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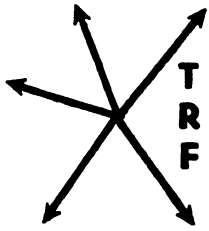

TRANSPORTATION RESEARCH FORUM

The Impact of Container Standards on Integrated Transportation

*by Fred Muller, Jr.**

INTRODUCTION

During the past decade there has been a growing awareness and acceptance on the part of industry in the United States and elsewhere in the world, of the need to achieve economies in the distribution of goods, in order to insure continued profitability and to maintain competitiveness in the world market areas.

The foregoing is not to infer that managements have not always been interested in economies, efficiencies, profitability and their ability to compete, but emphasizes that increasing costs of labor and materials, (the two largest costs of production) directed attention to areas in which significant cost reductions could be affected, the major one being that of the physical distribution of products.

Business Logistics a modern philosophy is directed to the overall determination of optimum methods to be used in the movement of goods and other elements or factors which contribute to the distribution of products. The most significant element to be considered in the Business Logistics total cost theory is transportation.

Transportation accounts for approximately 50-60 billion dollars annually, in the total cost of the distribution process. Other significant items which raise the total cost of physical distribution to approximately 20 percent of our gross national product includes warehousing, inventory, advertising, sales and promotion, the middleman's profit, etc. Significantly management has looked to transportation as the greatest possibility of appreciable cost reduction.

STANDARDIZATION OF TRANSPORTATION

In recognition of the possibility to optimize transport through the standardization of primary transport systems components necessary to unrestricted equipment interchange, an organizational meeting was held in New York under the auspices of the then American Standards Association to determine whether standardization of a modular series of container sizes capable of unrestricted interchange between the major carrier modes, would be a possible course of action to institute. It was the unanimous opinion of the organizational group that a project having as its objective the determination of a series of container sizes designed for maximum interchange between, rail, marine and highway carriers should commence at the earliest opportunity.

The project was organized and designated ASA MH-5. Subsequent to the initiation of the MH-5 project, it was found practical to petition the Inter-

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national Organization for Standardization at Geneva to institute a similar project based on global needs under the procedures available within the International Organization for Standards thereby expanding the domestic United States' MH-5 project to an international level.

The International Standards Organization project was designated ISO TC-104 and separated into three working groups; Working Group A,—Terminology; Working Group B,—Dimensions; and Working Group C,—Specifications and Testing. As previously mentioned the scopes of both the MH-5 project and the ISO TC-104 projects have as their major objectives the establishment of minimum number of container sizes having a modular relationship and a designed interchange compatability in order to provide minimum restrictions, and optimum transfer between rail, marine and highway carrier on an inter-continental basis. The omission of the air carrier mode, which is not an oversight, reflects the problems existing at that time with regard to their ability to accept large freight containers with their tare weight penalty. Liason with air carrier groups has been maintained to keep them informed as to the progress of the MH-5 and ISO TC-104 Committees and to assess the development of compatibility between air carriers and other major transport modes, as well as to insure that when large freight container systems reached the point where they could be efficiently interchanged with the air carriers, an air oriented Committee could be activated.

Underlying the formal designation of scope and the designed purpose of the parallel projects, was the sincere desire on the part of countries throughout the world to develop a common denominator approach between the land transport systems—from continent to continent. It was felt that, in terms of future trade, establishment of such a common denominator approach would be of inestimable value to the trading nations of the world in that goods, in import and export movements between continents, would find a ready compatibility available for interchange of containers between the rail, marine and highway carriers. In this connection, it was emphasized that surface transportation systems of the major trading nations of the world could be coordinated without deterring the development of domestic transport operations responding to the environmental needs of each of the continents involved.

Beyond the cost benefits inherent through coordination of transport systems on an intercontinental basis equally attractive reductions were to be made available such as the lowering of annual costs to both industry and consumer in the distribution of the product. Further, through cooperative and reciprocal agreements between government and regulatory bodies, it was felt that there could be significant reduction in the documentation required in the movement of goods from the point of origin to final destination, as well as significant reductions in pilferage, damage, and in packaging requirements necessary to safeguard the movement of goods throughout the distribution cycle.

To date, the accomplishments of both the United States of America Standards Institute MH-5 Committee, as well as the ISO TC-104 Committee have been publicized throughout the world and hailed as a significant

achievement in the development of a coordinated global transportation system.

ACHIEVEMENTS

While the effort is not completed as yet, there have been major achievements both from the domestic United States standards activity, and the International Organization for Standards. Accomplishments to date are in the form of recommendations and proposals which have reached final state acceptance in both U.S. and International Standards areas. One of the proposals having major import and direct bearing on the ultimate objectives to be achieved is the acceptance by both the International Organization for Standards and the United States of America Standards Institute of large freight container dimensions based on a modular relationship.

The container dimensions accepted to date have an 8-foot by 8-foot end configuration and modular nominal lengths of 5', 6-2/3', 10, 20, 30 and 40-foot. The actual lengths, are specified as somewhat less than the nominal in order to achieve a modular grouping relationship of the various container sizes within the maximum 40-foot dimension prescribed. The 8-foot x 8 foot end configuration is a maximum affected only by manufacturing tolerances.

In addition to the dimensional standards pronounced, operating requirements have been developed which describe the environmental load factors to be considered in design and construction of containers capable of being transported by the various transportation modes.

CRITERIA

The derivation of operating requirements or design load factors have been based on a selection of the most restrictive conditions representative of the environment to which a container is exposed in movement by rail, marine or highway carriers.

For instance, it is generally agreed that the most critical of transportation modes is the marine operation of vertical cell containerships, ie., ships having vertically oriented frames formed by angles or other restraining means to contain modular sized containers when vertically stacked six high. In this arrangement containers must be capable of supporting the loads imposed by the five containers stacked above, plus dynamic factors produced by a ships roll of 30 degrees having a 13 second period, as well as a vertical acceleration of 0.8 g which is produced by the ship's heave and pitch. The next most restrictive carrier from the standpoint of its affect on container design and construction is that of the rail mode, where logitudinal restraint induced by coupler run-in and run-out, as well as by impacting and shunting yard operations has been determined to be in the order of magnitude of 1.5 g. In addition, the force input through the point of restraint at the base of a container in the rail movement produces an effect on the end panel which has been accepted as 0.4 g of the revenue load in the container uniformly distributed. These major dynamic environmental factors are well above any values to which a container is subjected in the highway movement.

HANDLING

In addition to the establishment of design load factors representing environmental conditions through which a container must move in its function the need for a universal handling system is considered paramount to a truly integrated-coordinated transport system. By universal system for handling is meant the ability to interchange equipment in as unrestricted a manner as possible between the various modes of transport such as from highway to rail, or marine, the ability to handle containers by automatic or semi-automatic methods or by use of conventional equipment in existance, and the ability to secure the container to provide the security and integrity of the unit as it travels through its environment. Both the USA SI MH-5 and the ISO TC-104 projects have set forth various proposals designed to provide means by which containers can be handled and secured consistant with functional requirements of a system. The proposals being considered for acceptance are of a container corner structure system which details dimensions and configurations of apertures in the side, end, top and bottom surfaces of the corners of standard containers.

There have been many designs of corner fittings such as castings, weldments and fabricated or integral corner structure in which apertures and surfaces previously defined are considered as a part of the structure of a container.

Dynamic and static design criteria for a corner fitting system are dictated by the major loads encountered in the handling and securing operations to which a container is exposed when being transported by rail, highway or the marine mode and when handled by conventional, semi-automatic or automatic means.

Implementation of container operations and systems prior to the establishment of final International Organization for Standards proposals has resulted in the introduction of increased operating requirements which have affected the final acceptance of a corner fitting or a corner structure standard.

USA SI MH-5 VS. ISO TC-104

When comparing the recently published USA SI MH-5 standard which describes a corner fitting system adopted for U.S. domestic use and the current proposals of the ISO TC-104 Committee for corner fittings-structure, it can be shown that the introduction of additional operating requirements as recently recommended in International meetings renders the U.S. fitting deficient insofar as it's ability to handle a 40-foot container loaded to 30 long tons when lifting at the bottom corners at angles of 30 degrees from the horizontal. In addition, the ability of the container corner fitting to withstand lashing loads encountered when containers are stacked on the decks of ships is also in question. International criteria for longitudinal restraint related to rail impacts or shunting has been established as 2.5 g the sum of a 2 g deceleration and a factor of 1.25. The U.C. criteria for longitudinal restraint is based on the assumption that containers traveling in the rail mode would be afforded protection from impact through use of energy absorption devices, sufficient to restrict longitudinal decelerations or accelerations to 1-1/2 g. The major differences between the ISO proposal

and the USA SI MH-5 proposal for container corner structure lies in the recent introduction of additional operating criteria to include the lifting of 40' containers at the bottom corners at angles of 30 degrees from the horizontal, and acceptance of lashing loads applied to containers stacked on ships deck.

Proposals formulated on the basis of technical evaluation by a group of experts recommend increasing the side, end wall and base thickness of a corner fitting or structure so as to enable the corner fitting or structure to withstand safely the loads specified in the operating requirements. In the USA SI MH-5 Committee deliberation, counter proposals have been developed which follow the premise of modifying the present existing corner fitting standard to make it capable of performing as required by the new criteria.

SUMMARY

To recapitulate, the USA SI MH-5 Committee have achieved a degree of success in that the dimensional characteristics of a series of containers designed on a modular basis for interchange between rail, marine and the highway carrier modes have been pronounced as American Standards. In addition, the USA SI MH-5 Committee have developed United States' standards for design load factors representing environmental conditions and practical dynamic and static conditions to which containers moving by rail, marine and highway modes will be subjected. Further, the USA SI MH-5 Committeees have progressed a proposal for corner fittings through the various committees and review groups to the point of its acceptance as a U.S. standard.

The ISO TC-104 Committee have accepted for recommendation as ISO standards dimensional proposals identical to the U.S. domestic standards and including the same tolerancing systems and interrelationship of modular sizes. In addition, ISO TC-104 operating requirements, while stated in somewhat different terms than the USA SI MH-5 design load factors, represents fairly accurately identical conditions described in the U.S. Standards' document. The major exceptions in the ISO TC-104 insofar as operating requirements is concerned has to do with the longitudinal restraint which is stated as 2.5 g vs. the 1.5 g specified by the U.S. MH-5 Committee.

The resolution of the corner fitting question and the establishment of practical and meaningful testing specifications will finalize the fundamental requirements for a standard intermodal system of containers having modular relationship thereby permitting interchange between rail, marine and highway carrier modes on an intercontinental basis.

CONCLUSION

It is hoped that at meetings to be held in Moscow in June of this year, the vital question of corner fitting or corner structure and related design load criteria, as well as testing specifications will be accepted so that the entire concept can be implemented with as great a degree of assurance of universal acceptability as possible. It is only through international acceptance of fundamental and basic requirements of design load factors, dimension and equitable interchange capability that a truly intercontinental container system

can become useful and meaningful to the movement of goods between continents at higher degree of efficiency and economies not presently available.

Present implementation of container operations including large investments in the form of ships, containers, related handling equipment, as well as the construction of facilities at the port interfaces and inland terminal areas is ample indication of the consideration and acceptance of containerization as a medium available to commerce and industry for expanded import and export movement of products between continents and in domestic transport.

In this connection the availability of standards describing the fundamental requirements for developing systems based on design ingenuity and the maximum use of materials of construction is paramount to the successful implementation of containers as a means to improve the efficiency and economy in the physical movement of goods from point of origin to the point of final destination. Without a system of acceptable, meaningful standards systems designs will proliferate to the extent that they will mitigate against realization of the promises inherent in integrated coordinated transport.

While much remains to be done toward the finalization of International Standards there have been many achievements, notably the acceptance of dimensions, design load factors, and handling systems. In addition, other important areas are being considered and proposals are being formulated having as their objective the minimization of documentation required for the through movement of containers, reciprocal customs agreements which will permit unrestricted movement of containers from point of origin to final point of destination on an intercontinental basis and marking and indentification systems which will permit the logistics control necessary to the efficient use of a world-wide container operations.

The ultimate result of the standardization efforts under the direction of the USA SI MH-5 and the ISO TC-104 Committees will be the establishment of an International coordinated transport system based on a modular series of container sizes which will permit the unrestricted movement of freight containers capable of interchange between the major transport carriers producing more efficient utilization of transport systems, the coordination of domestic transport facilities and a significant reduction in the annual cost to both industry and consumer in the distribution of products.