Legislative & Planning Services
Planning Services
1151 Bronte Road
Oakville ON L6M 3L1

April 9, 2019

Lesley Griffiths, Panel Chair
Milton Logistics Hub Project Review Panel
c/o Canadian Environmental Assessment Agency
160 Elgin St. Ottawa ON K1A 0H3

By email: MiltonHubPanel@ceaa.gc.ca
CEAR registry 80100

Dear Ms. Griffiths:

Re: Halton Municipalities' Comments on CN's Responses to Review Panel's Information Requests (IRs) - Ultimate/Maximum Intermodal Terminal Capacity of the Milton Logistics Hub

On behalf of the Halton Municipalities, I am following up on my letter to the Review Panel dated July 12, 2018 that primarily addressed the ultimate/maximum capacity of the Milton Logistics Hub.

By separate correspondence also delivered today, the Halton Municipalities are responding to your request to provide comments on CN responses to the Review Panel's second set of information requests (IRs), namely IRs 6 through 8. We are also providing an updated brief to replace the March 29th "Sufficiency Brief re SAEEs." This update considers the sufficiency of all submitted information relevant to assessing the significance of adverse environmental effects from the Project and cumulatively.

As CN has now completed its responses to all of the Review Panel's IRs, the present letter provides the Panel with information relevant to assessing the capacity of the Milton Logistics Hub and highlights information deficiencies from CN on that capacity.

Attached to this letter is a report to Curt Benson at the Region from John Vickerman of Vickerman & Associates dated April 8, 2019. Mr. Benson is the Region's Director of Planning Services and its Chief Planning Official. You will recall that Mr. Vickerman has been retained by the Halton Municipalities for his international expertise in intermodal facility design. He has previously provided input to the panel beginning in March 2017.

Using a methodology applied to more than two hundred port and intermodal facilities in North America and overseas, Mr. Vickerman conservatively calculates the capacity of the Milton Logistics Hub under different scenarios. Each scenario applies progressive adjustments to CN's proposed planning design and operations for the Milton Logistics Hub. In Mr. Vickerman's opinion, the capacity of the Milton Logistics Hub could readily be increased within the same terminal footprint and without major changes in yard equipment. His report describes various adjustments to increase capacity from the CN proposed volume of 450,000 containers annually to a volume of approximately 1 million container lifts annually.

Mr. Vickerman further concludes that, within its current 160 ha footprint, a re-design of the Milton Logistics Hub that included current technologies could allow the facility to reach an annual capacity of considerably more than 1 million containers.

Mr. Vickerman's findings are consistent with two basic observations. First, the proposed Milton Logistics Hub occupies approximately twice as much land as CN's existing Brampton intermodal facility. Second, the Milton Logistics Hub is currently proposed to handle 450,000 containers annually whereas the Brampton facility handles approximately 1 million containers annually. These two observations suggest that the Milton Logistics Hub is located on sufficient lands to handle more not less than what the Brampton facility now handles.

Mr. Vickerman's report reinforces municipal concern that CN has not provided sufficient information to address those Panel IRs that concern the design capacity of the site and projected needs. Specific recommendations on what information is needed are set out at the end of the Technical Memorandum attached to my July 12, 2018 letter.

The related municipal concern is that CN has based all predictions of Project and cumulative effects on the proposed throughput of 450,000 containers annually and has provided no information on predicted effects using the ultimate/maximum capacity requested by the Panel. This appears to us to be a fundamental deficiency of the submitted information.

As you are aware, the Halton Municipalities have many responsibilities affected by the proposed Milton Logistics Hub. Virtually all of these responsibilities intensify or increase if terminal throughput increases from what is now proposed. I therefore underscore municipal interest in having CN provide the requested information on this terminal's ultimate/maximum capacity.

Should CN provide future information on the capacity of the Milton Logistics Hub, the Halton Municipalities re-affirm our interest in providing a peer review of this information. We also confirm our interest in having the Review Panel and all participants use Mr. Vickerman's modelling to assist this panel process.

Sincerely,

<Original signed by>

Jane MacCaskill, CPA, CA, MBA
Chief Administrative Officer

On behalf of the Halton Municipalities

Cc: Bill Mann, CAO
Town of Milton

Ray Green, CAO
Town of Oakville

Brent Marshall, CAO
Town of Halton Hills

Tim Commisso, Acting CAO
City of Burlington

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April 8, 2019

Halton Region
1151 Bronte Road
Oakville ON L6M 3L1 Canada
Attention: Mr. Curt Benson, Director, Planning Services & Chief Planning Official

Dear Mr. Benson,

Re: Proposed CN Milton Intermodal Terminal Logistics Hub Project – Federal Environmental Assessment (EA) Panel Review and Section 98 (2) CTA Application Sustainable Capacity Analysis and Estimate

Executive Summary

CN proposes to construct and operate a new satellite intermodal rail terminal including the realignment and extension of existing mainline railroad tracks (the "Milton Logistics Hub"). CN has not disclosed a detailed calculation of the ultimate/maximum capacity for the proposed Milton Logistics Hub.[1] Instead, CN has indicated that the Milton Logistics Hub is forecast to handle up to 350,000 containers at the start of operation and 450,000 containers annually at full operation.[2]

I have been asked to provide a comprehensive container throughput analysis and capacity estimate for the Milton Logistics Hub. I used my "***P****ort* ***R****ail* ***I****ntermodal* ***S****imulation* ***M****odeling*" (PRISM) tool and modeling methodology, described below, to calculate the ultimate sustainable capacity of the Milton Logistics Hub in numbers of containers per year.

In my opinion, the sustainable capacity of the Milton Logistics Hub could readily be increased through design enhancements and efficiencies, to a level of approximately 1 million container lifts annually, without changes in yard equipment technology and within the same general terminal footprint for the Milton Logistics Hub. As explained further below, this value is a sustainable, conservative estimated capacity for the Milton Logistics Hub. Notably, CN submits that its Brampton intermodal terminal ("Brampton Terminal"), which is approximately 50% smaller in area than the footprint of the Milton Logistics Hub, and handles approximately 1 million containers annually.

A re-design of the Milton Logistics Hub, including the deployment of modern intermodal industry technologies and a redesigned layout, could allow the Milton Logistics Hub to reach an annual sustainable capacity of considerably more than 1 million containers.

I. Background

A. *Scope of Report*

The Halton Municipalities requested that Vickerman & Associates ("Vickerman" or "I") provide the following evaluation and analysis of the Milton Logistics Hub:

(a) Identify the factors internal to the planning, design, and operation of the Milton Logistics Hub which govern its ultimate/maximum capacity, identifying specific capacity limiting factors;

(b) Calculate the capacity of the Milton Logistics Hub as presently proposed to be operated by CN;

(c) Calculate the potential capacity of the Milton Logistics Hub, should the Project be modified in a way that is generally consistent with CN's current proposal; and;

(d) Opine on the potential capacity of the Milton Logistics Hub with a re-designed layout and the deployment of modern intermodal equipment technologies.

This report is submitted in response to the Halton Municipalities' request and represents my own professional opinion, methodology and capacity analysis.

B. *Intermodal Terminal Capacity Analysis*

I co-developed the PRISM terminal capacity modelling tool and methodology, which I have been using for approximately 30 years to calculate container terminal throughput capacity and estimate sustainable capacity for modern marine/intermodal terminals. I provide background information regarding the PRISM tool and methodology in Appendix A.

The PRISM model and tool simplifies the intermodal terminal into five key components, and determines a throughput capacity for each terminal component. This allows for terminal refinements to be tested and balanced for efficient overall terminal throughput flow.

The five key components of the PRISM model and tool are as follows:

1. **Train Arrival & Departure Activities:** The movements and functions of an intermodal double stacked train during arrival and departure operations for an intermodal rail terminal. It includes the breakdown of the unit train into components suitable for proper intermodal rail terminal operations using road locomotive power, switch engine locomotives or track-mobiles.

2. **Train Unloading/Loading Operations:** The functions and operations involved in unloading and loading containers on or off a double stacked train, by the use of intermodal yard cranes and yard tractors/hostlers.

3. **Track to Container Storage Area Transfer:** The functions and operations involved in the movement of containers from the double stacked train to the proper location in the container yard storage area.

4. **Intermodal Yard Storage Operations:** The functions and operations involved in storage of containers within the intermodal terminal yard container storage areas using intermodal terminal yard crane equipment.

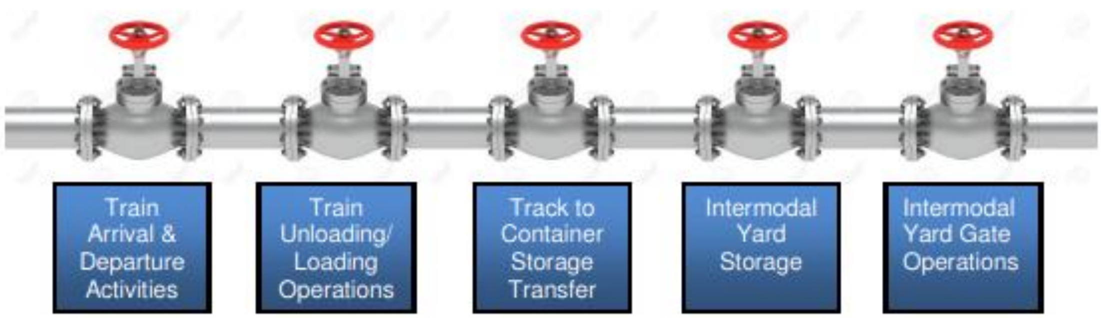
5. **Intermodal Yard Gate Processing Operations:** The functions and operations involved within an entry/exit intermodal terminal gate complex including inbound and outbound truck movements, truck queue, truck driver identification, The Terminal Operating System processes and truck and container tare and net container weight determination for shipping and customs requirements.

The five key components described above generally relate to and are comparable with the "primary physical components" affecting terminal capacity described by CN.[3]

The PRISM model can be used to balance all terminal components so that none of the components are undersized (causing a "bottle neck") or oversized (causing a waste of capital expenditure).

It is helpful to conceptualize the PRISM model components as valves in an analogous pipeline, where each component can constrict the flow (of containerized cargo) within the pipeline (intermodal terminal). Obviously, if one valve constricts the pipeline, the entire terminal capacity is affected. For example, if the gate processing valve is shown to be the most constricting element of the terminal, gate operations will be evaluated, and improvements made so that the gate capacity is increased and is properly sized with respect to the rest of the container intermodal terminal throughput capacity.

This operational industrial engineering analysis is iteratively repeated in the PRISM tool until the entire pipeline exhibits no restrictive pipeline segments (impediments) and the entire pipe has the capacity to flow the container cargo unimpeded by a particular pipeline segment in the system. The following graphic is a simple analogous illustration of the intermodal terminal overall capacity seen as a series of capacity pipes and values.



Each of the five components of the PRISM model have an independent capacity calculation accomplished for that specific terminal component. The lowest capacity component numerical value is defined as the "***Limiting Component***" constraining terminal capacity. The capacity of the entire intermodal terminal is restricted to the "*Limiting Component*" capacity value.

With beneficial modifications and adjustments to the "*Limiting Component*" features, the associated value of a terminal's capacity can be increased. However, if the "*Limiting Component*" capacity value numerically exceeds the value of the "*Next Limiting Component*" capacity value, the "*Next Limiting Component*" capacity value becomes the "*Limiting Component"* constraining terminal capacity.

C. ***Sustainable Capacity***

The concepts of Maximum Practical Capacity (MPC) and Sustainable Practical Capacity (SPC) are terms often referred to within the intermodal industry.

Maximum Practical Capacity (MPC) is the intermodal terminal capacity which is achieved under a practical yet ideal operating scenario and with the best operational conditions in place and assumed. MPC is independent of most market forces. It is governed by terminal equipment, equipment conditions, terminal operations, manpower availability as well as train arrival and departure schedules.

MPC can be achieved or even exceeded for short periods. However, this high level of intermodal terminal operation will seldom be tolerated at that level of stress within the intermodal terminal system for very long. Terminals that occasionally reach MPC generally lose money due to abnormal increased wear and tear on terminal equipment and personnel and increased intermodal terminal equipment breakdowns.

Sustainable Practical Capacity (SPC) is the intermodal terminal capacity which is most profitable to the terminal operator. SPC is calculated based on MPC, and is typically accompanied by a thorough economic analysis of a terminal operations. However, SPC is typically **70% to 75% of MPC**. Cargo volume surges above SPC levels up to MPC capacity levels could occasionally occur for periods of time. However, if SPC is exceeded for long periods, the intermodal terminal operator will generally consider improving terminal facilities or upgrading terminal infrastructure and operations.

I have presented both values in this report. When I use the term "sustainable capacity" in this report, I am referring to the conservative SPC.

Appendix B to this report identifies the various intermodal terminal characteristics relevant to the MPC and SPC calculations for the proposed Milton Logistics Hub: (1) the key design and operational areas of the Milton Logistics Hub; (2) CN's proposed key design and operational characteristics for the Milton Logistics Hub; and (3) the PRISM tool and model operating assumptions.

II. Milton Logistics Hub Capacity Results – No Changes to Terminal Footprint or Technology

Summary

The below PRISM model analysis of Scenarios A – C apply progressive adjustments to CN's proposal for the Milton Logistics Hub. This analysis shows that the Milton Logistics Hub sustainable capacity could readily be increased without substantial intermodal terminal capital and equipment costs and generally within the same terminal footprint parameter, to the level of approximately 1 million container lifts (1.7 million TEUs[4]) annually.

NOTE: My estimates of sustainable capacity for Scenarios A – C are conservative. The PRISM model calculated sustainable capacity (SPC) at 59% of MPC rather than the typical 70-75% as stated above. In my opinion, the SPC percentage is lower than expected in the circumstances primarily because of the spaciousness of CN's design for the Milton Logistics Hub, as shown in the currently available drawings from CN. If certain terminal components, particularly storage, were designed more compactly in the final planning, operations and design drawings, the sustainable capacity could increase up to an additional 10-15%.

A. *Scenario A: CN's Proposal for the Milton Logistics Hub*

I calculated the following sustainable capacity with PRISM using the planning, design and operations currently proposed by CN for the Milton Logistics Hub. The Limiting Component is Component 4, Intermodal Yard Storage.

Terminal Sustainable Capacity Model Results (Containers/Lifts per year):

SCENARIO A: CN'S PROPOSAL FOR THE MILTON LOGISTICS HUB			
CN MIT TERMINAL COMPONENT	**MPC LIFTS/YEAR**	**SUSTAINABLE CAPACITY (SPC) LIFTS/YEAR**	**EXPLANATORY NOTES**
Component 1 Train Arr. / Dep. Activities	**3,005,184**	**1,767,755**	
Component 2 Unloading/Loading Data	**2,257,382**	**1,327,872**	
Component 3 Track to Storage Transfer	**1,693,037**	**995,904**	Second Next Limiting Component
Component 4 Intermodal Yard Storage	**784,750**	**461,618**	**LIMITING COMPONENT**
Component 5 Intermodal Gate Processing	**1,272,960**	**748,800**	Next Limiting Component

As presented in the foregoing table, the sustainable capacity of the Milton Logistics Hub, as presently planned, designed and proposed to be operated by CN, is approximately 461,618 container lifts per year or 784,751 TEUs annually. Component 4, Intermodal Yard Storage, is the primary Limiting Component.

B. ***Scenario B: Removing Component 4 Constraint with Storage Yard Enhancements***

Specific recommended adjustments to the "***LIMITING component***" of Scenario A to logically increase the proposed Milton Logistics Hub capacity are described below. The upgrades generally implemented by CN to increase capacity at the Brampton Terminal (see IRR2.44), were reviewed and evaluated for improving the intermodal yard storage capacity Limiting Component for the Milton Logistics Hub.

The following intermodal yard storage capacity enhancement descriptions could be deployed at the Milton Logistics Hub within the same proposed terminal footprint and within the same general parameters of what has been proposed for the Milton Logistics Hub.

In order for the terminal to reach the next higher capacity threshold and based on the above sustainable capacity computation for Scenario A, approximately 287,182 annual container lifts would have to be added to the Milton Logistics Hub annual sustainable capacity of 461,618 SPC lifts per year to reach the next capacity threshold for the terminal of 748,800 SPC lifts per year (intermodal gate processing component).

Selected Yard Storage Enhancements to Increase Terminal Capacity:

In general, terminal enhancements that reduce the overall average intermodal terminal operational container dwell time for the entire Milton Logistics Hub facility will increase the overall throughput capacity.

The following intermodal terminal enhancements could readily be deployed within the Milton Logistics Hub current footprint to increase the intermodal terminal sustainable storage yard capacity. The following enhancements could be employed without changing yard crane technology and generally remaining within CN's proposed physical constraints:

Enhancement No. 1: Increase the effective average "*loaded*" grounded container stacking height from approximately 2.5 high to 3.5 high container grounded stacks. It is assumed that the CN Reach Stacker Yard Crane has a five-high container stacking reach.

Enhancement No. 2: Increase the effective average "*empty*" container stacking height up to a five-high container grounded stacking height. It is assumed that the CN Reach Stacker Yard Crane has a five-high container stacking reach.

Enhancement No. 3: Increase the effective height of horizontally stacked terminal container chassis. Consider vertically stacking terminal chassis gaining an approximate 9 to 1 ground area average advantage.

Enhancement No. 4: Reconfigure the terminal grounded storage areas and increase the size and number of grounded container stacks within the current Milton Logistics Hub footprint area. There is ample potential acreage to expand the grounded container storage area increasing the static storage capacity of container slots.

Appendix C to this report provides references and example calculations for each identified terminal enhancement.

The above intermodal yard storage area enhancement concepts could be deployed in a greater or lesser degree to lift the effective annual sustainable storage capacity to the next threshold level.

The total terminal potential enhancement storage capacity for all four enhancements would increase the total storage capacity by approximately 118%. Component 4 capacity would then climb to an approximate annual throughput capacity of 1,006,326 lifts/containers.

Depicted in the chart below are the individual enhancements and their respective container lift capacity increase amounts.

SCENARIO B: Individual Storage Enhancement Capacity Increase – Per PRISM Capacity Model Analysis

Terminal Enhancement	Enhancement Description	Approximate Static Container Slot Capacity Increase	Annual PRISM Lift Capacity Increase
Enhancement No. 1	Increase Stacking Height of *"Loaded" Grounded Container*	60% Increase in Slots	276,970 Container Lifts
Enhancement No. 2	Increase Effective "Empty" Container Stacking Height of Grounded Containers	15% Slot Increase	69,243 Container Lifts
Enhancement No. 3	Increase Effective Height of Horizontally Stacked Chassis	8% Slot increase	36,930 Container Lifts

Enhancement No. 4	Reconfigure Terminal Container Storage Areas to Increase Container Capacity	Potential increase in container ground slots of 35% assumed	161,565 Container Lifts

The resulting sustainable capacity results (Containers/Lifts per year) are presented in the following chart, where Component 5 – Gate Processing is now the Limiting Factor.

Terminal Sustainable Capacity Model Results (Containers/Lifts per year):

SCENARIO B: REMOVING THE COMPONENT 4 CONSTRAINT W/ STORAGE ENHANCEMENTS			
CN MIT TERMINAL COMPONENT	**MPC LIFTS/YEAR**	**SUSTAINABLE CAPACITY (SPC) LIFTS/YEAR**	**EXPLANATORY NOTES**
Component 1 Train Arr. / Dep. Activities	**3,005,184**	**1,767,755**	
Component 2 Unloading/Loading Data	**2,257,382**	**1,327,872**	
Component 3 Track to Storage Transfer	**1,693,037**	**995,904**	**NEXT LIMITING COMPONENT**
Component 4 Intermodal Yard Storage	**1,710,755**	**1,006,326**	
Component 5 Intermodal Gate Processing	**1,272,960**	**748,800**	**LIMITING COMPONENT**

As presented in the foregoing table, the sustainable capacity of the Milton Logistics Hub can be increased to 748,800 container lifts per year by lifting the constraint of Component 4, Intermodal Yard Storage, through various intermodal yard storage enhancements. Component 5, Intermodal Gate Processing is now the next limiting capacity constraining component.

In general, the PRISM model will produce the exact same throughput capacity calculation number for each component enhancement in question. However, depending on the enhancement selected, other terminal components could be affected by the proposed terminal enhancement. In the case of the four terminal enhancements considered in Scenario B, the terminal enhancements proposed will not appreciably effect other terminal components capacity calculations.

C. *Scenario C: Removing Component 5 Constraint with Intermodal Gate Enhancements*

An enhancement adjustment to the above "***LIMITING component***" (intermodal terminal gate processing) of Scenario B to increase the Milton Logistics Hub capacity is described below. The upgrades generally implemented by CN to increase capacity at the Brampton Terminal facility (see IRR2.44), were reviewed and evaluated to determine whether their application at the Milton Logistics Hub would increase the intermodal gate processing capacity Limiting Component at the Milton Logistics Hub.

In general, the following intermodal gate processing capacity enhancement could be deployed within the same terminal footprint and within the same general site parameters of the proposed Milton Logistics Hub. Based on the above sustainable capacity computation, approximately 247,104 annual container lifts would have to added to the overall Milton Logistics Hub annual capacity of 748,800 SPC lifts per year to reach or exceed the next capacity threshold for the terminal of 995,904 SPC lifts per year (intermodal track to storage transfer component).

The following intermodal terminal enhancement could be deployed to increase the sustainable capacity of the intermodal gate processing:

Enhancement A: Increase the Milton Logistics Hub number of entry gate lanes from 10 to 14 lanes. This change would increase the overall intermodal terminal capital costs. The entry gate planning and design would have to be re-evaluated, particularly if discrete element computer gate simulation analysis was used in the entry gate design.

SCENARIO C: Terminal Key Design & Operational Enhancement Assumptions for Increased capacity

Intermodal Terminal Enhancement	Attribute Enhancement Description	Explanatory Note
Enhancement A	Increase the Number of Gate lanes from 10 to 14	There is sufficient land area surrounding the intermodal gate proposed by CN to expand the intermodal gate by 4 lanes[5]

SCEANRIO C: Terminal Key Operational Enhancement Calculations for Increased Static Capacity

Intermodal Terminal Enhancement	Attribute Enhancement Description	Approximate Static Container Slot Capacity Increase	Computational Explanatory Note
Enhancement A	Increase the Number of Gate lanes from 10 to 14	40% Increase in Gate Processing Capacity	The SPC gate processing component could increase from a SPC of 748,800 container lifts per year to 1,048,320 container lifts per year with the addition of 4 gate lanes

In my opinion, Enhancement A "*Increase the number of gate lanes from 10 to 14"* will yield a 40% increase in gate processing capacity, increasing the Component 5 sustainable capacity to an annual capacity of 1,048,320 container lifts per year. The resulting sustainable capacity model results (Containers/Lifts per year) are presented in the Table below, with Component 3 – Track to Storage Transfer now becoming the Limiting Component for overall terminal capacity.

In my professional opinion, there is sufficient acreage and space to increase the number of gate lanes from 10 to 14 using the proposed Milton Logistics Hub terminal design parameters. As with the prior terminal enhancements, the PRISM tool will produce the exact same throughput capacity calculation number for each component enhancement in question. In this case of the gate lane increase described above, the terminal enhancements proposed will not affect other terminal component capacity calculations.

Terminal Sustainable Capacity Model Results (Containers/Lifts per year):

SCEANRIO C: REMOVING COMPONENT 5 CONSTRAINT W/ INTERMODAL GATE ENHANCEMENTS			
CN MIT TERMINAL COMPONENT	**MPC LIFTS/YEAR**	**SUSTAINABLE CAPACITY (SPC) LIFTS/YEAR**	**EXPLANATORY NOTES**
Component 1 Train Arr. / Dep Activities	**3,005,184**	**1,767,755**	
Component 2 Unloading/Loading Data	**2,257,382**	**1,327,872**	
Component 3 Track to Storage Transfer	**1,693,037**	**995,904**	**LIMITING COMPONENT**
Component 4 Intermodal Yard Storage	**1,710,755**	**1,006,326**	
Component 5 Intermodal Gate Processing	**1,782,144**	**1,048,320**	

From the above PRISM model run, we can see that the lowest three Terminal components are all nearly at 1 million container lifts annually and are approximately balanced and within 5 percent of one another – within the approximate degree of accuracy of the PRISM tool. To reach terminal capacity throughputs of greater than 1 million container lifts would require substantial intermodal terminal layout changes, and terminal design changes. These changes may also require the application of new intermodal terminal yard crane equipment technologies.

Component 1 and 2 from the capacity model analysis above involve factors that are typically controlled by the intermodal rail marketplace and are generally predicated on railroad customer logistical and supply chain requirements, like Beneficial Cargo Owner demand and shipper volumes, all of which are external factors to the railroad.

III. Milton Logistics Hub Capacity – Redesigned Terminal Layout and Technology

I have considered the potential capacity of the Milton Logistics Hub with a redesigned layout and the deployment of modern intermodal equipment technologies. Potential enhancements include replacing CN's proposed Reach Stacker yard cranes with zero emission electric drive Wide Span Cranes ("WSCs") or Rail Mounted Gantry ("RMG") cranes using modern intermodal equipment technologies. This would require changes to the current CN terminal design for the Milton Logistics Hub, including reconfiguring and widening the proposed site plan and straightening pad tracks to accommodate RMG/WSC.

In my opinion, there is sufficient acreage within the 400-acres of the Milton Logistics Hub to expand and widen the intermodal yard proper to achieve the track configurations desired for a RMG/WSC crane configuration.

A re-design the Milton Logistics Hub using modern intermodal industry technologies and enhanced intermodal terminal design could increase the annual sustainable capacity to considerably more than 1 million containers.

IV. Scenario Summary Overview of the Milton Logistics Hub Capacity Estimates

PROPOSED MILTON LOGISTICS HUB SCENARIOS: A, B & C: MPC & SPC ESTIMATES			
PROPOSED SCENARIOS	**MPC LIFTS/YEAR**	**SUSTAINABLE CAPCITY (SPC) LIFTS/YEAR**	**EXPLANATORY NOTES**
SCENARIO A: CN's Proposal for the Milton Logistics Hub			
SCENARIO A: CN PROPOSED OPERATION	**784,750**	**461,618**	**Limiting Component 4**: Intermodal Yard Storage
SCENARIO B: Removing the Constraint of Component 4 through Storage Enhancements			
SCENARIO B: STORAGE ENHANCEMENTS	**1,272,960**	**748,800**	**Limiting Component 5**: Intermodal Gate Processing
SCENARIO C: Removing the Constraint of Component 5 through Entry Gate Enhancements			
SCENARIO C: *INTERMODAL GATE ENHANCEMENTS*	**1,693,037**	**995,904**	**Limiting Component 3**: Track to Storage Transfer

Sincerely,

Vickerman & Associates LLC

<email address removed>

John Vickerman, President

GLOSSARY OF TERMS

ACRONYM	MEANING
DST	Double Stacked Train
IRR	Information Request Response
HOSTLER	Intermodal Yard Tractor
MPC	Maximum Practical Capacity
PRISM	Port Rail Intermodal Simulation Modeling
RMG	Rail Mounted Gantry Crane
RTG	Rubber Tired Gantry Crane
SPC	Sustainable Practical Capacity
TEU	Twenty Foot Equivalent Unit
WSC	Wide Span Crane

APPENDIX A – PRISM Intermodal Terminal Capacity Tool Background

I first managed the development of the PRISM tool in the late 1980s for the San Pedro Bay Ports of Los Angeles and Long Beach "*Cargo Handling, Operations, Facilities and Infrastructure Requirements Study (OF&I)*" referred to as the"*2020 Strategic Port Master Plan*". I was the Principal-In-Charge and Project Manager for the 2020 Strategic Port Master Plan Project. This industrial engineering and operational research effort ultimately became the basis for the PRISM tool. The model was expanded, further developed, tested and calibrated for the next 30 years, being employed in over 200 port and intermodal rail terminal capacity projects worldwide.

The PRISM tool capacity modelling fundamental principles can be found in the publication: "*Improving Productivity in U.S. Marine Container Terminals*" produced by the US National Research Council (NRC) and published by the National Academy Press in 1986. This publication was prepared under the guidance of the U.S. DOT Maritime Administration (MARAD) and describes a theoretical basic methodology for assessing port and intermodal terminal capacity. The methodology was endorsed by the "Committee on Productivity of Marine Terminals MARINE BOARD" and the "Commission on Engineering and Technical Systems" - NRC.

The PRISM tool architecture can be modified, when appropriate, to suit specific intermodal container terminal requirements and configurations and was developed for the following purposes:

- Identify the need for additional intermodal terminals or expansion of existing ones;
- Identify current physical and operational constraints on maximum terminal throughput capability;
- Create a "*balanced"* terminal cargo flow through efficient terminal operations; and
- Evaluate and compare various productivity measures that utilize improved technologies for handling, transferring, and storing intermodal container cargo.

The PRISM tool has been widely accepted, and never rejected, within the North American port and intermodal transportation industry as a credible tool to estimate the MPC and SPC of both marine and intermodal container terminals.

Notable examples where the V&A PRISM capacity model was credibly employed include:

- Major North American port and intermodal rail terminal capacity analysis and development projects for 67 of the 90 general cargo port and intermodal terminals, including the New York City Economic Development Corporation Strategic Master Plan for New York Harbor, and all four port and intermodal terminals for the Virginia Port Authority.

- A 2003 comprehensive evaluation of projected economic trends to determine the ability of the North American transportation system to respond to changing and increasing trade patterns, undertaken by the National Chamber Foundation of the U.S. Chamber of Commerce. Based on economic forecasts and future import/export trends, the NCF study examined 16 of the largest North American ports and their inland highway and railroad intermodal terminals and networks to determine current and projected freight capacities. It factually described the current conditions of the United States and Canadian freight system, and exposed the major fault lines in the North American port and rail transportation system.

- The offering by the American Association of Port Authorities of a week-long intensive port and intermodal terminal management training course called the "*Marine Terminal Management Training Program*" that covered marine and intermodal terminal design and container handling systems. I taught this topic as part of this training course for more than 20 years and it included a technical resource binder for the V&A PRISM model.

The PRISM tool is a model and software that uses major components or major operational characteristics of the intermodal terminal and other data points to calculate the maximum and sustainable capacity of the intermodal terminal.

APPENDIX B – MILTON LOGISTICS HUB TERMINAL CHARACTERISTICS

(1) "Basic Area" Calculations for the Proposed Milton Logistics Hub Key Design & Operational Areas

The following diagrams and area calculations consider the various key planning, design, and terminal operational characteristic areas for the Milton Logistics Hub.

Approximate Intermodal Terminal Operational Area Acreage Calculations

As depicted in CN's Attachment IR2.26-1, Drawing No. 01-SK-01, the following intermodal terminal general areas are illustrated and their respective approximate terminal areas were calculated. The areas are generally based on my professional expertise and experience (such as estimates for usual and customary container storage stacking heights) as well as notes and indications on the CN engineering site plan drawings.

A. Intermodal Yard:

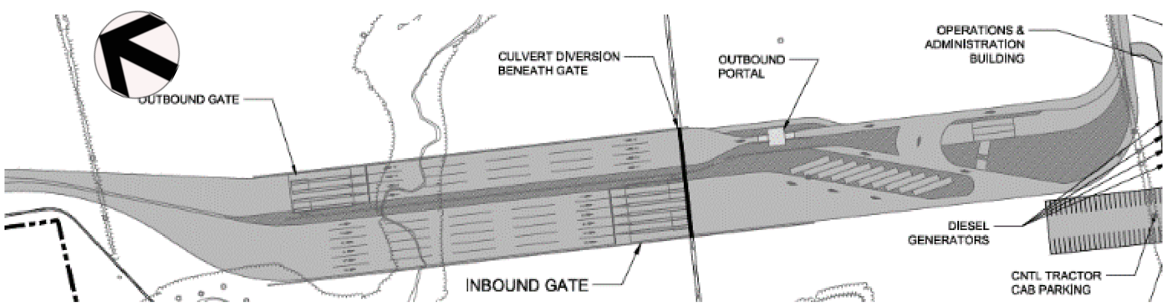
136 m. wide x 2,360 m. long – Effective area = 136 m. x 2140 m. = 291,040 sq. m.
446 ft. wide x 7,743 ft. long – Effective area = 446 ft. x 7,021 ft. = 3,131,366 sq. ft.

71.89 acres

B. Intermodal Gate:

64 m. wide x 530 m. long – Effective Area = 72,080 sq. m.
210 ft. wide x 1,739 ft. long – Effective Area = 365,190 sq. ft.

8.38 acres



C. Terminal Admin/Garage:

C1. Operation/Admin/Garage:

160 m x 52 m – Effective Area = 8,320 sq. m.
525 ft. x 171 ft. – Effective Area = 89,775 sq. ft.

2.06 acres

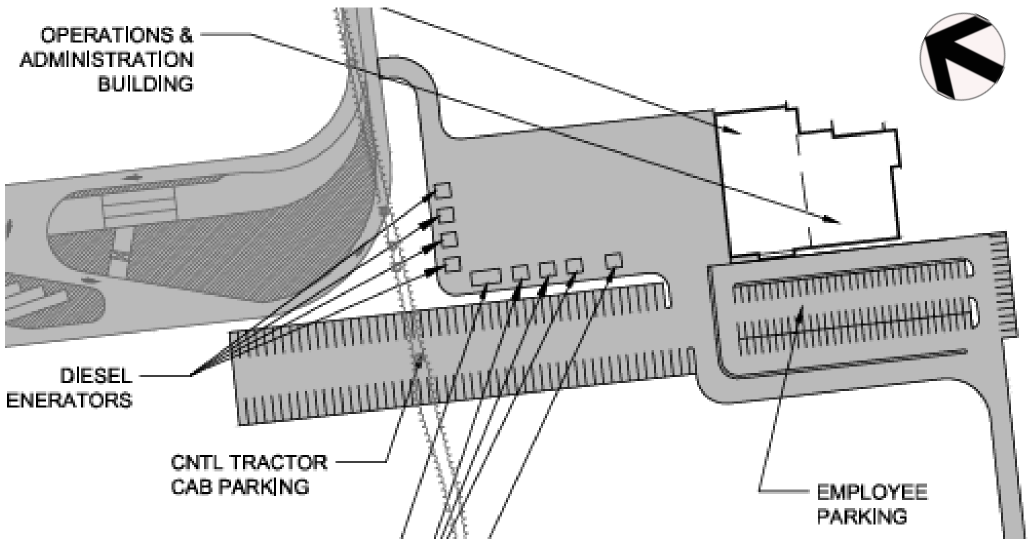
C2. Parking Areas:

265 m x 35 m – Effective Area = 9,275 sq. m.

869 ft. x 115 ft. – – Effective Area = 99,935 sq. ft.

2.29 acres

Sub-Total = 4.35 acres



Approximate Total Proposed Milton Logistics Hub Intermodal Terminal Acreage:

Total Intermodal Terminal Acreage: 84.62 acres

(2) CN's Proposed Key Design & Operational Characteristics

Table 1: CN's Proposed Key Design & Operational Characteristics		
Intermodal Terminal Characteristic	**Terminal Attributes**	**Explanatory Note / Observation**
Targeted Annual Container Throughput	**Initial Operational: 350,000 Containers Full Operation: 450,000 Containers (Similar Customer Base to Brampton) (2.7% dangerous goods)[6]**	**Montreal Throughput 375,000 container/year (Maximum: 500,000 containers/year) (Montreal: 65% Port Traffic, 35% Domestic) Calgary: 280,000 to 300,000 Containers/year[7]**
Terminal Acreage	**Total Project Area:400 acres (161.9 Hectares)[8]**	**Terminal Approx.9,514 feet (2,900 meters) in length[9]**

Container Storage Stacking Heights	**Average container storage stacking height for three high stacked containers is 2.5. Average container storage stacking height for four high stacked containers is 3.5.**	**Container stack heights limited to 3 high for loaded containers, 4 high for empty containers[10]**
Container Trains Per Day	**4 trains per day[11]**	**Two New Trains & Two Mainline Trains Calgary: 2 Trains In 2 Trains Out per day[12]**
Required Train Length	**8,000 feet to 14,000 feet Average Current Train Length = 7,000 feet (Anticipated Long Train = 14,000 feet)[13]**	**Min Pad Track Length = 8,605.6 feet Site Selection Criteria = 10,000 feet[14] Montreal: Up to 12,000 feet[15]**
Yard Cranes & Yard Equipment	**8 to 12 Reach Stackers (Yard Crane) 8 to 10 Yard Hustlers (Yard Tractors) 3 to 4 Yard Maintenance Vehicles 3 to 4 Yard Light Vehicles[16]**	**Only Mobile "Reach Stacker" Cranes Used Calgary: 6 Reach Stackers Montreal: 11 Reach Stackers (1-2 in maintenance at any given time)**
Operational Working hours	**Round the Clock Operations, 24/7/365[17]**	**Three Shifts Per Day, Shift = 8 Hours**
Terminal Operational Yard Tracks	**Three Pad Tracks & Three Service Tracks: Totaling 67,290 feet (20,510 meters)[18]**	**Service Track 1 - 15,137.80 feet (4,614 m.) Service Track 2 - 17,260.50 feet (5,261 m.) Service Track 3 - 8,372.70 feet (2,552 m.) Yard Pad Track 4 – 8,605.64 feet (2,623 m.) Yard Pad Track 5 – 8,792.65 feet (2,680 m.) Yard Pad Track 6 – 9,120.73 feet (2,780m.)[19]**
Paved Reach Stacker Work Pads	**Three 213.25 feet (65 meter) x 6561.68 feet (2,000 meter) Paved Work Pad[20]**	**Montreal and Calgary did not "pave" this area with asphalt or concrete pavement[21]**
Gate Operations	**Initial Gate Traffic: 650 trucks/Day in & out Full Operation: 800 trucks/Day in & out[22]**	**CN's Speed Gate ™ Automated Self Service System – Calgary Gate is most similar[23]**
Gate Truck Que Lane Length	**1.0 mile (1.7 km) Inbound/Outbound Que Lane[24]**	**CN considers the truck que lane Gate includes access que road[25]**
No. Gate Lanes	**6 Inbound Lanes / 4 Outbound Lanes[26]**	**No reversible lanes**
Truck Trip Generation	**560 to 670 Daily Avg. Low Jan., High Nov.[27]**	**Assumed Truck Volume Averages: Max. Trucks Inbound - Trucks/Hour: 51 Max. Trucks Outbound - Trucks/Hour: 49[28]**
CN Trucks	**20% CN Trucks at the Gate[29]**	**24/7/365[30]**

Alternate Trucks	**With Container In: 57%, With Container Out: 61%[31]**	**Empty Chassis: In: 31%, Out 28% Bobtails: In: 12%, Out 11%[32]**

(3) PRISM Tool – Operating Assumptions

Table 2: PRISM Tool Operating Assumptions

Intermodal Terminal Characteristics	Model Operational Assumption	Explanatory Notes & Reference Notes
Operating Train Length	10,000 ft. DST	CN "*anticipated long train*". Information Request Response (IRR) 2.28 and 29, DST train pulls into terminal in one movement via road power, IRR2.29
Typical DST Train Rail Car Size	305 ft. couple to couple - five car permanently articulated platforms 53 ft. all-purpose DST rail car	PRISM Model intermodal car length criteria selected, many intermodal car lengths are possible within a DST train
Number of TEUs per train Car	Two 40-foot container positions would not be occupied – Average 16 Twenty Foot Equivalent Units (TEUs) per DST platform car	General Intermodal Industry Parameters, 1 Container Lift = 1.7 TEUs
Typical Truck Gate Average Processing Capability	Inbound & Outbound Portal truck average processing time = 4.0 minutes/truck, Gate Lane Processing Capability: 15 vehicles per hour per gate lane	PRISM Model Parameters, IR2.26-1 CN Plan, Profile and Typical Sections
Percent of Cargo Going Direct to DST Train	50 Percent of the cargo moves directly track side	PRISM Model Parameter selected based on IRR2.30
Average Container Terminal Dwell Time	Two Days Average Terminal Container Dwell Time	Industry Parameter; IRR2.17 page 73 – MIT is "Moderate Volume Terminal"
Percent of Terminal Cargo that is Containerized	100 Percent	Site Visits, No other cargo is referenced in IRR#2

APPENDIX C – Scenario C Storage Yard Enhancements

References and example calculations for each identified terminal enhancement:

Terminal Enhancement	Attribute Enhancement Description	Approximate Static Container Slot Capacity Increase	Computational Explanatory Note
Enhancement No. 1	Increase Stacking Height of *"Loaded" Grounded Container Storage*	Container Ground Slots = 1,478 2.5 X GS = 3,695 Slots 4.0 X GS = 5,912 Slots 60% Increase in Slots[33]	Increase the effective "*loaded*" grounded container stacking height from approximately 2.5 high to 3.5 high (Approx. 40% Increase in Static Container Slots [34]
Enhancement No. 2	Increase Effective "Empty" Container Stacking Height of Grounded Containers	Assuming 30% Empties (IRR2.30) = 1,109 GS At 554 Ground Slots Approx. 15% Slot Increase[35]	Increase the effective "empty" container stacking height up to an avg. of 5 high from 3.5 high (100% increase in static empty storage slots)
Enhancement No. 3	Increase Effective Height of Horizontally Stacked Chassis	Assume 1233 containers per day (IRR2.30 Carter Ratio) & 70% Chassis Req. = 863 chassis Stacked 3 high = 288 Gained Slots – 8% Slot increase[36]	Increase the effective height of horizontally stacked Terminal chassis by vertically stacking chassis (9 to 1 ground Slot average advantage) (Gain 8 Ground Slots every 9 chassis)
Enhancement No. 4	Reconfigure Terminal Container Storage Areas to Increase Container Capacity	Potential increase in container ground slots of Approximately 35%[37]	The reconfigured storage area could reasonably yield more than 1,300 container slots above the 2.5 high container slot capacity

ENDNOTES

[1] Canadian National Railway Company, Information Request Response, Package 2 – Milton Logistics Hub Project Review Panel (2017 May 5) (online: < https://www.ceaa-acee.gc.ca/050/evaluations/document/120379?culture=en-CA>, accessed April 5 2019) [**IRR2**], responses 2.30(d) and 2.44(a), at pp 123, 153-155.
[2] Stantec Consulting Inc, *Milton Logistics Hub: Environmental Impact Statement*, Prepared for Canadian National Railway Company (2015 Dec 7) (online: <https://www.ceaa-acee.gc.ca/050/evaluations/document/104074?culture=en-CA>, accessed April 5 2019) [**EIS**] at section 1.2, page 2.
[3] IRR2, response 2.30(c), at p 122.
[4] A Twenty Foot Equivalent Unit (TEU) is an inexact measurement unit of cargo capacity with dimensions generally equal to that of an International Standards Organization (ISO) 20 ft. standard metal shipping container (20 feet (6.1 m) long and 8 feet (2.44 m) wide). Two TEUs are equal to one FEU (forty-foot-equivalent unit). The TEU is the approximate measure of container cargo capacity often used to describe the capacity of intermodal and port container terminals. Because the TEU is an approximate measurement unit, it cannot be converted precisely into other units of measure. Most containers are manufactured according to specifications from ISO and are suitable for multiple transportation modes. For the PRISM capacity model analysis, TEUs are converted to container lifts (numbers of intermodal containers) using the formula: One Container Lift = 1.7 TEUs. A lift is the process of moving a single intermodal ISO container or trailer to and or from an intermodal train rail car.
[5] Terminal operational observations were taken by the author as a part of the Halton CN Terminal Visitation Team site visits at the CN Montreal Intermodal Terminal on August 29, 2017 and the CN Calgary Logistics Park on August 30, 2017. See Halton Municipalities, Region of Halton *Site Visit Report*, Attachment I (Meeting Notes) to Letter dated January 23 2018 from Jane MacCaskill, Chief Administrative Officer of Halton Municipalities, to Milton Logistics Hub Review Panel (online: <https://www.ceaa-acee.gc.ca/050/evaluations/document/121500?culture=en-CA>, accessed April 5 2019) [**Site Visits**]; IRR2, Appendix I, Attachment IR2.26-1, Drawing Nos. 01-SK-01 & 01-SK-02
[6] EIS at subsection 3.4.2; Canadian Transportation Agency, *Application by CN pursuant to s 98(2) for Milton Logistics Hub* (2016 Jan 22) (online: <https://www.ceaa.gc.ca/050/documents/p80100/116633E.pdf>, accessed April 5 2019) [**CTA**] at ¶54; IRR2, responses 2.30 at p 121.
[7] Site Visits.
[8] EIS at section 1.3; IRR2, response 2.18 at p 74.
[9] Canadian National Railway Company, Milton Intermodal Project: Preliminary Project Information, Presented to: Town of Milton & Halton Region (2015 January) (online: https://www.ceaa-acee.gc.ca/050/documents/p80100/101296E.pdf, accessed April 5 2019) at page 2.
[10] CN states that "container stack heights will be limited to 3 high for loaded containers, 4 high for empty containers" in Canadian National Railway Company, Information Request Response, Package 5 – Milton Logistics Hub Project Review Panel (2018 June 12) (online: < https://www.ceaa-acee.gc.ca/050/documents/p80100/122961E.pdf>, accessed April 5 2019) [**IRR5**], response 5.20 at p 10.
[11] CTA at ¶58.
[12] CTA at ¶58; Site Visits.
[13] IRR2, response 2.29 at p 111.
[14] EIS, Appendix F, at subsection 4.1.1.
[15] Site Visits.
[16] EIS at subsection 3.4.2.4.
[17] CTA at ¶54.
[18] CTA at ¶22.
[19] CTA at ¶22.
[20] CTA at ¶25.
[21] CTA at ¶22.
[22] CTA at ¶69;
[23] CTA at ¶71; IRR2, response 2.35, at pp 133-134; Site Visits.
[24] EIS at subsection 3.3.5; CTA ¶70.
[25] EIS at subsection 3.3.5.

[26] EIS at subsection 3.3.5.
[27] EIS, Appendix E.17 at 5.0, p 10-11.
[28] EIS, Appendix E.17 at 5.0, p 10-11.
[29] IRR2, response 2.25, at p 94.
[30] IRR2, response 2.25, at p 96.
[31] IRR2, response 2.30, Table IR2.30-2 at p 121.
[32] IRR2, response 2.30, Table IR2.30-2 at p 121.
[33] Site Visits; IRR2, Appendix I, Attachment IR2.26-1, Drawing Nos. 01-SK-01 & 01-SK-02.
[34] A static container slot is a grounded or stacked container storage location
[35] Site Visits; IRR2, Appendix I, Attachment IR2.26-1, Drawing Nos. 01-SK-01 & 01-SK-02.
[36] Site Visits, Available Industry Equipment Technology.
[37] Site Visits; IRR2, Appendix I, Attachment IR2.26-1, Drawing Nos. 01-SK-01 & 01-SK-02.