Transportation Management Plan for the Chicago Central Area Circulator

Richard J. Hocking and Mark P. Medema, *Barton-Aschman Associates, Inc.*

The economic well-being and quality of the Chicago Central Area is a function of many different factors, one of which is the transportation system. The ability to move people and goods to, from, and within the Central Area is important to its survival. The transportation system must be regularly improved to maintain this relationship. As one of the public transit elements of the transportation system, the Central Area Circulator is a vital part of the needed improvements. The Circulator will provide distributor and circulator service within the Central Area. To perform this function, it needs to access all of the significant land use areas. To do this, the Circulator will make use of existing street right-of-way. This requires close coordination with the other users of these streets. It is these relationships that the Traffic Management Plan (TMP) addresses. The TMP contains three primary elements: description of the principles for managing the transportation system for the Central Area, definition of the strategies and operating policies to uphold the principles, and development of the management actions to integrate the Central Area Circulator into the Central Area transportation system.

The economic well-being and quality of the Chicago Central Area is a function of many different factors. One of these is the transportation system.

The vision for the Chicago Central Area is one of significant growth and improvement. It will continue to enhance its role as a world-class commercial and cultural center. Such activities will increase transportation demand. The regional and Central Area transportation system will need to be improved both in capacity and in quality to serve these needs.

As one of the public transit elements of the transportation system, the Central Area Circulator is a vital part of the needed improvements. It will increase capacity and provide high-quality service. The Circulator will use light rail transit (LRT) technology, operating on rails and powered by overhead wires. Principal features will be

- Thirty-two stations located at about three-block intervals;
- "Proof of payment" fare collection process for fast and efficient boarding;
- LRT vehicles with low floors to provide full accessibility, multiple doors for convenient access, and other amenities to promote a positive transit image;
- Urban design and streetscape features along streets with LRT tracks and at stations;
- Service throughout the day to late evening, with headways of 6 to 7.5 min; and
- A fleet of 30 to 40 LRT cars.

The system will service about 12.9 km (8 mi) of corridor within the Central Area. This will provide access to the commuter rail terminals in the West Loop, the core of the Loop, the North Michigan Avenue area, Navy Pier, Lakefront, and McCormick Place.

The specific improvements will be coordinated with other transit services, and will be located within the public street right-of-way to be compatible with the other users of the street system. It is these latter relationships that the Traffic Management Plan (TMP) addresses; that is, how to incorporate the Circulator into the street system while maintaining other needed street functions. This plan contains the strategies and actions necessary to develop and operate the transportation system to meet the stated goals, objectives, and principles.

The TMP has two primary characteristics. First, it is an ongoing management structure that will be used to address traffic needs and operations on a daily basis. Second, the TMP contains specific operating recommendations that are subject to review and modification as the Circulator project proceeds.

The TMP for the Central Area Circulator has evolved from a three-step process:

- Describe the principles for managing the transportation system for the Central Area;
- Define the strategies and operating policies to uphold the principles; and
- Develop the management actions to integrate the Central Area Circulator into the Central Area transportation system.

Framework for the Traffic Management Plan

The TMP concerns the use of the system of public street rights-of-way. The focus is on the street and alley system as it is used by general traffic, trucks, taxis, buses, and the Circulator. The overall purpose of the plan is to coordinate these modes to achieve needed transportation services.

Perspective

The street and alley system provides for the movement of vehicles and pedestrians and for access to land uses. The right-of-way is largely a fixed asset, although some large development projects can add right-of-way to the system. For this asset to be used effectively and provide the greatest benefit, a concept for management is required.

As the Central Area continues to grow, use of the fixed asset (i.e., right-of-way) will change, or there will be a demand for change. A significant change to the right-of-way will be created by the Circulator. This will affect the function of the street, the allocation of space between general traffic and transit, and revisions to various utility and service activities. The presence of this mode needs to be reflected in the modifications in management of the street system.

The importance of interagency coordination (City of Chicago Departments of Transportation, Streets and Sanitation, Planning and Development, the Police and Fire departments, and the Chicago Transit Authority, Metra, and others) suggests that the implementation, monitoring, and ongoing management of the TMP will require an operational structure. Endorsement and implementation of the plan by this group would be essential.

Purpose and Principles

The purpose of the surface transportation system is to provide the safe and efficient movement of people and goods within and through the Central Area. It must serve several modes of transportation and provide appropriate service to all sectors of the Central Area. It must respect the physical environment and the activities of the land uses.

On the basis of this goal, a series of principles has been defined that will serve to guide the operation of the Circulator within the TMP:

- Transit: (*a*) Transit and pedestrian movements shall have priority over automobile movements; (*b*) light rail vehicles shall operate in exclusive lanes; and (*c*) light rail vehicle movements shall have traffic signal priority over other vehicle movements, except for emergency vehicles.
- Automobiles: (*a*) Vehicle movement shall have priority over vehicle parking, loading, and drop-off; (*b*) automobile trips with Central Area destinations shall have priority over automobile trips traveling through the Central Area; and (*c*) street traffic flow will be maintained at reasonable levels of service for local access and circulation.
- System: (*a*) A functional classification of Central Area streets reflecting these principles shall be established and appropriately implemented and (*b*) the Central Area transport system shall be actively managed, controlled, and enforced.

System Concepts

To translate these principles into a specific traffic management plan for the portions of the Central Area affected by the Circulator, certain system concepts have

been considered. The intention is to use these concepts to create an overall context or framework for the street-specific elements of the TMP. The system concepts are categorized in terms of their setting, organizational considerations, functional classifications, and management strategies. Together, they establish the framework for the TMP.

Setting

Certain key facts about the Central Area transportation system influence the TMP.

1. Regional highway and major street access capacity to and from the Central Area can be expanded only marginally. No new major regional or citywide routes are likely in the future.
2. Regional transit lines still have the ability to increase their line-haul capacity for travel to the Central Area.
3. Air quality standards demand that mobile source (most vehicle traffic) air pollution be reduced. Current trends in national environmental policy development will probably reinforce or enhance the need for better air quality performance for the transportation system in the Chicago region.
4. Within the Central Area, the principal physical resource for the transportation system is the network of public street rights-of-way. Because of the extent of existing and committed development and the value of these land uses, the right-of-way network is largely a fixed resource. It is crucial to use this fixed asset in the optimal manner to achieve the Central Area transportation goals.
5. The street system has a grid configuration. This provides significant flexibility for the user in that multiple paths are available for most trips. Rather than depending on single streets, access and circulation needs can be served by several streets operating in combination.

Organizational Considerations

The concept of traffic management will be implemented taking into consideration the following organizational features:

1. The use of a street is guided by regulatory means, such as restrictions on the use of the curb lane, one-way flow, and turning movements at intersections.
2. The volume of traffic on a given street can be maintained in reasonable balance with available capacity. This can be achieved by controlling the amount of traffic entering the street. Ways of controlling input flow include introducing discontinuity, restricting access to streets by constraining turn movements, and adjusting traffic signal phasing.
3. Access to property by driveways or alleys should be located in such a way as to be safe and consistent with street function.
4. The organization of allowable movements should define circulation paths (e.g., around-the-block circulation) that achieve reasonable access to landuse sectors.
5. The hierarchy of streets needs to reflect logical connections and linkages within the system. These functions change only at intersections or interchanges.
6. The presence of very high concentrations of pedestrians needs to be recognized in the operating strategies.
7. Time management concepts should be used to obtain maximum productivity from the street system.

Functional Classifications

Streets in downtown Chicago serve a number of functions that are determined by such factors as street capacity, traffic demand, and connections to major arteries and public transit routes. The basic street system is defined in terms of three functional classes of streets: primary arterials, major collectors, and local streets (see Figures 1 through 4).

The functional classification of the existing street system will undergo minor revisions with the introduction of the Circulator. The existing classifications serve the city very well. The geographical distribution of arterials, collectors, and local streets provides the necessary through traffic requirements, distribution to and from the expressways, and access to individual land uses. The Circulator alignment and coordinated traffic management concepts attempt to preserve these system characteristics.

Management Plan

Strategies represent operating concepts that are recommended for application to the Central Area street system. These strategies are described in two sets of concepts. The first are broader in scope, defining the means to achieve positive overall system relationships. The second set describes specific actions for the TMP.

System Strategies

System strategies focus on a series of essential relationships that coordinate regional access, area circulation, and land use access. These strategies will be followed in conjunction with three primary system operations: dedicated lanes for the Circulator, a transit priority traf-

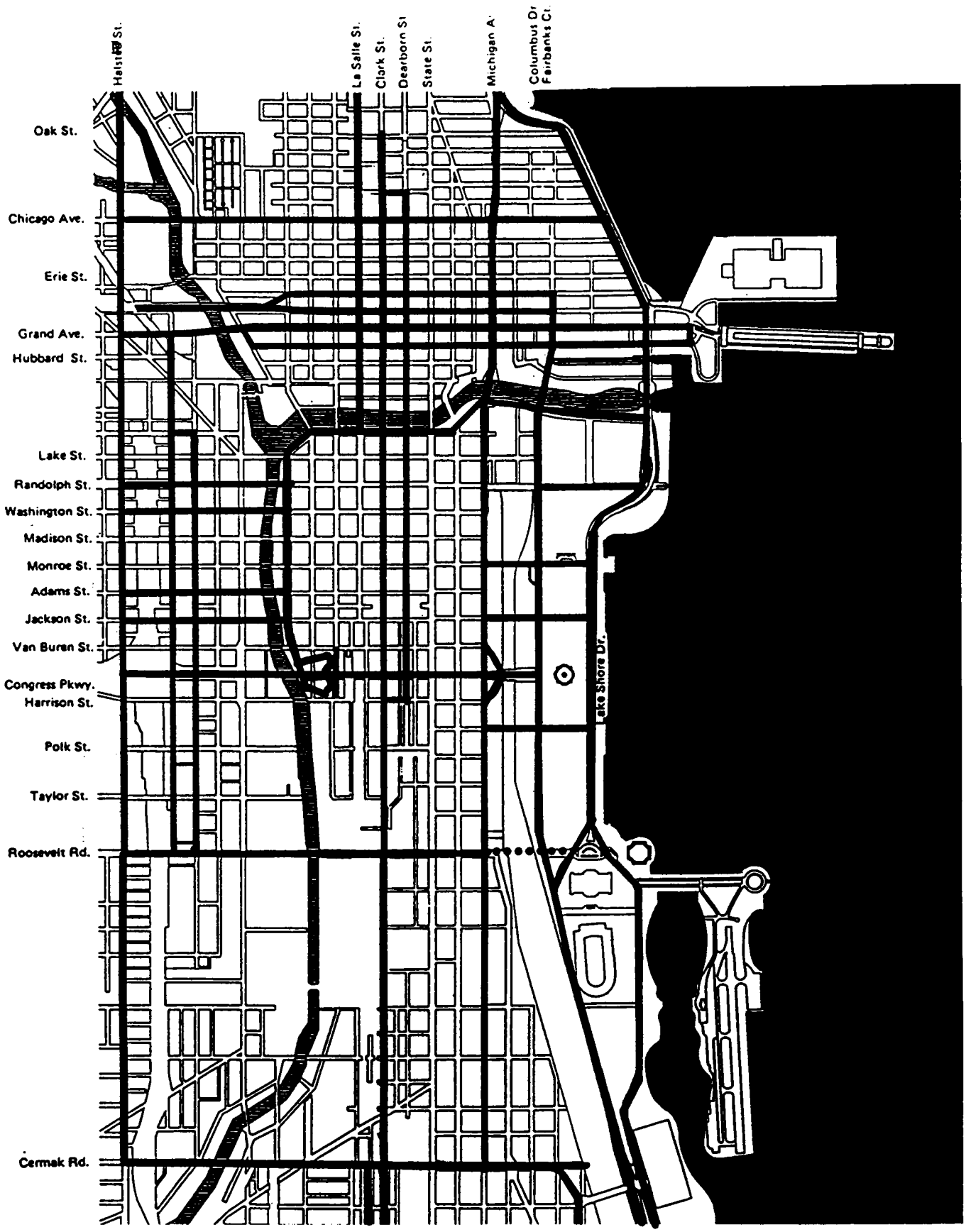

FIGURE 1 Primary arterials.

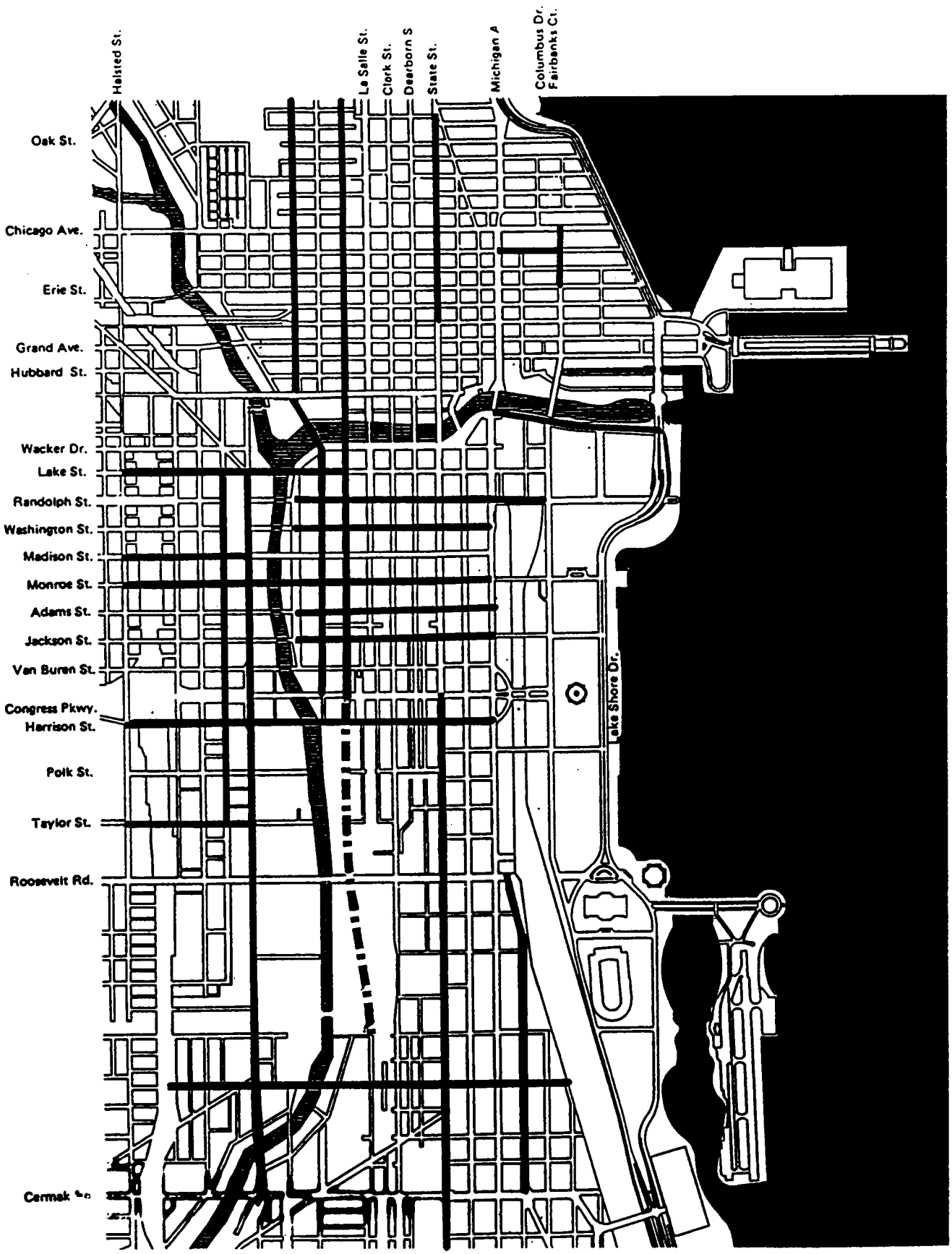

FIGURE 2 Collector streets.

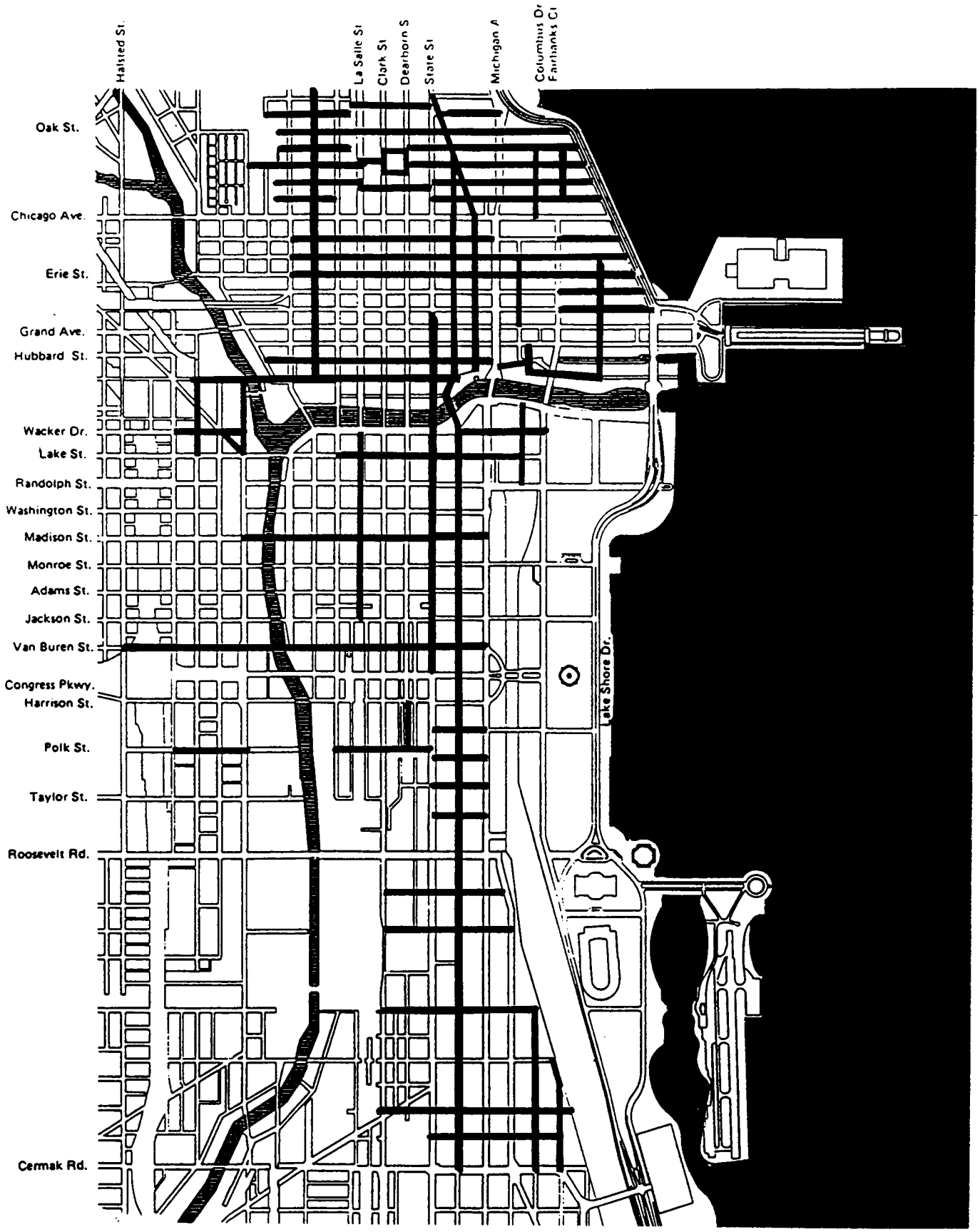

FIGURE 3 Local streets.

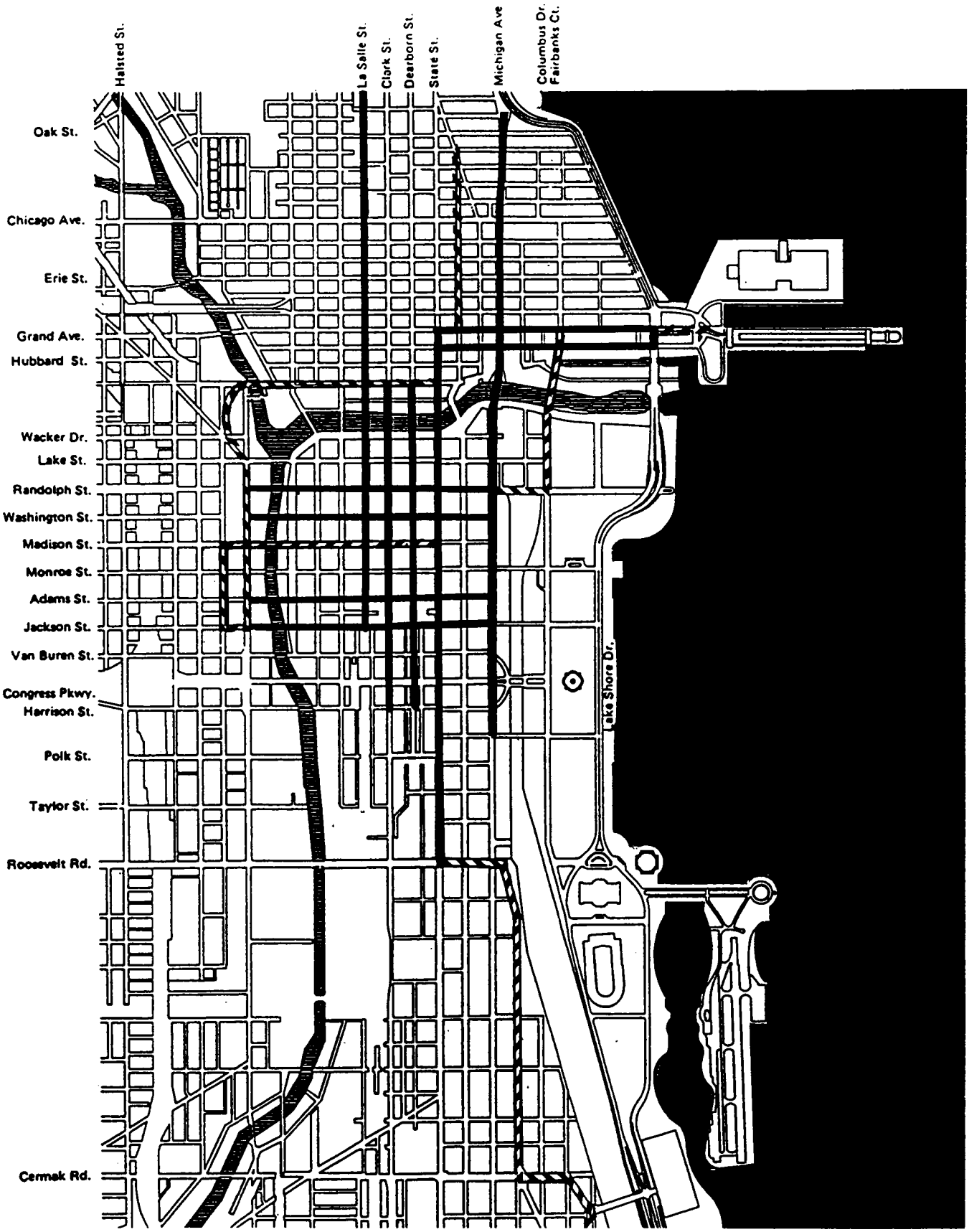

FIGURE 4 Transit priority streets.

fic signal system, and using built-in street capacity by converting parking spaces to traffic lanes. Specific aspects of these operations are as follows:

1. Dedicated LRT lanes are provided for the operation of the light rail vehicles (LRVs). The dedication of these lanes to LRVs will increase the person-carrying capability of the street. A dedicated transit lane can carry up to 11,200 persons per hour. An automobile lane in downtown Chicago can carry nearly 650 to 900 people per hour. A bus lane can carry up to 7,500 people per hour.
2. LRT priority traffic signals are to be provided along the Circulator alignment. The traffic signal system will give priority to LRVs while maintaining safe crossing times for pedestrians and minimizing delays to cross street and parallel traffic. This signal system will support the movement of the greatest number of people through the Central Area with minimal delay. These signals will be coordinated with the rest of the traffic signals in the Central Area.
3. A significant number of Central Area streets devote two curb lanes to parking. Because most of these streets have four-lane-wide pavements, 50 percent of the potential traffic movement capacity is not being used (25 percent for streets with one curb lane of parking). This built-in capacity will be utilized as curb lanes are converted to traffic movement. There has been expansion in the off-street parking system in most sectors of the Central Area to compensate for spaces to be removed from on-street use.

Specific Actions

The TMP comprises a series of features that reflect operating policies and actions. The TMP's specific features are traffic operations (i.e., traffic lanes and traffic controls), pedestrian movement areas, special operations for other vehicles (trucks, emergency vehicles, buses), property access, enforcement of the traffic management system, and safety.

Traffic Operations

The key features of traffic operations will be as follows:

1. Trackway alignments do not close any existing streets to vehicular traffic use.
2. The desired widths of all travel lanes is 3.4 m (11 ft) on city-maintained streets and 3.6 m (12 ft) on state-maintained streets. In many circumstances, given the need to maintain sidewalk widths for pedestrians, travel lanes 3 m (10 ft) in width are used.

At a few intersections where the pavement will be striped to provide a 2.7-m (9-ft) turning lane and an adjacent 2.7-m (9-ft) through lane, travel speeds through the intersection will decrease. However, these intersection approaches will be able to serve a higher demand with two 2.7-m (9-ft) lanes than with a single 5.5-m (18-ft) lane.

In instances where there is a single travel lane 4.9 to 5.5 m (16 to 18 ft) wide, pavement markings will be provided to effectively define a 3.7-m (12-ft) travelway. This will be done to discourage vehicles from driving next to one another in narrow travel lanes over long street segments. These pavement markings will allow stopping vehicles to pull out of the travel lane and not stop through traffic. Where lanes are not wide enough to allow stopped vehicles to pull out of through traffic, stopping shall be prohibited. Stopping shall be further discouraged through the use of urban design techniques.

3. Pavement markings will be placed in the LRV lanes to inform motorists that automobile traffic is prohibited in those lanes. The elongated white diamond and solid white striping will be used. Single wide vehicle travel lanes will also be marked as described above to channel traffic into the appropriate area. The travel paths of turning LRT trains at junctions will also be indicated.
4. Parking is prohibited on Circulator streets. The TMP seeks to prioritize pavement space for traffic movement. The street system has much built-in capacity that is not now being used. This potential capacity can be used to accommodate more transit service while maintaining reasonable operations for other traffic. This would be consistent with the Clean Air Act requirements.
5. Circulation with in the Central Area will remain much the same as at present. The Circulator alignment will not close any blocks to automobile traffic. Certain turning movements will be prohibited to ensure the flow of through traffic.
6. Signalized intersection operations will be managed locally rather than by a central control system; this will provide the needed flexibility to deal with localized variables that may affect intersection operations. This is a system separate from, yet linked to, the Loop traffic control system. The latter is operated by CDOT utilizing a central controller concept. Most of the street intersections that the Circulator will cross will be signalized. Local intersection traffic signal controllers will regulate the allocation of green time to LRV, car, and pedestrian movements.

The allocation of green time will depend on receiving and processing information transmitted from the LRVs and the need to serve all pedestrian movements in a cycle. LRVs will receive priority treatment with respect to allocating green time to LRVs as soon as possible

through the truncation or reduction of green time for conflicting traffic movements. To the extent possible, LRVs will move concurrently with automobile and pedestrian traffic to minimize overall person delay. However, the traffic signal controllers will be capable of providing exclusive green time to specific LRV movements to enhance intersection safety. This is necessary at locations where parallel turning movements of automobiles across the tracks are permitted. The turning movements will require a separate phase and will not be provided during the LRT phase.

An important consideration of the signal timing will be minimization of added delay for streets intersecting the Circulator streets. This is especially significant for streets used by CTA bus routes. Because of the short amount of time needed to serve LRV movements, the use of concurrent (with LRV movement) traffic signal phases, and the provision of safe pedestrian clearance time to cross the Circulator streets, the amount of signal green time for the intersecting streets will not change substantially.

To facilitate overall traffic management operations, the controllers will have the capability of being integrated into the proposed Loop traffic signal system to provide operational status information, and they will be capable of accepting and responding to local commands for vehicle queue clearance. The controller functions will also provide flexibility so as not to preclude integration with future CTA bus priority operations.

The traffic signal controllers will provide timing functions to accommodate eight LRV phases in addition to the normal vehicular and pedestrian phases. The traffic signal controllers will provide separate outputs to illuminate LRV, vehicular, and pedestrian signals. LRVs will receive signal head displays that are distinct from those displayed for vehicular and pedestrian movements.

7. The phasing sequence for the LRV signals varies by location. The first difference is between concurrent and nonconcurrent intersections. Concurrent intersections are where the LRV can move with parallel traffic. This occurs where no turning movements are allowed across the tracks or where a separate turn lane exists so that turning movements can be separated from through traffic. Nonconcurrent intersections are where the LRV requires a separate transit phase and all automobiles must stop. The transit phases will be called as needed. They will be supplied when the signal cycle allows them to be serviced. Limitations in the time available in the cycle length may postpone processing a call until the next cycle.

8. The length of the signal cycle is dictated by the sum of the required individual phase lengths. Limitations exist on the maximum cycle length owing to the amount of time pedestrians and vehicles must wait during a red phase. In the core of the Central Area the pedestrian stop time is most important because pedestrians tend to have a short tolerance (around 30 sec) for stop time. The cycle length should also be a factor of 3,600 sec (1 hr) so that cycles can be coordinated on a clock schedule.

The standard cycle length for the Circulator signals will be 75 sec. This is consistent with the plans for a new signal system in the core of the Central Area. Some existing closed-loop signal systems in the Central Area operate on a longer cycle (e.g., Michigan and Congress). The Circulator cycle length will be able to match the standard 75-sec and the 105-sec closed-loop cycle length systems.

9. The duration of each signal phase is based on the amount of time required to process the required demand subject to a minimum time required for clearance. The duration of an automobile phase is directly proportional to the percentage of total automobile demand moving during the particular phase. This varies by intersection. The minimum time required for each through automobile phase is the time necessary to clear pedestrians from the intersection. This time is calculated by providing a minimum walk time of 7 sec plus a don't walk time equal to the time necessary for a pedestrian to clear the intersection at an average walking speed of 1.2 m/sec (4 ft/sec).

The phase length for an LRV phase is determined by the amount of time required to clear an LRV through the intersection. This is determined on the basis of three factors: speed, length, and size of intersection.

10. Standard traffic control signs identifying the exclusive use of the LRV lanes will be placed outside of the travel lanes and LRV lanes to inform motorists of the prohibition of automobile traffic in the LRV lanes. In locations where special operations are to be undertaken, added signing features will be considered. These will include use of redundant signs, larger signs, and illuminated signals. They will be used where LRVs make turning movements or change lanes, or where traffic across the tracks is prohibited. Low-clearance signs will also be used where the wire height is less than 4.9 m (16 ft). The minimum wire height is 4.3 m (14 ft), which is larger than all legally permitted vehicles. There are a limited number of double-deck tour buses for which special routing will need to be considered because of their height. Clearance signs will be posted with a 0.6-m (2-ft) safety factor for electrical clearance. Signs will be posted at low-volume access drives for either regulator purposes (time-based restrictions) or warning purposes.

Pedestrian Movement

An important element of the TMP concerns pedestrians. Pedestrian facilities require a significant share of the po-

tentially available public right-of-way. From a TMP perspective, the elements for pedestrians will be as follows:

1. Traffic signal phasing will always incorporate sufficient pedestrian crossing time, that is, the time for persons to cross the street walking at a reasonable speed. This is critical for such dense pedestrian zones as Inner Loop, North and South Michigan Avenue, commuter rail stations, CTA rapid transit stations and bus stops, and Circulator stations.
2. Sidewalk widths must be sufficient to accommodate peak movement volumes. Specific guidelines will be found in the Urban Design Plan being prepared as part of the Circulator project.
3. Pedestrian movements are to be managed so that they occur at intersection crosswalks. Measures such as urban design treatment would be instituted to minimize midblock crossing.
4. The pedestrian movement corridors with the highest use potential and need for space are the Loop and North Michigan Avenue corridors.

Other Vehicles

1. Truck operations: The need for goods delivery, service, and maintenance is associated with land use activities in the Central Area. The TMP includes the concept of time management for as much of this demand as can be practicably accommodated. Trucks would be able to use the LRT track areas with authorization when the Circulator is not in operation. Within the Central Area, certain streets are critical for truck and service access. Another critical truck operations component is the alley system. Alleys are most common in the Loop area, providing service for most of the properties. Access to the alleys will be maintained in the TMP.
2. Bus system: The introduction of a supplemental transit system into the downtown street system and the dedication of lanes to the LRV will require modifications to the bus system. The goal of the Circulator project is to discontinue duplicate bus service to reduce trips in the Central Area.
3. Emergency vehicles: The Central Area must continue to be accessible for emergency vehicles. Land uses cannot be landlocked, nor can any facilities be constructed to prevent appropriate access. The TMP maintains access on all streets in the system to allow for this contingency.

Property Access

Within the core of the Central Area, there is significant competition for use of the curb lanes: stopping, standing, parking, through movement, and turning movements. To facilitate circulation, the TMP recommends that the capability to make turning movements be given a high priority. Concerning property access, the TMP recommends the following:

- Access to all properties is maintained: access points are relocated to other streets or alleys where possible, or permitted across LRV tracks if necessary.
- Where driveway access is retained, access is managed by time management or directed by personnel, controlled by signals, or guided by signs and markings.
- Public alley access may be eliminated for vehicle use or may be modified to one-way directions. This is contingent on the need for goods or service access and feasible opportunities to redirect alley access to non-Circulator streets.
- Where alley access is retained, access is managed by time management or directed by personnel, controlled by signals, or guided by signs and markings.
- Curb lanes are prioritized for traffic turning purposes. Loading and service zones may be relocated, provided by recessed bays, or served by time management, or new off-street loading space may be created.
- Special traffic control devices may be needed where the crossing of LRV tracks is permitted. Midblock crossings generally will be controlled by passive measures (i.e., signs). Motorists will be required to use caution when turning, as in the case of a left turn in front of oncoming traffic. The special treatment of the pavement in a different texture and color, as well as the visible barrier separating LRV and automobile lanes on street systems, should reinforce this caution. In instances where there is a high demand for crossing the tracks (e.g., large parking garages) or locations with poor sight lines, an active measure (e.g., a signal) identifying the proximity of an LRV may be placed at the exit of the driveway to control the automobiles entering the street system.
- Plans for future developments should not provide for access locations requiring crossing of tracks. In the planning of future developments, access locations shall be prohibited along an alignment where vehicles would cross the tracks. Access on cross streets should be far enough away from the LRV street so that queues do not extend onto the tracks. Any potential impedance to LRV operations should be avoided.

Enforcement

An important element of the TMP will be enforcement activities. The enforcement concept entails various regulations and managed use of street space. Sufficient resources will be needed to operate the street system. Although an effective traffic signal control system will

manage traffic flow and the best signs and markings will be used, there will be an urgent need for comprehensive enforcement activities, which will focus on seven types of actions in relation to traffic management:

1. A public awareness program is planned before the Circulator goes into operation, including training of police and fire department personnel to coordinate safety and enforcement programs.
2. A special education period during initial start-up time will require traffic control personnel in selected locations, and special delineation devices may be required.
3. The city must maintain a commitment to comprehensive enforcement without relaxation. Enforcement personnel will need to be able to issue citations for any Circulator-related violations. The adjudication process will need to be capable of processing the potential increased volume of such citations. It will be necessary for the courts to impose an appropriate penalty. If not, the credibility and effectiveness of enforcement will be reduced to the point that traffic operations will worsen. Equitable and constant enforcement is needed to achieve overall public support for traffic management regulations. The enforcement activities need to have a response capability. The policy will be to eliminate any track encroachments. The use of towing vehicles and other resources should be quick and efficient.
4. Encroachment on LRT track (i.e., delays to LRT operations) must be prevented. The issue of encroachment must apply to all sections of the Circulator system. Stopping, parking, or traveling along the LRT tracks must be prevented. Also, in a limited number of blocks where the available pavement width (outside of the LRT track zone) is less than 5.5 m (18 ft), the risks of circulation blockage are significant. Regulations prohibiting stopping, standing, and parking would require extra enforcement activities in these areas. These enforcement activities would be focused on locations most likely to have problems or most critical for Circulator or traffic operations.

Minimizing track encroachment would require patrols along the entire system. Seven areas would be considered high priority for encroachment enforcement: in the vicinity of the Chicago & North Western Atrium Center on Madison and Canal Streets, Madison Street between State and Canal Streets, State Street through the mall area to Congress Parkway, Randolph Street between State Street and Michigan Avenue, State Street between Wacker Drive and Grand Avenue, Grand Avenue and Illinois Street between Columbus Drive and State Street, and Wabash between Illinois Street and Walton Street.

With Circulator routes operating on 6-min peak-period and 10-min midday headways, encroachment enforcement needs to be continuous, especially during a normal business day (7:00 a.m. to 7:00 p.m.). These activities need to be coordinated with an incident response team that can quickly remove encroaching vehicles. This process entails various procedures for ordering towing or similar responses, available space in facilities where vehicles are impounded, and information management to document the activities.

5. Traffic signal controls at intersections must be observed. For traffic signal locations, the most critical issue is controlling pedestrian flow. People need to obey the walk and don't walk signals. This is very important at intersections where LRV turns are made or where turning phases for general traffic are included in the signal cycle. For these operations to work without delay, pedestrians will need to be managed. A familiarization period during the start-up time for this system will require the presence of traffic control officers at selected locations.

For the TMP to be effective, the field activities focus on track encroachment and intersection operations. Traffic control officers are present at many Central Area intersections. There are approximately 100 signalized intersections along the Circulator streets. Enforcement is needed most at intersections where the Circulator has turning movements and significant pedestrian volumes are anticipated.

6. "No Parking, Stopping, or Standing" signs along the alignment must be observed.
7. Because of the special nature of the Circulator project, a comprehensive training program is recommended for all involved personnel. This would be especially important in (*a*) assisting traffic control officers to understand the special traffic signal controllers and the signal phasing at key intersections and (*b*) understanding the procedures and communication system between traffic enforcement personnel and train operations personnel; these activities would identify the contingency plans associated with special problems, emergencies, and other disruptions.

Safety

Actions to promote safe operating conditions have the highest priority. These safety measures concern the interaction between LRVs, general traffic, and pedestrians. The keys to a safe operating environment are

1. Clear operating conditions, that is, all motorists and pedestrians understand how they are to use the street system (no confusion or ambiguity);
2. Reasonable operating speeds for LRVs and general traffic in relation to safe stopping distances, including reaction time and space;

3. Appropriate visibility for motorists and pedestrians to see all other traffic movements;
4. Measures to maintain awareness as to the passage of LRVs along any street; and
5. Education programs to continually support safe behavior, especially in relation to obeying traffic controls and the awareness of LRV operations.

Monitoring and Evaluation

An inventory of past, present, and future traffic volume data, such as 24-hr traffic counts and peak-hour traffic counts by turning movement, bus volumes, truck volumes, and pedestrian counts should be included in a transportation data base program. This data base is an essential resource for the TMP and requires hands-on implementation.

Any management plan needs to have criteria developed by which it can be evaluated. The management plan should be constantly evaluated and revised to respond to any changes in conditions. Three criteria have been promoted to evaluate the traffic management plan:

1. Local land use access should be maintained (at locations where access is not available from other streets and alleys).
2. Circulation of traffic should be maintained at a level where queuing at intersections does not disrupt traffic flow at upstream intersections. The primary approach to developing workable traffic conditions is first to assess the peak-hour queue conditions at intersections under future-volume conditions with optimized signal timing. If queue spillback is evident and no geometric or design improvements are available, an assessment of possible routes for traffic diversion is made to reassign future traffic volumes to the post-Circulator street system. Queue conditions are then reevaluated, and the process continues until equilibrium is reached.
3. Person delay should be minimized. The person capacity of the street system depends on the type of vehicle in use. Because transit vehicles carry more people than do automobiles, a transit lane can provide substantially more person capacity than an automobile lane. Person delay is a measure of the amount of time that a person traveling on any mode is delayed at an intersection. It is similar to the concept of vehicle delay, which is more commonly used in defining traffic impacts. The key difference between the two measures is that vehicles that carry more people can incur varying amounts of delay. Thus, a person traveling on an LRT system that has priority signalization at intersections would experience less delay than a person traveling the same route in another type of vehicle (e.g., bus or automobile). Priority signalization minimizes the delays to the modes transporting the greatest number of persons. Because LRVs would, on average, experience less delay at intersections and carry more passengers than would automobiles and buses, total person delay is lower. Evaluations of typical intersection level of service are based solely on vehicular capacity and delay; they do not account for the substantial reduction in person delay that results from the transit service.

None of these address the current "acceptable" criteria in use that dictate the free flow of traffic by use of the level of service (LOS) scale (LOS C or D is a typical standard). Because LOS deals entirely with average vehicular delay at an intersection, it is not suited to addressing new transit modes in an urban setting.

Implementation

The recommendations outlined in this paper will require interagency coordination and approval by a number of different city and state agencies. Each policy decision should be agreed upon by the city of Chicago. The specific strategies and actions outlined should be adopted by the separate departments responsible for various functions of the city, including the Department of Transportation, Department of Planning and Economic Development, Department of Revenue, Department of the Environment, Department of Law, Department of Consumer Services, and Department of Streets and Sanitation. Also, a number of ordinances will need to be passed by the City Council to allow implementation of this plan.

These implementation conditions will be challenging requirements. The commitment to ongoing management and enforcement must be maintained at a high level. The Central Area is a complex environment. Managers will need to be alert to changing situations.