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**INTERMODAL CONTAINER TRANSPORTATION LOGISTICS
AND ITS IMPACT ON THE CUBAN ROAD**

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ABSTRACT

In Cuba, the container movement chain has been characterized by the massive arrival of containerized cargo in the past five years, above the reception and operational capacity of the main container specialized port terminal, for excessive storage time import containers in port terminals, especially in the TCH, for the staying time of import containers within the national economy beyond the limits set for return shipping and for the poor use of available capacities in the domestic economy - port – transport chain, among other reasons.

It has been established a multidisciplinary group to study the new logistics required by the country to ensure the rational, economical and efficient transport means and road infrastructure that supports the logistics warehouses. The main issues under consideration and some of the results are presented in the present paper. It addresses the changes in container logistics chain in the country and the impact of the new management, meaning the sustained and increasing use of intermodal transport, which has transferred large volumes of freight from road to railway with a consequent saving of resources and environmental protection.

1. INTRODUCTION

Before the start of the global economic crisis, Cuba experienced a significant increase in the arrival of cargo, due to development programs for oil, natural gas, nickel, tourism, Electric Power, water works, construction, food production, health and rehabilitation of transport. Thus, the movement of containerized cargo increased in all its logistics. Roads and railways assumed this increase to the tendency of domestic load traffic. Firstly, the loads from the import; secondly, from the internal movement (domestic traffic); and finally, from the export cargoes. All this has meant the revival of port activities and cargo transportation in domestic economy, activities which had suffered a significant decline in the decade of the 90's.

In Cuba, the Container Multimodal Transport Logistics Cuba was stressed, and therefore operational solutions have had to seek, in road infrastructure and in the strategic field to meet the new requirements. The strategy, important researches are developed by specialists from the Ministry of Transportation, Transportation Research Institute and Havana's Politechnical University, from which some results are already in this work.

In general, in Cuba the chain of movement of containers during the past five years has been characterized by:

- The massive arrival of containerized cargo, over the reception and operational capacity of the main containers specialized port terminal port, the Container Havana's Terminal (TCH).
- The need to reactivate the business of taking other container port terminal without the needed conditions.
- Excessive storage time of import containers in port terminals, especially in the TCH
- Length of stay of import containers within the national economy, beyond the limits set for return by the shippers.
- Poor use of available capacities in the domestic economy - transport - port chain.

- Each actor in the chain has partial information of the situation and there is an entity that integrates container cycle management
- Noncompliance of the rotation cycles agreed with the shippers.
- Excessive expenditure of financial resources for their stay.
- No correspondence of arrivals of containers in port terminals with the container territorial destination within the country

There is no doubt that we need to develop and implement new models in the country to manage and trace the movement of containers, to ensure a high level of service to customers with a system of analysis and monitoring for making timely, effective and efficient decisions in this field. The development of the management and container tracking system currently under development should focus on covering the whole cycle of container in its chain of movement in the country

On the other hand, new investment in infrastructure and equipment for transport and ports have to be in function of strategic development at the country level, of a logistics so specialized, as the intermodal transport of containers is.

2. CHARACTERIZATION OF CONTAINER FLOWS, ITS ORGANIZATION, INFRASTRUCTURE AND EQUIPMENT.

In short, will address the elements that have characterized the container shipping, port loading and extraction, transportation of containers within the country (modal and multimodal) and the return of containers to their owners.

The maritime transport of containers is done in the lines or regular services of nine shipping services, among which one is Cuban (Melfi Marine), a joint venture (Nirint), and the rest are foreigners. The latter ones transported 75 % of import containers during the year 2009. Among the major foreign shipping lines with regular container shipping operating in Cuba are CMA-CGM, Cambur Sud, Crowley Line Service, Holland Maas Shipping, MSC, ZIM and Maersk Line.

The port unload and extracting. Statistics show that in recent years, the annual increase of containers unloaded in the port terminals and in particular the TCH, was 7% and 10% of containers handled. The relationship of containers unloaded from 40' with those ones from 20' was 63% in 2009.

At the country level the habilitation of containers is behaving in 3 days on average, the time between the approval and removal is very high (5 days) for a length of stay of 8 days, which shows organizational problems in the chain of movement of containers, among which is found the use by agencies and companies of the port as warehouse to meet their capacity deficit. The TCH and Haiphong port terminals maintain a similar performance to that one of the country. In the case of Santiago de Cuba the situation is aggravated by reaching, length of stay after 8 days habilitation, which directly influences the increase in length of stay of containers in the Terminal.

The internal transportation and return of containers to the owners.

Maximum formation of the container specialized train

There are several factors limiting the formation of specialized train for the transportation of containers: The length of the sidings, availability of equipment, both

towed tractive as the gauge of the buildings adjacent to the railway line, the drag of locomotive.

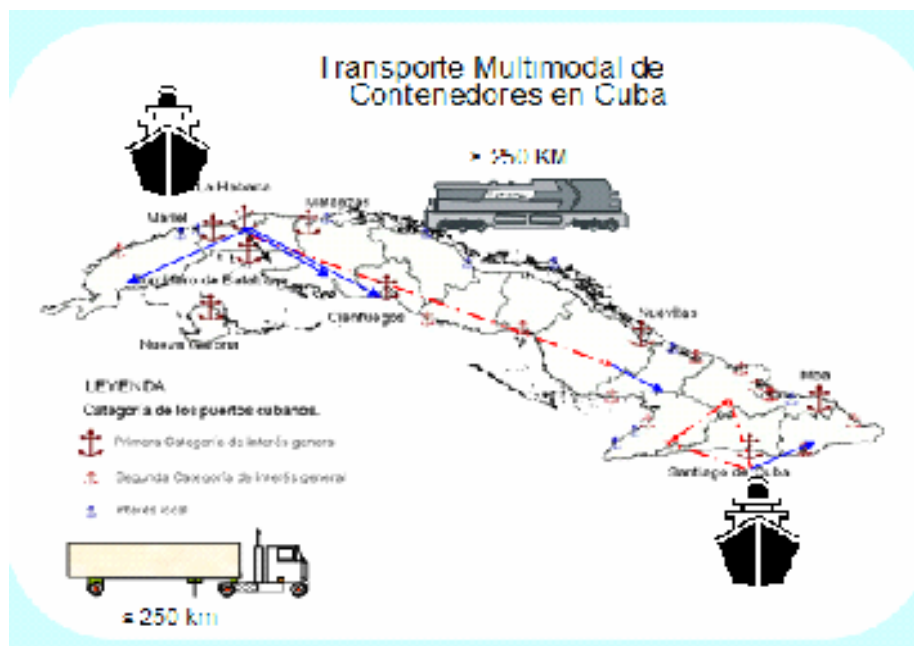
About the maximum length of the train. The current rule on each train is 30 container plates, with the total length of the train of 635 m, exceeding the capacity in three of the Central Line sidings. The Central Line has a total of 63 sidings between Havana and Santiago de Cuba, of which only three have a capacity less than the length of the train with 30 plates, which are: Campo Florido with 592 m, 620 m Coliseum Columbus with 628 m. Any action resulting in an increase in train length, should be in line with the capacity of the sidings. This is a limitation on the railway infrastructure.

About the railway traction. This train should consist of a locomotive and 30 plates carrying containers, a box helper for the crew and cabooses. According to the rotation 4 locomotives are needed in service for this service. The turnaround time is 96:00 pm. The rotation of the engine of the train is four days, therefore, requires four locomotives available to be allocated for exclusive use in this service

Container plates. Container plates that form this train has a capacity of 60 tons or three TEUs, a length between couplers 19 620 mm, a maximum speed of 80 km / h and a tare weight of 22 tons. To upload 30 plates per day it is necessary that the rotation period not be more than 7.3 days; however, in practice there are delays that increase this indicator causing a decrease in the number of plates available for loading.

Automotor transport. Before 2006, the MITRANS' Trucking Union had a fleet of vehicles for transporting containers, which with the volumes that were already producing, proved not to meet the demand of the domestic economy, much less the increase of load volumes that the country begun to face . In this regard, The Container Operations Company TRANSCONTAINER was created, which has a dedicated fleet under its command in the major regions of the country where they operate containers.

3. CHANGES IN THE LOGISTICS OF INTERMODAL CONTAINER TRANSPORT AND IMPACTS OF ITS NEW MANAGEMENT.



a) Determination by statistical and other methods of increasing the volumes of transportation of containers arriving into the country annually.

From a multi-criteria analysis, the future scenario of flow of containerized cargo was modelled, and in function of trends investment needs were assessed in: roads and storage, port equipment and lifting in the Unload and Load Centers and major receiving container depots of the country, identified the needs of automotive and railway transport and infrastructure and equipment for the exploitation operation of a Container Tracking Management System

b) Adoption and Enforcement of the Procedure for the Management of the Container Activities at country level.

A procedure ruling the actions of the agencies was put in force to control traffic through the country of import, export containers and those ones from the domestic economy. The same is applicable to all entities operating containers or respond to any of the seizures involved in this process. The Working Group of the Container Activity forming part of the Internal Economy - Transport - Port Operation also was created.

c) Creation of the Container Operations Enterprise TRANSCONTAINER, with the task of ensuring: 80% of automotive transportation originating in Havana, the remaining 20% with own transportation agencies that have the infrastructure and logistics equipment within the country for it. 100% of interprovincial shipments expected to railway transport, including transport operators seeking above-mentioned agencies. 100% of automotor transport expected from the port of Santiago de Cuba. 100% of automotor transport linked to the provincial loading and unloading facilities.

d) Organization of the railway movement of containers with two trains:

Train No 1. Daily National Habana - Santiago de Cuba - Havana:

- Ascending Havana – Santiago de Cuba: full import containers from Havana port to Camaguey and domestic traffic from Havana to Santiago de Cuba, returning empty containers from Tunas and Holguin to Santiago de Cuba.
- Descending Santiago de Cuba - Havana: full import containers from the port of Santiago de Cuba to Holguin and Las Tunas, returning empty domestic traffic to Havana; returning empty containers from Camaguey, Ciego Avila and V. Clara to Havana.

Train No 2. Daily, Territorial Santiago de Cuba - Bayamo - Santiago de Cuba.

c) Evaluation of the use of intermodal container transport technologies, little used in Cuba. The implementation in selected trades of the Exchange System of Trailers, the expanding of the use and exploitation of side autoloading and the use of hydraulic lifting equipment in storage containers for selected clients was studied.

d) Study of the new logistics of transportation of containers in the country after the transfer of the Havana's Container Terminal to the potential International Container Terminal MARIEL and its Special Zone of Logistics.

The study is part of the universe and complexity of the flow of containers in the country and its new system of transportation logistics for both containerized cargo transported by road to the currently transported by railway, and which is expected to pass from road to railway to release a major automotive containerized cargo traffic. Evaluating its environmental impact and benefits of shifting the movement of containers within the major cities, using alternative roads in the periphery in the Cuban roads and the steady increase in railway traffic. This is intermodal, combined in every possible from road to railway, using

the important advantages of road transport over short distances and the indispensable benefits of railway over long distances and mass transit

e) Introduction of intermodal transport technologies are not exploited in Cuba.

We evaluated the introduction of Transtrailer (Bimodal Transportation), the Ferrocamión or piggyback, and depressive Iron for double-stack containers.

The Transtrailer (Bimodal Transportation) has no limitations. Their input is valued economically compared to other transportation alternatives.

The Ferrocamión or piggyback. In 1988 the Transportation Research Institute (IIT) conducted a study that showed the economic feasibility of introducing the ferrocamión in Cuba. In 1990 two trailers experimental traffic Argentine Pratty 30 t each were done and portable metal ramps were built that were located in the Arenal CCD and Holguin. A total of 30 trips were a successful experiment transporting paper and metals to the East and feldspath from Holguin to Havana.

The iron rail for double depressive container stowage.

The height of 6.15 m, which reach the plate loaded with double-stack depressive exceeds the 25-gauge road overpasses must pass through the Central Line. Obstacles exist, but less importance, such as power lines, telephone and so on. A depressive plate loaded with a single pallet has less capacity than normal iron (a TEUs less). Therefore, it is not advisable to use plates depressed as long as the limitation on the height of the gauge of the steps mentioned above.

f) Development of container tracking and management system

The fundamental principles underpinning the traceability system are to ensure:

1. Follow up on any container, whether for import, export or for internal circulation in the national economy
2. Update on the status of each container registered in the system, minimum delay in capturing information.
3. Track your approach to the process cycle
4. Integrated planning of activities for which the container must pass in their life cycle
5. Control of activities by passing the container
6. Control of payments involving each of the activities for which the container passes
7. Control of the cumulative payments of each container

The main novelty of this work is that it designs and implements a comprehensive control of the cycle of the container where are present the main actors in this chain of movement of containerized cargo in the country. The systems that exist in the world today only control part of the cycle of the container.

g) Development of Model Flow Container Management in Cuba.

The flow management model of containerized cargo in the country, ensure the movement of import and export container in the foreseen logistics cycle, with appropriate costs and the level of service required in the country. We have no information that exists in the world a model of this kind to manage the flow of containerized cargo at the state level.



4. CONCLUSIONS

We must develop and implement new models in the country to manage and trace the movement of containers, to ensure a high level of service to customers with a system of analysis and monitoring for making timely, effective and efficient decisions in this field. The development of container tracking and management system should focus on covering the whole cycle of container in the chain of movement in the country. The exploitation of the country's road infrastructure should include the movement of import arrivals by major container ports, depending on the territorial final destination within the country using intermodal container transportation alternatives and fulfilling the country's regulations in this regard.

The container is a great piece of engineering that has revolutionized trade, straining the acceleration of new technologies in the international port and maritime activity in the development of the equipment and infrastructure of the railway and automotor transport of the countries.

Cuba works in this field with the view of sustainable development, is seeking security, reliability in operations, effectiveness and efficiency of logistics processes that define this string. The way has just begun, despite having accumulated some experience. The results already are seeing

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