CHANGING URBAN STRUCTURE AND ITS IMPLICATIONS FOR TERMINALS AND PICKUP AND DELIVERY PROBLEMS IN METROPOLITAN AREAS

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Within the past 2 decades, tremendous advances have been made both in our understanding of the relationships between transportation and urban structure and in the methods for study of such relationships. The traffic flow studies of the period prior to World War II evolved into the origin-destination studies of urban areas during the immediate post-war period from about 1945 until the mid-1950's. These, in turn, were expanded into the comprehensive transportation-land use studies, such as those in the Detroit, Chicago, Pittsburgh, and Philadelphia areas, during the decade between about 1955 and 1965. Since 1965, such studies have become integral parts of the comprehensive planning process, and, indeed, have become indispensable prerequisites for securing, by local governmental agencies, of federal assistance for a wide variety of programs and projects in metropolitan areas, without which the development of such areas could not, in most instances, effectively proceed.

As a result of such studies, we know a great deal about the structure of cities and metropolitan areas and about the roles of various patterns of land uses and economic activities in the generation of traffic flows. We can project, with reasonable accuracy, the traffic that may be expected to be generated by various combinations of land uses at various densities and at various distances apart; we can test alternative patterns in terms of the optimal systems of traffic facilities as the basis for metropolitan planning. Indeed, such testing has become virtually standardized and is an accepted part of the planning process. The methods of conducting such planning studies are constantly being improved, and the assumptions and hypotheses relative to the relationships among land use, locations of activities, and internal and external flows that they generate are being constantly refined.

The movement of persons is generally much better understood than the movement of goods. While the origin-destination surveys and the comprehensive metropolitan transportation-land use studies have produced vast quantities of information about the demographic and occupational characteristics of persons making trips as well as the purposes of the trips, information about the characteristics of goods movements is, by comparison, seriously deficient. We have, in most of the metropolitan areas that have been subjected to comprehensive studies, data on truck movements and information as to whether the trucks were loaded or empty, but data on commodities are generally either unavailable or fragmentary.

SYSTEMS OF METROPOLITAN COMMODITY FLOW

The difficulties of gathering and analyzing data on the flows of goods into, within, and out of cities and metropolitan areas are, in several significant respects, considerably greater than the difficulties of gathering, processing, and interpreting data on person movements. A person is a discrete entity, and the passenger-mile is a single unit. On the other hand, goods are of infinite variety, and the significance of a ton-mile will vary widely, depending on the nature of the good: whether it is package freight, dry bulk, or liquid; whether it is of high value in proportion to bulk, or of low value; whether it

moves in less-than-truckload or less-than-carload or in truckload or carload lots; whether it is changed in form en route or at intermediate stages in the production chain; or whether it proceeds without break-of-bulk. Some progress has been made in uniform classification and in coding of the infinite variety of goods for statistical studies, and a beginning is being made in the gathering of data for urban planning purposes in this field, but for the most part, the difficulties remain.

The alteration in the form of goods, as the result both of break-of-bulk and of processing, poses formidable obstacles in the study of the significance of goods movement in city and metropolitan planning. For example, it is well known that urban areas generally receive far greater tonnages of freight than they ship out and that the unbalance creates major problems for the carriers in the form of low outbound load factors and, hence, underutilization of equipment. This is particularly true for those carriers primarily concerned with the transportation of bulk commodities, including grains, ores, and fossil fuels. In the processing and utilization of these commodities there is, of course, a reduction in bulk, and the outbound movements of the processed goods and the products constitute far less tonnage than the inbound movements.

This unbalance, however, varies by type of carrier. Trucks, whose flexibility permits relatively economic utilization for movement of manufactured products in contrast to that permitted by the relative inflexibility but scale economies of ships, barges, trains, and pipelines, show less unbalance directionally than do those modes that are more adapted to bulk transportation. Nevertheless, all urban areas consume more tonnage than they produce, insofar as the total of all carriers is concerned. The difference, however, is not usually considered in terms of transportation requirements, for it is predominantly in the form of wastes: liquid wastes, which are disposed of in the oceans, lakes, and streams; gaseous and small-particulate solid wastes, which are disposed of in the air; and solid wastes, which are disposed of in bodies of water as solutions, suspensions, or solid fill, or on land as fill, "sanitary" or otherwise.

We know very little about the movement of materials in the urban systems. How much of the waste material is, or can be, recycled? What are the transportation requirements of a city or metropolitan area for various levels of recycling? How would more effective conservation measures, brought about in part as a result of the increasing concern for environmental quality, affect the total demand for transportation services for waste and recycled products in metropolitan areas? Where should the waste products be utilized in subsequent processes, and how would the location of such processing facilities affect the quantity, character, amount, and location of the transportation facilities required? It is evident that comprehensive studies of the complete cycles of movement of materials of all kinds are required. For these studies, there is urgent need for the development of techniques for gathering and analyzing flow data.

In several respects, our present knowledge of environmental quality in relation to urban land uses and densities is not unlike our knowledge of traffic generation as a function of the same variables. These are interdependent; because there are reciprocal relationships, none can be regarded as an independent variable. Just as accessibility takes 2 forms—mutual proximity, as expressed in land values and densities on the one hand, and flows, as expressed in transportation and communication costs on the other—so air pollution, for example, has a limiting or inhibiting effect on development, which ultimately may be reflected in ceilings on density of both land use and traffic, and which, in turn, may limit the desirability, and hence the land values, of central-city locations. Costs of pollution control to an individual establishment may not be completely unrelated to density, which, in turn, is related to accessibility.

The dichotomy of centripetal and centrifugal forces in the shaping of cities and metropolitan areas applies to both forms of access; it is as applicable to patterns of density of air and water movements as it is to movements of automobiles, trucks, or railroad commuters.

If we are to understand the role of commodity flows and goods movements in urban and metropolitan growth and development, we cannot confine our concern to conventional modes on fixed routes, whether common, contract, or private carrier. The total urban environment must be considered. The potentialities of such an approach are demonstrated in a small way, for example, by the recent concern of some

railroads for the development of traffic in solid wastes (garbage) from urban areas to disposal areas, such as in abandoned strip mines, at some distance from the originating areas.

TRENDS IN INTERNAL LOCALIZATION OF METROPOLITAN GOODS MOVEMENT

In spite of the deficiencies in both data and concept relative to total movements of matter of all kinds in urban areas, and at the risk of dwelling on the obvious, it may be advantageous to summarize some of the dominant trends in recent years relative to the changing patterns of urban development as they affect the patterns of internal and external movement of goods, as conventionally understood to include commodities, fuels, and manufactured products.

The conventional models of urban structure and growth are of some help. Most urban complexes embody, in their internal organization, varying combinations of the 3 classical geographic models: the concentric circle, the wedge or sector, and the multiple-nucleus models. All of these models involve gradations in density and, to a greater or lesser degree, segregation of land uses. The concentric circle model involves a dominant nucleus around which densities grade off in every direction, with growth taking place on the fringes and with densities increasing in the inner zones. The wedge or sector model also involves outward gradations of density, but the density gradient is less steep along the major transportation routes that are assumed to be radial, focusing on the core of the city. The multiple-nucleus model, which is not inconsistent with the other two, has several nucleii, around each of which the density gradient may take either concentric or radial form or both, even though one or more of the nucleii may be dominant. All of these models are mutually compatible, and all include dominant nucleii where densities peak. The urban land economist explains these models in terms of competitive bidding for the most accessible sites, which are at and near the nodes on the transportation network, with a consequent sorting out or stratification of land uses and establishments in relation to their ability to benefit from, and hence to pay for, the most accessible sites where the land costs are highest.

Since the advent of the automobile, motor truck, and modern highways, 2 mutually reinforcing trends have dominated the picture of urban growth. One has been the spread of urbanization into the surrounding countryside, marked by the outward spread of the built-up area—the "metropolitan explosion"—and giving rise to what is commonly known as the "urban sprawl." The peripheral movement has, of course, not been confined to residential developments. Equally significant has been the growth of commercial and industrial nodes in the formerly outlying portions of the metropolitan areas and along the major transportation corridors connecting metropolitan centers up to several hundred miles apart and thereby producing an intermetropolitan coalescence, such as that along the Northeast Corridor and other corridors throughout North America. The second trend has been a general reduction in urban densities within the built-up areas. This is a reflection, very largely, of the increased flexibility of highway transportation in contrast to that of public transportation that had been used for both persons and goods movement and that depended for its effectiveness on minimum threshold densities to justify the provision of expensive fixed-route facilities. The dispersion of urbanization and of flows have been concomitant. Because the newer developed urban areas are based on dispersed desire lines rather than on relatively few high-density routes, such areas did not need to be developed at densities comparable with those of the older urban areas that constitute, in most instances, the metropolitan cores. On the other hand, the lower densities eliminated the necessity for many high-investment fixed routes and, at the other end of the scale, low-density infrequent branch-line and local services of the common carriers.

These 2 trends, mutually reinforcing, have produced a pattern of low-density urban development, transcending the old limits of most cities and extending beyond the old metropolitan boundaries. Land is urbanized at an accelerating rate. In spite of a recent slowing up of the rate of population growth, as revealed by the 1970 census, there is still a substantial growth of metropolitan populations, reinforced by the out-migration of large numbers of people from the older inner portions of these areas. Not only has

there been a significant numerical increase in the metropolitan populations, there has also been a further increase in the suburban, exurban, and interurban population resulting from out-migration. Superimposed on these trends has been a general trend toward increased affluence, with an augmented demand for more land per person. The ranch house and split-level have replaced, generally, the multifamily apartment house. The planned shopping center, which is essentially an island surrounded by a sea of parking, has replaced on the one hand the old central retail district and on the other hand the streetcar-oriented traditional shopping nucleations and the interminable ribbons of commercial frontage in the older areas of cities. The industrial park with its single-story factories and warehouses has largely replaced the older multistory industrial buildings. In addition, there has recently been a surge of interest in the preservation of open space conveniently accessible to the metropolitan populations. The result of all these trends has been a substantial decrease in the density of population in urbanized areas. This has occurred both in the peripheral areas of recent urbanization and in the older central-city areas that have been partially evacuated and in some instances partially subjected to urban renewal and extensive demolition for highways and other nonresidential uses. The geometric increases in per capita demand for urban land has been superimposed on the increased metropolitan population and the decreasing densities of the older urban core areas to produce a doubling of the amount of urban land in each generation. There is every prospect that these trends will continue.

Among the multiplicity of new urban nodes that has develped in recent years are the "interfaces" or transfer points where goods and people are transferred between interregional and intercity carriers on the one hand and between intracity and intrametropolitan carriers on the other. These include marine terminals, airports, railroad COFC and TOFC terminals, and concentrations of motor truck terminals. Such facilities contribute directly to the economic base of their respective cities and metropolitan areas through the employment and purchases on site as well as through the commercial and industrial establishments that locate within easy access of the available carriers using such terminals. They also have a substantial multiplier effect on employment and purchases of the many suppliers of goods and services that are essential to their construction and operation. The rapidly changing technology of international, interregional, and intercity transportation has played a major role in the rapid evolution of the internal structure of urban and metropolitan activities and land uses.

Except for bulk movement of commodities and fuels that terminates directly at the consuming plants from water carriers, railroads, and pipelines, virtually all goods originate or terminate by motor truck on city streets and intercity highways, regardless of whether the truck is the line-haul carrier. Urban commodity flow studies, therefore, are predominantly studies of motor truck movements. These movements are of 3 types: (a) line-haul truck movements originating, terminating, and passing through the respective urban areas; (b) pickups and deliveries to and from line-haul highway carriers; and (c) collection and delivery of goods to and from other carriers, involving change of mode in which nonhighway carriers perform the line-haul.

In a consideration of the major spatial patterns of truck movements within urban areas as in a consideration of person movements, the local streets may generally be disregarded, except in terms of local access, because the arterials and the expressways perform the overwhelmingly dominant ton-mile transportation. The pattern of major highways, therefore, is the dominant consideration in the planning of industrial and commercial location at the regional scale and is also of importance in residential development.

Except in some of the peripheral areas, the major arterial or preferential street and highway pattern is, literally, inherited from the horse-and-buggy age. It is generally ill-adapted to modern traffic, and, of necessity, has been largely replaced by newer highways, generally limited-access expressways. In this transformation of the urban and metropolitan pattern of movement and of the functional differentiation of areas, the federal Interstate Highway System has played a dominant role. One-third of the investment in that system is in metropolitan areas. In most such areas the system is used by the dominant volume of motor freight traffic as well as by internal passenger movements.

The comprehensive transportation-land use studies provide substantial information relative to the numbers and directions of truck movements, both internal and external, but they do not furnish adequate data regarding the commodities carried or the origins and destinations of the commodities. It is vital that plans be made and techniques developed for obtaining such data.

We do not know, for example, the actual amount of goods required to supply the industrial and commercial establishments or the residential consumers in most cities, much less the volumes handled by each mode. Few of our present statistics, regardless of mode, are broken down into geographically meaningful areas. Just as economists can develop detailed input-output matrices for national areas but generally lack data for smaller areal units, so geographers and planners find data on flows of goods generally unavailable for subnational areal units such as metropolitan regions. Such data are at least as vital for physical planning as input-output data on flows of money and credit are for economic base studies.

The planning of highway locations in cities and metropolitan areas has heretofore been largely dominated by the requirements for person transportation; it is time that goods movements be given at least equal consideration. Without data on the flows of specific commodity groups and major commodities on the urban highways, even though the volume of truck traffic is known and can be extrapolated into the future, the detailed planning of the location, character, and extent of prospective new urban nodes and nucleii is seriously impaired.

Zoning, for example, must provide adequately but not excessively for commercial nodes at and near interchanges and access points along the expressway system, but at the same time it must discourage excessive traffic generation that would impair movement on the nearby access roads. It must provide sufficient but not excessive areas, in the right locations, for clusters of motels, automobile and truck servicing facilities, and retail and service centers that are or will be highway oriented. Also, the relaxation of limitations in many states against "double bottoms"—trucks with 2 or more trailers—gives rise to the problem of adequate provision for, and location of, marshaling yards for the truck-trains, analogous to the railroad classification yards that were, and continue to be, major users of land in and near the large industrial cities. Of particular concern, now, is the question of how to retain and, if possible, enhance the quality of the urban environment in spite of the proliferation of such facilities.

TRUCK TERMINALS

Within the urbanized areas, the intercity movements involve collection and delivery. This traffic shares the highways and streets with the internal movements. Both involve traffic between collection and dispersal points—warehouses, intermodal interfaces, and truck terminals on the one hand and ultimate origins and destinations on the other. With the development of intermodal, unitized cargo handling, including containers, many industries are freed from their former dependence on locations alongside railroads where they depended on private sidings. The railroad freight house and team-track terminal have largely been replaced by the intermodal COFC and TOFC terminal, which need not be, and preferably should not be, located close to the central core of the city. The decentralization of industrial and commercial establishments that generate freight traffic has been paralleled by the decentralization—or at least the movement to peripheral locations—of the freight terminal facilities. Except for heavy industries that depend on bulk movement of raw materials and fuels by rail or water, the highway and street systems have become much more important localizing forces than the railroads.

A major problem in some urban areas is the determination of the appropriate uses of the land formerly used for railroad terminal facilities, not all of which is so related to the general pattern or plan of the city or metropolitan area as to be best used for industry. Whereas many railroads pioneered, decades ago, in the development of organized industrial districts, today such carriers have tended to emphasize their real estate operations, involving not only industrial but diversified land development including commercial concentrations in the cores of the cities where obsolete terminal facilities are being replaced by noncarrier projects and, in some instances, by housing or

other noncommercial, nonindustrial developments in other portions of the regions. In many instances former industrial switching yards have been and are being replaced by nonrailroad uses, as the major classification yards and associated intermodal transfer facilities are being constructed, reconstructed, or enlarged on the peripheries of the built-up urban areas or well beyond them.

In line with these trends, containers and piggyback trailers need not and in many instances are "stuffed" not in proximity to major terminal concentrations but directly at the plants of the shippers. Consolidation, whether by over-the-road motor carriers or by forwarders, can take place in almost any industrial or heavy commercial area accessible by adequate highways. The railroad-oriented locations of carloading companies, formerly characteristic of areas in proximity to railroad classification yards, may be expected to decline in relative importance.

Similarly, the concentrations of motor truck terminals that have developed within the past 3 decades in the larger cities are undergoing rapid change. The proliferation in New York City of truck terminals in the lower west side of Manhattan and across the Hudson in northern New Jersey and the heavy concentration in Chicago of truck terminals on the Near Southwest Side close to the Loop are far from optimal. In the latter city, some of these concentrations were encouraged by the designation of specially zoned districts from which any land uses other than those associated directly with motor trucking were excluded.

Such motor truck terminal concentrations were advantageous in the sense that they permitted minimum over-the-street movements between terminals on interline hauls and transfers between terminals. Also, such locations, peripheral to the central business district but close to the warehouse-light manufacturing districts that surrounded it, allowed transfers of minimum lengths to be made between shippers and consignees on the one hand and the truck terminals—both carrier and forwarder operated—on the other. However, the changes of recent years in methods of merchandising, the rapid growth of industries and major retail centers on and beyond the urban peripheries, and the development of radial-circumferential systems of expressways in the metropolitan areas have caused outlying locations for such motor truck facilities to become increasingly attractive. These are accessible both to the radial routes and to the belt highways, connected in turn with the major intercity and interstate routes. Major shifts are now taking place in the locations of truck terminal and forwarder terminal facilities, which should be considered, not only for themselves but in terms of their effects on industrial and commercial location, in the process of projecting the results of comprehensive transportation-land use studies into the formulation and updating of metropolitan and city plans. As in the case of redundant railroad freight and passenger terminal facilities in the central cores of cities, the reuse of areas of declining importance as truck terminal sites demands investigation.

PORT TERMINALS

In many cities, waterfront cargo terminals have been of considerable significance in the development of land use and circulation patterns. Many cities have inherited remnants of nineteenth century facilities, and the associated concentrations of manufacturing and distribution facilities have now largely or entirely reached the end of their economic life. A large number of coastal, lake, and inland ports have as major elements of their renewal programs the redevelopment, primarily for nontransportation uses, of their downtown waterfront areas since manufacturing, wholesale distribution, water carrier general cargo terminals, waterfront rail freight terminals, and truck terminals have relocated well beyond the congested central areas. New York, Philadelphia, Chicago, Baltimore, Jacksonville, Miami, St. Louis, and San Francisco, among other cities, have in process major renewal programs along their downtown waterfronts; few if any of these involve continuation or rebuilding of freight terminals.

The new technology of general cargo handling—container ships and rapid intermodal transfer on the waterfronts, LASH ships in which barges are loaded aboard oceangoing vessels without break-of-bulk, and roll on-roll off ships, which is the maritime equivalent of rail piggyback—demands increased emphasis on good landward access to the

waterfronts by rail but more particularly by highway and on extensive areas for cargo handling on shore. At the same time the linear extent of berthage for ships in proportion to traffic volume is greatly reduced. A thousand-container ship, with a capacity of about 20,000 tons, can unload and load within a single working day and requires about 700 ft of berthage. Such a vessel contrasts with the conventional break-of-bulk cargo ship of perhaps 12,000 tons that would require a week for turnaround in a typical port and about 600 ft of berthage. Thus, the new vessels represent a quantum leap in scale economies. On the other hand, the vastly greater amount of cargo handled per day creates increased demand not only for freer movement of vehicles to and from the waterfront areas but also for vastly increased land areas. When container ships were first seriously considered, a decade ago, it was believed that 7 to 10 acres of land within the terminal behind the waterfront for each berth would be sufficient. The newer terminals are laid out with 20 to 25 acres per berth. Access roads also demand increased space; turnaround of a large container vessel may involve as many as 2,000 truck movements in and out of the terminal in a single day.

Few cities need be concerned, however, with the problems of development of and access to waterfront general cargo terminals. The tremendous economies of scale, combined with the high costs of construction and operation of the sophisticated modern ships will cause traffic to be concentrated in fewer but extremely efficient ports. Modern highways, together with railroad COFC and TOFC, facilitate the concentration of hinterland traffic at the most efficient ports, while at the same time such ports will continue to generate a major part of their waterborne traffic within and near their own metropolitan areas, as in the past. Other ports will have increasing difficulty in attracting both cargo and ships, and there is a real danger that some will find that their investments in container facilities for general cargo will be financially disastrous. Inland highway, railroad, and air freight facilities permit vast extensions of the competitive hinterlands of the major ports, and, in spite of extensive improvements in the harbor and inland waterway channels, shippers will increasingly tend to favor the major ports. Bulk traffic, on the other hand, will continue to be handled primarily at private facilities, usually in association with industries on adjoining waterfront sites. Such facilities, like those for general cargo, however, demand increasingly efficient handling equipment at the terminals. Major movements, such as those of coal in unit trains, will continue to be concentrated at a very limited number of specialized ports.

There is urgent need for a national port plan, which would indicate the magnitude of the nation's requirements for both general cargo and bulk ports. Such a plan would be of great assistance in preventing overinvestment in harbor and channel improvements, terminals, and inland access facilities. It should indicate for each coast, the Great Lakes, and the inland river system the extent of total port requirements, the approximate number of ports of each type that may be required, and their general locations with relation to the respective metropolitan areas and hinterlands. Proposals for such a plan, or even for a nationwide study of port requirements, has met with resistance; each locality and port organization expects to win for itself a major share of the available traffic. We have an interstate highway plan, a national airport plan, and are now developing a plan for railroad passenger service; a national port plan is equally needed.

AIRPORTS

Among the most important of the newer concentrations of industry in many metropolitan areas are those associated with major airports. The proximity of air terminal facilities, both for passenger travel and for cargo movements, is stimulating the development of new nodes in the urban fabric, not unlike those which were earlier associated with the centrally located railroad freight terminals and which more recently developed in proximity to large railroad classification yards. The Centex Industrial District, associated with O'Hare International Airport on the edge of Chicago, and the complex of industries in proximity to Los Angeles International Airport, for example, are comparable in many respects to the earlier developments of the Central Manufacturing District in Chicago and Los Angeles and the Clearing Industrial District in Chicago, all of which were originally developed to take advantage of the nearby complexes of railroad

freight terminal facilities. The traffic generated by the airports themselves as well as by the associated industrial phalanxes underline the necessity of considering major airports as attractive elements in the pattern of facilities for internal goods movement within metropolitan areas.

Although air cargo tonnage represents but a very small fraction of the total cargo movement to and from metropolitan areas, its importance is far out of proportion, first, because it is composed of high-value, concentrated goods and, second, because it is predominantly in the form of small shipments and generates large volumes of vehicular movement on the highways in proportion to the volume of the goods. Although few airports in themselves can generate sufficient traffic to justify special provision of rail passenger access facilities, the employment generated within major airports, the supplying of the airport personnel, and the symbiotically linked industries in the vicinities of the airports frequently require special provision of highway access. On the other hand, airports, like maritime ports, represent such high investments that few can generate sufficient cargo traffic to require special all-cargo flights by very large aircraft. Because ground transportation is generally required for numerous small shipments to and from airports, pickup and delivery services with airport industrial complexes and air freight terminals as major nodes can frequently combine air cargo with other LTL movements to their mutual advantage. It may be very useful to conduct studies of the traffic-generating potentials of such combinations of multimodal terminals in the vicinities of commercial airports.

SUMMARY AND CONCLUSION

Except for bulk traffic, goods movement in urban areas is dominated by the motor truck, and there is little prospect in the foreseeable future of any major technological change that would reduce the dominance of the freewheeling vehicle on the streets and highways. No other mode of transportation has this flexibility: the ability to serve, door-to-door, the numerous individual establishments and households that generate traffic. On the other hand, the truck, like the automobile, is a relatively uneconomic line-haul carrier. Therefore, in addition to furnishing line-haul service whether by common, contract, or private carrier organizations between cities, the truck has become the originating and terminating vehicle for the overwhelming proportion of intercity movements. The flexibility of the truck in originating and terminating movements is combined with the economies of scale of other modes, whether large truck units on the highways, railroad cars, ships, barges, or airplanes, for virtually all intercity and interregional movements of general freight. It has freed many industrial and commercial establishments from the necessity of locating along railroad lines, and has been a major contributor, along with the automobile, to the deconcentration of both residence and business. Urban density profiles—the gradations from city center to periphery—have less steep gradients, and the origins and destinations of freight movement have tended to become more dispersed than during earlier periods when rail transportation was dominant.

Although railroad lines and port terminal areas continue to be important for some types of industries, an increasing proportion of traffic-generating activity can choose from among many more alternative locations than ever before. For this reason, the availability of the ubiquitous truck has reinforced the necessity for relating the planning of land uses, the urban form and structure, to the location of transportation routes and terminals.

The emerging city is increasingly a multinodal one. Even though the central core may continue to be the largest in each of the respective metropolitan areas, its relative importance will continue to be reduced, with many of its functions taking place in the newer industrial and commercial nodes. Transfer facilities at intermodal terminal areas continue to be important for some types of industries, an increasing proportion of traffic-generating activity can choose from among many more alternative locations than ever before. For this reason, the availability of the ubiquitous truck has reinforced the necessity for relating the planning of land uses, the urban form and structure, to the location of transportation routes and terminals.

The emerging city is increasingly a multinodal one. Even though the central core may continue to be the largest in each of the respective metropolitan areas, its relative importance will continue to be reduced, with many of its functions taking place in the newer industrial and commercial nodes. Transfer facilities at intermodal terminals consitute new focuses of urban activity and new centers for the emerging highway networks. Such facilities include truck transfer stations, railroad and forwarding company piggyback and trailer transfer facilities, air cargo terminals, port terminals, and bulk storage facilities for fuels.

The comprehensive transportation-land use studies, developed from the earlier origin-destination studies and combined with real property inventories as essential parts of the urban and metropolitan planning process, have lagged in not giving as great emphasis to development of models of freight movement as they have to passenger movement. In addition, there is relatively little understanding of the patterns of movement of waste materials or of the cycling and recycling of the total complex of commodities and goods that enter, circulate within, and leave the urban areas. Substantial payoffs may be anticipated from studies of the flows individual commodities in the urban systems, of the relations of such flows to the spatial patterns of industrial and commercial activity and of land uses, of the demands on the transportation systems resulting from increased attention to the environmental conditions attendant on the transformation of economic goods into waste products and of the possible recycling of such wastes, and of the relationships between commodity flows on the one hand and personal movement on the other, both of which share the major routes and facilities serving urban areas.

The planning of future relationships among systems of freight transportation and the location of the various land uses must, furthermore, involve considerations of alternative patterns of movement in order to minimize the total volume of ton-miles generated, just as the more-or-less standardized transportation-land use studies that are now major parts of the planning process consider optimization of the networks of routes for passenger flows. Much of the experience in the development of techniques for studies of the latter can be transferred, with modifications, to studies of commodity flows. The principal difference is in the great variety of commodities, each category of which may involve specialized variables not applicable to the others. The stimulation of research on the development and applications of such studies would constitute a major result of this conference.

INFORMAL DISCUSSION

Donald M. Hill

Why is it so apparent that time and money given to goods movement should be equal to that given to studies of people movement when the primary responsibility for goods movement rests with private enterprise?

Mayer

Delivery and pickup of goods are an important elements in every form of activity that goes on in the city. The environmental effects, including air pollution, noise, and congestion, that goods movement generates are just as important as those generated by passenger movement. Because some of the facilities for goods movement constitute major land uses in themselves, for example, the port terminal areas, the truck terminal areas, and the cargo facilities at the major airports, and are indeed major elements of a city and metropolitan pattern, their location will have a dominant influence on all the other land use and activities that make up the city.

Hill

We do not tell drivers what route to follow or where to park their cars. Why do we think we can tell truckers what route to follow and what they should load and unload?

Mayer

We do tell drivers, do we not? We have all sorts of regulations. We have regulations on speed; we have prohibited turns in some intersections and that sort of thing. Trucks are another form of movement. We do have certain roads, such as parkways, that are prohibited to trucks because of their adverse environmental effects and because of the mutual incompatabilities of the various places to be served by these facilities. It seems to me entirely legitimate to consider truck movements as being in almost every respect parallel to passenger movements. The effect may be more widespread.

David Glickman

You are perfectly correct when you state that there is all kind of opposition to the proposals that have been made by various agencies. However, I wonder whether you are also correct in terms of your analysis of the issue behind your statement. You make the plea for a national port plan, and you suggest that a national port plan would be comparable in terms of national planning to the Interstate Highway System plans, national airport planning, and railroad passenger planning. I would suggest that none of these plans is a rational plan, determined on the basis of the most effective utilization of the facilities required. The proposed passenger rail plan has gaps and segments all through it. It involves an indeterminant expenditure of funds for segmented transportation. The national airport plan, as you call it, is not a plan designed to rationalize aviation movements. This is a plan to service demand as it now exists. This is a very different type of planning from that which you are conceiving of in terms of national port planning.

My second comment is that, in other nations where national port planning has been resorted to, the virtues, or the lack of virtues, are by no means determinant in this point of time. Some nations that have resorted to national port planning have, as you know, slid back. They have, in effect, modified the plans to such a degree that they no longer resemble national port plans. Within our federalized system of government, is national port planning the desired alternative to what we now have, which is essentially a structure of individual, competing ports organized locally and regionally and financed locally and regionally?

Mayer

I did not mean to imply that a national port plan would designate necessarily specific ports, but rather that it would be some kind of an estimate of the demand for ports, perhaps regionally or by companies, and not entirely analogous, obviously, to the airport plan or the highway plan. The Interstate Highway System is a national plan; it is a national network. I would rather not comment on Railpax because I agree with you completely; it has too many missing links and it is not a system.

I think the analogy of port development and competition in private enterprise is not entirely applicable because the ports are (the ports themselves as distinguished from the terminals) public and not private. The channels, also, are public. We do have to have some allocation of our resources, for example, in the federal development of channels. We also have to have some national or at least regional estimates of port requirements to guide investment. The investment in port facilities is very often by public authorities. Bond issues are either revenue bonds derived from the operation of these facilities and, hence, they have to be economically viable and not excessively developed, or they are generally obligation bonds that involve the credit of the local government, whatever it may be. These bonds are brought by institutional investors, insurance companies, and universities, whose own resources have to be allocated.

There is a real ever-present danger of overinvestment. I am not saying that the federal government should dictate which ports should be developed or how they should be developed, but I do think we need at least the first steps in the planning process, and that is some overall estimates of what the future requirements are likely to be in order that the decisions may be on the basis of information broader than just the specific local interests.