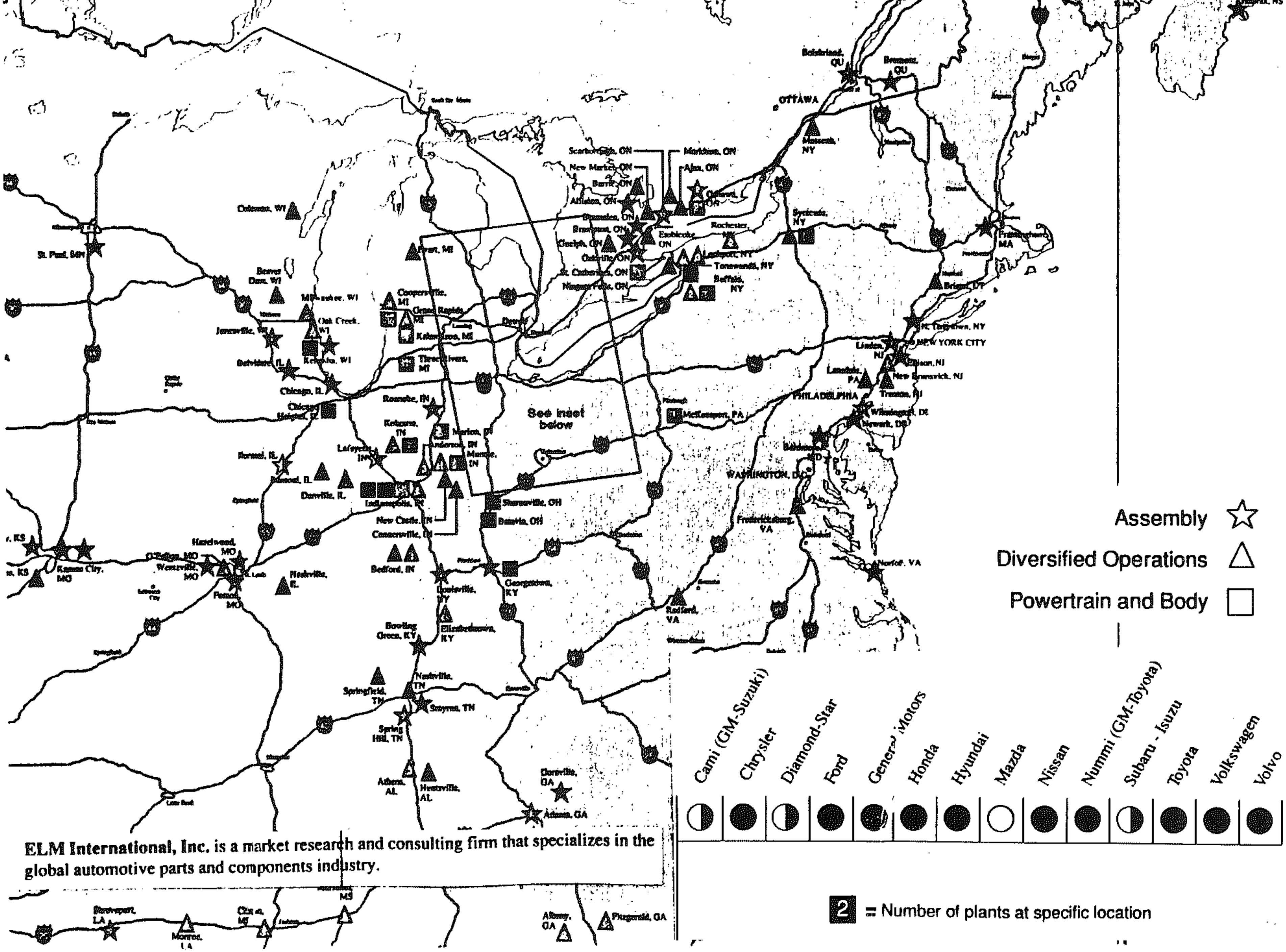
ress ENTER to continue with next 12 periods. Enter a beginning
ayment number if desired or enter 0 to quit.

APPENDIX V

Auto Industry Manufacturing Plant Locations

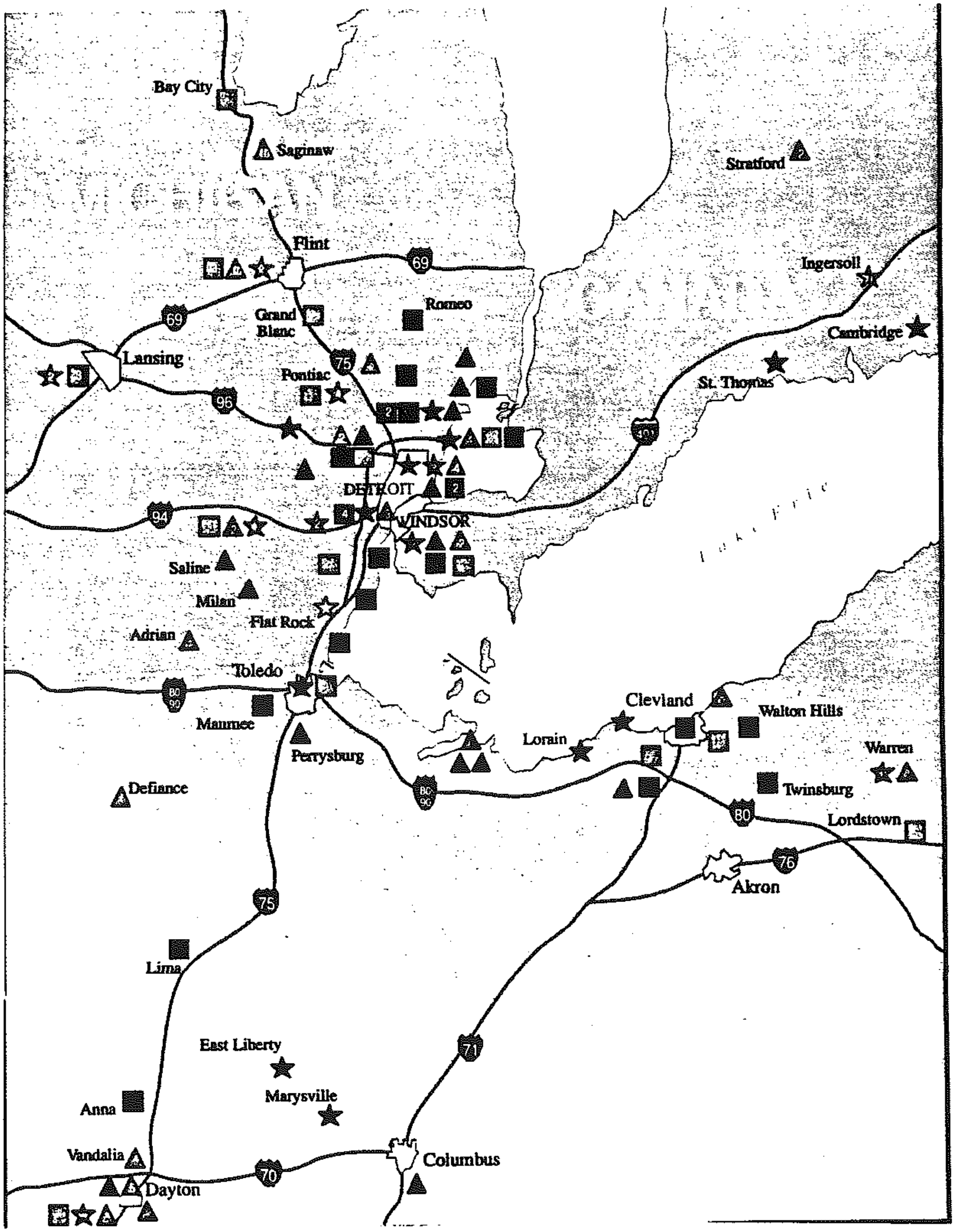
U.S.-Canada-Mexico

AUTO MANUFACTURERS PL T LOCATIONS U.S.-CANADA

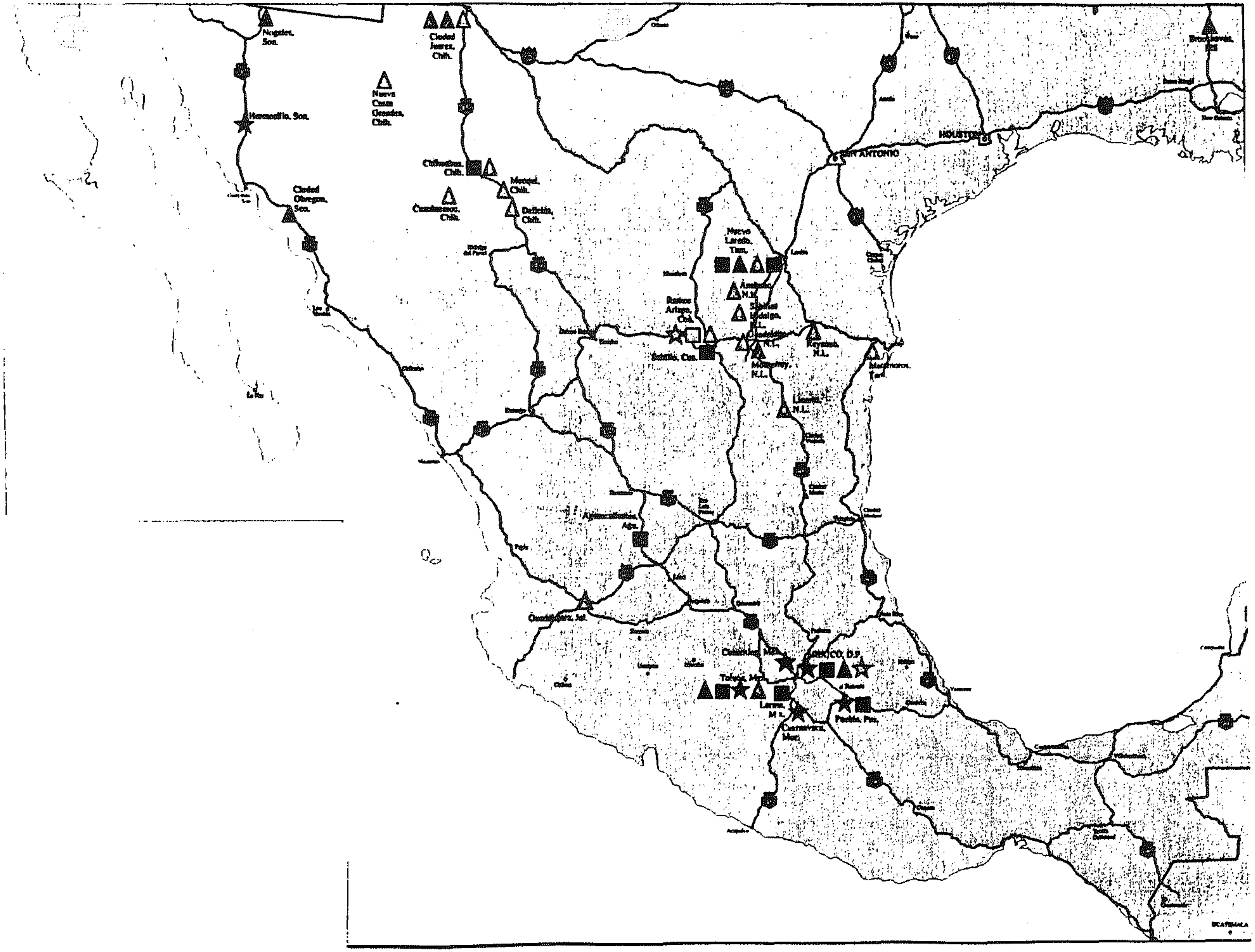


ELM International, Inc. is a market research and consulting firm that specializes in the global automotive parts and components industry.

AUTO MANUFACTURERS PLANT LOCATIONS
MICHIGAN-OHIO-ONTARIO



AUTO MANUFACTURERS PLANT LOCATIONS MEXICO



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Higgenbothem, Marc H., Director of Corporate Planning, and Douglas G. Low, Group Manager, Marketing Development, Grand Truck Western; and Lisa Fedele, Manager, Marketing Projects and R.L. Young, Business Planning, Canadian National, Interview with John C. Taylor, James L. Roach, and Bill Bailey of the Michigan Department of Transportation, Detroit, Michigan, August 28, 1991.

Jefferson, L. Dale, Director - Sales, Sales & Marketing; and William W. Reichardt, National Account Manager, Automotive Sales Department, both of CSX Transportation and Distribution Services Group, Interview with John C. Taylor, Detroit, Michigan, June 3, 1991.

Karnes, Larry, Supervisor, Marine Unit, Freight Transportation Planning Section, Michigan Department of Transportation, Telecon Interview with John C. Taylor, Lansing, Michigan, July 3, 1991.

Kellow, James H, representing the Beztak-DeWin Partnership, Telecon Interview with John C. Taylor, Detroit, Michigan, August 8, 1991.

Kelly, Tom, Oak Yard, Canadian Pacific, Telecon Interview with John C. Taylor, Detroit, Michigan, August 22, 1991.

Kelly, Tom, Oak Yard, Canadian Pacific, Telecon Interview with John C. Taylor, Detroit, Michigan, October 28, 1991.

Kittides, Christopher P., President, BEI Associates, Inc., Interview with John C. Taylor, Detroit, Michigan, July 30, 1991.

Kittides, Christopher P., President, BEI Associates, Inc., Telecon Interview with John C. Taylor, Detroit, Michigan, September 18, 1991.

Luptak, Jerry, Bill Powers, and Jim Kellow, all representing the Beztak-DeWin Partnership, Interview with John C. Taylor, Detroit, Michigan, August 22, 1991.

MacDonald, Don, Director, Logistics Operations, General Motors Corporation; and Michael E. MacDonald, Director, Transportation Economics and Planning, Logistics Operations, General Motors Corporation, Interview with John C. Taylor, Detroit, Michigan, June 13, 1991.

MacDonald, Michael E., Director, Transportation Economics and Planning, Logistics Operations, General Motors Corporation, Telecon Interview with John C. Taylor, Detroit, Michigan, September 10, 1991.

McCarthy, Dan, Vice President of Operations, CAST, Telecon Interview with John C. Taylor, Montreal, Canada, September 5, 1991.

Mitchell, Larry F., Supervisor, Transportation Analysis and Review Section, Transportation and Traffic Office, Ford Motor Company, Interview with John C. Taylor, Dearborn, Michigan, May 22, 1991.

Nordlund, Keith, Project Manager, Southwestern Ontario, Canadian National, Interview with John C. Taylor, Toronto, Ontario, Canada, December 7, 1989.

Nordlund, Keith, Project Manager, Southwestern Ontario, Canadian National; and Tom Thompson, Technical Superintendent, Southern Ontario District, Interview with John C. Taylor, Toronto, Ontario, Canada, December 13, 1989.

Nowicki, Paul, General Director of Intermodal Marketing, Santa Fe Railroad, Telecon Interview with John C. Taylor, October 14, 1991.

Osgood, David, American Association of Railroads, Telecon Interview with John C. Taylor, Washington, D.C., August 15, 1991.

Pendleton, Dan C., Vice President, Marketing, American President Domestic Companies, Ltd., Interview with John C. Taylor, New York, New York, April 29, 1991.

Pendleton, Dan C., Vice President, Marketing, American President Domestic Companies, Ltd., Telecon Interview with John C. Taylor, Oakland, California, August 23, 1991.

Powers, Bill, Christopher P. Kittides, John Williams, and Jim Kellow, all representing the Beztak-DeWin Partnership, Interview with John C. Taylor, Detroit, Michigan, June 10, 1991.

Pozzobon, Gord, Manager of Development, Canadian Pacific, Interview with Dan Ruch and Jim Cowan, A.T. Kearney, Inc., Toronto, Ontario, Canada, December 18, 1989.

Pozzobon, Gord, Manager of Development, Canadian Pacific, Telecon Interview with John C. Taylor, Toronto, Ontario, Canada, July 16, 1991.

Pozzobon, Gord, Manager of Development, Canadian Pacific, Telecon Interview with John C. Taylor, Toronto, Ontario, Canada, June 17, 1991.

Pozzobon, Gord, Manager of Development, Canadian Pacific, Telecon Interview with John C. Taylor, Toronto, Ontario, Canada, May 29, 1991.

Pozzobon, Gord, Manager of Development, Canadian Pacific; and Mike Blackwell, Automotive Group, Canadian Pacific, Interview with John C. Taylor, James L. Roach, and Bill Bailey of the Michigan Department of Transportation, Toronto, Ontario, Canada, August 7, 1991.

Prince, Ted, K-Line Rail-Bridge, Telecon Interview with John C. Taylor, New Jersey, October 1, 1991.

Roach, James L., Manager, Freight Transportation Planning Section, Michigan Department of Transportation, Interview with John C. Taylor, Lansing, Michigan, June 7, 1991.

Roach, James L., Manager, Freight Transportation Planning Section, Michigan Department of Transportation, Interview with John C. Taylor, Lansing, Michigan, May 14, 1991.

Roberts, Robert L., District Sales Manager; Greg A. Lewis, Assistant District Sales Manager; Fred W. Florian, International-Automotive Accounts Manager; and A. Scott Grasso, all of Norfolk Southern Corporation, Interview with John C. Taylor, James L. Roach, Bob Tuttle, and Larry Karnes of the Michigan Department of Transportation, Detroit, Michigan, May 30, 1991.

Scroggie, Bob, Director, Transportation Office, Chrysler Motors, Telecon Interview with John C. Taylor, Sterling Heights, Michigan, August 16, 1991.

Smith, David, Senior Analyst, Manalytics, Inc., Telecon Interview with John C. Taylor, San Francisco, California, September 18, 1991.

Smith, Harold, Chief City Planner, Planning Department, City of Detroit, Interview with John C. Taylor, Detroit, Michigan.

Stamper, Dan, President, Detroit International Bridge Company, Telecon Interview with John C. Taylor, Detroit, Michigan, August 7, 1991.

Tebay, Mike D., Vice President, Corporate Development, CSX-Sealand Intermodal, Inc., Telecon Interview with John C. Taylor, New Jersey, September 30, 1991.

Walker, Bob, Marc H. Higgenbothem, Bob Schelling, and Andy Kallabus, Grand Truck Western, Interview with John C. Taylor, Bill Bailey, and James L. Roach of the Freight Transportation Planning Section, Michigan Department of Transportation, Detroit, Michigan, June 28, 1991.

Williams, John, President, Woodside Consulting Group, Telecon Interview with John C. Taylor, Woodside, California, September 6, 1991.

Yeager, Phillip C., Chairman, The Hub Group, Inc., Telecon Interview with John C. Taylor, Chicago, Illinois, August 6, 1991.

Young, Ron, Project Officer, Business Planning, Canadian National, Telecon Interview with John C. Taylor, Toronto, Ontario, Canada, August 16, 1991.