EXHIBIT B
WEST 6TH STREET ACCESS MANAGEMENT PLAN

West 6th Street Access Management Plan

Douglas County, Kansas

City of Lawrence, Kansas

May 27, 1998

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Section One

INTRODUCTION

Much of the recent development expansion in the City of Lawrence has occurred in the northwest quadrant of the City. This growth has been encouraged through major capital investments, such as the new high school and the South Lawrence Trafficway. In response to the rapid development trends, the Lawrence-Douglas County Metropolitan Planning Commission prepared a development plan for the area north of 6th Street and west of Folks Road. This plan, entitled The Northwest Plan, was intended to guide development "to create a safe, convenient, predictable, satisfying and aesthetically pleasing living and working environment". One of the goals of the plan was to outline appropriate land use in the area. Another goal of the plan was to promote West 6th Street as a four to five lane arterial with few crossing intersections.

In conjunction with the City and County having an interest in the preservation of West 6th Street as a principal arterial street, the Kansas Department of Transportation (KDOT) has identified West 6th Street (U. S. Highway 40) as a priority corridor in their Corridor Management Policy. The West 6th Street Access Management Plan is the result of the City/County/State partnership in seeking to establish practical guidelines and design standards for the improvement of West 6th Street.

The development of the West 6th Street Access Management Plan followed a progression of both policy and technical input to arrive at the final recommendations. At the very outset of the study, a public forum was held to provide community citizens with an opportunity to pose questions and to voice opinions and concerns. The comments made in the public forum were considered along with the guidelines for West 6th Street development presented in The Northwest Plan, as the technical process moved forward.

The technical process began with the development of future traffic forecasts. The Lawrence Douglas County Metropolitan Planing Office (MPO) is equipped with a countywide traffic simulation model which can be used to replicate traffic volumes on the major street network from land development densities. Future traffic projections for West 6th Street were developed from anticipated future land uses as presented in The Northwest Plan.

These future traffic projections were assigned to West 6th Street from the adjacent land parcels under four different access scenarios. The first scenario was the most stringent. That scenario represented access to West 6th Street as presented in The Northwest Plan: only one point of access between Wakarusa Drive and the ramps for the South Lawrence Trafficway. This three quarter mile access scenario was consistent with the intent of the KDOT Corridor Management Policy. The second scenario represented access at half mile spacings: Wakarusa Drive, Queens Road, George Williams Way, and the South Lawrence Trafficway. The third scenario, was more liberal still, in providing full access on quarter mile spacings. The fourth scenario provided full access at quarter mile spacings and right-turn only access at eighth mile points.

Once traffic forecasts had been assigned under these scenarios, the future traffic operation at each intersection was analyzed, and the quality of the traffic flow was rated using federal guidelines.

In addition to recommending an access management policy for the development of West 6th Street, the West 6th Street Access Management Plan also presents recommended design guidelines, such as appropriate travel speeds, roadway sections, right-of-way needs, and pedestrian considerations.

The recommendations of the study include a four lane median divided arterial with a posted speed of 45 m.p.h. Full access to West 6th Street would only be allowed at quarter mile spacing.

Section Two

THE NORTHWEST PLAN

The purpose of the West 6th Street Access Management Plan has not been to challenge decisions that have previously been adopted by the community, but rather to build on them. To that end, the recommendations and guidelines presented in The Northwest Plan and adopted by the Lawrence City Commission January 7, 1997, provided the starting point for the development of the West 6th Street Access Management Plan. With reference to West 6th Street, The Northwest Plan identifies the following issues:

"West Sixth Street is promoted as a 4-5 lane major arterial with few crossing intersections, one being at Wakarusa Drive."

"West Sixth Street is classified as a principal arterial. Horizon 2020 describes the purpose of a principal arterial as being of great importance "...as they connect major traffic generators such as the central business district to other major activity centers...Since movement, not access, is the primary function, access management is essential to preserve capacity and enhance safety as early as 1988, in an interlocal agreement between the County and the City, it was recognized that "...direct access for the development adjacent to the Trafficway and to West 6th Street, west of Wakarusa Drive, shall be by frontage or intersection roads to be paid for by the owners of new development", and individual driveway curb cuts onto West 6th Street, west of Wakarusa Drive, was to be prohibited. The policy was reiterated in an interlocal agreement dated February 15, 1993, as "...the County and City agree that West 6th Street shall develop as a limited access roadway with access only at its intersection with arterial or collector streets and with frontage and intersection roads paid for by the owners of new development." That agreement also called for the aggressive pursuit of state funding for improvements to West 6th Street.

Transportation 2020 designates improvements to West 6th Street as a priority. According to the improvement project application submitted for state funding on September 26, 1996, the "...project would reconstruct the existing two-lane roadway to a four-lane arterial street with a landscaped median, and protected left turn bays at designated full access intersections".

"In any planned improvement of US 40 Highway/W. 6th Street west of Wakarusa Drive, construction of a separate multi-use path south of and parallel to the street is recommended."

The access to West 6th street anticipated by The Northwest Plan has been pictured in the Figure 1 excerpt which shows one access point to West 6th Street between Wakarusa Drive and the South Lawrence Trafficway.

Section Three

KDOT CORRIDOR MANAGEMENT POLICY

KDOT published the Corridor Management Policy for the purpose of assisting "local government units, KDOT employees, Metropolitan Planning Organizations (hereafter MPO's), architects, consulting engineers, contractors, developers and the general public with the criteria and procedures necessary to obtain reasonable access to abutting properties while maintaining safety and efficiency in the movement of people and goods on the State Highway System."

"A higher level of performance (fewer access points) will be required for higher class routes, routes (or segments) that are expected to experience substantial development/growth and locations where highway improvement projects are programmed or are likely. To achieve this principal and meet the stated goals, criteria for issuance of Highway Permits will reflect the importance of a corridor to the State Transportation System. Criteria for access will be based, in part, on the route classification system under the following categories:

A Routes: All routes on the Interstate Highway System. These routes are to be protected by full access control.

B Routes: This category not only applies to all B routes on the State Highway System, but also to all non-Interstate routes designated on the National Highway System regardless of route classification. Further, this category applies to all segments identified as a "growth corridor".

These routes are to be protected by allowing for direct access only when alternative access is infeasible. When direct access is necessary, shared access will be required whenever possible.

West 6th Street (US Highway 40) is classified as a B Route in a developed area, with type 6 access (high volume with 500 vehicles per day and over).

The general spacing goal presented by the KDOT policy is consistent with those adopted in The Northwest Plan.

Section Four

PUBLIC FORUM

On March 16, 1998 a public forum was held in City hall to obtain comments from the general public pertaining to the project. Comments presented represented a wide range of viewpoints. Some members of the community expressed their desire for protecting the integrity of West 6th Street to carry traffic, while others expressed their desire to have access directly onto West 6th Street, while still others expressed a point of view somewhere between the two positions. A brief presentation was made by Land plan Engineering, speaking on behalf of several property owners who have property adjacent to West 6th Street. Land plan Engineering presented a consorted development plan representing the development and access desires of those several property owners. The plans presented depicted 13 breaks in access onto West 6th Street between Wakarusa Drive and the South Lawrence Trafficway east ramps, inclusive.

Section Five

TRAFFIC FORECASTS

In order to determine what level of access West 6th Street will be able to sustain and still maintain quality traffic flow, projections of traffic demands for the year 2020 were developed. The MPO had previously developed a traffic simulation model for the Douglas County area. This model, QRS2, works on the principal of relating land use to traffic generation, and assigning that traffic to a coded street network. The validity of the model can be verified when employment and housing census data coded into the model reasonably generate and assign traffic to the models street network, which volumes can be verified with actual traffic counts. Once the model has been properly verified, it can be used to test the impact of future land development on the existing street network, or the effect on future or existing traffic, resulting from a major roadway improvement.

The land uses used to develop the traffic forecasts were those identified in Horizon 2020 and The Northwest Plan. These general land use patterns are reflected in Figures 2 and 3. The MPO staff furnished the project consultant a projection of the future land development densities for the City of Lawrence and Douglas County, along with a copy of the model street network. The model was then modified to reflect future traffic demands based on land use projections along the West 6th Street corridor. A description of the modification parameters has been included in the technical appendix. These future traffic demands were assigned onto four different street network scenarios. The scenarios differed from each other in the frequency of access onto West 6th Street.

- The first scenario represented the access spacing as depicted in The Northwest Plan, with only one break in access between Wakarusa Drive and the South Lawrence Trafficway.

- The second scenario depicted breaks in access at approximately half mile spacings between Wakarusa Drive and the South Lawrence Trafficway.

- The third scenario depicted breaks in access at quarter mile spacings.

- The fourth break in access scenario depicted the same quarter mile spacings as scenario 3, plus right turn only breaks at eighth mile points.

A factor of ten percent of the daily traffic projections provided by the model was used to estimate future peak commuter hour turning movements. Figures 4, 7, 10, and 13 depict the peak hour traffic demands for each scenario for the year 2020. These peak hour traffic demands provided the basis for assessing the quality of future traffic flow that could be anticipated for each scenario.

Section Six

TRAFFIC FLOW QUALITY

The quality of traffic flow at intersections is defined on the basis of average vehicle delay. The Highway Capacity Manual presents a calculation methodology for assigning the quality of traffic flow, or level of service (LOS), a grade between A and F, based on average vehicle delay. Figures 6, 9, 12, and 15 depict the intersection levels of service in the West 6th Street corridor. The number of through and auxiliary lanes required to achieve those levels of service have been depicted in Figures 5, 8, 11, and 14. The Highway Capacity Manual defines different level of service calculations for stopped controlled intersections than for signalized intersections. In order to establish the appropriate type of intersection traffic control for each intersection, the projected peak hour traffic demand for each intersection was compared to actual signal installation warrants as defined in the Manual on Uniform Traffic Control Devices (MUTCD). The MUTCD contains legal guidelines for traffic control installation in the state of Kansas. Those intersections appearing to have peak hour entering traffic sufficient to warrant signalization, were so identified for the analysis purposes. All others were considered to have stop sign control for analysis purposes. The capacity analysis calculations have been included in the technical appendix. The capacity analysis also provided results by which the adequacy of intersection spacing to accommodate traffic queues at signalized intersections entirely between adjacent intersections, was assessed. The analysis showed that in all scenarios the spacing was sufficient between intersections so that traffic queues would not spill back from one intersection to the adjacent intersections. The queuing reports have been included in the technical appendix. The total vehicle delay projected for the corridor during the analysis period for each scenario has been summarized in Table 1.

Table 1
Total Peak Hour Vehicle Delay

Scenario	Total Delay (Vehicle-Hours)
3 / 4 Mile Access	64
1 / 2 Mile Access	65
1 / 4 Mile Access	117
1 / 8 Mile Access	105

The capacity analysis software also provided an assessment of whether the intersection spacing would be conducive to effective signal coordination. In all scenarios the analysis indicated a strong benefit in coordination between the South Lawrence Trafficway interchange ramps, and between near intersections on West 6th Street and the north frontage street. Coordination could be achieved along West 6th Street on all scenarios. The coordination assessment reports have been included in the technical appendix.

The results of the analysis show that the ¾ mile spacing of access provides the least overall vehicle delay along West 6th Street. However, because the future developments would obtain access to West 6th Street only through a few points, the reverse frontage road, Overland Drive, would need to be constructed to a five-lane template in order to adequately collect and distribute the traffic for that scenario. Furthermore, the need for double left turn lanes on West 6th Street and on Overland Drive to accommodate the heavy turning movements would require wider medians on West 6th Street, and would require wide medians on Overland Drive, which would tend to limit access on a street designed to provide access. Double left turn lanes would also be required on the cross streets, as depicted in Figure 5.

Similar results were obtained from the ½ mile spacing scenario. Although overall vehicle delay on West 6th Street ranked very close to that experienced by the ¾ mile spacing scenario, a five-lane road section would still be required for Overland Drive. Double left turns would no longer be required for West 6th Street, but would still be required for two of the cross streets, as depicted in Figure 8.

Although the results of the ¼ mile spacing scenario showed a substantial increase in the calculated vehicle delay along West 6th Street, the individual levels of service at each intersection was shown to be acceptable. Under this scenario, fewer auxiliary turn lanes would be needed, and no double left turn lanes would be required. Overland Drive could accommodate traffic demands with a three-lane road section without a median, thus providing ready access to the road, which would be its intended purpose.

The results of the fourth scenario would be very similar to the results of the third scenario as to vehicle delay, level of service, and roadway template on Overland Drive. However, because West 6th Street will be a high speed roadway, it would be important to provide auxiliary lanes for right turning traffic to accelerate and to decelerate for those movements, out of the through traffic stream on West 6th Street. This would require a dedicated right turn lane along the full length of West 6th Street, thus creating a seven-lane road section instead of a five-lane section.

The results of the analysis reveal certain advantages and disadvantages for each scenario. As an aid in comparing the pros and cons of each alternative access scenario, a decision matrix has been developed as Table 2.

Table 2
Alternative Decision Matrix

Access Scenario	W. 6th St. Combined Delay (Veh-hours)	Number of System Signals	Width of W. 6th Street (feet)	Width of Overland Drive (feet)	Minimum Intersection Level of Service
3/4 Mile Spacing	64	6	86′	86′	C
1/2 Mile Spacing	65	8	74′	74′	C
1/4 Mile Spacing	117	9	74′	40′	D*
1/4 Mile Spacing With 1/8 Mile right turns	105	9	98′	40′	D*

*Intersection of Wakarusa & West 6th Street only; All others LOS C or Better

The results of the comparison indicate that the quarter mile spacing provides adequate level of service while minimizing the width of the roadway templates needed. The quarter mile access scenario is recommended as the overall alternative to most cost effectively meet the needs of the corridor. With this scenario, it is recommended that Overland Drive be located no closer than a quarter mile north of West 6th Street, and that full access onto the cross streets not be provided closer than 300 feet north or south of West 6th Street.

Adoption of the recommended spacing scenario would require amendment of The Northwest Plan.

Section Seven

DESIGN CRITERIA

A Policy on Geometric Design of Highways and Streets (AASHTO) provides guidelines for arterial street design. These guidelines have been applied to West 6th Street as described in The Northwest Plan and Horizon 2020.

Typical Sections

The expectations for the improvement of West 6th Street, as identified in The Northwest Plan, to a four lane arterial with a landscaped median and a parallel pedestrian and bike path, establishes the character of the West 6th Street arterial improvement. Acceptance of the basic improvement concept adopted in The Northwest Plan defines the typical street section to be constructed. Figure 16 depicts the two applicable typical sections that are recommended for West 6th Street. The sections depict four 12 feet wide through travel lanes and a 22 feet wide center median area of sufficient width to provide for one auxiliary left turn lane, and a remaining median wide enough to accommodate a 30 inch sign along with adequate clearance, at intersections. Outside the street, the sections depict a 6 feet wide sidewalk on one side, and a 10 feet wide bike and pedestrian path on the other. The normal right of way width would be 100 feet with 50 feet wide easements on both sides. At intersections where auxiliary double left and right turn lanes will be needed, an additional right of way width will need to be acquired. Lighting foundations have also been depicted in the typical sections. Adequate lighting is important to the safe operation of an urban arterial.

Consideration was also given to other possible roadway templates, including four lanes only, and four lanes with a center dual left turn lane. Although it may at first appear that these roadway templates could function equally well as the five lane with median section, such is not the case. Medians provide the following value items to a project:

- On a high-speed arterial such as West 6th Street, raised medians provide the important function of separating opposing traffic flows.
- Medians also function to channelize turn movements at intersections.
- Medians can also provide opportunities to enhance roadway aesthetics.

In view of the advantages of medians for this type of facility, the construction of medians is recommended for West 6th Street, consistent with the previous planning and grant application.

Design Speed

The basic design parameter on which other design criteria are dependent is design speed. Based on the intended function of West 6th Street as a primary arterial in a developing area, a design speed of 50 mph would be appropriate. Curbs are an acceptable edge treatment for urban streets at that design speed. At higher speeds or in a rural setting, shoulder treatment should be considered instead of curbs. It is recommended that the posted speed on West 6th Street be established 5 mph under the design speed.

Section Eight

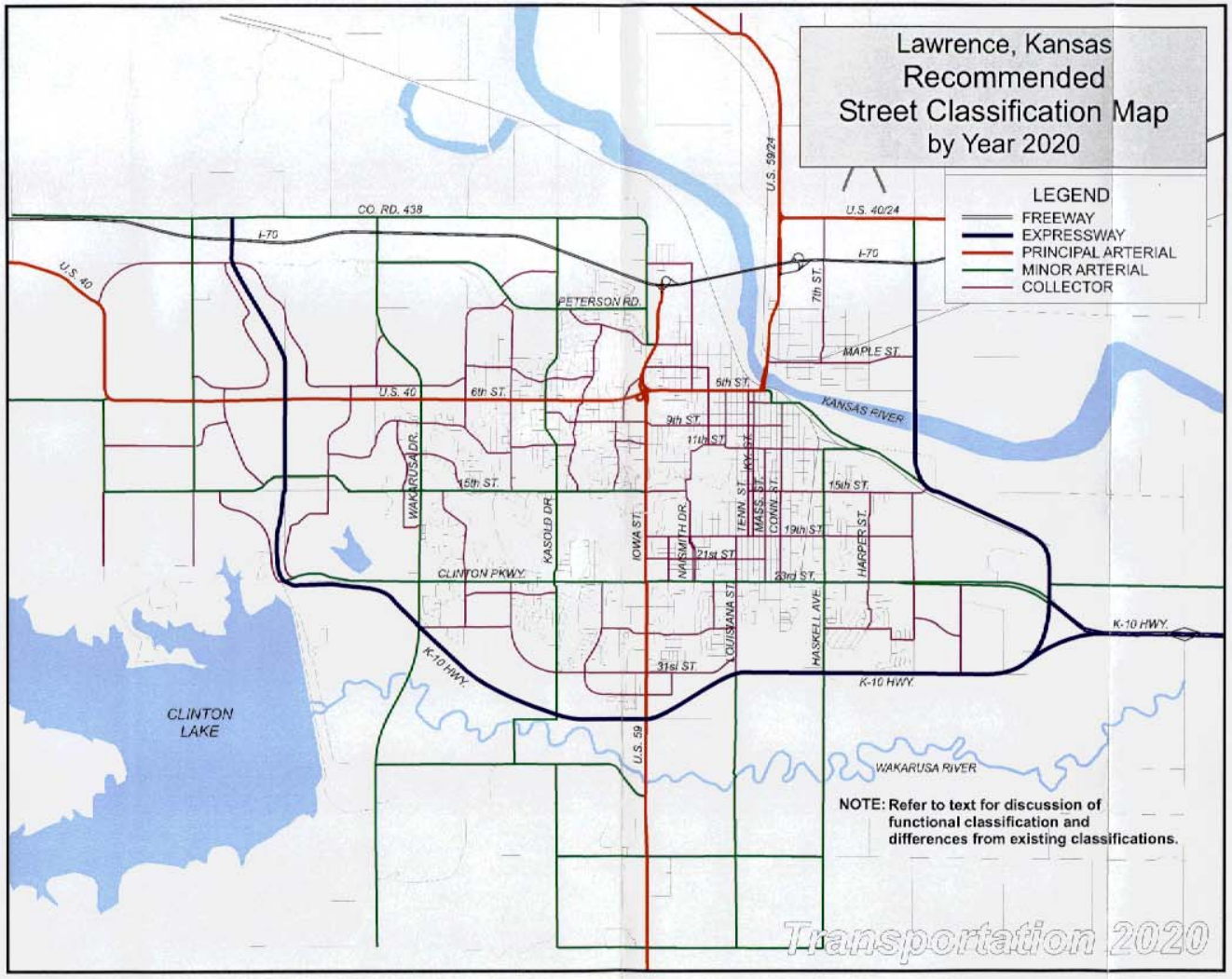
SUMMARY

The results of the literature review and the analysis indicate that based on the projected 20 year development growth in northwest Lawrence, West 6th Street could operate at an acceptable level of service with the minimal infrastructure investment under the ¼ mile full access scenario. This recommended access scenario would meet KDOT's access requirements, but would not meet the City's guidelines as presented in The Northwest Plan, which would need to be amended with reference to access spacing.

The Northwest Plan has identified the improvement of West 6th Street to consist of a four lane street with a landscaped median and a parallel bike path. Typical sections consistent with that definition were developed to illustrate the use of the required right of way of 100 feet and 50 feet easements. These design features are still appropriate for West 6th Street. A design speed of 50 mph has been recommended as appropriate for this facility.

Overland Drive would be a three-lane roadway template.

Figures



This map was changed recently by TAC. 23rd, east of Iowa, became a minor arterial.

Figure 1: Recommended Street Classification

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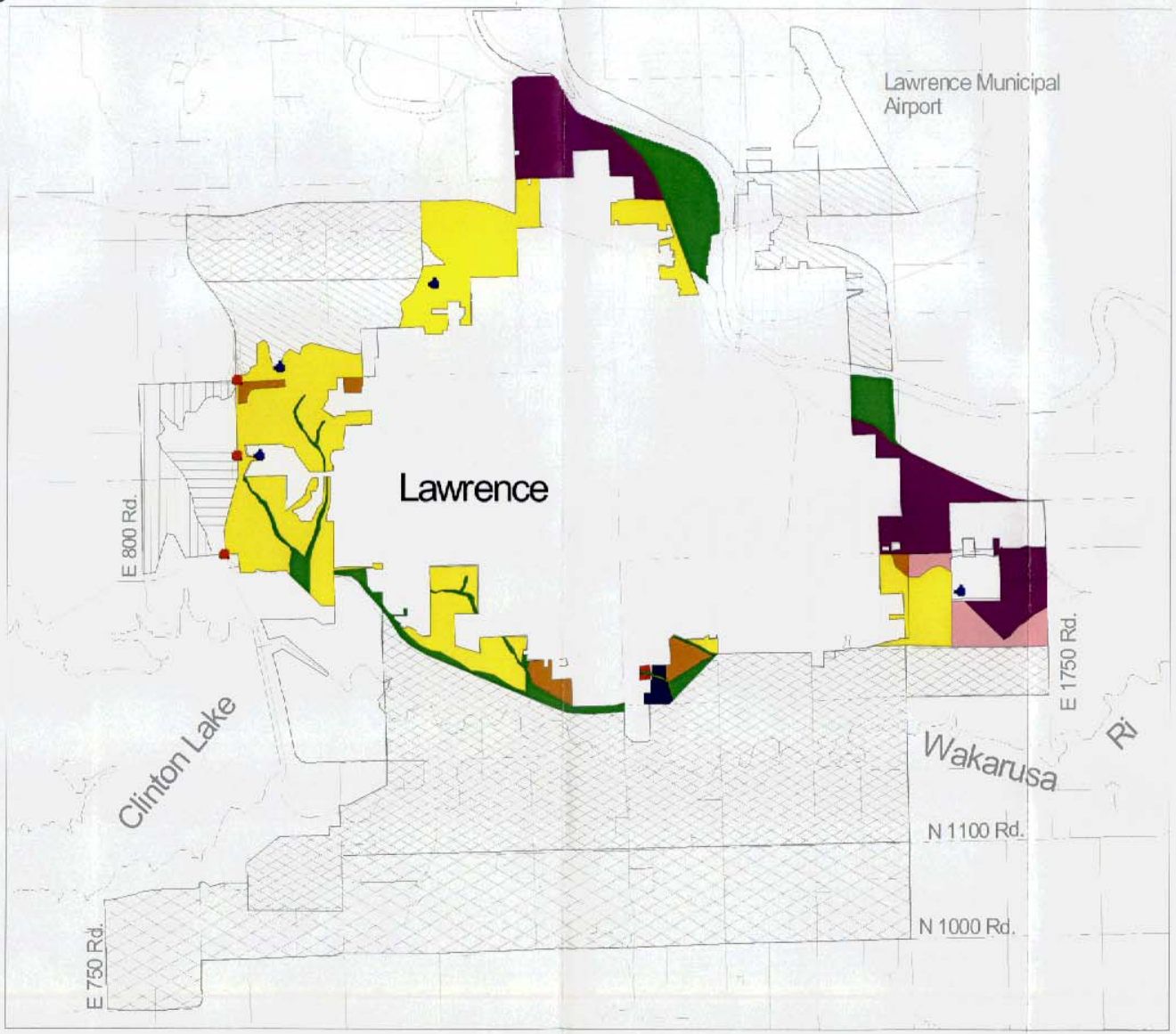

Figure 2 Urban Growth Area - Service Areas 1 through 4 (future land use).

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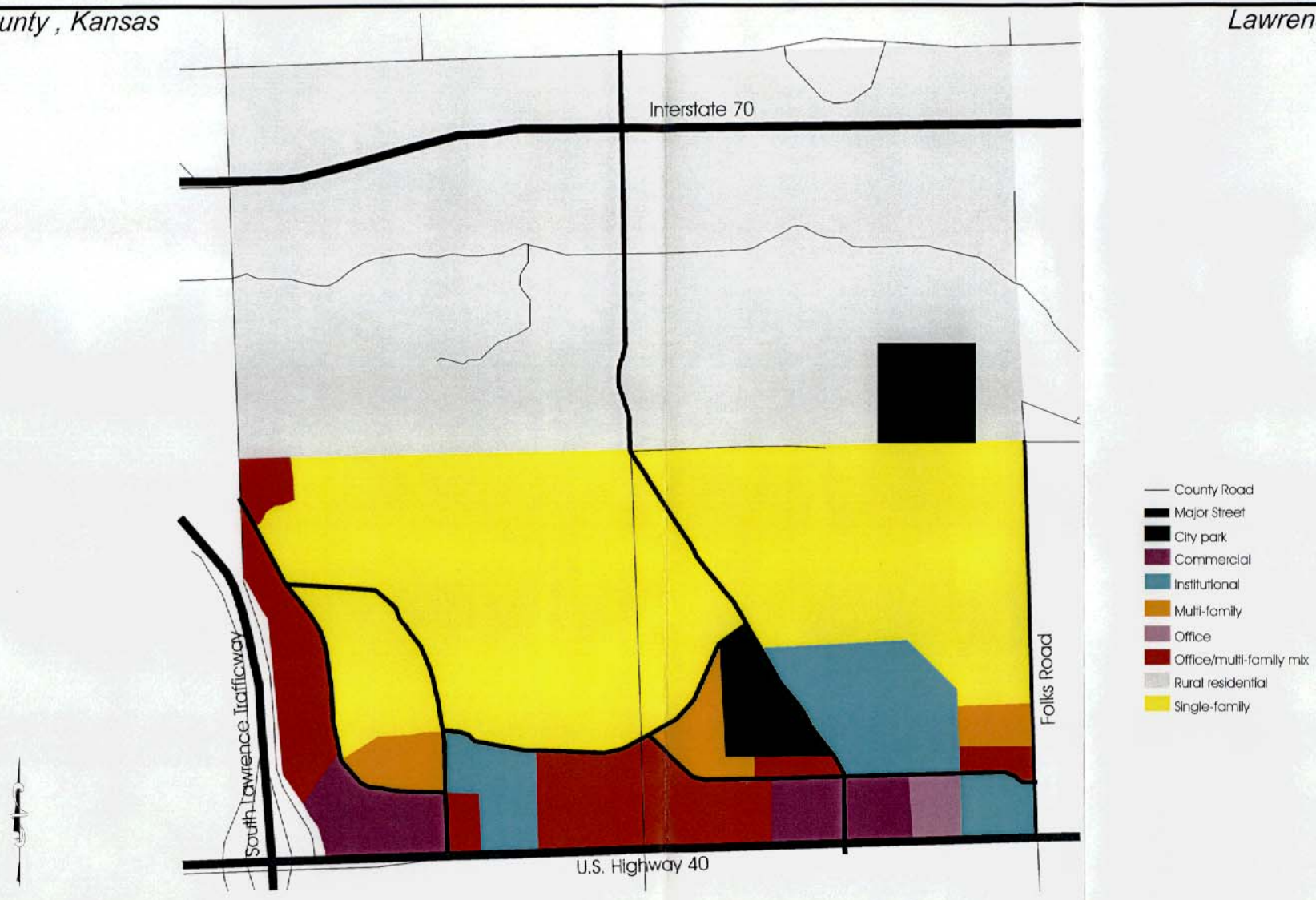

Note: Actual environmental conditions which place constraints on development are not shown on this map. Refer to the comprehensive plan for guidance on environmental condition maps, studies, and policies.

Lawrence-Douglas County Metropolitan Planning Office
October 2, 1996

Figure 3 The Northwest Area Proposed Land Uses

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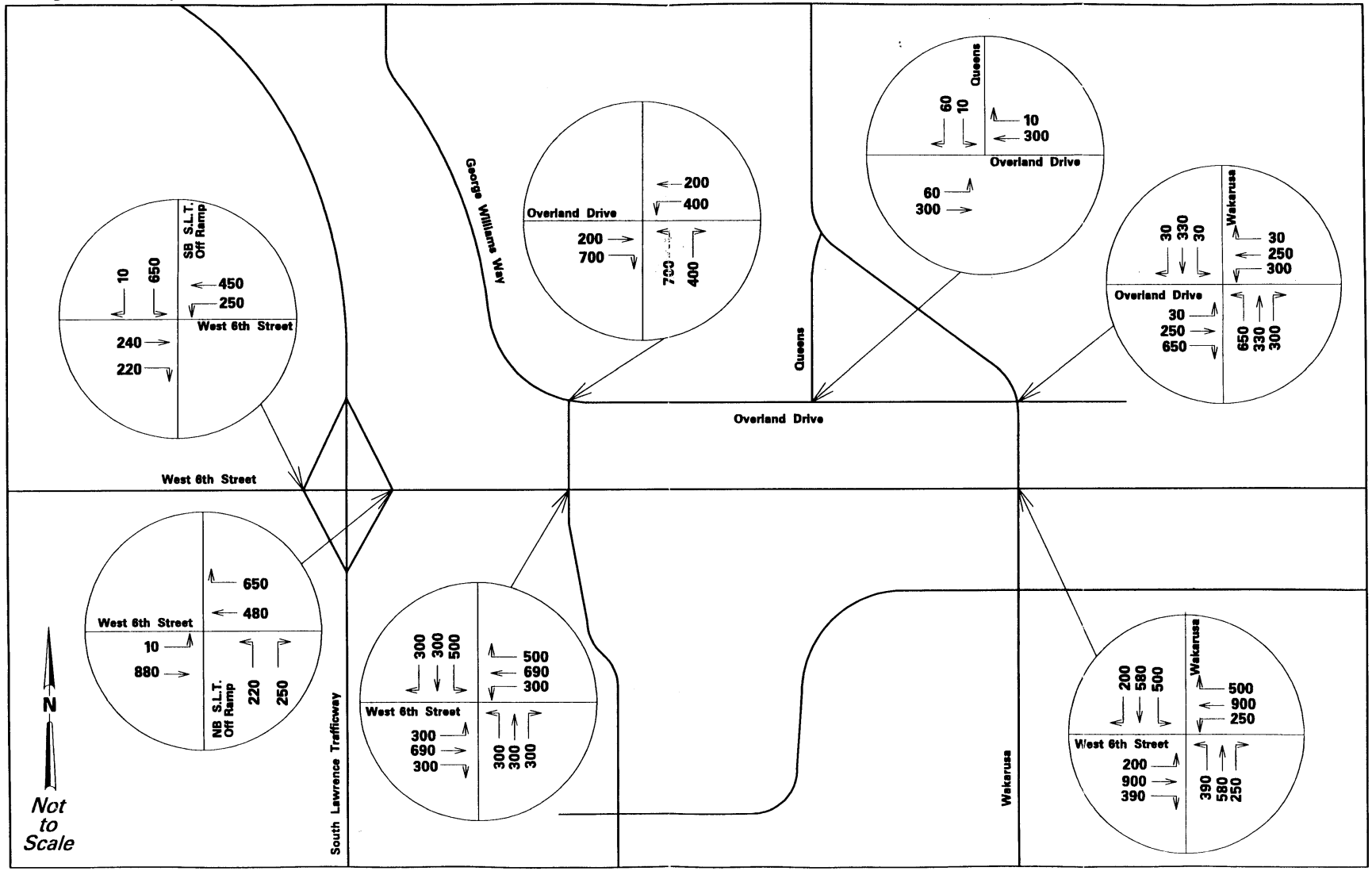

Figure 4 Scenario 1 (3/4 Mile Spacing) Peak Hour Volumes

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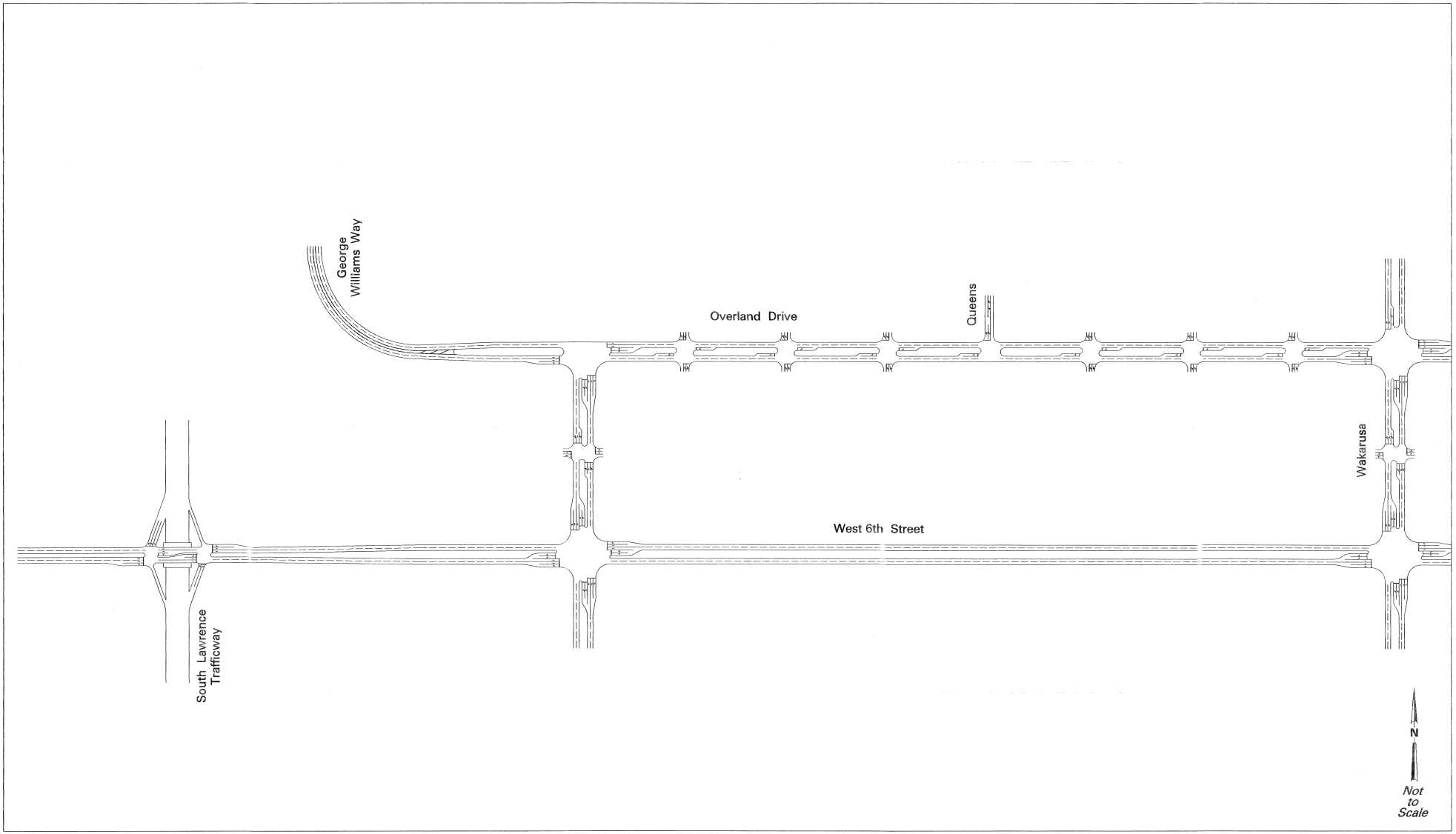

Figure 5 Scenario 1 (3/4 Mile Spacing) Lane Configuration

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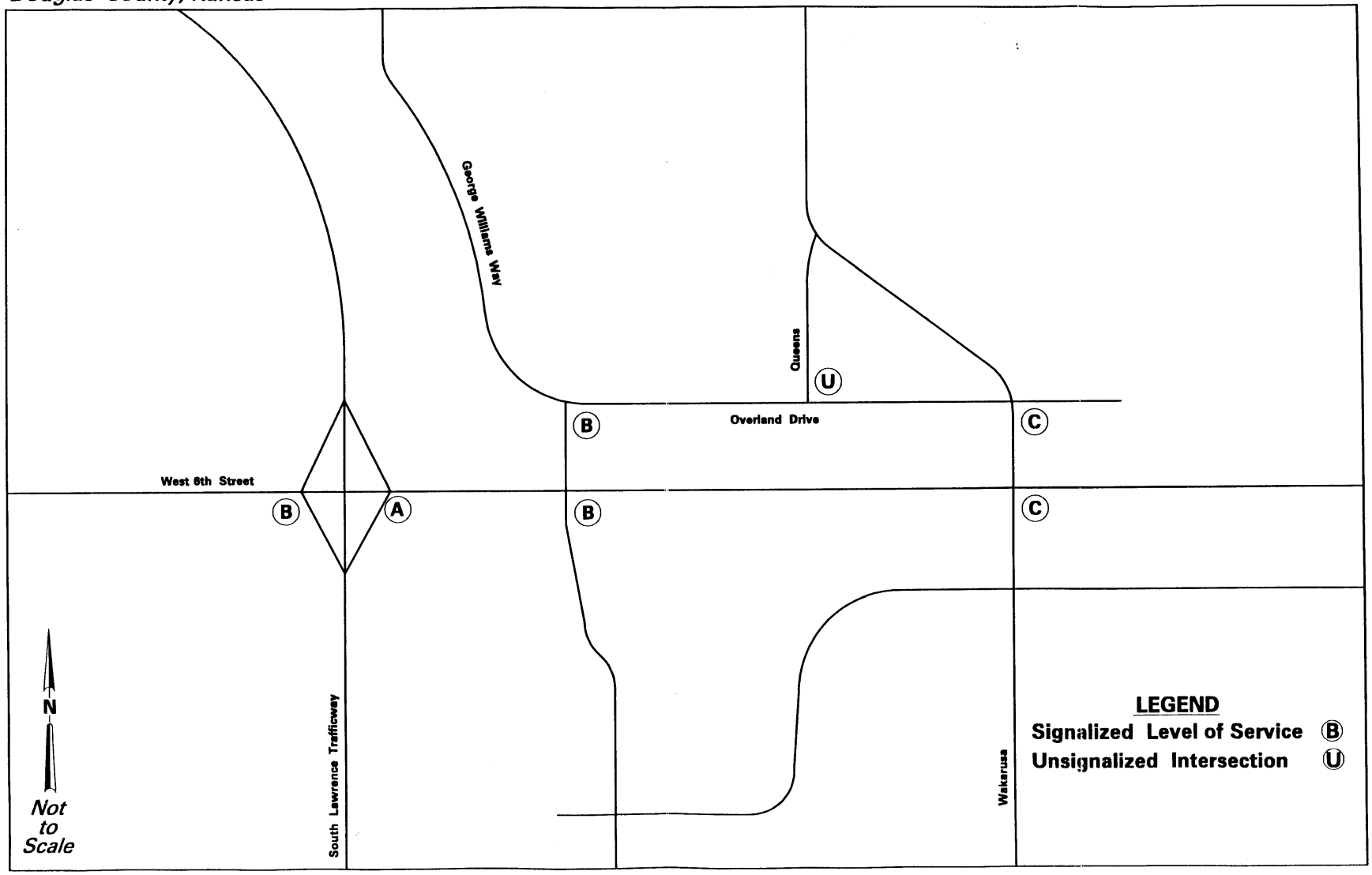

Figure 6 Scenario 1 (3/4 Mile Spacing) Level-of-Service

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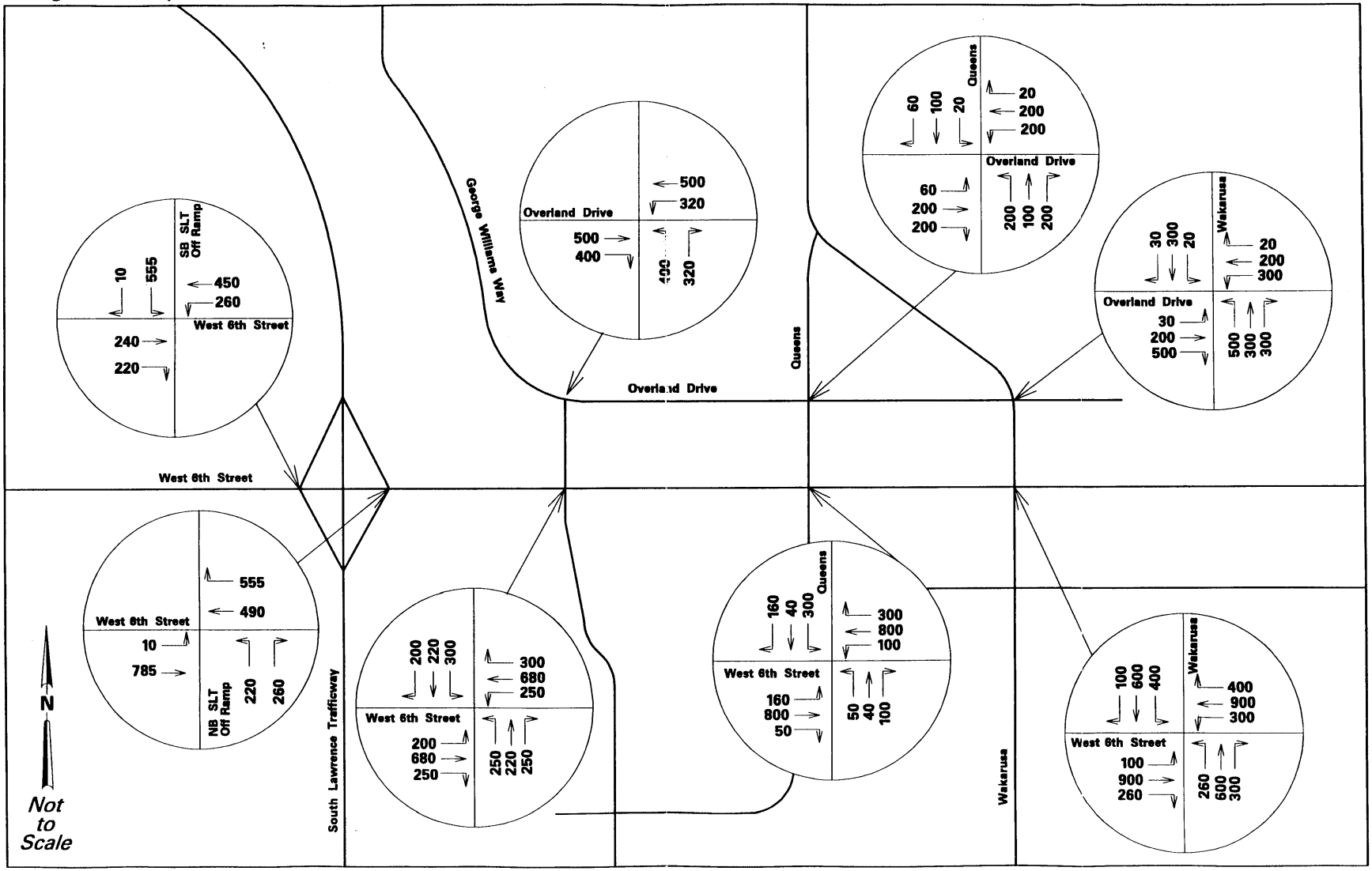

Figure 7 Scenario 2 (1/2 Mile Spacing)Peak Hour Volumes

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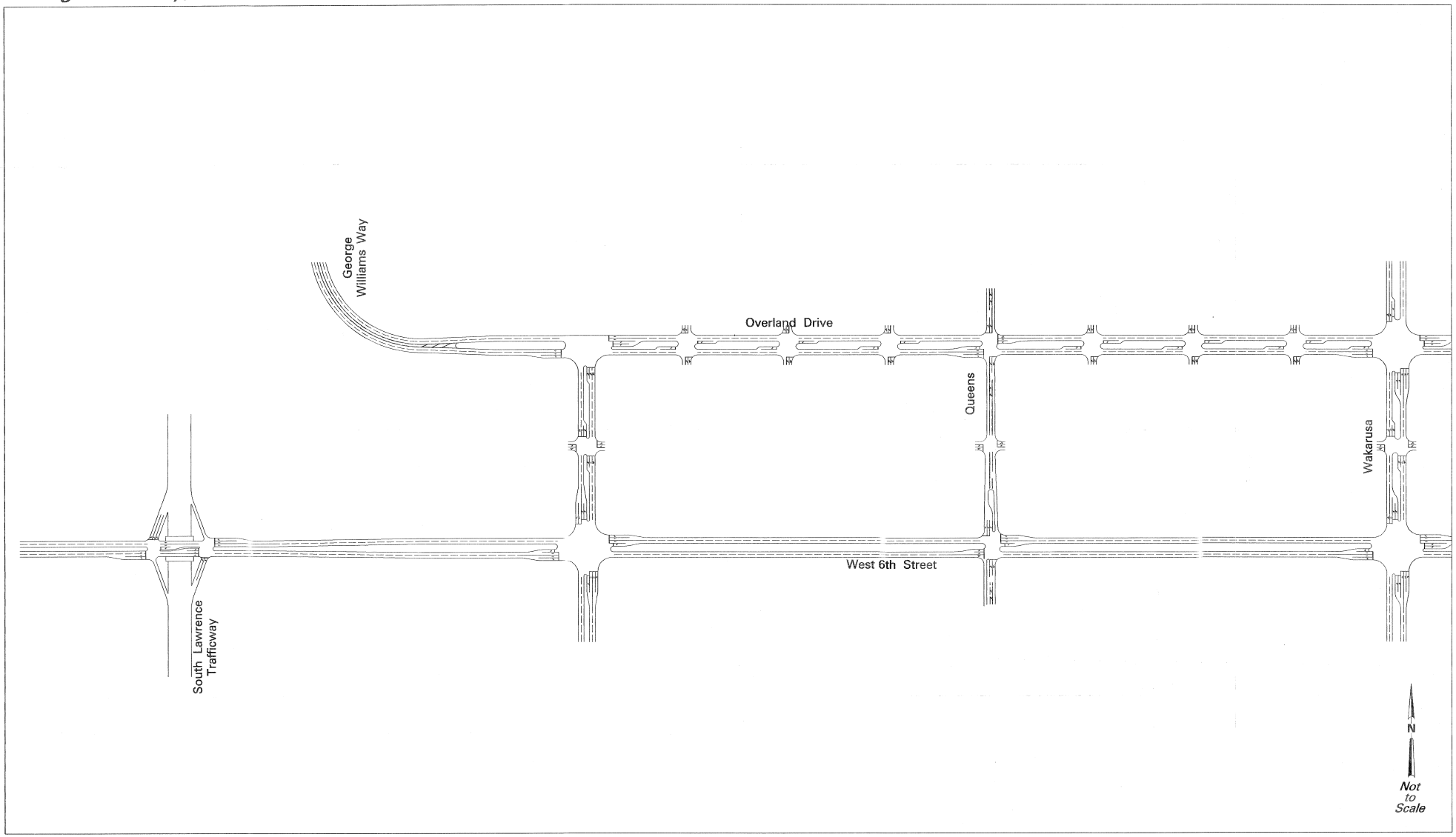

Figure 8 Scenario 2 (1/2 Mile Spacing) Lane Configuration

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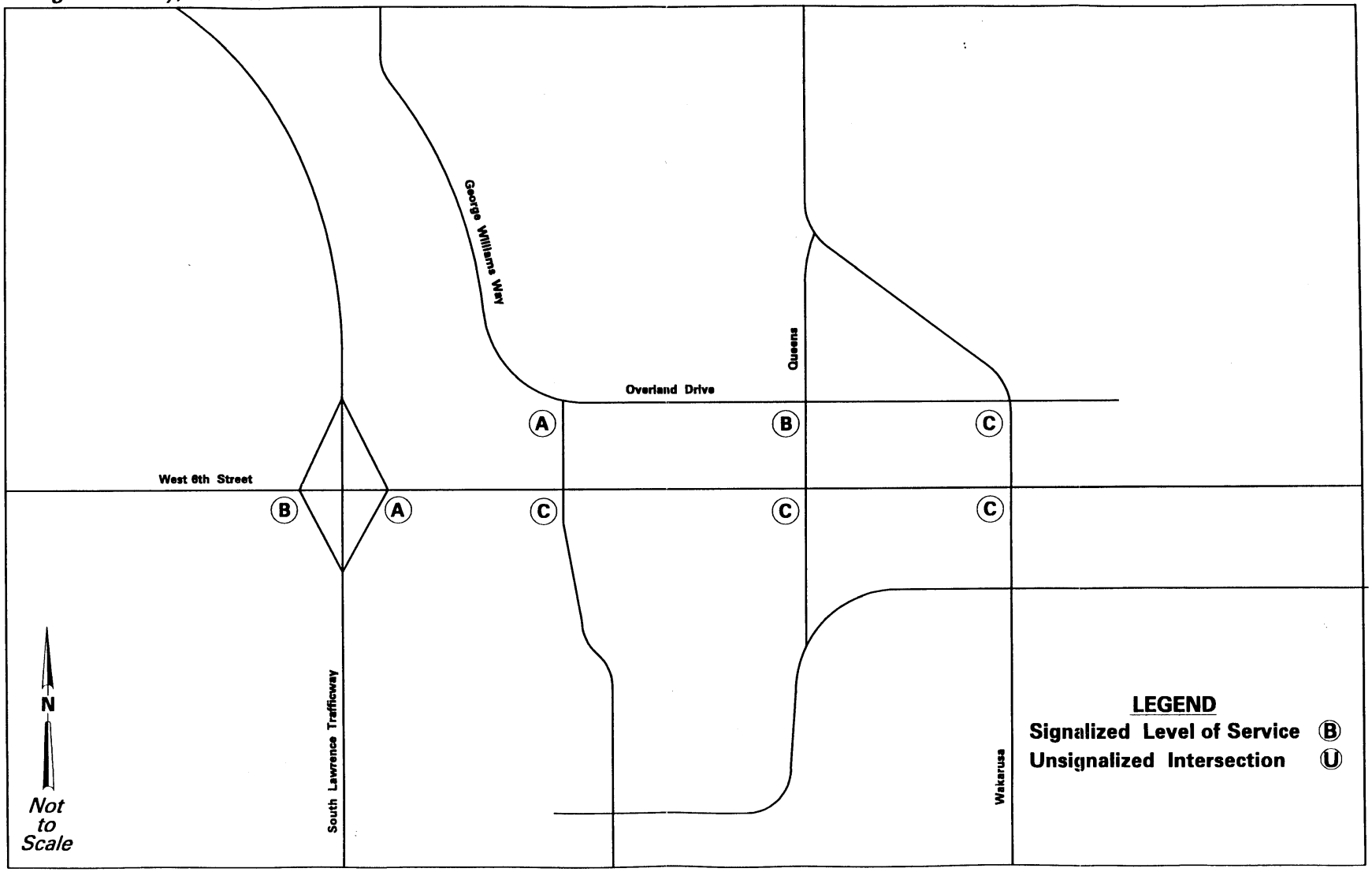

Figure 9 Scenario 2 (1/2 Mile Spacing) Level-of-Service

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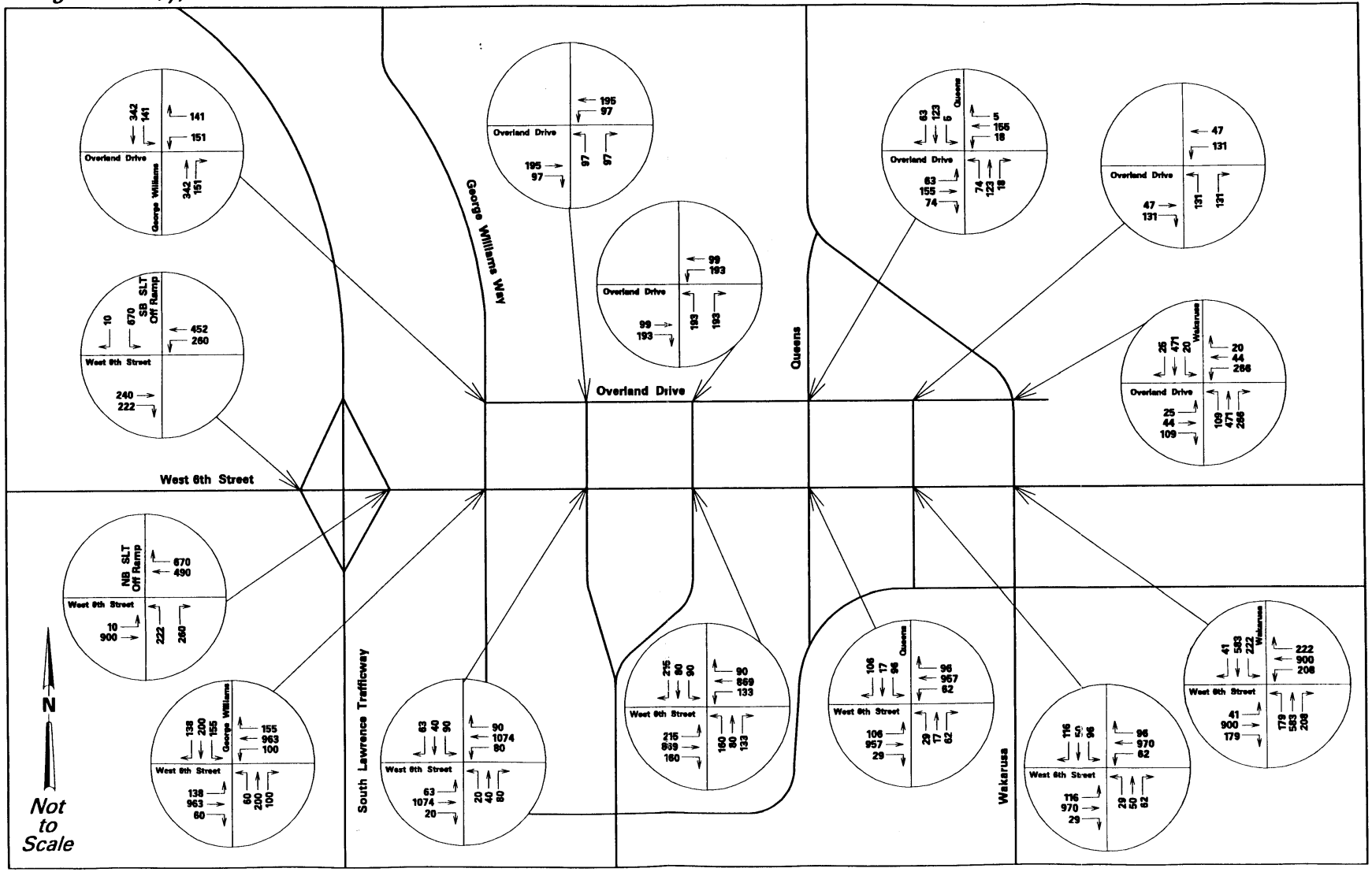

Figure 10 Scenario 3 (1/4 Mile Spacing) Peak Hour Volumes

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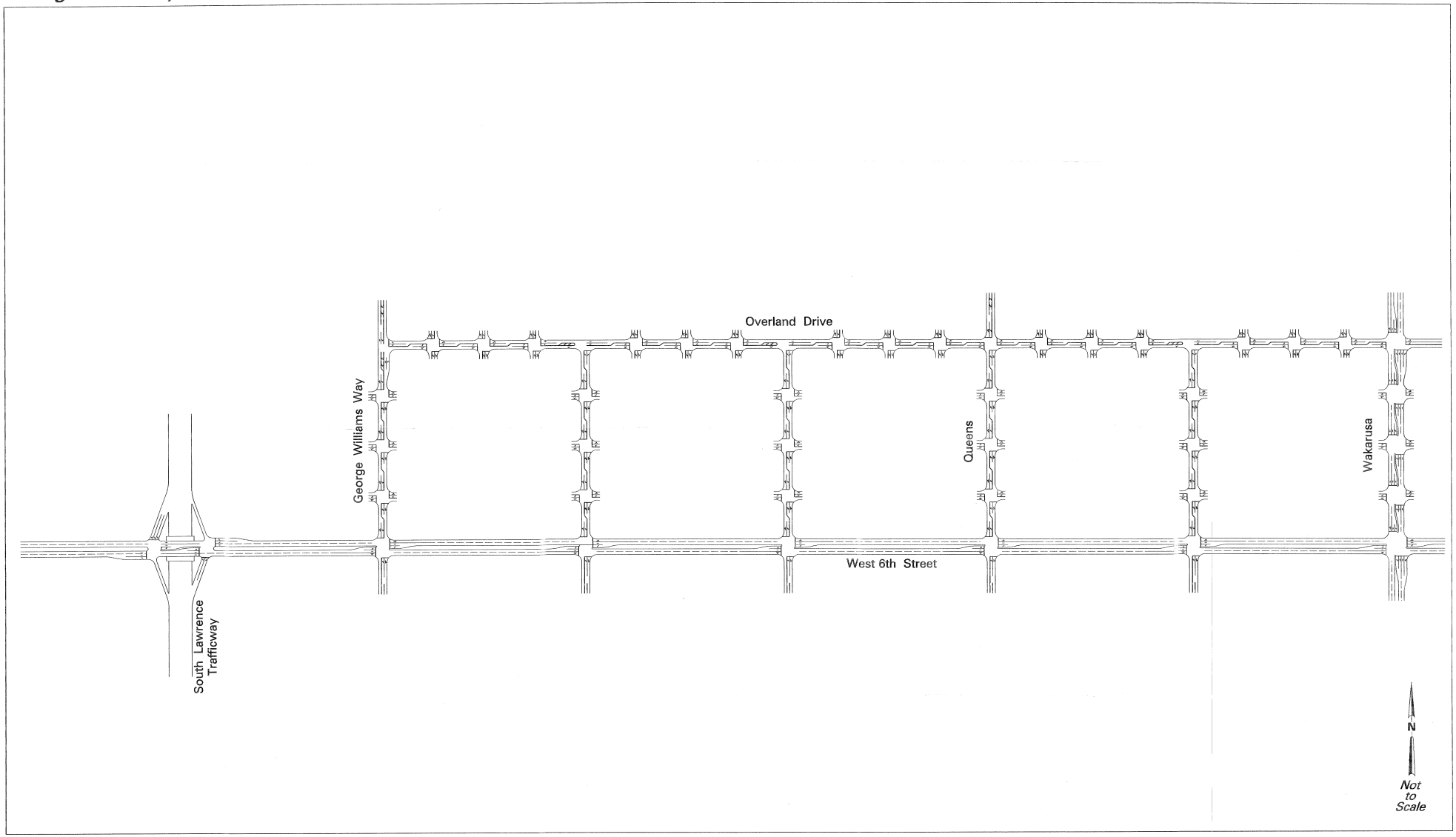

Figure 11 Scenario 3 (1/4 Mile Spacing) Lane Configuration

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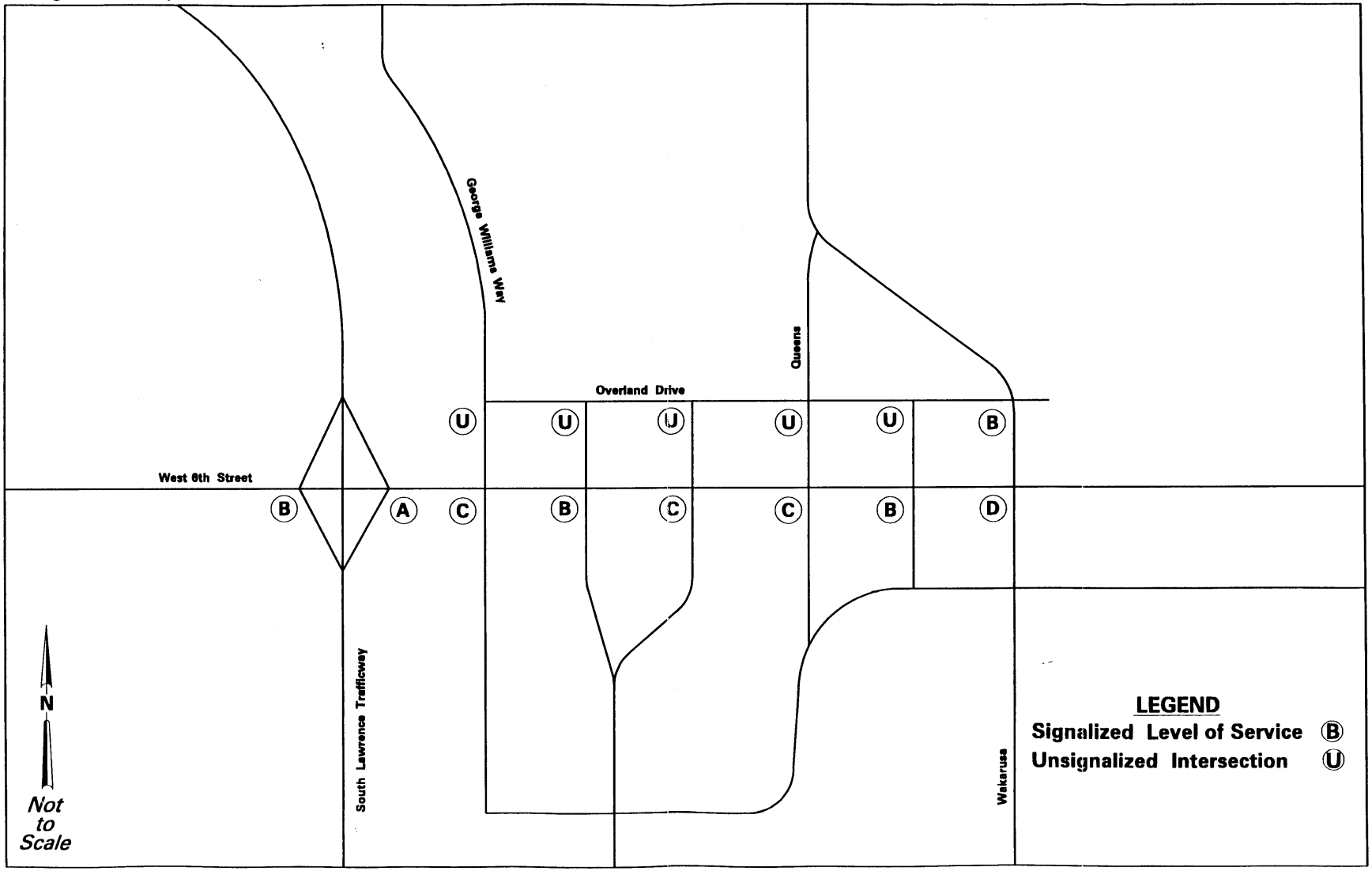

Figure 12 Scenario 3 (1/4 Mile Spacing) Level-of-Service

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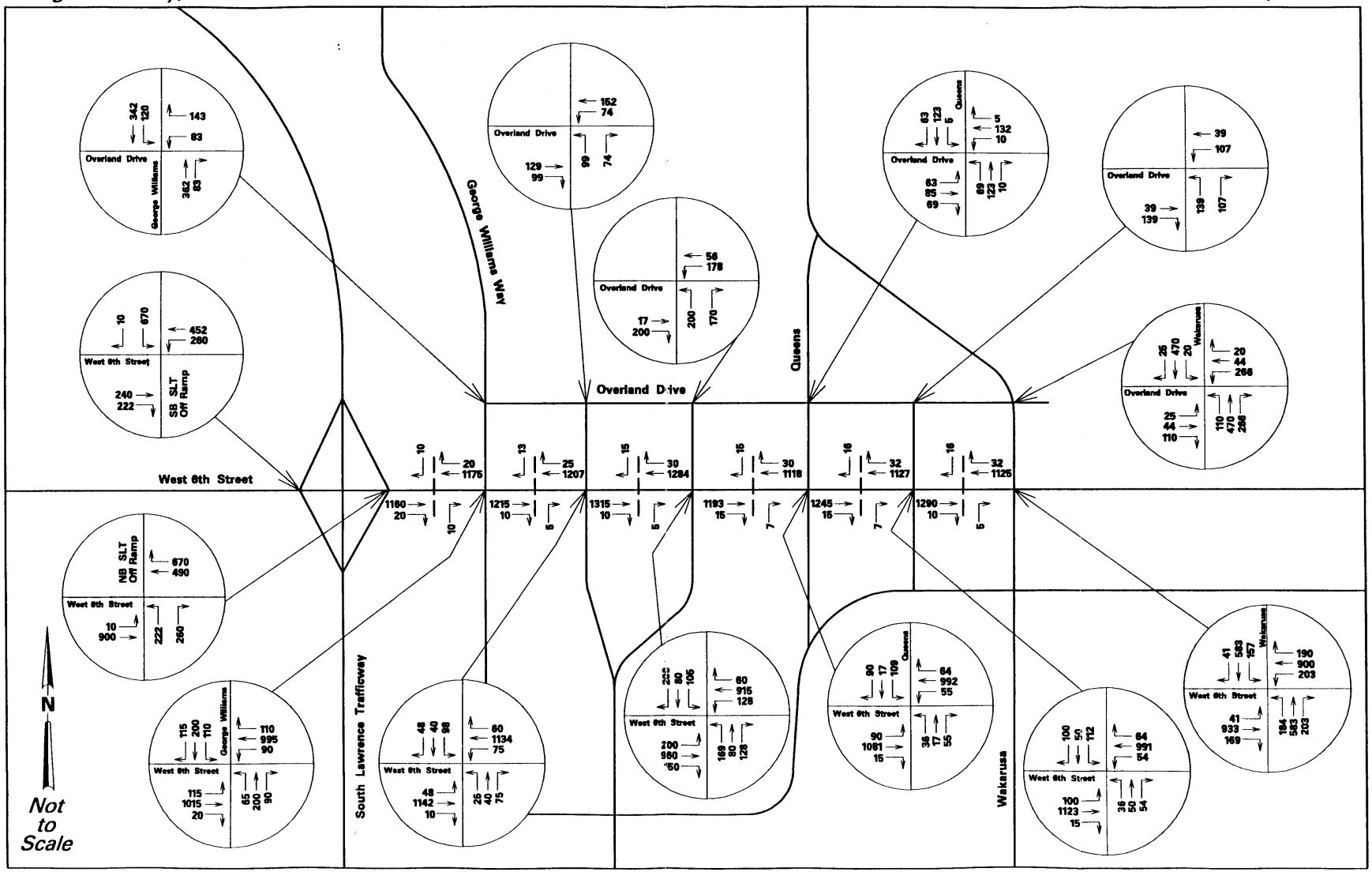

Figure 13 Scenario 4 (1/8 Mile Spacing) Peak Hour Volumes

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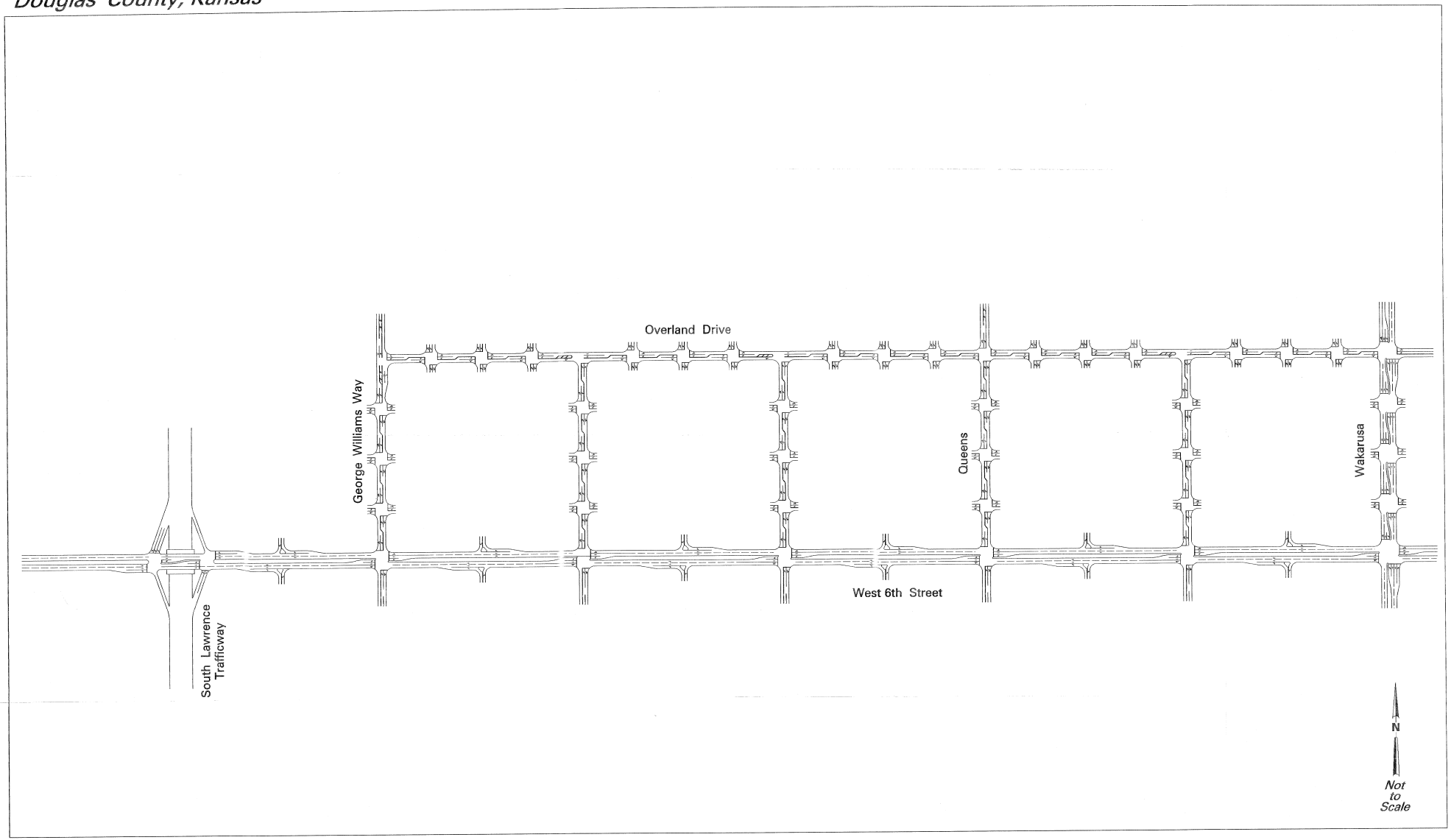

Figure 14 Scenario 4 (1/8 Mile Spacing) Lane Configuration

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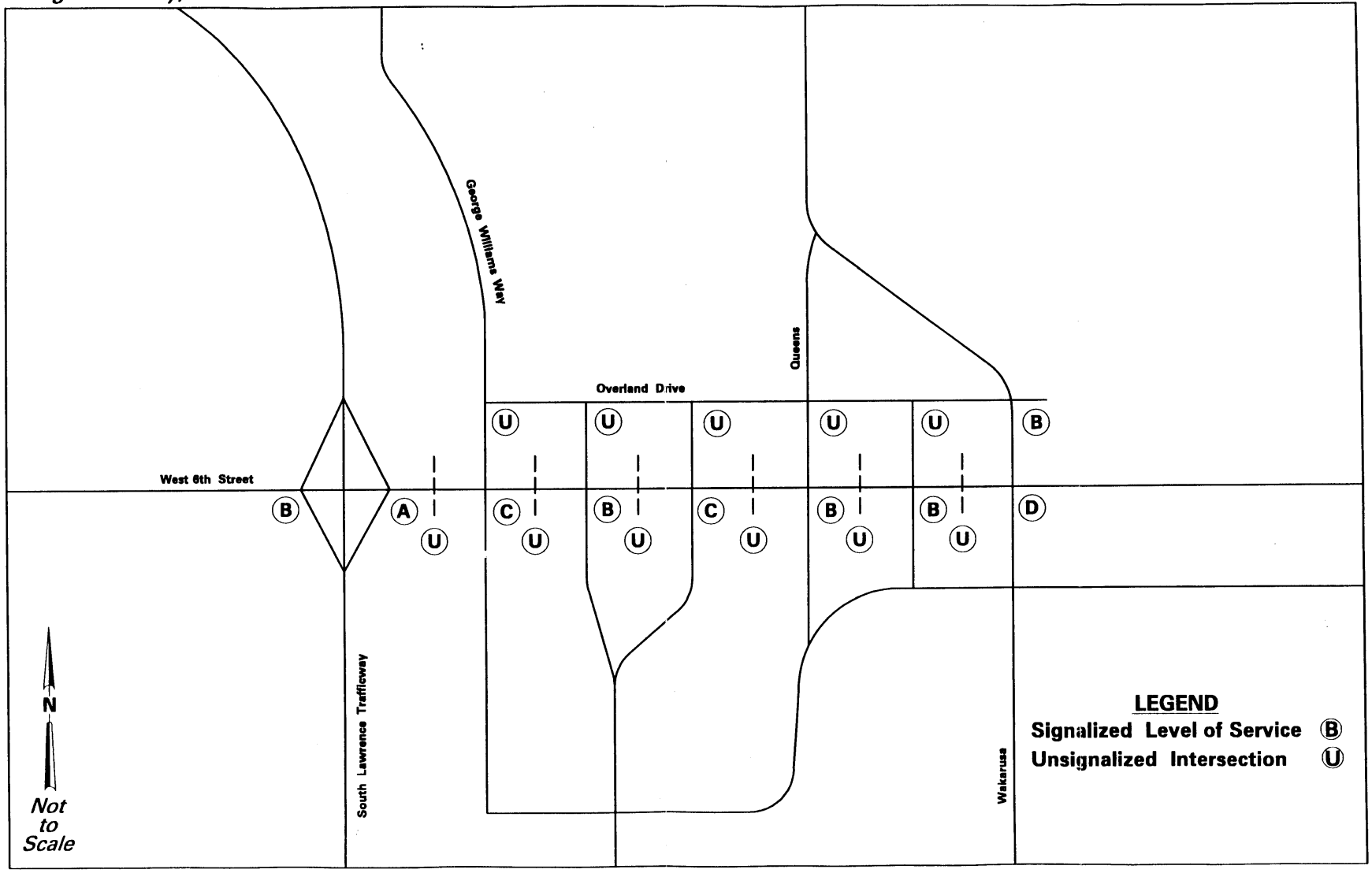

Figure 15 Scenario 4 (1/8 Mile Spacing) Level-of-Service

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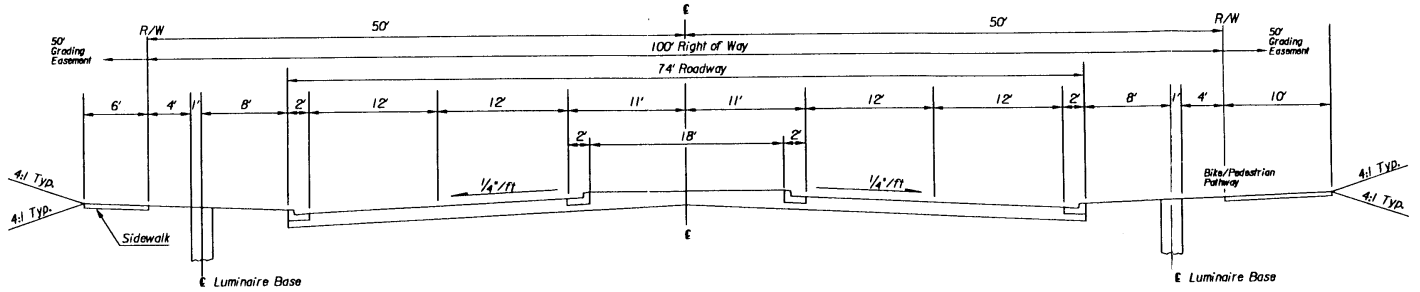
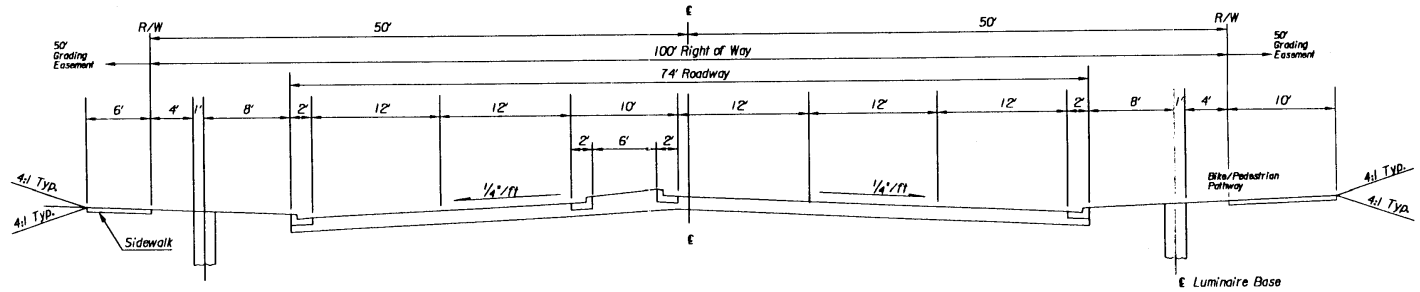


FULL MEDIAN SECTION



TURN BAY MEDIAN SECTION

Figure 16 Typical Sections

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