

DATE: February 18, 2009
TO: Oregon Transportation Commission
FROM: Matthew L. Garrett
Director
SUBJECT: I-5 Kuebler Boulevard Interchange Area Management Plan

Requested Action:

Adoption of the I-5 Kuebler Boulevard Interchange Area Management Plan (IAMP).

Background:

The Kuebler IAMP has been prepared pursuant to OAR 7340051-0155(b) and the ODOT Guidelines for Preparation of Interchange Area Management Plans. ODOT has worked with the City of Salem, Marion County and the Salem-Keizer Area Transportation Study to prioritize construction of a new northbound on-ramp as the next phase of the I-5 Kuebler Boulevard interchange project. ODOT has worked with the city and county to develop the IAMP to protect the function of the reconstructed interchange for at least 20 years. The IAMP has been found consistent with the City of Salem Comprehensive Plan

Attachments

- A IAMP Executive Summary*
- B Findings of Consistency with OAR 731-0015-0055 and 0065*
- C Letter documenting Comprehensive Plan Consistency from the City of Salem*

Copies (w/attachments) to:

I-5/Kuebler Boulevard Interchange Management Plan

Final Report
May 1999



Oregon Department of
Transportation



Prepared by:
DKS Associates

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I. Executive Summary

Introduction

This report describes the final results of the I-5/Kuebler Boulevard Interchange Management Plan Study and presents recommendations regarding the future development of the interchange area.

The study was undertaken to determine if the long-range transportation impacts of a proposed land use plan for the interchange area developed by the City of Salem could be accommodated within a reasonable set of transportation system improvements. If it was determined that this would not be possible, an additional objective of the study was to identify refinements to the city's Proposed Land Use Plan that would be necessary to achieve a balance between future transportation system capacity and travel demand. Once the appropriate mix of land use and transportation system improvements was identified, the final two objectives of the study were to estimate the cost of the improvements and to establish a method for equitably allocating future interchange area capacity to individual parcels within the Proposed Plan area.

The Proposed Plan, as reflected in the city's overlay zones, identifies a substantial amount of future development totaling nearly 750 acres. The central theme of the plan is mixed-use development, featuring a combination of residential, commercial, and industrial uses.

The study was organized according the following basic tasks:

- I. Identification of Existing Land Use and Transportation Conditions
- II. Estimation of Future Land Use and Transportation Conditions
- III. Identification of Required Mitigation Improvements
- IV. Additional Analysis of Proposed Plan Scenario
- V. Development of Capacity Allocation Mechanism

Transportation impacts for the Proposed Plan scenario were identified for both the 2015 and 2006 time frames. The intent of the 2006 analysis was to obtain a "snapshot" of conditions for an intermediate time period prior to 2015 when the ultimate impacts of the Proposed Plan would be realized. For comparison purposes, transportation impacts were also identified for a Baseline land use scenario that reflects the development assumptions contained in the Comprehensive Plan for the interchange area. Impacts for this scenario were analyzed for the 2015 time frame only.

Findings

EXISTING CONDITIONS

Existing transportation conditions were analyzed with regard to traffic volumes, levels of service, traffic operations, and safety for I-5 and Kuebler Boulevard. The primary finding of the analysis was that with the exception of the Battle Creek Road intersection, there are no significant existing traffic problems along Kuebler Boulevard or I-5 within the study area. Battle Creek Road is the only signalized intersection where substandard level of service (LOS "F") occurs during the p.m. peak hour. This results in occasional backups of westbound traffic to the 27th Avenue intersection.

FUTURE CONDITIONS

Future transportation conditions were identified for traffic volumes, level of service, and traffic operations for I-5 and Kuebler Boulevard. The analysis was based on future traffic volume estimates produced by a "focused" traffic forecasting model developed specifically for the study area. The model was derived from the SKATS regional travel forecasting model, in which the regional model zone system and network were refined within and near the study area. Adjustments were also made to the focus model trip matrix within the study area.

The major findings of the future conditions analysis were:

For the 2015 Baseline scenario, levels of service along Kuebler Boulevard would deteriorate compared to existing conditions, but would still be adequate at all signalized intersections except Battle Creek Road. Levels of service at the unsignalized intersections of Stroh Road, 27th Avenue, and 36th Avenue would be LOS F, however, and signals would be warranted at all of these locations. In addition to the existing backup problem at Battlecreek Road, minor operational problems may be caused by backups of westbound left-turning vehicles into inside through lane at Commercial Street. Assuming the three-lane widening improvement along I-5 to the north and south of Kuebler Boulevard, adequate levels of service would be maintained at all freeway locations except the southbound off-ramp junction at Kuebler Boulevard, where the level of service would drop to LOS E.

2. Level of service impacts of the 2015 Proposed Plan scenario along Kuebler Boulevard would be similar, but somewhat worse, compared to those of the Baseline scenario. In addition to Battlecreek Road, the level of service for the Turner Road intersection would decrease to LOS F. As with the Baseline scenario, the level of service for all of the unsignalized intersections would be

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LOS F, and signals would be warranted at each of these locations. Traffic operations would be similar to those for the Baseline scenario, with westbound through lane backups at Battlecreek Road and, possibly, minor westbound left-turn lane backups at Commercial Street. One reason for the similarities between the impacts of the Baseline and Proposed Plan scenarios is that a portion of the traffic that would otherwise use Kuebler Boulevard for the Proposed Plan scenario would be unable to do so, because v/c ratios would be near 1.0 for the Baseline scenario even without the additional traffic from the Proposed Plan area development. This would result in the diversion of traffic to other study area roads. Levels of service along I-5 would be the same as for the Baseline scenario, with the exception of the southbound segment south of Kuebler Boulevard, which would operate at LOS D.

3. Without the three-lane widening improvement along I-5, LOS E and LOS F conditions would occur for several freeway segments and ramp junctions for the Proposed Plan scenario. This would result in at-capacity or breakdown operational conditions. There would be no significant differences in the impacts along Kuebler Boulevard without the I-5 widening.
4. Adequate levels of service would occur for the 2006 Proposed Plan scenario at all existing signalized intersections along Kuebler Boulevard, with the exception of Kuebler Boulevard/Battle Creek Road, which would operate at LOS "F". LOS "F" would also occur at the unsignalized intersections of Kuebler Boulevard/Stroh Lane, Kuebler Boulevard/27th Avenue, and Kuebler Boulevard/36th Avenue. Levels of service would be adequate along I-5 except at the southbound Kuebler Boulevard off-ramp junction (LOS "F") and the southbound mainline segment south of Kuebler Boulevard (LOS "E"). Proposed Plan area traffic would contribute very little to the degradation in level of service along I-5, with LOS conditions remaining the same with or without this traffic.

MITIGATION IMPROVEMENTS

Mitigation improvements were determined for locations along Kuebler Boulevard and I-5 where LOS standards would not be met with the Proposed Plan scenario. An LOS standard of "E" was used for Kuebler Boulevard and a standard of "D" was used for I-5. In addition, mitigation improvements were identified for a roadway network alternative in which no widening improvements were assumed for I-5 south of Highway 22. The major mitigation findings were:

1. With mitigation, adequate levels of service could be attained for the 2015 Proposed Plan scenario at all locations along Kuebler Boulevard and I-5. The major improvements would be the widening of Kuebler Boulevard to four

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travel lanes between I-5 and Commercial Street and the addition of a second lane on the I-5 southbound off-ramp at Kuebler Boulevard. The off-ramp improvement would include an auxiliary lane along I-5, extending north of the Turner Road overcrossing. Other improvements would include signalization of the Stroh Road, 27th Avenue, and 36th Avenue intersections along Kuebler Boulevard and the addition of turning lanes at several of the intersections. The estimated total cost of the improvements is \$8,355,000 (current dollars).

2. Based on the above finding, it does not appear that any refinements to the 2015 Proposed Plan scenario will be necessary. The development levels assumed in the Proposed Plan can be accommodated with a reasonable set of mitigation improvements. The Kuebler Boulevard widening is identified in the *Salem Transportation System Plan*¹ as a high priority improvement item that will be needed within the next ten years.
3. Findings 1. and 2., together with implementation of Recommendation 1. – Transportation contained in the following section, will establish conformity of the city’s Proposed Land Use Plan with the requirements of OAR 660-012-0060 relating to plan and land use regulation amendments.
4. Required mitigation improvements along Kuebler Boulevard for the 2006 Proposed Plan scenario would consist of an additional through lane in each direction at Battle Creek Road and signalization at the intersections of 27th Avenue and 36th Avenue. Along I-5, an additional freeway lane would be required to mitigate the LOS “F” conditions at the southbound off-ramp junction at Kuebler Boulevard and the southbound freeway segment south of Kuebler Boulevard. This indicates that the planned three-lane widening improvement along I-5 would have to be accelerated in order to achieve adequate levels of service at these locations.
5. The total cost of the mitigation improvements along Kuebler Boulevard for the 2006 Proposed Plan scenario would be roughly \$1,124,000. Cost estimates for the I-5 improvements were not developed because these are a part of the 2015 base case network.

ADDITIONAL ANALYSIS

Subsequent to the identification of transportation impacts and mitigation improvements for the 2015 Proposed Plan scenario, an issue was raised by the project management team that the traffic volumes may have been underrepresented because they did not reflect the additional traffic that would use Kuebler Boulevard with the recommended capacity improvements. Therefore, it was suggested that a new traffic forecast should

¹ City of Salem, Salem Transportation System Plan, August 1998.

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be prepared using a network that included the improvements. The key improvement related to the traffic forecasts was the addition of a through travel lane in each direction between the I-5 southbound ramps intersection and Commercial Street, resulting in a continuous four-lane section.

Reassessment of the 2015 Proposed Plan scenario using the revised forecasts produced the following key results:

1. Traffic volumes along Kuebler Boulevard to the west of I-5 for the revised forecast were significantly higher (20 – 50%) than the original forecast. To the east of I-5, the increases were much smaller, ranging from 0 – 10%. Even with the higher volumes, acceptable levels of service would be maintained along Kuebler Boulevard, with the exception of Kuebler Boulevard/Commercial Street and Kuebler Boulevard/Battle Creek Road, where LOS “F” would occur. LOS “E” could be attained at these locations with the addition of turning lanes on specific intersection approaches.
2. Excessive turning lane queues (greater than 250 feet) would occur at six intersections. This could result in vehicle back-ups into the adjacent through lane at two of the intersections (Kuebler Boulevard/Commercial Street and Kuebler Boulevard/I-5 northbound ramps). Excessive through lane queues (greater than 400 feet) may also occur at most of the intersections, but likely would not result in significant operational problems.
3. Levels of service and operational impacts for I-5 were not examined due to the close similarities between the original and revised I-5 volumes.

CAPACITY ALLOCATION MECHANISM

A capacity allocation mechanism was developed for allocating future interchange roadway capacity to specific development projects within the Proposed Plan area. This included a trip allocation method, a Supplemental Transportation System Development Charge (STSDC) that will be used to partially fund the mitigation improvements, and an implementation framework for allocating capacity and administering the STSDC. The allocation mechanism was based upon the original Proposed Plan scenario analysis and not the analysis reflecting the revised Proposed Plan traffic volumes. Major findings related to the capacity allocation mechanism were:

1. Total future interchange area roadway capacity to be allocated for the Proposed Plan development is 3,830 p.m. peak hour vehicle trips. The capacity allocated to each TAZ within the Proposed Plan area is equal to the number of modeled p.m. peak hour interzonal trips assigned to/from the TAZs for the 2015 Proposed Plan scenario.

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2. In order to fund the interchange area roadway improvements, a Supplemental Transportation System Development Charge (STSDC) of \$643 per p.m. peak hour trip was developed. This includes a widening improvement for the southbound I-5 off-ramp at Kuebler Boulevard, together with a southbound auxiliary lane along I-5. The STSDC will be in addition to the city's existing Transportation System Development Charge (TSDC), which is used to fund transportation improvements identified in the *Salem Transportation System Plan*.² The portion of total cost for each improvement to be funded by the STSDC was determined based on the percentage of Proposed Plan area trips using the improvements.
3. An implementation framework for the STSDC was developed, including a "trip rights" allocation method, fee assessment and administration procedures, and recommended revisions to the city's development code for implementation of the STSDC. Trip rights is the maximum number of p.m. hour trips that each parcel within the interchange area will be allowed to generate. They will be allocated to the individual parcels within the TAZs based on the relative trip generation potential of each parcel. Trip rights may be transferred between owners of property within the same TAZ in any manner acceptable to the owners.
4. Assessment of the STSDC for specific development proposals will be based upon the estimated number of p.m. peak hour trips to be generated by the development. Credits will be allowed for the cost of qualified public improvements constructed by the project proponent, as well as implementation of transportation demand management (TDM) programs.
5. Administration of the STSDC will be similar to that for the TSDC.
6. The STSDC program will need to be monitored to determine if the estimated improvements and costs reflect current conditions. The program should be extended beyond 2015 if the rate of development for the Proposed Plan area is slower than that anticipated in the *I-5/Kuebler Boulevard Interchange Management Plan Final Reconnaissance Report*.³

² City of Salem.

³ Oregon Department of Transportation, *I-5/Kuebler Boulevard Interchange Management Plan Final Reconnaissance Report*, November 1998.

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Recommendations

The recommendations listed below are based upon the study findings as well as input received from the project management team.

LAND USE

The first two land use recommendations relate to the total amount of development that will be allowed to occur within the interchange area by 2015. The latter three recommendations are alternatives describing the timing of development relative to the implementation of interchange area roadway improvements. A decision on which alternative to be carried forward by the city in the plan adoption process will be made once the plan has been circulated for comment among interchange area property owners and other interested persons.

1. If the improvements already planned within the study area (as identified in *Salem Transportation System Plan*⁴) and the Proposed Plan mitigation improvements will be implemented within the planning horizon (2015), no refinements to the proposed land uses are recommended in order to achieve balance between transportation system supply (capacity) and demand along Kuebler Boulevard and I-5 within the study area.
2. If the improvements already planned within the study area (as identified in *Salem Transportation System Plan*⁴) and the Proposed Plan mitigation improvements will not be implemented within the planning horizon (2015), refinements to the proposed land uses should be identified, if necessary, in order to achieve balance between transportation system supply (capacity) and demand along Kuebler Boulevard and I-5 within the study area.
3. If property owners within the Proposed Plan area: 1) pay their “fair share” of the cost of mitigation improvements through a Supplemental Transportation System Development Charge (STSDC) or similar funding mechanism; and 2) construct any project-specific mitigation measures, if required; development should be allowed to occur whether or not the improvements required to maintain adequate levels of service on Kuebler Boulevard and I-5 are implemented concurrently with the development. This includes improvements already planned as well as mitigation improvements.

or

4. If property owners within the Proposed Plan: 1) pay their “fair share” of the cost of mitigation improvements through a Supplemental Transportation System

⁴ City of Salem.

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Development Charge (STSDC) or similar funding mechanism; and 2) construct any project-specific mitigation measures, if required; development should be allowed to occur only if the improvements required to maintain adequate levels of service on Kuebler Boulevard only are implemented concurrently with the development. This includes improvements already planned as well as mitigation improvements.

or

5. If property owners within the Proposed Plan area: 1) pay their “fair share” of the cost of mitigation improvements through a Supplemental Transportation System Development Charge (STSDC) or similar funding mechanism; and 2) construct any project-specific mitigation measures, if required; development should be allowed to occur only if the improvements required to maintain adequate levels of service on Kuebler Boulevard and I-5 are implemented concurrently with the development. This includes improvements already planned (including widening of I-5 to three lanes in each direction between Highway 22 and Kuebler Boulevard and between Kuebler Boulevard and Delaney Road) as well as mitigation improvements.

TRANSPORTATION

1. If the Proposed Plan is adopted, the *Salem Transportation System Plan*⁵ should be amended to include the mitigation improvements within the study area described earlier in this report.
2. If the Proposed Plan is implemented, all of the improvements already planned as well as the mitigation improvements described earlier should be constructed within the planning horizon (2015).
3. Funding for the state and local portions of the improvement costs described earlier should be obtained in a timely manner so that the improvements required to maintain adequate levels of service may be provided concurrently with increased future development levels.
4. Funding and construction of the planned three-lane widening of I-5 south of Highway 22 should be accelerated, since without this improvement, inadequate levels of service (LOS “E” or worse) would occur at two locations along I-5 by 2006, with or without the Proposed Plan development.
5. Consideration should be given to mitigation of traffic impacts along other study area roadways due to the significant increases in volume that may occur for some of these roadways with the Proposed Plan development. (Specific roadways and

⁵ City of Salem.

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impacts will be identified at the time of project proposals). Consideration should also be given to partial funding of improvements for other roadways through a supplemental development charge.

6. The *I-5/Kuebler Boulevard Interchange Management Plan* will define future required transportation system improvements within the study area related to I-5 and Kuebler Boulevard. However, the city may require additional analysis of impacts and required improvements for other study area roadways at the time of project proposals.
7. If changes are made to the Proposed Plan land uses or to Comprehensive Plan land uses outside of the interchange area during the 2015 **planning period** that would result in significant changes in local and/or regional traffic volumes within the study area, the appropriate elements of the *I-5/Kuebler Boulevard Interchange Management Plan* should be updated.

CAPACITY ALLOCATION MECHANISM

1. Interchange area capacity should be allocated first by traffic analysis zone, according to the number of modeled interzonal trips for each TAZ, and then by parcel within each TAZ, in proportion to the potential trip generation of each parcel.
2. A supplemental funding mechanism (such as an STSDC) should be established to partially fund the Proposed Plan mitigation improvements for Kuebler Boulevard and I-5.
3. If an STSDC or similar mechanism is established to fund the portions of improvement costs to be paid for by interchange area property owners, the following are recommended:
 - The portion of total cost for each improvement eligible for funding through the STSDC should be equal to the total cost of the improvement less the portion of cost to be funded through the existing Transportation System Development Charge (TSDC);
 - The portion of total cost for each improvement to be funded by the STSDC should be equal to the STSDC-eligible portion of the cost multiplied by the percentage of total future trips using the improvement that have one or both ends in the Proposed Plan area;
 - The STSDC should be equal to the sum of the STSDC-funded portions of all improvement costs divided by the sum of trips using the improvements with one or both ends in the Proposed Plan area;

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- “Trip rights” should be equal to the maximum number of trips that each interchange area parcel will be allowed to generate, as determined by the parcel-level capacity allocation method described above;
“Trip rights” should be transferable between property owners within the same TAZ in any manner acceptable to the owners and the city;
- STSDC fees for specific developments should be calculated as the number of p.m. peak hour trip ends for development, as estimated using the *ITE Trip Generation Manual*⁶ methodology, multiplied by the STSDC;
- STSDC credits should be provided for the construction of qualified public improvements and the implementation of approved TDM plans;

The STSDC program should be updated every five years and monitored more frequently to determine if adjustments are needed to reflect current required improvements and construction costs.

⁶ Institute of Transportation Engineers (ITE), Trip Generation (Washington D.C.: Institute of Transportation Engineers, 1997).

II. Introduction

This report describes the final results of the I-5/Kuebler Boulevard Interchange Management Plan Study and presents recommendations regarding the future development of the interchange area.

The study was undertaken to determine if the long-range transportation impacts of a proposed land use plan for the interchange area developed by the City of Salem could be accommodated within a reasonable set of transportation system improvements. If it was determined that this would not be possible, an additional objective of the study was to identify refinements to the city's Proposed Land Use Plan that would be necessary to achieve a balance between future transportation system capacity and travel demand. Once the appropriate mix of land use and transportation system improvements was identified, the final two objectives of the study were to estimate the cost of the improvements and to establish a method for equitably allocating future interchange area capacity to individual parcels within the Proposed Plan area.

The Proposed Land Use Plan is the product of a local planning effort conducted by the city for the interchange area over a period of two years. An initial study, the *I-5/Kuebler Boulevard Urban Interchange Transportation and Land Use Study*,⁷ was completed in August 1995. Subsequently, some of the specific land use designations recommended in the study were revised by the City of Salem Planning Department. These revisions were incorporated in a set of overlay zones for each quadrant of the interchange for the purpose of defining, in detail, the future uses that will be permitted within the interchange area. The Proposed Plan, as reflected in the overlay zones, identifies a substantial amount of future development totaling nearly 750 acres. The central theme of the plan is mixed-use development, featuring a combination of residential, commercial, and industrial uses. The Proposed Plan area is shown in Figure 1.

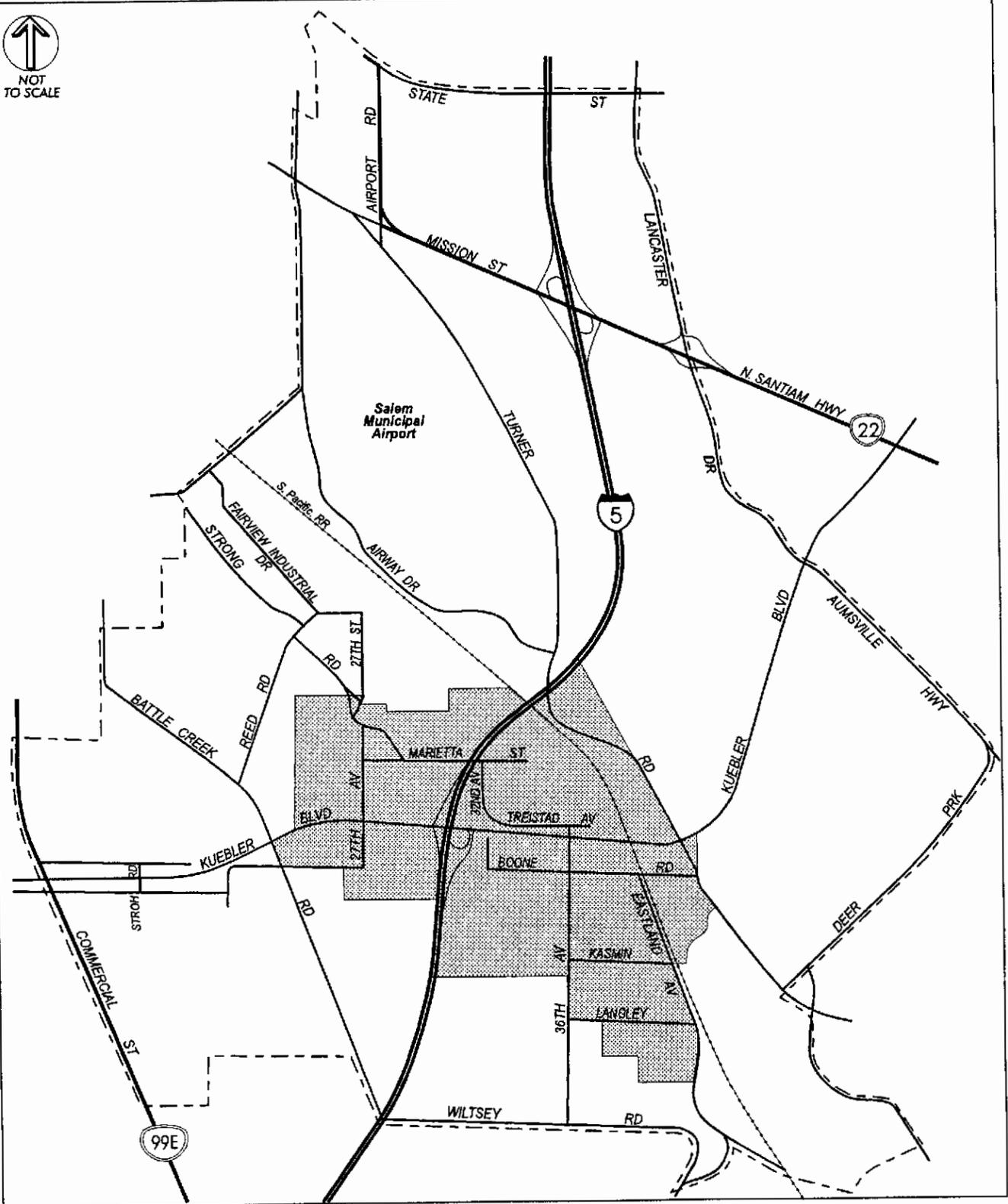
A study area was established for the purpose of analyzing the potential impacts of the Proposed Land Use Plan on the surrounding transportation system. The study area, also shown in Figure 1, is bounded roughly by State Street to the north, Lancaster Drive, Aumsville Highway, and Deer Park Drive to the east, Wiltsey Road to the south, and 25th Street, Madrona Avenue, and Commercial Street to the west.

The Proposed Plan area has direct access to the surrounding region via I-5 and Kuebler Boulevard. I-5 serves the north Salem and Keizer areas, while Kuebler Boulevard

⁷ City of Salem, Interstate 5/Kuebler Boulevard Urban Interchange Transportation and Land Use Study, August 1995.



NOT TO SCALE



LEGEND

- - - Study Area Boundary
- ▨ Proposed Plan Area

**Figure 1
VICINITY MAP**

Introduction

provides access primarily to the south Salem area. I-5 and Kuebler Boulevard also connect to Highway 22 to the north and to Highway 99E to the south and west. Local access is provided via Battlecreek Road, Turner Road, 27th Avenue, and 36th Avenue.

The study was organized according the following basic tasks:

- I. Identification of Existing Land Use and Transportation Conditions
- II. Estimation of Future Land Use and Transportation Conditions
- III. Identification of Required Mitigation Improvements
- IV. Additional Analysis of Proposed Plan Scenario
- V. Development of Capacity Allocation Mechanism

Transportation impacts for the Proposed Plan scenario were identified for both the 2015 and 2006 time frames. The intent of the 2006 analysis was to obtain a “snapshot” of conditions for an intermediate time period prior to 2015 when the ultimate impacts of the Proposed Plan would be realized. For comparison purposes, transportation impacts were also identified for a Baseline land use scenario that reflects the development assumptions contained in the Comprehensive Plan for the interchange area. Impacts for this scenario were analyzed for the 2015 time frame only.

This report summarizes and integrates information contained in several reports and memorandums produced previously in the study:

- The *I-5/Kuebler Boulevard Interchange Management Plan Final Reconnaissance Report*,⁸ documenting existing and future (2015) land use and transportation conditions within the study area;
- The technical memorandum “Additional Analysis of Proposed Plan Scenario - Revised”,⁹ documenting the additional analysis of the 2015 Proposed Plan scenario and the analysis of the intermediate (2006) phase of the Proposed Plan scenario;
- The technical memorandum “Interchange Area Capacity Allocation Mechanism”,¹⁰ documenting the development of a mechanism for allocating future interchange roadway capacity to specific development projects within the Proposed Plan area.

⁸ Oregon Department of Transportation, *I-5/Kuebler Boulevard Interchange Management Plan Final Reconnaissance Report*, November 1998.

⁹ DKS Associates, “Additional Analysis of Proposed Plan Scenario - Revised”, November 1998.

¹⁰ DKS Associates, “Interchange Area Capacity Allocation Mechanism”, October 1998.

III. Existing Conditions

Land Use

The northwest quadrant of the Proposed Plan area consists of approximately 175 acres. It is largely undeveloped, with single family dwellings interspersed throughout the quadrant. Most of the existing dwellings are located on the west side of 27th Avenue. The southwest quadrant totals roughly 65 acres and is currently undeveloped. The northeast quadrant is 270 acres in size and consists of a sparse mix of single family residential, industrial, and agricultural uses. The southeast quadrant contains 340 acres, with a majority of the land in agricultural uses, interspersed with single family residences.

Transportation System

The existing transportation system was examined with regard to roadway features, traffic volumes, level of service, traffic operations, and safety.

Field checks were conducted to develop an inventory of existing roadway features for Kuebler Boulevard and I-5, containing such information as speed limits, number of lanes, lane and shoulder widths, and the location of bus stops, bike facilities, and sidewalks. This information is summarized in the *I-5/Kuebler Boulevard Interchange Management Plan Final Reconnaissance Report*.¹¹

In addition to the existing roadway network, there are several committed or planned roadway improvements within or near the Kuebler Boulevard/I-5 interchange area.¹² These are:

- Widening of I-5 to three lanes in each direction from Highway 22 to Kuebler Boulevard.
- Widening of I-5 to three lanes in each direction from Kuebler Boulevard to Delaney Road.
- Addition of an on-ramp from westbound Kuebler Boulevard to northbound I-5.
- Widening of Kuebler Boulevard to four lanes from Commercial Street to the I-5 interchange.
- Widening of Kuebler Boulevard from Aumsville Highway to the I-5 interchange.
- Construction of a traffic signal at 27th Avenue.

¹¹ Oregon Department of Transportation, 16-17.

¹² City of Salem Public Works Department, Memorandum to City of Salem Planning Commission, October 1, 1996.

Existing Conditions

- Construction of a traffic signal at 36th Avenue.
- Extension of Fairview Industrial Drive from Reed Road to Marietta Street at the I-5 Overpass.

An additional modification to the existing local street network will be the deletion of Strong Road between Madrona Avenue and Reed Road.

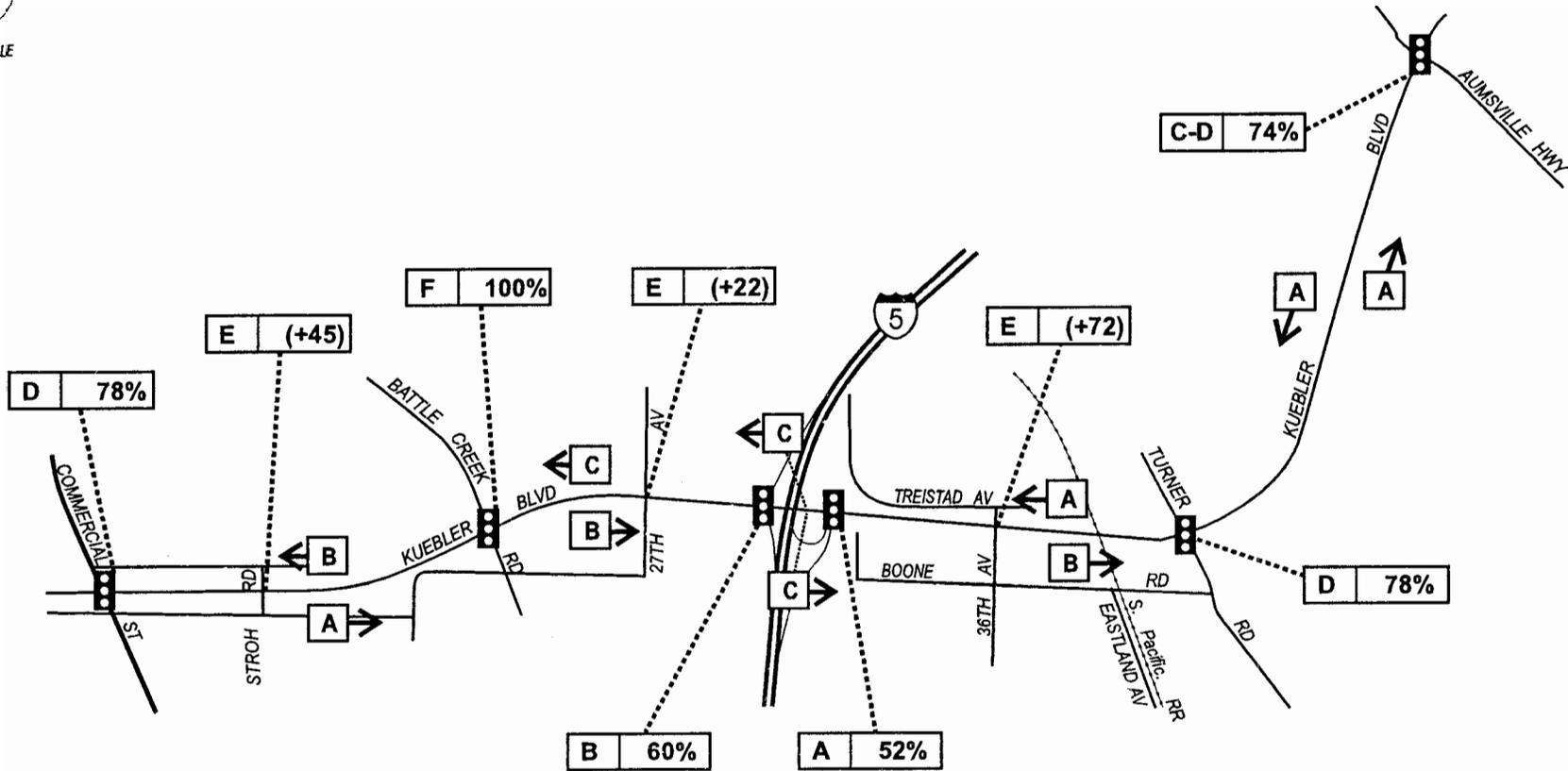
Existing traffic volumes were obtained from traffic counts provided by ODOT Region 2 and the City of Salem Public Works Department. Two-way p.m. peak hour volumes along Kuebler Boulevard range from roughly 1,200 vehicles per hour (vph) to the east of I-5 to 2,000 vph to the west of I-5. Average daily traffic approaches 22,000 vehicles near Commercial Street. Along I-5 to the south and north of Kuebler Boulevard, p.m. peak hour volumes range from 3,500 to 4,400 vph, while daily volumes range from 47,000 to 57,000 vehicles. P.M. peak hour and daily link volumes are shown in Figure 2.

Level of service analysis was performed for the p.m. peak hour. Level of service serves as an indicator of the quality of operation at an intersection or roadway segment. LOS grading ranges from A to F, with LOS A assigned when little or no delays are present and low volumes are experienced. LOS E represents “at capacity” operation; no more vehicles could be added to the intersection or road segment without causing a breakdown in traffic flow. LOS F indicates long delays at intersections and/or forced traffic flow.

The City of Salem’s level of service policy states that city streets shall be allowed to function at Level of Service “E” during the morning and evening peak travel hours.¹³ When streets and intersections experience, or are expected to experience, extended periods of Level of Service “E” or instances where the street is at Level of Service “F”, despite the use of traffic management measures, the city will consider designing and constructing additional physical capacity.

The results of the level of service analysis for Kuebler Boulevard are shown in Figure 3. As can be seen, all of the signalized intersections currently operate at LOS D or better, with the exception of Kuebler Boulevard/Battlecreek Road, which operates at LOS F. All of the unsignalized intersections operate at LOS E, which is the level of service for the worst traffic movement (left turns from the side street onto the through street). Arterial segment level of service, which measures the quality of traffic flow over each segment of an arterial, was also analyzed for Kuebler Boulevard. LOS C or better was estimated for all of the segments, with an overall LOS A in the eastbound direction and LOS B in the westbound direction for the entire arterial.

¹³ City of Salem, Salem Transportation System Plan, August 1998.



LEGEND

Intersections

- Signalized Study Intersection

00% - Saturation Level

(000) - Reserve Capacity

Arterial Segments

- Segments Occur Between Signalized Intersections

Figure 3
EXISTING PM PEAK HOUR LEVEL OF SERVICE
Kuebler Boulevard

Existing Conditions

Along I-5, level of service was estimated for freeway segments and ramp junctions (i.e., points of merging and diverging for on- and off-ramps). ODOT's level of service standard for interstate facilities in areas such as the Kuebler Boulevard interchange is LOS D. The existing p.m. peak hour level of service was found to be LOS C or better for all freeway segments and ramp junctions, with the exception of the southbound off-ramp at Kuebler Boulevard, which operates at LOS D (see Figure 4).

P.M. peak hour traffic operations along Kuebler Boulevard were observed in the field. Two potential operational problems exist at the intersections of Kuebler Boulevard/Commercial Street and Kuebler Boulevard/Battle Creek Road. At the Commercial Street intersection, vehicles turning left on the southbound approach occasionally back up into the inside through lane on Commercial Street, effectively reducing capacity to one through lane. At Battle Creek Road, large vehicle queues occur continuously along westbound Kuebler Boulevard, backing up to the intersection of Kuebler Boulevard/27th Avenue and occasionally beyond. This affects westbound traffic coming from the Kuebler Boulevard/I-5 southbound ramps intersection.

Accident data was analyzed for roadway segments, intersections, and freeway segments within the study area by calculating average annual accident rates for three year periods. This information is summarized in the *I-5/Kuebler Boulevard Interchange Management Plan Final Reconnaissance Report*.¹⁴

¹⁴ Oregon Department of Transportation, 30.

IV. Future Conditions

Land Use

BASELINE SCENARIO

The Baseline scenario reflects the land use assumptions contained in the comprehensive plan for the interchange area. As shown in Figure 5, the land use designations are:

- industrial, for the area primarily east of I- 5
- developing residential, for the area primarily west of I- 5, as well as a portion of the northeast quadrant of the interchange area.

Land use quantities for 2015 are summarized by quadrant below.

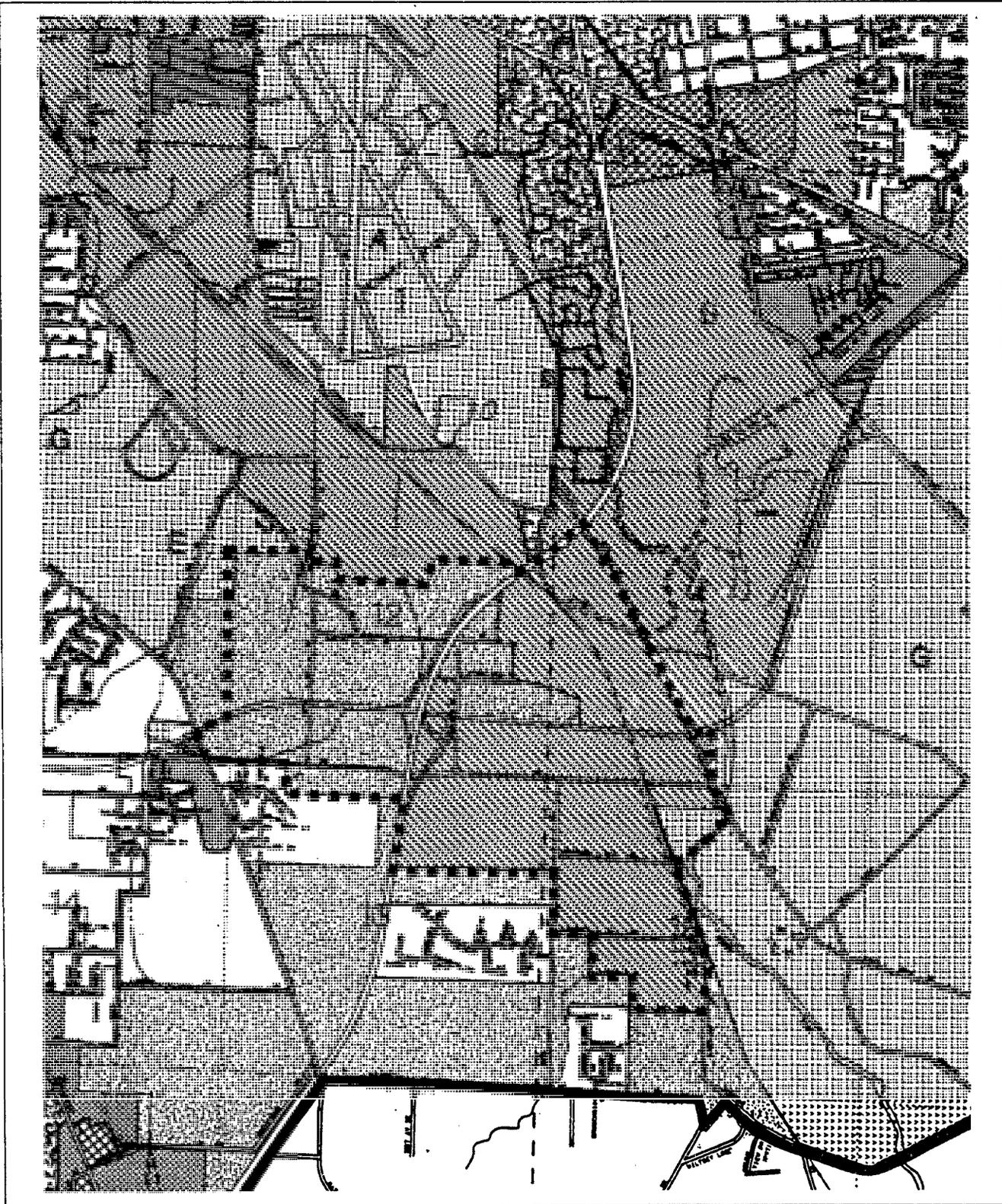
Table 1
2015 Baseline Scenario Land Use (acres)

	Northwest	Southwest	Northeast	Southeast	Total
Developing Residential	159.3	73.7	47.4	0.0	280.4
Industrial	11.2	0.0	136.5	325.5	473.2
Total	170.5	73.7	183.9	325.5	753.6

PROPOSED PLAN SCENARIO

The basic planning concept for the Proposed Plan is to provide a mix of residential, office, and commercial uses that serve the surrounding community as well as I-5. The scale of this development is local, rather than regional, in nature. The industrial lands on the east side of I-5, however, are to serve as a regional employment center.

The Proposed Plan is structured by interchange quadrant. Each quadrant has a primary function that varies in scale and intensity. The northwest quadrant, shown in Figure 6, is a residential neighborhood offering a full range of urban housing options of varying densities integrated with a mixed use core. The mixed use core is oriented to the residential areas, but also provides limited services to I-5. The northern edge of the quadrant is a transitional area for industrial uses, particularly because of its proximity to the Fairview Industrial Park to the north. The southwest quadrant (Figure 7) is a



LEGEND

- ■ ■ ■ - Proposed Plan Area
- ▨ - Industrial
- ▩ - Developing Residential
- - Single-Family
- ▤ - Community Service/Government



Figure 5
BASELINE (Comprehensive Plan)
LAND USE SCENARIO

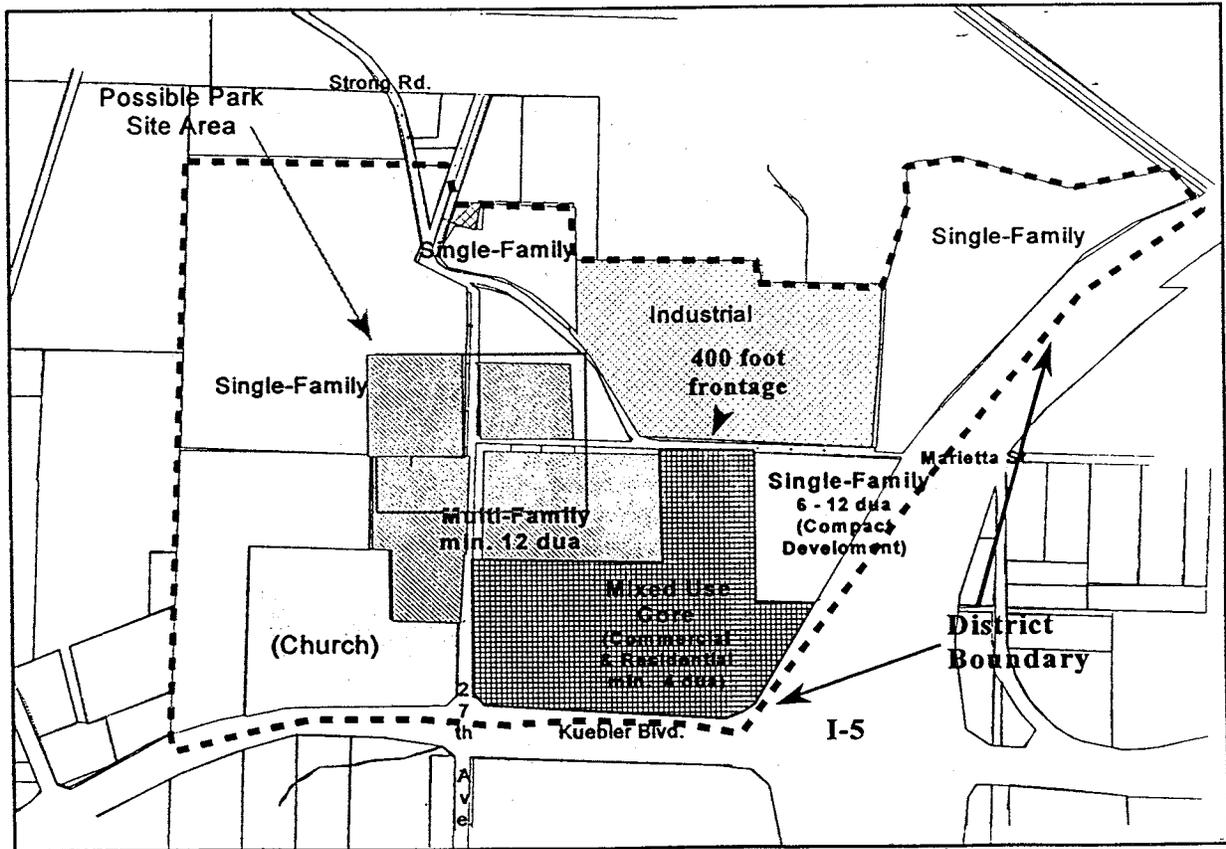


Figure 6
PROPOSED PLAN SCENARIO
Northwest Quadrant

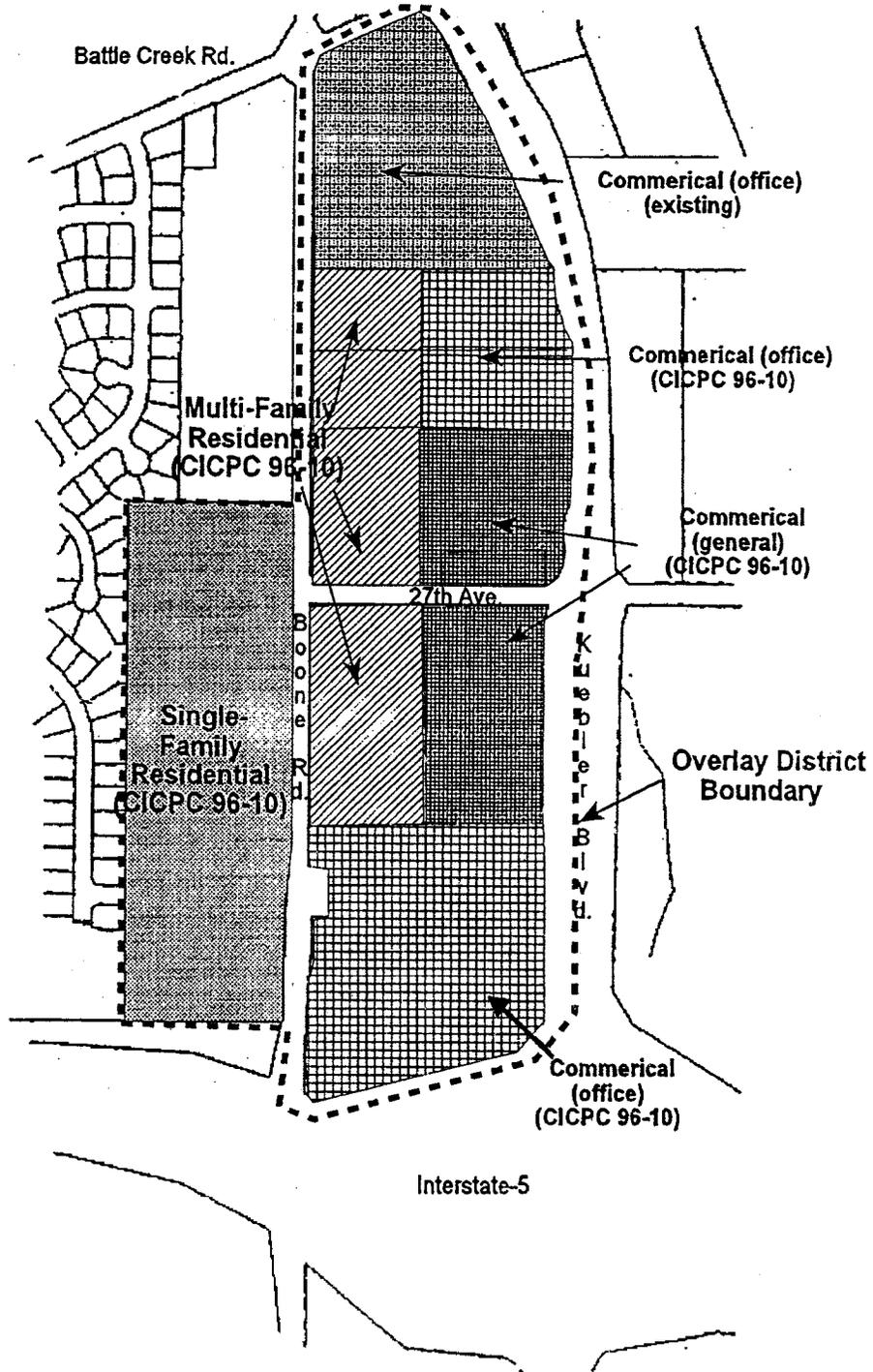


Figure 7
PROPOSED PLAN SCENARIO
Southwest Quadrant

Future Conditions

community service node with office uses that are linked to the existing residential neighborhood to the south through a transitional residential area that offers a variety of housing options. This area provides community-scale office and service-oriented uses with limited I-5 services. The northeast quadrant (Figure 8) is divided into neighborhood residential on the west side and regional industrial employment on the east side. The southeast quadrant is a regional industrial employment area immediately adjacent to the interchange area with a residential neighborhood further to the south. The Proposed Plan zoning for this quadrant is identical to that for the Comprehensive Plan (see Figure 6); however, the levels of development assumed with the Proposed Plan are much higher. The city's draft overlay zones for the northeast, southwest, and northwest quadrants are contained in the *I-5/Kuebler Boulevard Interchange Management Plan Final Reconnaissance Report*.¹⁵

Land use quantities for the 2015 Proposed Plan are summarized by quadrant below.

Table 2
2015 Proposed Plan Scenario Land Use (acres)

	Northwest	Southwest	Northeast	Southeast	Total
Single Family Residential	102.2	20.1	44.1	5.2	171.6
Multi-Family Residential	23.9	13.9	22.7	0.0	60.5
Commercial Office	0.0	28.3	2.6	0.0	30.9
Public Use	0.0	0.0	3.6	0.0	3.6
Mixed Use	25.0	0.0	0.0	0.0	25.0
General Commercial	0.0	11.3	0.0	0.0	11.3
Industrial	19.4	0.0	111.0	320.3	450.7
Total	170.5	73.6	184.0	325.5	753.6

A description of the process for developing the 2015 land use estimates, including densities and specific development types, is included in the *I-5/Kuebler Boulevard Interchange Management Plan Final Reconnaissance Report*.¹⁶

The 2006 Proposed Plan land use forecast was developed by establishing assumptions regarding the proportion of 2015 development that would occur by 2006 for each land use type within the interchange quadrants, then applying the percentages to the 2015 development totals to obtain 2006 development estimates by land use type.

¹⁵ Oregon Department of Transportation, A-1.

¹⁶ Oregon Department of Transportation, 36-41.

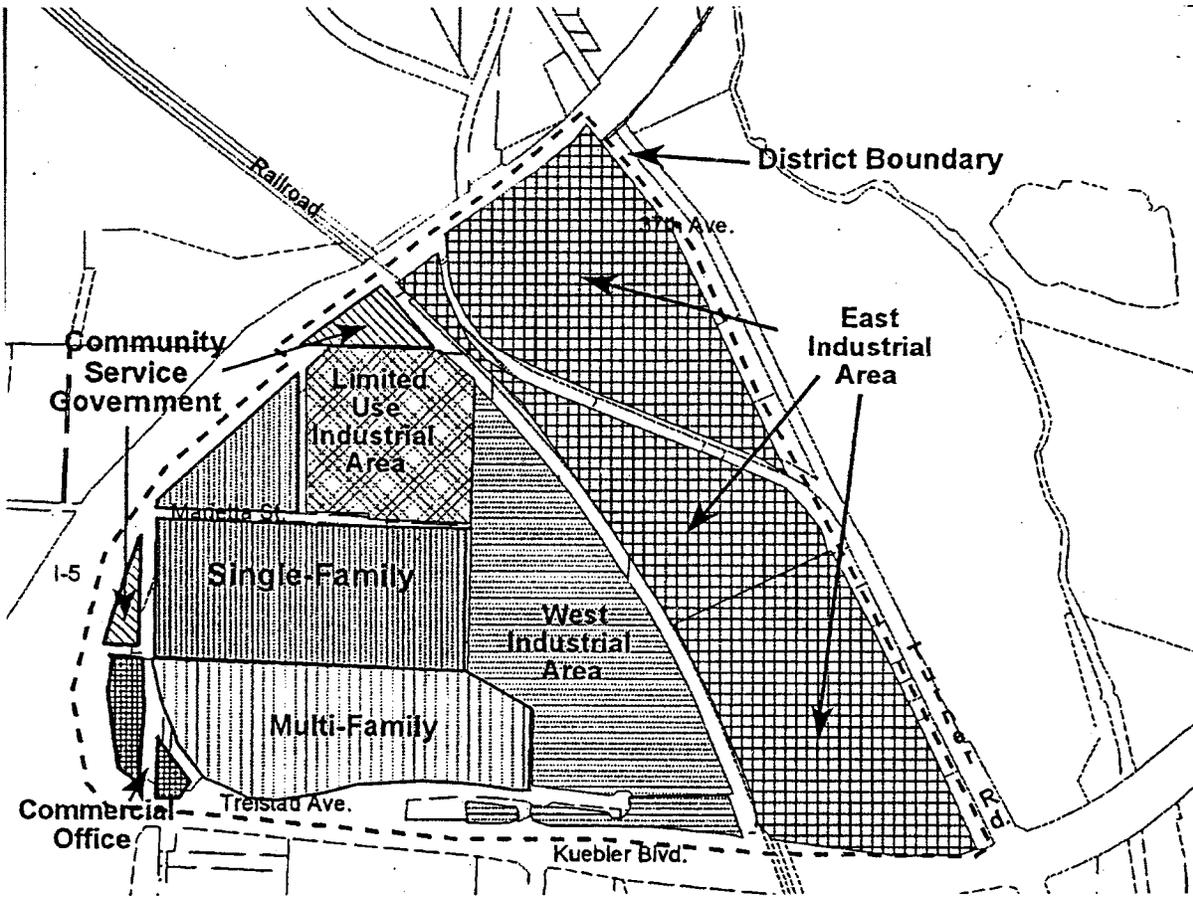


Figure 8
PROPOSED PLAN SCENARIO
Northeast Quadrant

Future Conditions

Because the Proposed Plan area is outside of the City of Salem's Current Developed Area (CDA), there was considerable uncertainty about the timing of future urban services, particularly water service, making the establishment of interim growth assumptions difficult. It is the city's policy to require developers to "front" the infrastructure costs of development, which, for the Proposed Plan area, would include the construction of a water reservoir at an estimated cost of \$4 - 6 million. These large up-front costs make this area less attractive than other sites, especially for residential development. For industrial development, infrastructure costs are less problematic under the city's current Chapter 66 – Urban Growth Management regulations.

Commercial development is also hampered by the parcelization of the area into relatively small and medium parcels, which may make it difficult to assemble a large project that could afford to front the infrastructure costs required to initiate development in the area. The other unknown is the amount of spillover development from the Portland metropolitan area that may occur as its industrial land base tightens under the 2040 Growth Concept.

The estimated percentages of 2015 development that may occur by 2006 for each land use type and quadrant are given below in Table 3, together with the estimated 2006 land use quantities.

Table 3
2006 Proposed Plan Scenario Land Use (acres)

	Northwest			Southwest			Northeast			Southeast			Total	
	2015	%	2006	2015	%	2006	2015	%	2006	2015	%	2006	2015	2006
SFU	102	25%	25.6	20.1	25%	5.0	44.1	0%	0.0	5.2	0%	0.0	171.6	30.6
MFU	23.9	25%	6.0	13.9	21%	2.9	22.7	0%	0.0	0	--	0.0	60.5	8.9
Commercial	0	--	0.0	28.3	25%	7.1	2.6	25%	0.7	0	--	0.0	30.9	7.7
Public Use	0	--	0.0	0	--	0.0	3.6	100%	3.6	0	--	0.0	3.6	3.6
Mixed Use	25	38%	9.4	0	--	0.0	0	--	0.0	0	--	0.0	25.0	9.4
Gen. Comm.	0	--	0.0	11.3	25%	2.8	0	--	0.0	0	--	0.0	11.3	2.8
Industrial	19.4	100%	19.4	0	--	0.0	111	25%	27.8	320	50%	160.2	450.7	207.3
Total	171		60.3	73.6		17.8	184		32.0	326		160.2	753.6	270.3

Transportation

TRAFFIC PROJECTIONS

Traffic forecasts for the interchange area were developed using a version of the SKATS regional travel forecasting model known as a focus model. The focus model was

Future Conditions

developed for the specific purposes of this study to produce more accurate forecasts of traffic within the interchange area than could be achieved with the standard regional model.

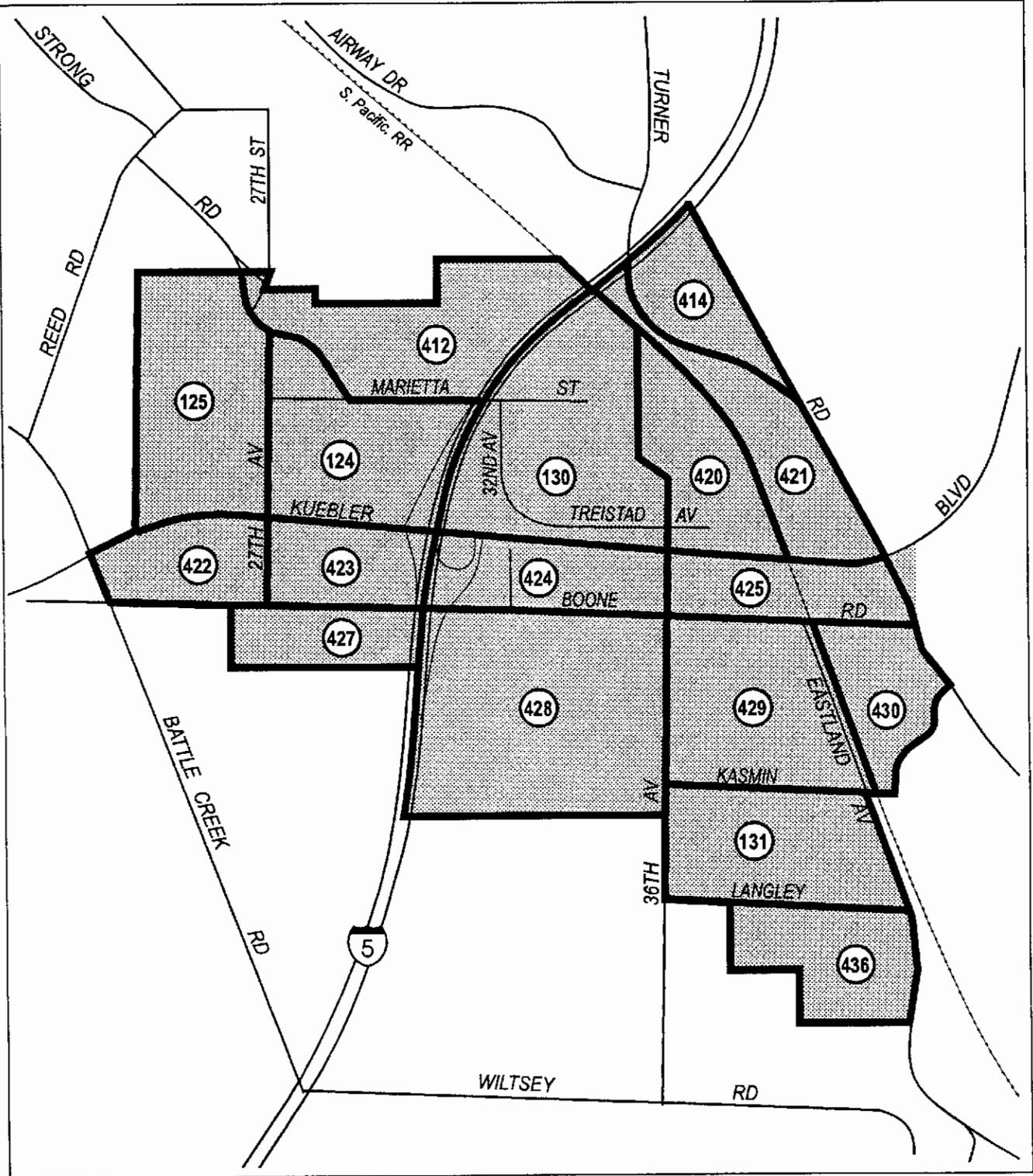
The focus model development process consisted of modifying the regional travel model to reflect the study area land uses and roadway network at a greater level of detail, and then testing the model using base year (1995) data to ensure that it was functioning properly. The regional model was modified by splitting the traffic analysis zones (TAZs) within the study area into smaller subzones and by adding local streets to the model roadway network, consistent with the level of detail of the zone system. Focus model zones within the Proposed Plan area are shown in Figure 9. The regional model trip table (containing all of the zone-to-zone trips) was also adjusted to reflect the refined zone system. Once these steps were completed, the focus model was run using base year input data and the results were compared to 1995 traffic count data.

The comparison indicated that the model's estimates of study area traffic volumes were not close enough to the counted (actual) volumes. Therefore, additional adjustments were made to the model trip table following an iterative process until the model's traffic estimates were sufficiently accurate for purposes of the study.

The 2015 traffic forecasts were produced by applying the focus model in the same way that it had been developed, but using input data representing future year land use and roadway network conditions. For the Baseline scenario, this involved converting the standard regional model trip table (reflecting comprehensive plan land uses) to the focus model zone system and adding detail to the future year model roadway network within the study area. In addition, the following committed or planned roadway improvements were included in the network:

- Widening of I-5 to 3-lanes in each direction between Highway 22 and Ilahee crossing.
- Addition of NB on-ramp at I-5/Kuebler Blvd. interchange from westbound Kuebler Blvd.
- Two-lane extension of Mildred Lane to Fabry Road.
- Extension of Fairview Industrial Dr. to Marietta St. west of I-5 (3-lanes).
- Deletion of Strong Road between Madrona Ave. and Reed Road.

For Proposed Plan scenario, a special regional model trip table reflecting the Proposed Plan land uses was created and then modified according to the focus model zone system. This was done because it was decided that the Proposed Plan land uses would result in shifts in regional tripmaking that would be too large to accurately represent with the



LEGEND

-  - TAZ Boundary Line
-  - TAZ Number
-  - Proposed Plan Area

Figure 9
PROPOSED PLAN AREA
TRAFFIC ANALYSIS ZONES

Future Conditions

standard regional model trip table. The same roadway network used for the Baseline scenario forecast was used for the Proposed Plan forecast, with the exception of a diamond interchange improvement for the existing intersection of Highway 22/Cordon Road that was assumed for the Proposed Plan scenario only.

The 2006 Proposed Plan scenario forecast was developed in the same manner as the 2015 forecast, in which a special regional model trip table was first created in order to more accurately reflect the land use assumptions contained in the Proposed Plan. The roadway network was developed by modifying the 2015 network to reflect only those improvements that, more likely than not, will be in place by 2006. The improvements, as agreed to by the project management team, were the following:

1. Two-lane extension of Mildred Lane to Fabry Road.
2. Extension of Fairview Industrial Dr. to Marietta St. west of I-5 (3-lanes).
3. Deletion of Strong Road between Madrona Ave. and Reed Road.

Two improvements that were assumed for 2015 but not 2006 were the widening of I-5 to 3-lanes in each direction between Highway 22 and Ilahee crossing and the addition of a northbound on-ramp at the I-5/Kuebler Blvd. interchange from westbound Kuebler Boulevard. Also, the diamond interchange improvement for the existing intersection of Highway 22/Cordon Road that was assumed for the 2015 Proposed Plan scenario was not assumed for the 2006 network.

A complete description of the focus model development and traffic forecasting process can be found in the *I-5/Kuebler Boulevard Interchange Management Plan Final Reconnaissance Report*¹⁷ and the memorandum "Additional Analysis of Proposed Plan Scenario- Revised".¹⁸

TRANSPORTATION IMPACTS

For 2015, overall p.m. peak hour trip generation for the Proposed Plan area would be roughly 4,100 trip ends (origins plus destinations), an increase of 3,400 trip ends (+450%) compared to the Baseline scenario. P.M. peak hour trip generation for the 2006 scenario would be roughly 1,200 trip ends. Detailed trip generation estimates by interchange quadrant and focus area TAZ are provided in Tables A-1 and A-2 of Appendix A.

¹⁷ Oregon Department of Transportation, 41-46.

¹⁸ DKS Associates, 16.

Future Conditions

Traffic Volume Impacts

Figure 10 shows the absolute and relative traffic volume impacts of the 2015 Baseline and Proposed Plan scenarios along Kuebler Boulevard and I-5. For the Baseline scenario, p.m. peak hour traffic volumes along Kuebler Boulevard increase from 10 to 45% compared to existing conditions, while volumes along I-5 increase from 60 to 90%. Volume increases for the Proposed Plan scenario are higher, ranging from 15 - 60% along Kuebler Boulevard and from 65 - 90% along I-5. In general, the volume increases for the Proposed Plan scenario are from 5 to 10% higher than for the Baseline scenario. Relative traffic volume impacts for other study area roadways are shown in Figures A-1 and A-2 of Appendix A.

Select zone assignments were run in *emme/2* for both the Baseline and Proposed Plan scenarios in order to identify the percentage of local trips (trips to/from the interchange area) vs. regional trips using the surrounding roadway network.

As shown in Figure 11, local traffic accounts for roughly 1 - 2 % of total traffic volume along I-5 and 5- 10 % of total traffic along Kuebler Boulevard for the Baseline scenario. Local streets with greater than 20% local traffic are 27th Avenue, Strong Road, Marietta Street, Trelstad Avenue, 36th Avenue, and Boone Road. As would be expected, the highest percentages of regional traffic occur along I-5, Kuebler Boulevard, and Battlecreek Road (see Figure 12). Relatively high regional traffic percentages also occur along Turner Road and Fairview Industrial Drive.

The percentages of local traffic along study area roadways are substantially higher for the Proposed Plan scenario than the Baseline scenario. Local traffic percentages range from 20% to nearly 60% along Kuebler Boulevard and the I-5 ramps and from 5% to 15% along I-5 (see Figure 13). Local roadways within the study area generally carry between 50% and 100% local traffic. The percentages of local traffic are particularly high along 27th Avenue, Marietta Street, Trelstad Avenue, and Boone Road.

Consistent with this, regional traffic percentages are lower along most study area roadways for the Proposed Plan scenario compared to the Baseline scenario. Along Kuebler Boulevard, regional percentages range from 40 - 70% east of I-5 and from 55 - 80% west of I-5 (see Figure 14). Regional traffic percentages along I-5 range from 85 - 95%. These lower percentages reflect not only the higher volumes of local traffic generated by the Proposed Plan scenario, but also the diversion of regional traffic to less congested routes when the higher volumes of local traffic area are loaded onto the network. This effect is particularly strong due to the near-capacity conditions that exist for several roadways for the Baseline scenario even without these additional volumes. Modeled volume-to-capacity ratios, for example, approach or exceed 1.0 for the

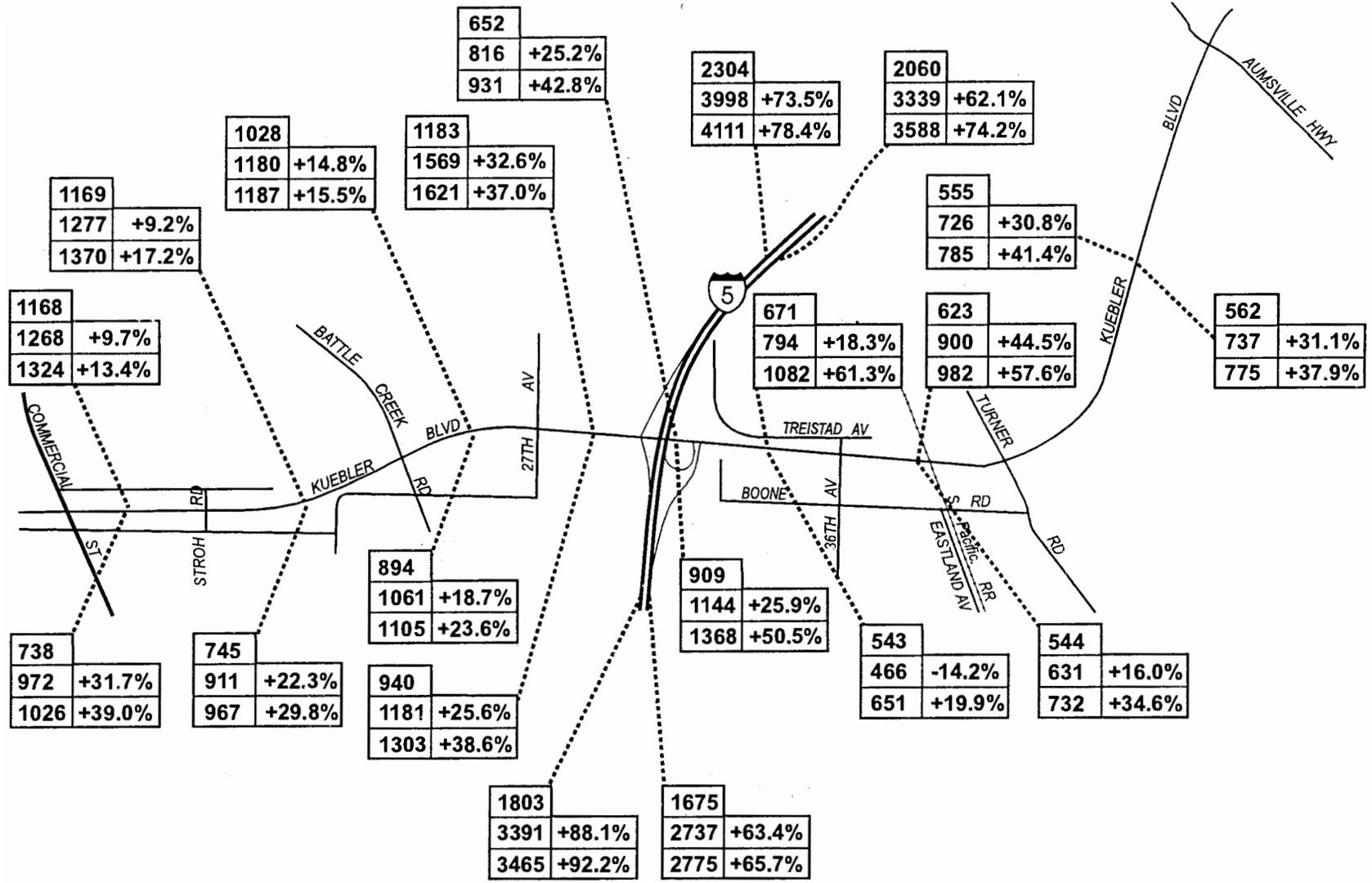


Figure 10
2015 PM PEAK HOUR
TRAFFIC VOLUME IMPACTS
Kuebler Boulevard and I-5

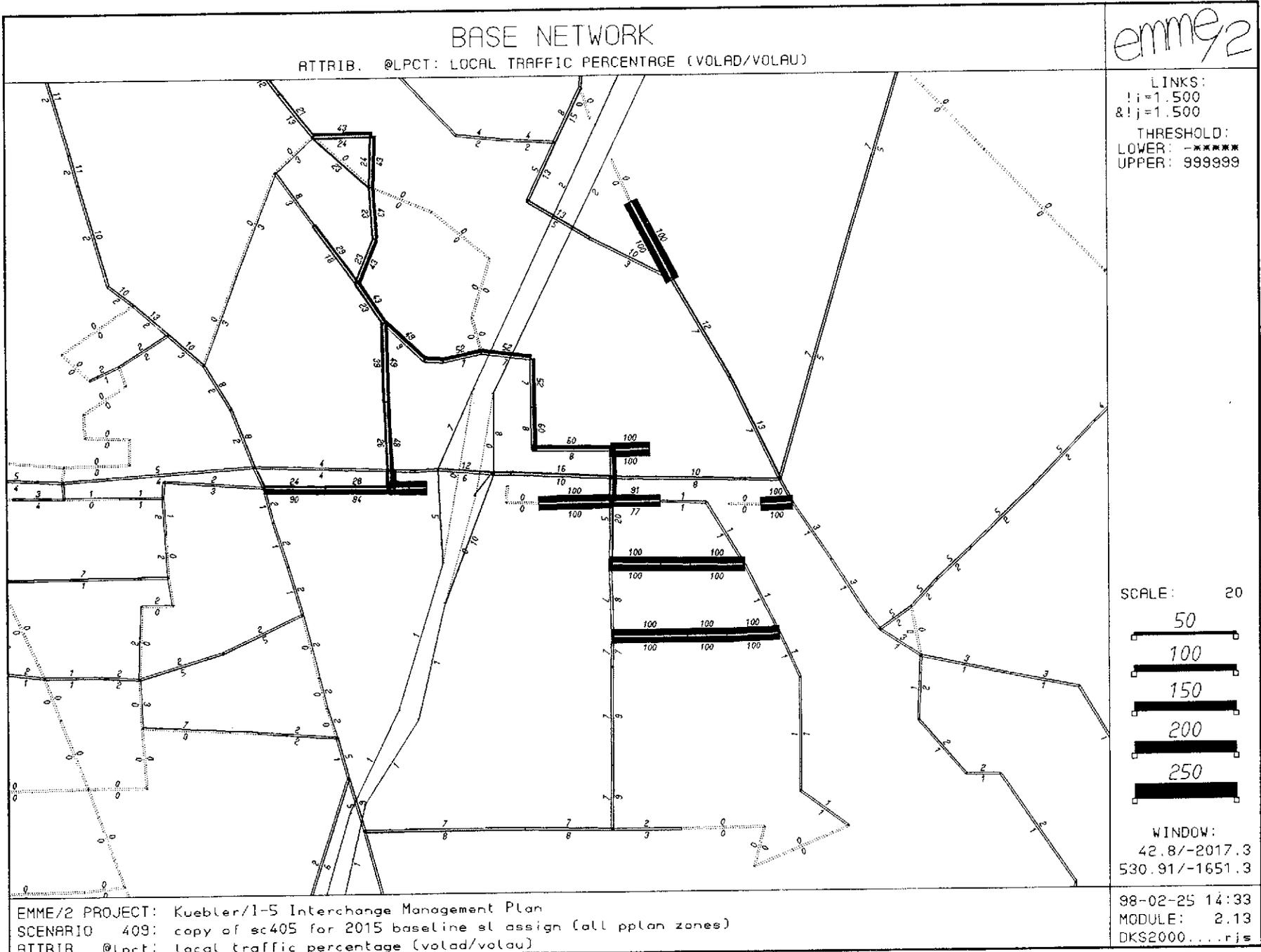


Figure 11
2015 BASELINE SCENARIO
Local Traffic Percentages

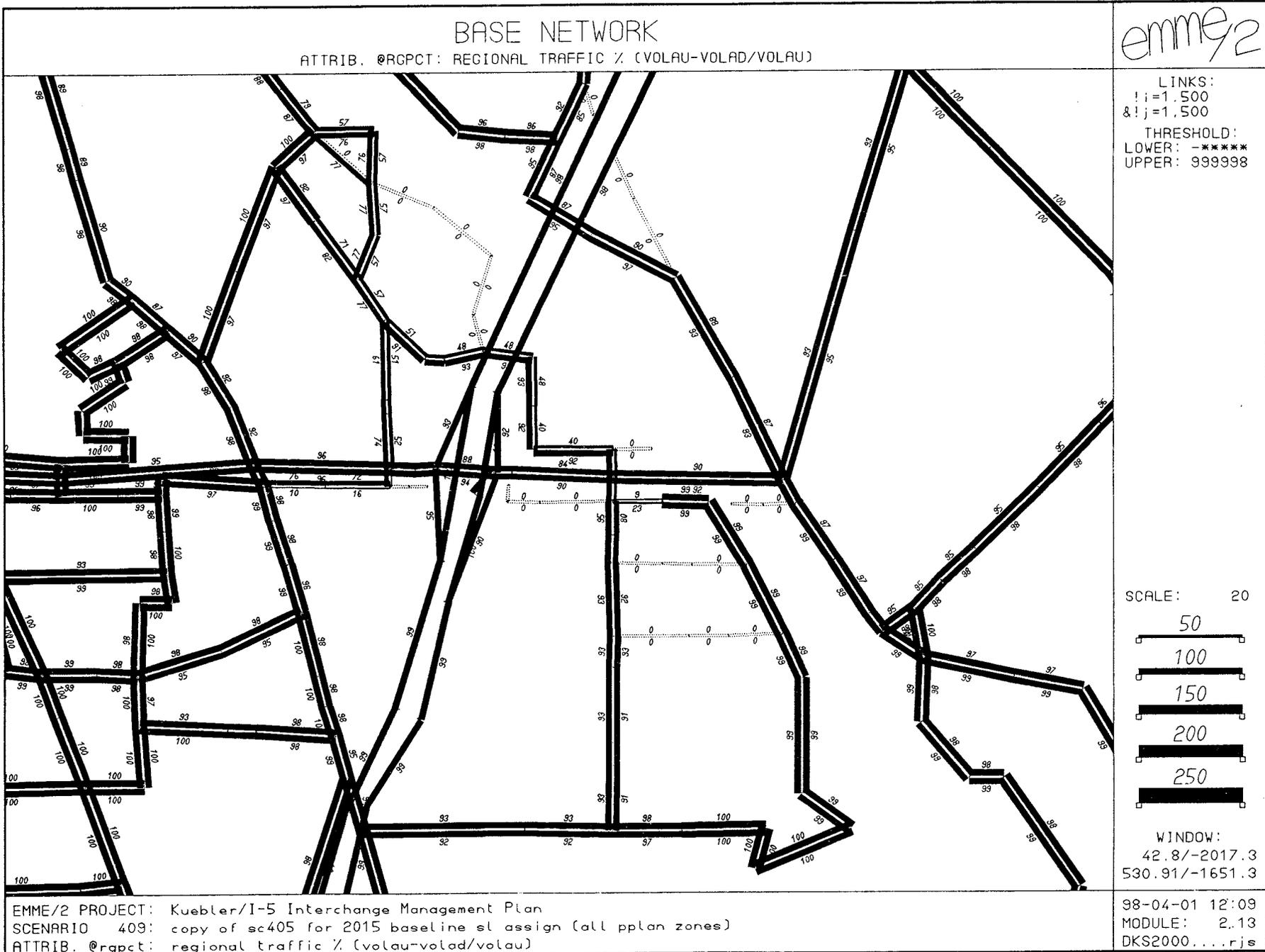


Figure 12
2015 BASELINE SCENARIO
Regional Traffic Percentages

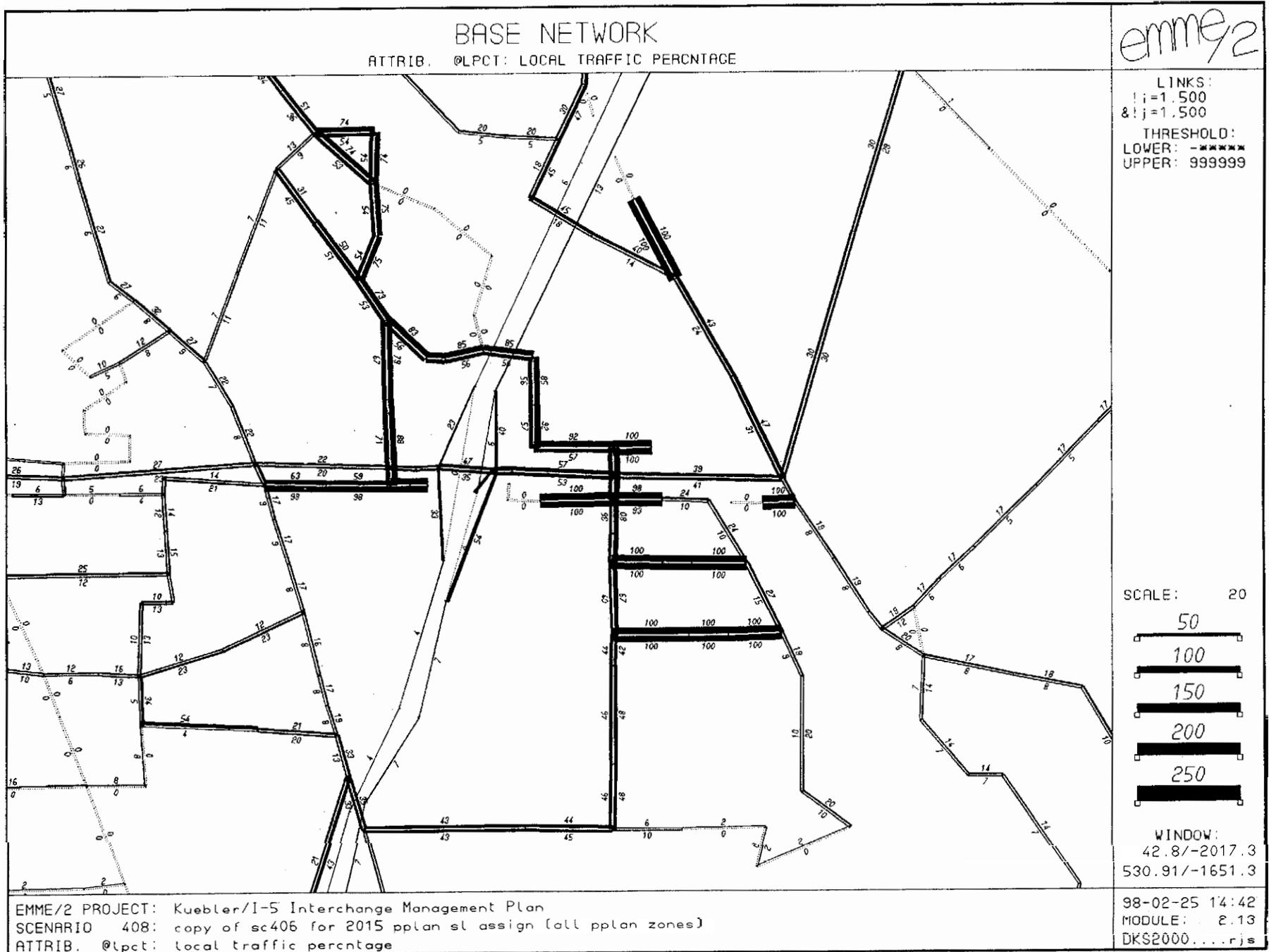
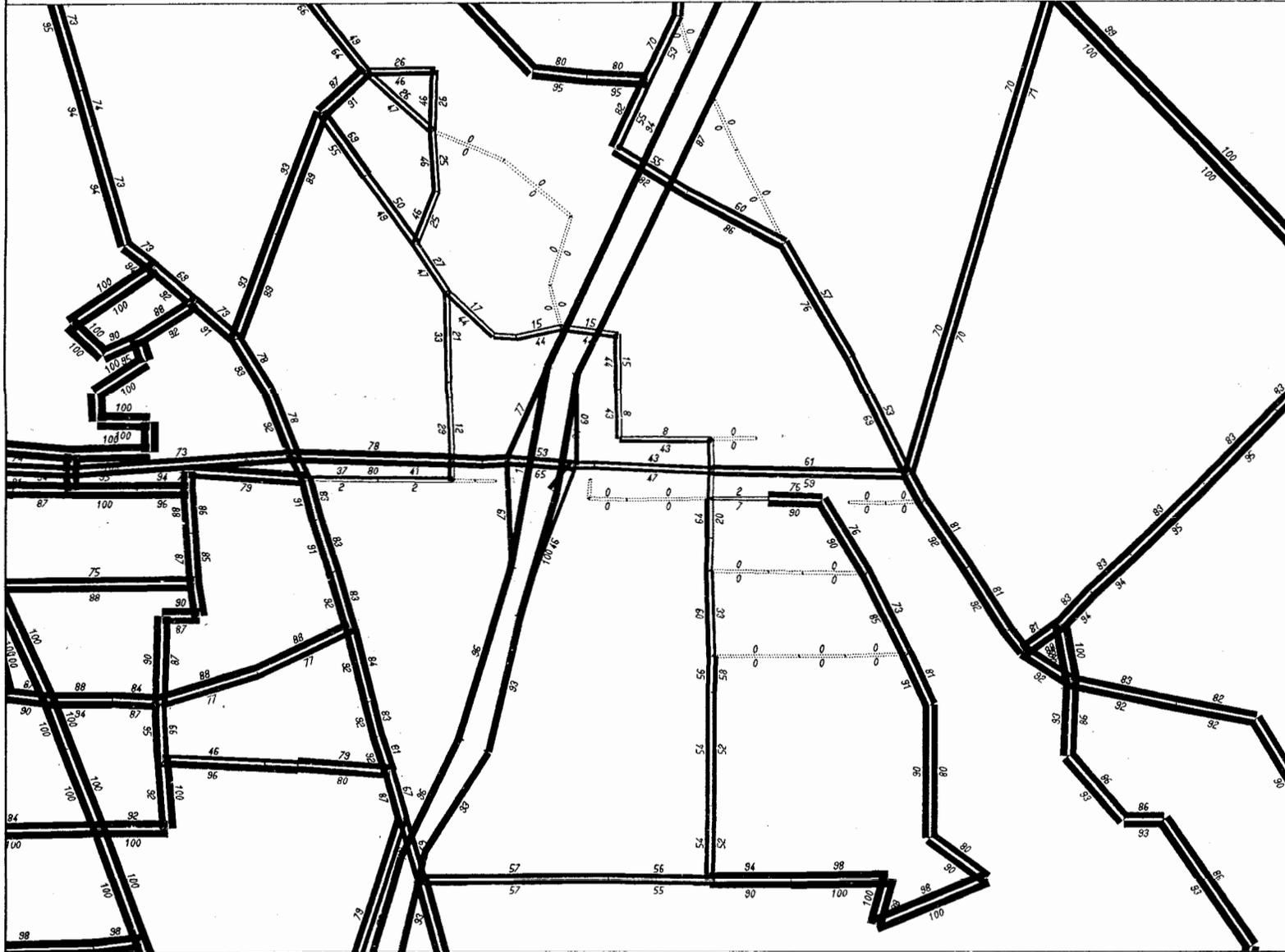


Figure 13
2015 PROPOSED PLAN SCENARIO
Local Traffic Percentages

BASE NETWORK

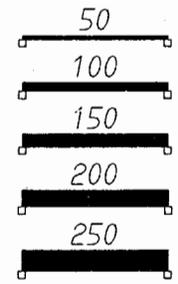
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emme/2



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SCALE: 20



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98-04-01 12:19
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Figure 14
2015 PROPOSED PLAN SCENARIO
Regional Traffic Percentages

Future Conditions

southbound I-5 off-ramp and several links along Kuebler Boulevard and Battlecreek Road for the Baseline scenario.

The high volume-to-capacity (v/c) ratios that would occur along Kuebler Boulevard for the Baseline scenario, particularly west of I-5, would have a significant influence on the relative impacts of the Proposed Plan scenario along Kuebler Boulevard. The effect of this condition would be limit the amount of additional traffic that could use Kuebler Boulevard as a result of the Proposed Plan development. Specifically, the following changes in study area traffic flows would likely occur with the additional traffic from the Proposed Plan development compared to the Baseline scenario:

1. A portion of the traffic from the Proposed Plan area would load onto Kuebler Boulevard, utilizing the available capacity and, in some cases, adding to the traffic on links that would already be over capacity with Baseline scenario, resulting in v/c ratios well over 1.0.
2. As described above, a portion of regional traffic volume using Kuebler Boulevard with the Baseline scenario would divert to less congested routes as a result of the increased local volumes from the Proposed Plan area.
3. Total traffic along other study area roadways would increase noticeably compared to the Baseline scenario, with some of the increase due to the insufficient capacity along Kuebler Boulevard to accommodate the additional volume. Other roadways with directional traffic volume increases of greater than 50 vph (generally the level at which changes in intersection level of service may occur) and 100 vph are shown in Figure 15. These include 27th Avenue, Fairview Industrial Drive, Madrona Avenue, Marietta Street, Trelstad Avenue, 36th Avenue, Turner Road, and Boone Road. The relative change associated with these increases ranges from 10% to 200+%.

Therefore, in part because of the inability of Kuebler Boulevard to absorb all of the traffic demand that would otherwise use this route, one of the main impacts of the Proposed Plan scenario compared to the Baseline scenario would be higher traffic volumes along a number of other roadways within or near the study area. A summary of traffic volume differences between the Proposed Plan scenario and the Baseline scenario for other study area roadways is provided in Table A-3 of Appendix A.

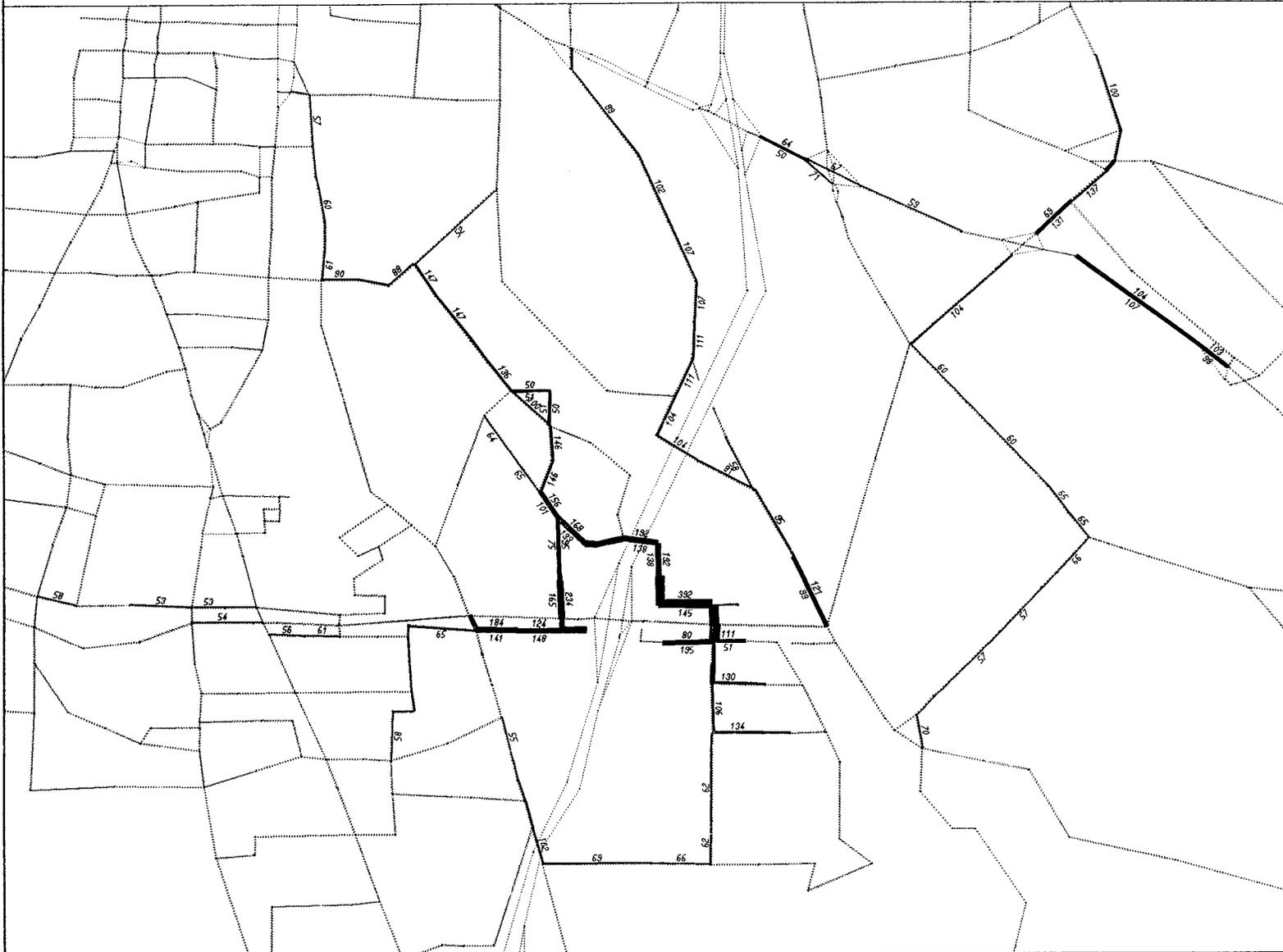
The absolute and relative volume impacts of the 2006 Proposed Plan scenario are shown in Figure 16. Volume increases along Kuebler Boulevard are generally in the range of 10 – 20 % to the west of I-5 and 20 – 30% to the east of I-5. The volume increases along I-5 are roughly 40%, with the exception of the southbound segment south of Kuebler Boulevard, which would increase by 55%. Traffic volumes for the 2015 Proposed Plan scenario are also shown for comparison purposes. As can be seen, the relative increases

BASE NETWORK

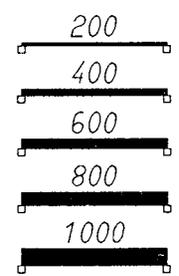
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emme/2

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 UPPER: 999998



SCALE: 100

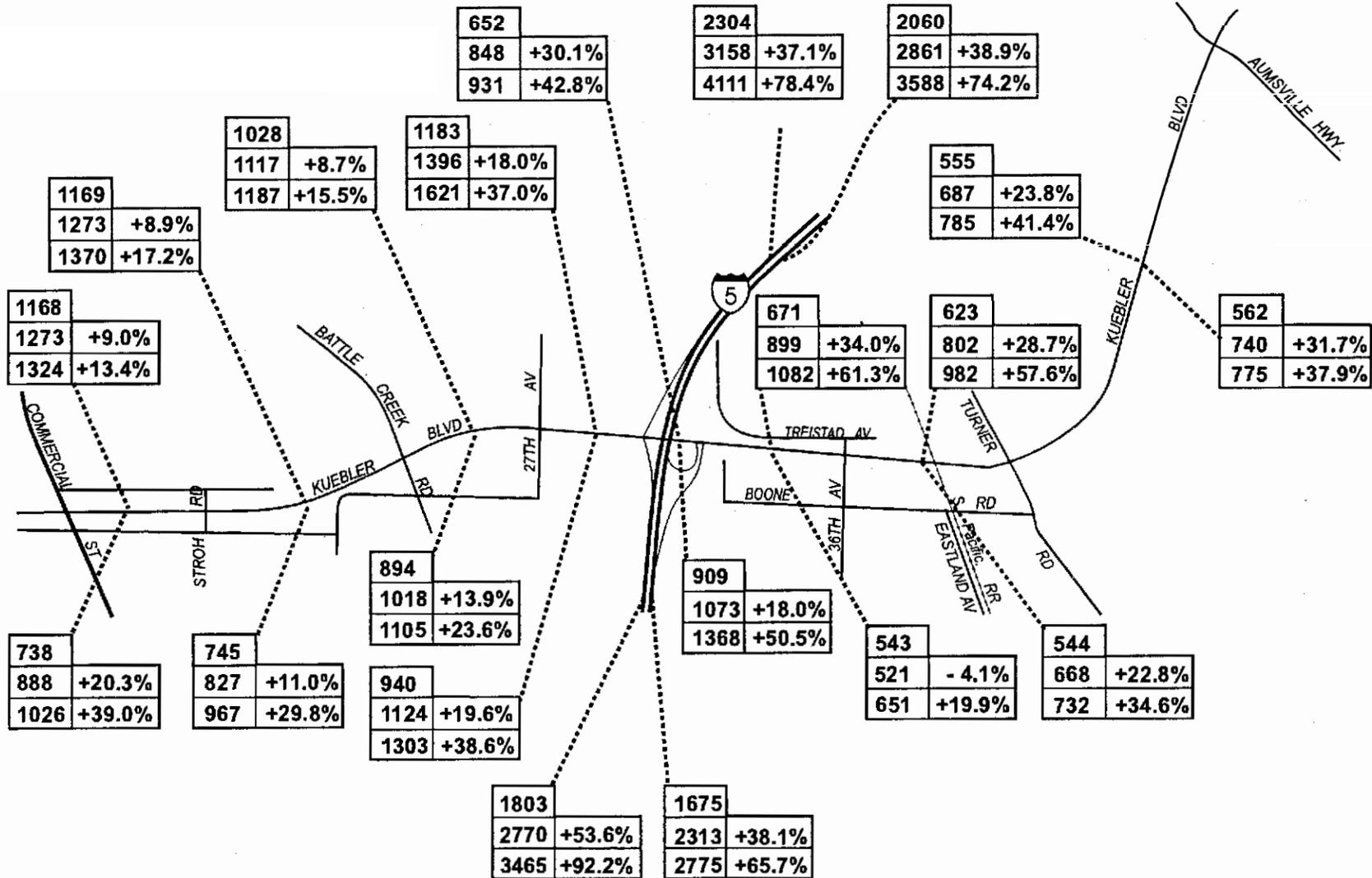


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98-04-09 14:47
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 DKS2000....rjs

Figure 15
2015 PM PEAK HOUR TRAFFIC VOLUME INCREASES
Proposed Plan vs. Baseline Scenario



LEGEND

Existing Conditions -	0000	
2006 Proposed Plan Scenario -	0000	+00.0%
2015 Proposed Plan Scenario -	0000	+00.0%

Figure 16
2006 PM PEAK HOUR
TRAFFIC VOLUME IMPACTS
Kuebler Boulevard and I-5

Future Conditions

for 2006 are roughly one-half those for 2015 along most segments of Kuebler Boulevard and I-5. Traffic increases for other study area roadways are shown in Figure A-3 of Appendix A.

Local traffic percentages, shown in Figure 17, generally range from 10% to 25% along Kuebler Boulevard and the I-5 ramps and from 2% to 6% along I-5. These percentages are significantly lower than the local traffic percentages for the 2015 Proposed Plan scenario, reflecting the lower level of interchange area development for the 2006 scenario. Consistent with this, regional traffic percentages are higher with the 2006 scenario, ranging from 75% to 100% along Kuebler Boulevard and from 94% to 98% along I-5 (see Figure 18).

Level of Service Impacts

Level of service estimates were prepared for Kuebler Boulevard and I-5 assuming the same roadway improvements included for the traffic forecasts.

Kuebler Boulevard

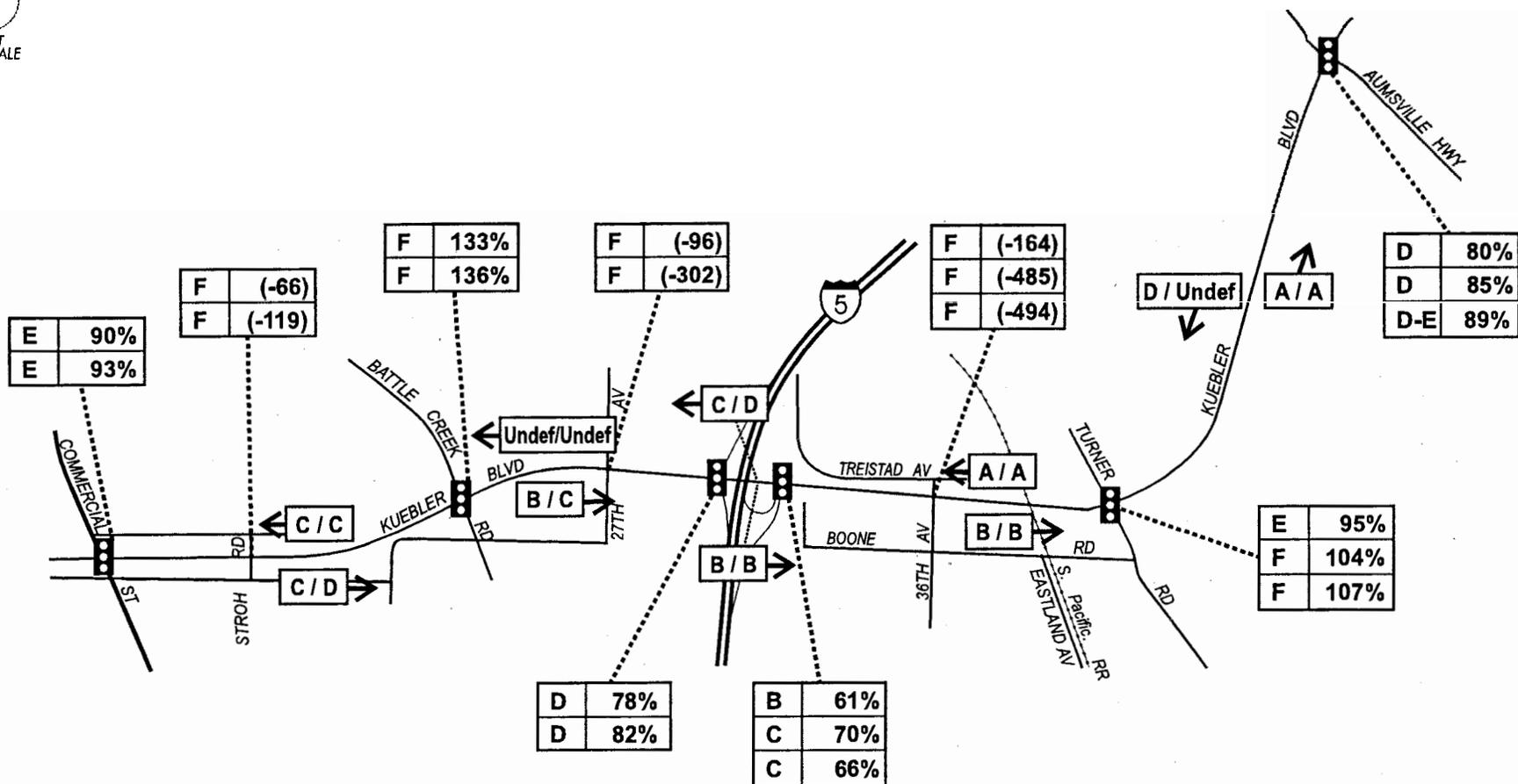
Figure 19 shows intersection levels of service for the 2015 Baseline and Proposed Plan scenarios. For the Baseline scenario, LOS D or better would occur at the signalized intersections of the I-5 southbound ramps, I-5 northbound ramps and Aumsville Highway. The signalized intersections at Commercial Street and Turner Road would operate LOS E, while the Battlecreek intersection would operate at LOS F. LOS F would also occur at the unsignalized intersections at Stroh Road, 27th Avenue, and 36th Avenue.

Intersection levels of service for the 2015 Proposed Plan scenario would be identical to those for the Baseline scenario, with the exception of the intersections of Kuebler Boulevard/I-5 northbound ramps and Kuebler Boulevard/Turner Road, where the levels of service would drop to LOS C and LOS F, respectively.

Based on the peak hour volume warrant contained in the *Manual of Uniform Traffic Control Devices*,¹⁹ signal warrants would be met at all of the unsignalized intersections for both the Baseline and Proposed Plan scenarios.

Arterial segment LOS is good in both directions along Kuebler Boulevard for the 2015 Baseline scenario, ranging from LOS A to LOS C (see Figure 19). The only exception to this is the westbound segment between the I-5 southbound ramps and Battle Creek Road,

¹⁹ National Joint Committee on Uniform Traffic Control Devices, Manual on Uniform Traffic Control Devices (Washington, D.C.: U.S. Government, 1988).



LEGEND

Intersections



- Signalized Study Intersection

A	00%
B	00%
C	00%

- Baseline Scenario

- Proposed Plan Scenario

- Proposed Plan Scenario with No I-5 Improvements

00% - Saturation Level

(000) - Reserve Capacity

Arterial Segments



- Baseline Scenario/Proposed Plan Scenario
(Segments occur between signalized intersections)

Undef - LOS Undefined

Figure 19
2015 PM PEAK HOUR LEVEL OF SERVICE
Kuebler Boulevard

Future Conditions

where the level of service is undefined. This is because the level of service for the through movement at the intersection of Kuebler Boulevard/Battle Creek Road is LOS F. At LOS F, intersection delay estimates become unreliable, so that accurate estimates of arterial travel speed, which include intersection delay, cannot be made. The overall arterial level of service is "B" for the eastbound direction and undefined the westbound direction.

With the exception of the westbound segment between Aumsville Highway and Turner Road, the arterial segment levels of service for the 2015 Proposed Plan scenario are the same as or one letter LOS lower than the Baseline scenario. Level of service for the Aumsville Highway - Turner Road segment is undefined because of the LOS F estimate for the westbound through movement at Turner Road.

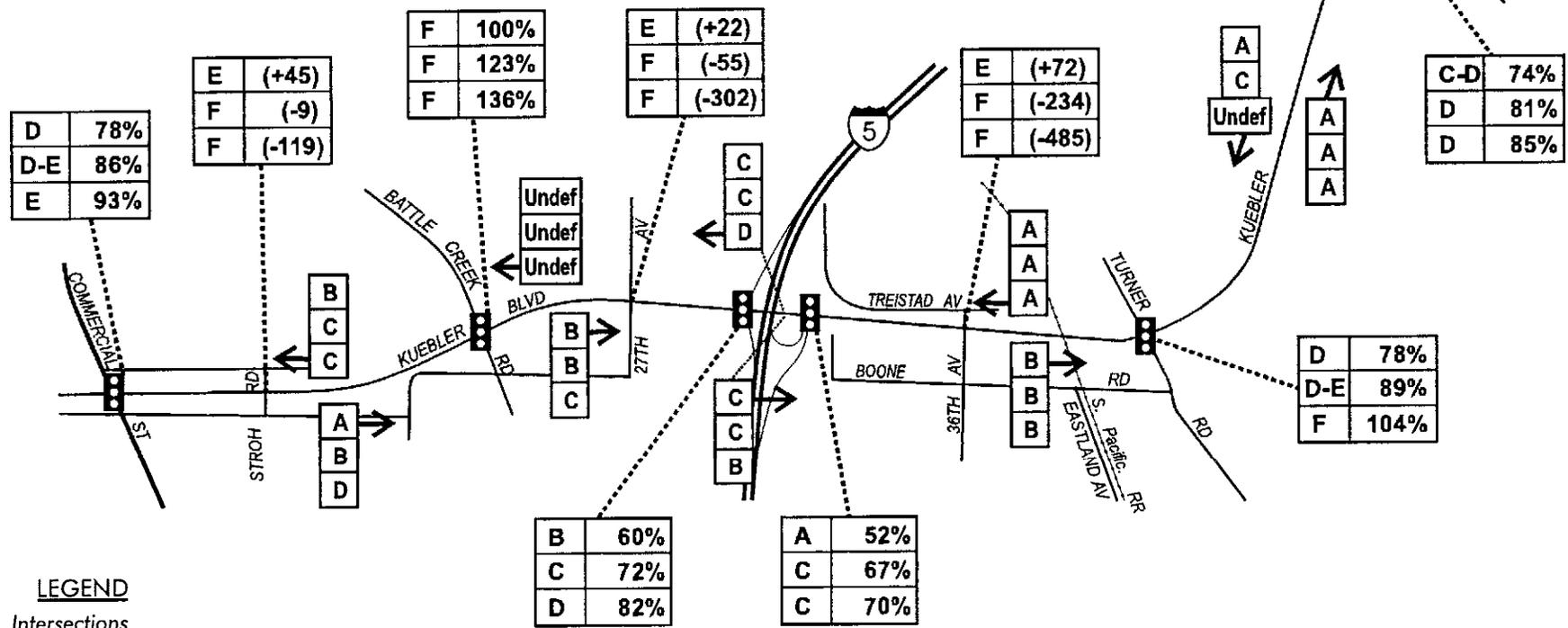
Adequate levels of service would occur at all of the existing signalized intersections along Kuebler Boulevard for the 2006 Proposed Plan scenario, with the exception of Kuebler Boulevard/Battle Creek Road, which would operate at LOS "F" (see Figure 20). LOS "F" would also occur at the unsignalized intersections of Kuebler Boulevard/Stroh Lane, Kuebler Boulevard/27th Avenue, and Kuebler Boulevard/36th Avenue. Based on the peak hour volume warrant contained in the *Manual of Uniform Traffic Control Devices*,²⁰ signal warrants would be met at Kuebler Boulevard/27th Avenue and Kuebler Boulevard/36th Avenue, but not at Kuebler Boulevard/Stroh Lane.

Arterial segment level of service for the 2006 Proposed Plan Scenario ranges from LOS "A" to LOS "C" in both directions along Kuebler Boulevard. Level of service is undefined in the westbound direction between 27th Avenue and Battle Creek Road. The overall arterial level of service would be "B" in the eastbound direction and undefined in the westbound direction.

I-5

2015 levels of service for the basic freeway segments and ramp junctions along I-5 to the north and south of Kuebler Boulevard are shown in Figure 21. These values reflect the widening of I-5 to three lanes in both directions. LOS C would occur along all of the basic freeway segments for both the Baseline and Proposed Plan scenarios, with the exception of the southbound segment south of Kuebler Boulevard, which would operate at LOS D. LOS C would also exist for all of the on- and off- ramp junctions for both the Baseline and Proposed Plan scenarios, except for the southbound off-ramp at Kuebler Boulevard, which would operate at LOS E for both scenarios.

²⁰ National Joint Committee on Uniform Traffic Control Devices.



LEGEND

Intersections

- Signalized Study Intersection

A	00%	- Existing Conditions
B	00%	- 2006 Proposed Plan Scenario
C	00%	- 2015 Proposed Plan Scenario

00% - Saturation Level

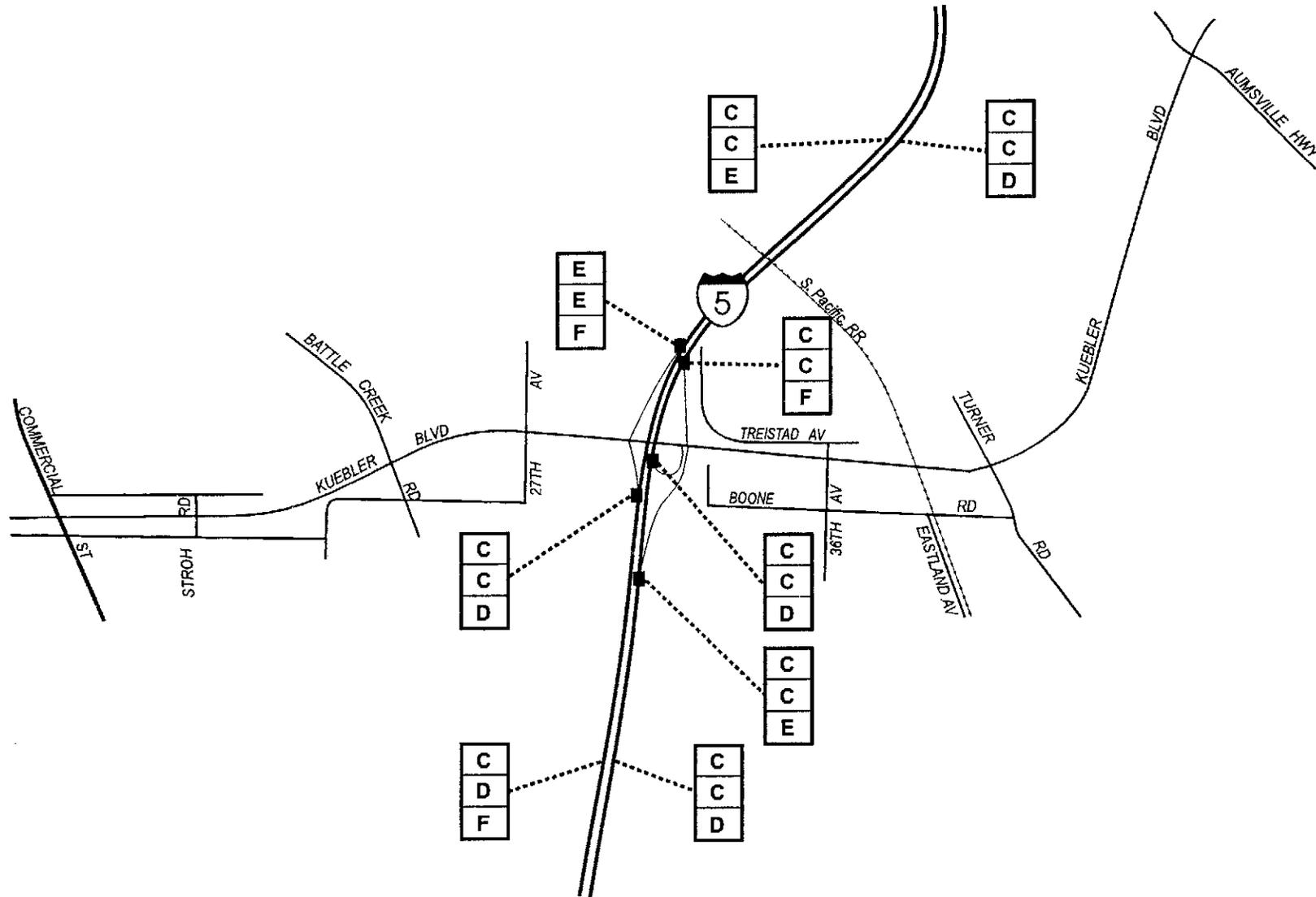
(000) - Reserve Capacity

Arterial Segments (Segments occur between signalized intersections)

A	- Existing Conditions
B	- 2006 Proposed Plan Scenario
C	- 2015 Proposed Plan Scenario

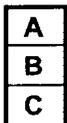
Undef - LOS Undefined

Figure 20
2006 PM PEAK HOUR LEVEL OF SERVICE
Kuebler Boulevard



LEGEND

■ - Ramp Junction



A - Baseline Scenario

B - Proposed Plan Scenario

C - Proposed Plan Scenario with No I-5 Improvements

Figure 21
2015 PM PEAK HOUR LEVEL OF SERVICE
Interstate-5

Future Conditions

As shown in Figure 22, level of service along I-5 for the 2006 Proposed Plan scenario would be adequate (LOS "D" or better) except at the southbound ramp junction at Kuebler Boulevard (LOS "F") and the southbound mainline segment south of Kuebler Boulevard (LOS "E"). As mentioned above, widening of I-5 south of Highway 22 to three lanes in each direction was not assumed for the 2006 scenario, nor was the addition of the northbound on-ramp from westbound Kuebler Boulevard. It should be noted that the level of service would be the same at these locations without the Proposed Plan area traffic, and that this traffic would contribute very little to the degradation in level of service. The reduced level of service would be related almost entirely to traffic from outside of the Proposed Plan area, i.e., regional traffic.

It is also interesting to note in Figure 22 that even with the substantially higher traffic volumes associated with the 2015 Proposed Plan scenario, the level of service would be higher at every location along I-5. This reflects the effects of the three-lane widening improvement for I-5 between Highway 22 and Delaney Road that was assumed for the 2015 scenario, but not the 2006 scenario.

Traffic Operations Impacts

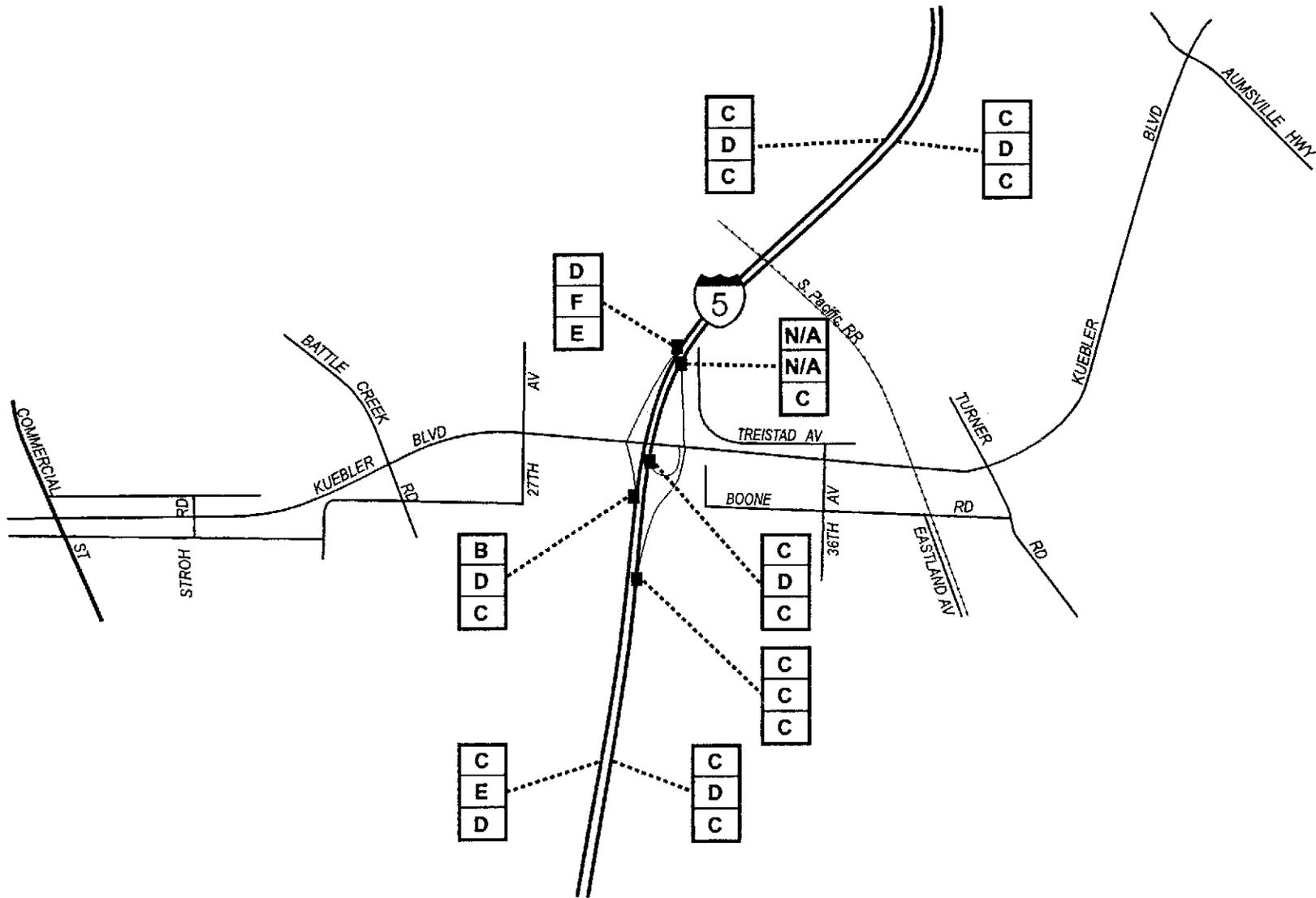
Kuebler Boulevard

Traffic operations impacts along Kuebler Boulevard were reviewed with regard to potential queuing problems at signalized intersection approaches. Queue lengths²¹ were estimated for each approach lane in both directions along Kuebler Boulevard.

For the 2015 Baseline scenario, turning lane queues would generally be less than 250 feet, except for the westbound left-turn lane at Commercial Street, where the queue would be roughly 340 feet. Based on the existing left turn lane length, this would likely cause problems with left-turning vehicles backing up into the inside through lane.

Turning lane queues for the 2015 Proposed Plan scenario would exceed 250 feet for the westbound left-turn lane at Commercial Street (280 feet), the westbound left-turn lane at the I-5 southbound ramps (340 feet), and the eastbound left-turn lane at Turner Road (360 feet). Operational problems could occur at Commercial Street, where left-turning vehicles may occasionally overflow into the inside through lane. At the I-5 southbound ramps and Turner Road, there would be adequate median length for storage of left-turning vehicles. Turning lane queues at all other locations would be less than 250 feet.

²¹ Queue lengths were estimated using ODOT's SIGCAP program. Estimated queue lengths correspond to 95 percentile values.



LEGEND

■ - Ramp Junction

- | |
|----------|
| A |
|----------|

 - Existing Conditions
- | |
|----------|
| B |
|----------|

 - 2006 Proposed Plan Scenario
- | |
|----------|
| C |
|----------|

 - 2015 Proposed Plan Scenario

Figure 22
2006 PM PEAK HOUR LEVEL OF SERVICE
Interstate-5

Future Conditions

For the 2006 Proposed Plan scenario, queues would exceed 250 feet for westbound left-turning vehicles at Commercial Street (340 feet) and eastbound right-turning vehicles at the I-5 northbound ramps (330 feet). At both locations, these queues could result in turning vehicles backing up into the adjacent through lane.

Locations with excessive through movement queue lengths (i.e., greater than 400 feet) are shown in Table 4.

Table 4
Excessive Queue Lengths - Through Movement

Location	Direction(s)	Queue Length (ft)	Number of Vehicles
<i>2015 Baseline Scenario</i>			
Kuebler Boulevard/Commercial Street	WB	470	19
Kuebler Boulevard/Battle Creek Road	EB/WB	750/1,030*	30/41*
Kuebler Boulevard/I-5 SB ramps	EB	420	17
Kuebler Boulevard/Turner Road	EB/WB	450/680*	18/27*
Kuebler Boulevard/Aumsville Highway	NB	530	21
<i>2015 Proposed Plan Scenario</i>			
Kuebler Boulevard/Commercial Street	WB	500	20
Kuebler Boulevard/Battle Creek Road	EB/WB	770/1,050*	31/42*
Kuebler Boulevard/I-5 SB ramps	EB	590	24
Kuebler Boulevard/Turner Road	EB/WB	430/740*	17/30*
Kuebler Boulevard/Aumsville Highway	NB	610	24
<i>2006 Proposed Plan Scenario</i>			
Kuebler Boulevard/Commercial Street	WB	450	18
Kuebler Boulevard/Battle Creek Road	EB/WB	680/950*	27/38*
Kuebler Boulevard/Turner Road	EB/WB	460/630	18/25
Kuebler Boulevard/Aumsville Highway	NB	520	21

* Queue length and number of vehicles based on saturation conditions and therefore not reliable.

Significant operational impacts may result from the westbound through vehicle queues at Battlecreek Road, which would likely extend to the 27th Avenue intersection for both

Future Conditions

scenarios. Although the through vehicle queues at the other locations are extensive, significant operational problems would be unlikely because there would be adequate distance between the intersections and there would be no driveway blockages due to the restricted access along Kuebler Boulevard. Left-turning vehicles may be impeded by through vehicles in reaching the left-turn lane at these locations, however.

In addition to Kuebler Boulevard, queue lengths on the northbound and southbound ramp terminal approaches were also checked. Storage lengths on the ramps appear to be adequate with both scenarios, so that lane blockages on the ramps and freeway mainline would not occur.

I-5

Based upon an examination of traffic volumes, the results of the level of service analysis, and the anticipated roadway geometry, no operational problems along the basic freeway segments north and south of Kuebler Boulevard are anticipated with either 2015 Baseline or Proposed Plan scenario. The only ramp junction which may experience operational difficulties is the southbound off-ramp at Kuebler Boulevard, which would operate at LOS E for both scenarios. Under this condition, flow levels would approach capacity limits and the turbulence of diverging maneuvers may become intrusive to all drivers in the ramp influence area. Small changes in demand or disruptions within the traffic stream may cause both ramp and freeway queues to begin forming.²²

As indicated in Figure 22, substandard level of service would occur for the 2006 Proposed Plan scenario along I-5 for the southbound freeway segment between Kuebler Boulevard and Delaney Road (LOS "E") and at the ramp junction for the southbound off-ramp at Kuebler Boulevard (LOS "F"). The LOS "E" condition for the southbound freeway segment describes operation at capacity. Speeds would drop below 60 mph and there would be virtually no usable gaps in the traffic stream. Any disruption to the traffic stream, such as merging vehicles or lane changes could cause following vehicles to give way, creating a ripple effect throughout the upstream traffic flow. There would be no ability to dissipate even minor disruptions, and any incident would result in serious breakdowns and extensive queuing.¹⁸

The LOS "F" for the southbound off-ramp represents breakdown or unstable operation. At this level, approaching demand flows exceed the discharge capacity of the downstream freeway and ramp. Queues form on the freeway and continue to grow as long as approaching demand flows exceed the discharge capacity of the section.¹⁸ Speeds at this level of service become highly variable.

²² Transportation Research Board, Highway Capacity Manual, Special Report 209 (Washington, D.C.: National Research Council, 1994).

Future Conditions

Impacts of Proposed Plan Scenario without I-5 Widening

Timing of the I-5 widening to three lanes in each direction south of Highway 22 is uncertain due to future funding constraints. Therefore, an additional network alternative for the Proposed Plan scenario was analyzed to determine the impacts of delaying the I-5 widening beyond 2015. To do this, the focus model trip table for the Proposed Plan scenario was reassigned to a 2015 roadway network that included only two lanes along I-5. This was done in order to reflect the changes in traffic assignment that would occur with the lower assumed capacity along I-5. Following this, level of service and operational impacts were analyzed along I-5 and at locations where the differences in traffic volumes appeared to be significant compared to the original Proposed Plan traffic forecast.

Kuebler Boulevard

Along Kuebler Boulevard, directional volumes to the east of I-5 would increase within the general range of 30 - 75 vph. To the west of I-5, the volume differences would be insignificant.

Based on these volume increases, LOS analysis was performed for the intersections along Kuebler Boulevard at the I-5 northbound ramps, 36th Avenue, Turner Road, and Aumsville Highway. As shown in Figure 19, the level of service would remain the same at the I-5 northbound ramps and deteriorate to a worse LOS F at the intersections of 36th Avenue and Turner Road. At Aumsville Highway, the level of service would drop to LOS D-E.

No significant differences in operational impacts are anticipated at the intersections of Kuebler Boulevard/I-5 northbound ramps or Kuebler Boulevard/Aumsville Highway.

I-5

As would be expected, volumes would decrease along I-5 with the two-lane alternative. North of Kuebler Boulevard, this decrease would be roughly 250 vph (-6.1%) in the southbound direction and 160 vph (-4.5%) in the northbound direction. South of Kuebler Boulevard, volumes would drop by 190 vph (-5.3%) in the southbound direction and 60 vph (2.2%) in the northbound direction.

The level of service impacts of lower capacity along I-5 would be significant. As shown in Figure 21, LOS E and LOS D would occur along the southbound and northbound basic freeway segments north of Kuebler Boulevard, respectively. South of Kuebler Boulevard, the LOS would be "F" in the southbound direction and "D" in the northbound

Future Conditions

direction. In addition to traffic volume, two significant factors contributing to the LOS F in the southbound direction are the rolling terrain and the relatively high percentage of trucks (20%). The LOS values for the southbound segments would fall below ODOT's LOS D standard.

Substandard level of service conditions would also exist for several of the ramp junctions at the Kuebler Boulevard interchange (see Figure 21). LOS values would range from "D" to "F", with LOS F occurring at the southbound off-ramp and the northbound on-ramp from westbound Kuebler Boulevard.

Traffic operational impacts would also occur with the reduced freeway levels of service. Operational characteristics associated with the LOS E condition along the southbound segment between Highway 22 and Kuebler Boulevard are described in the previous section. The LOS F condition south of Kuebler Boulevard in the southbound direction represents breakdowns in vehicular flow. LOS F usually exists within queues forming behind breakdown points caused by traffic incidents or congestion. Whenever LOS F conditions exist, there is potential for them to extend upstream for significant distances.²³

Operating conditions at LOS E for the northbound off-ramp and LOS F for the southbound off-ramp and the northbound on-ramp from westbound Kuebler Boulevard are also described in the previous section.

Although an analysis of the Baseline scenario with I-5 represented as two-lanes was not performed, it is likely that the impacts relative to the Proposed Plan scenario would be similar to those for the three-lane case described earlier.

²³ TRB.

Mitigation

V. Mitigation

Mitigation improvements were determined for locations along Kuebler Boulevard and I-5 where LOS standards would not be met with the Proposed Plan scenario. As described above, an LOS standard of “E” was used for Kuebler Boulevard and a standard of “D” was used for I-5. In addition, mitigation improvements were identified for the roadway network alternative in which no widening improvements were assumed for I-5 south of Highway 22.

Roadway Improvements

Based on the results of the transportation impact analysis, mitigation improvements for the 2015 Proposed Plan scenario would be required along Kuebler Boulevard at the intersections of Stroh Road, Battlecreek Road, 27th Avenue, 36th Avenue, and Turner Road. These improvements are summarized in Table 5 below.

Table 5
Kuebler Boulevard Mitigation Summary – 2015 Proposed Plan Scenario

Location	Improvement(s)
Kuebler Boulevard/Stroh Road	1. Signalization 2. Add eastbound through lane 3. Add westbound through lane
Kuebler Boulevard/Battlecreek Road	1. Add eastbound through lane 2. Add westbound through lane 3. Add southbound right turn lane
Kuebler Boulevard/27 th Avenue	1. Signalization 2. Add eastbound through lane 3. Add westbound through lane
Kuebler Boulevard/36 th Avenue	1. Signalization 2. Add westbound right turn lane
Kuebler Boulevard/Turner Road	1. Add westbound right turn lane

The addition of eastbound and westbound through lanes along Kuebler Boulevard between Commercial Street and I-5 is identified within the *Regional Transportation*

Mitigation

*Systems Plan 1996 Update*²⁴ and the *Salem Transportation System Plan*.²⁵ Signalization at the Kuebler Boulevard/27th Avenue intersection and the Kuebler Boulevard/36th Avenue intersection also have been identified as improvements by the City of Salem (see list of committed and planned improvements in Existing Conditions section). As described in the Transportation Impacts section, signal warrants would be met at all of the unsignalized intersections. The configuration of each of the intersections with the mitigation improvements is shown in Figure 23.

At Battlecreek Road, the addition of a second westbound through lane along Kuebler Boulevard would reduce the queue length for the through movement to 640 feet. While this would still be excessive, it would likely eliminate or significantly reduce the problem of vehicles backing into the 27th Avenue intersection.

Along I-5, mitigation for the 2015 Proposed Plan scenario would be required at the ramp junction for the southbound off-ramp at Kuebler Boulevard. This would be achieved with the addition of a second exit lane and auxiliary lane on the freeway mainline. Based on a discussion with ODOT design staff, the auxiliary lane would be roughly 2,300 feet in length (including taper).

LOS values for locations along Kuebler Boulevard and I-5 with mitigation improvements are shown in Figures 24 and 25. As can be seen, adequate levels of service would occur at all locations.

Mitigation improvements along Kuebler Boulevard for the 2006 Proposed Plan scenario would consist of the addition of an eastbound through lane and westbound through lane at Kuebler Boulevard/Battle Creek Road and signalization at the intersections of Kuebler Boulevard/27th Avenue and Kuebler Boulevard/36th Avenue.

Along I-5, an additional freeway lane would be required to mitigate the LOS “F” condition that would exist at the southbound off-ramp junction at Kuebler Boulevard for the 2006 Proposed Plan scenario. A less costly mitigation alternative consisting of a second off-ramp with a freeway auxiliary lane was tested, but this failed to improve the level of service. This is because without an additional freeway lane, too many non-exiting vehicles would remain in the diverge area, resulting in excessive vehicle density. With the additional freeway lane, the level of service at the ramp junction would improve to LOS “D”.

²⁴ Salem/Keizer Area Transportation Study (SKATS), Regional Transportation Systems Plan 1996 Update, March 1996.

²⁵ City of Salem.

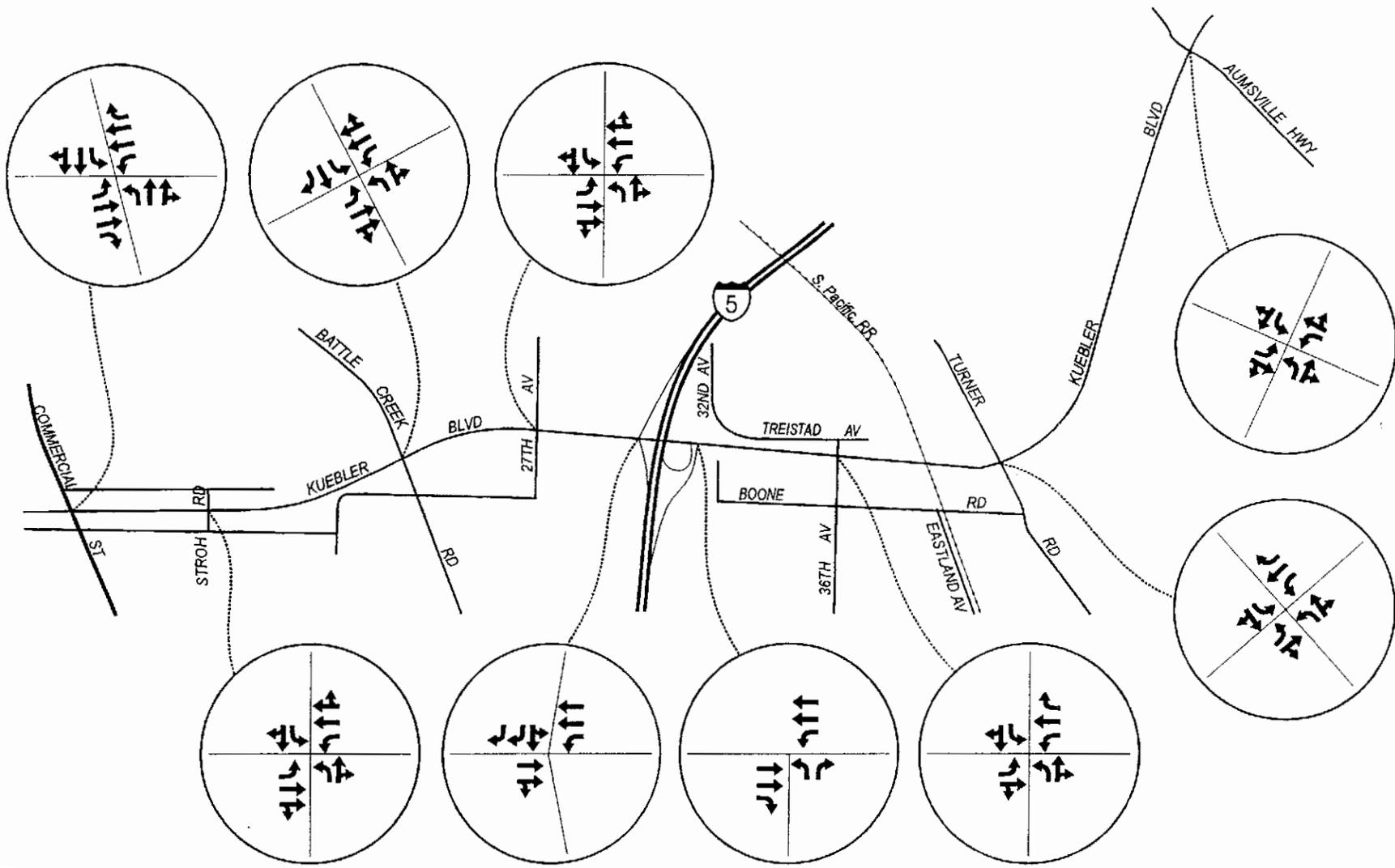
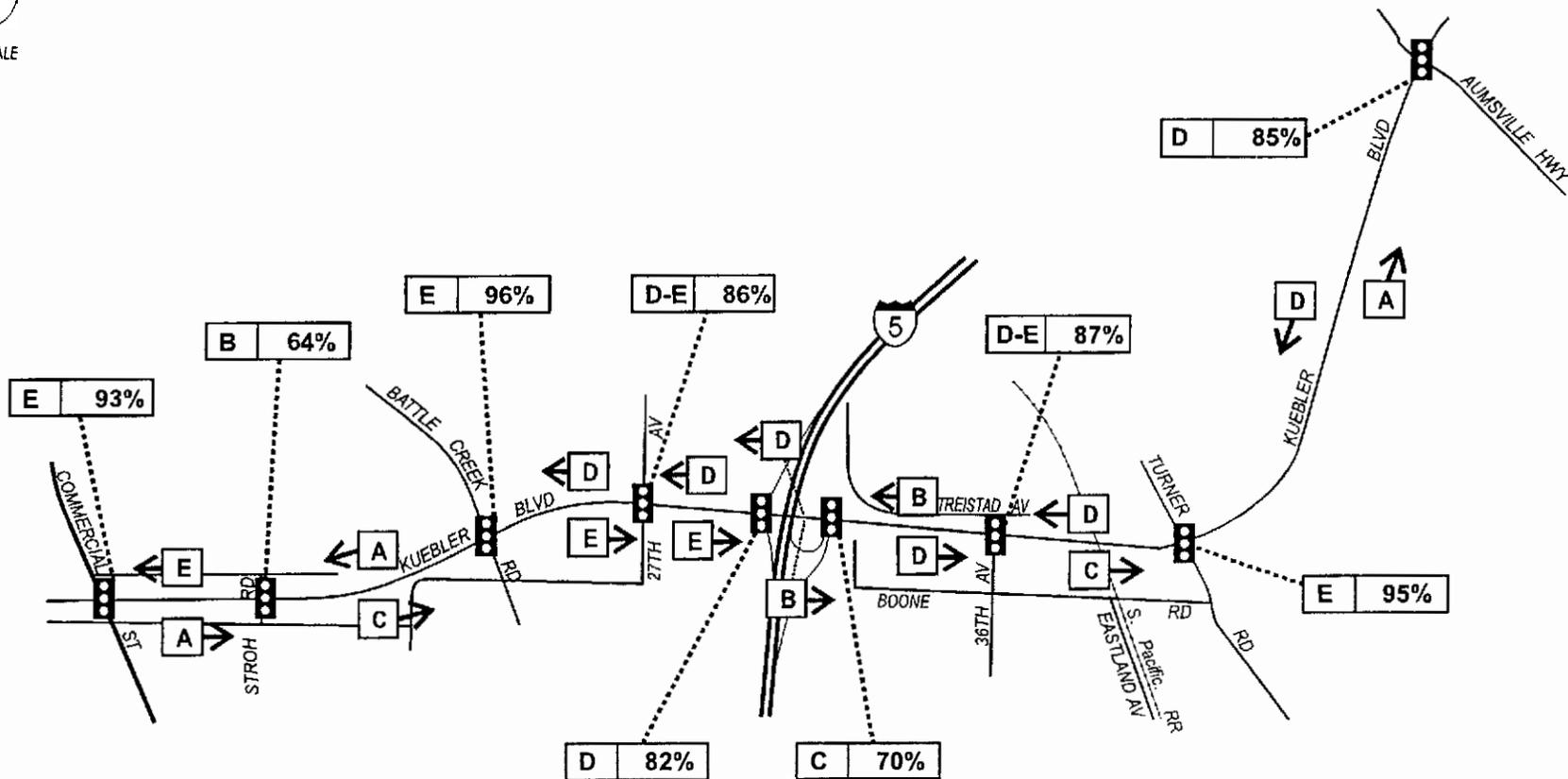


Figure 23
2015 INTERSECTION CONFIGURATION
WITH MITIGATION



LEGEND

Intersections

- Signalized Study Intersection

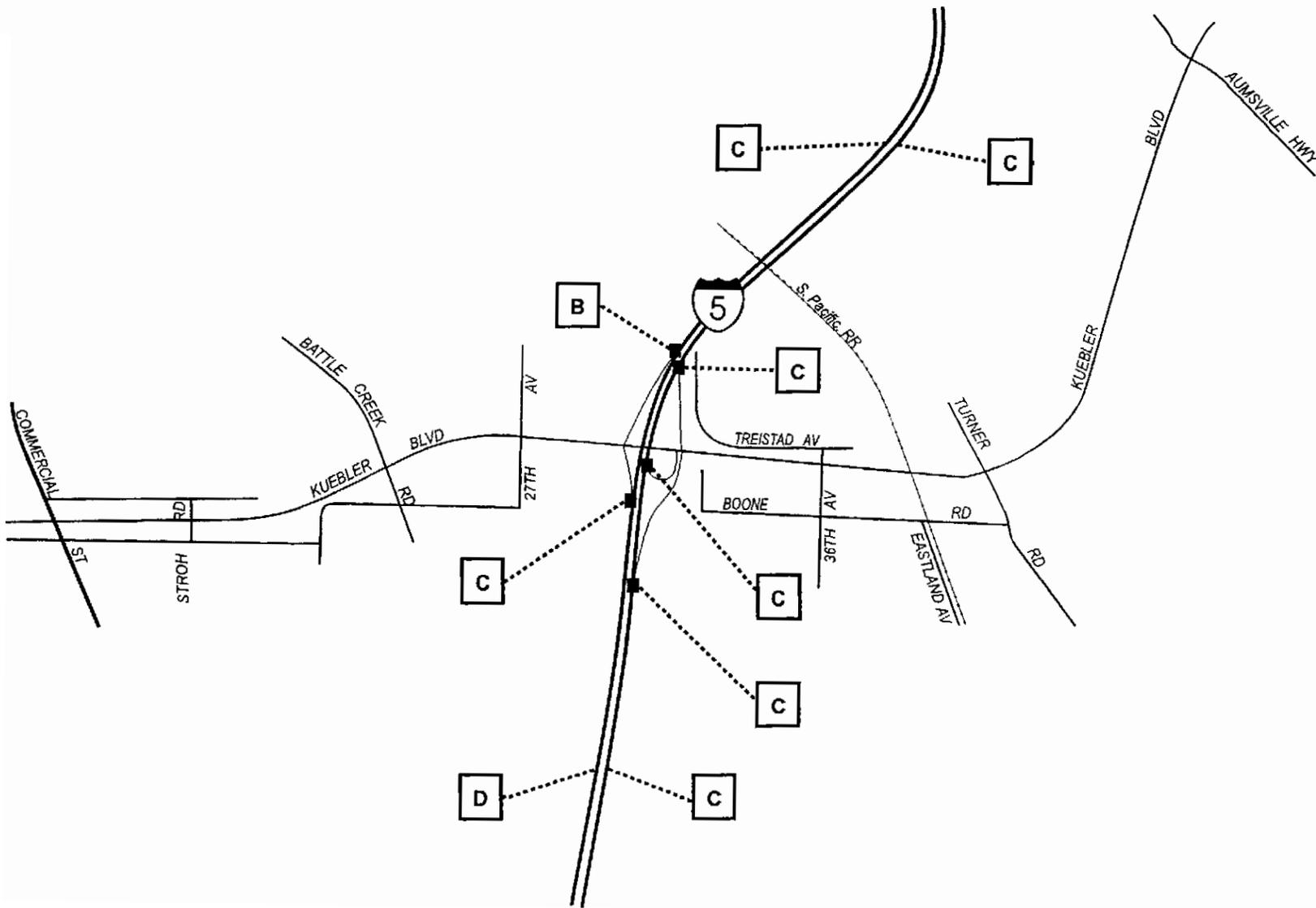
00% - Saturation Level

(000) - Reserve Capacity

Arterial Segments

- Segments Occur Between Signalized Intersections

Figure 24
2015 PROPOSED PLAN
LEVEL OF SERVICE WITH MITIGATION
Kuebler Boulevard



LEGEND

■ - Ramp Junction

Figure 25
2015 PROPOSED PLAN
LEVEL OF SERVICE WITH MITIGATION
Interstate-5

Mitigation

Similarly for the southbound freeway segment south of Kuebler Boulevard, the only mitigation improvement that would result in an adequate level of service would be an additional freeway lane. With this improvement, the level of service would be LOS "C".

The findings of the mitigation analysis at both of these locations indicate that the planned three-lane widening improvement along I-5 between Highway 22 and Delaney Road would have to be accelerated in order to maintain adequate levels of service.

Figures 26 and 27 show that with the mitigation improvements, adequate levels of service would occur at all locations along Kuebler Boulevard and I-5 for the 2006 Proposed Plan scenario.

Cost Estimates

Planning level cost estimates were identified for the improvements along Kuebler Boulevard and I-5 for the Proposed Plan scenario. Cost estimates from the *Regional Transportation Systems Plan 1996 Update*²⁶ and *Salem Transportation System Plan*²⁷ were used, if available. These included the four-lane widening improvement for Kuebler Boulevard between I-5 and Commercial Street and the Kuebler Boulevard signalization improvements. For improvements not included in the TSPs, cost estimates were developed by applying unit cost estimates to quantities by cost category. All of the estimates are expressed in current dollars.

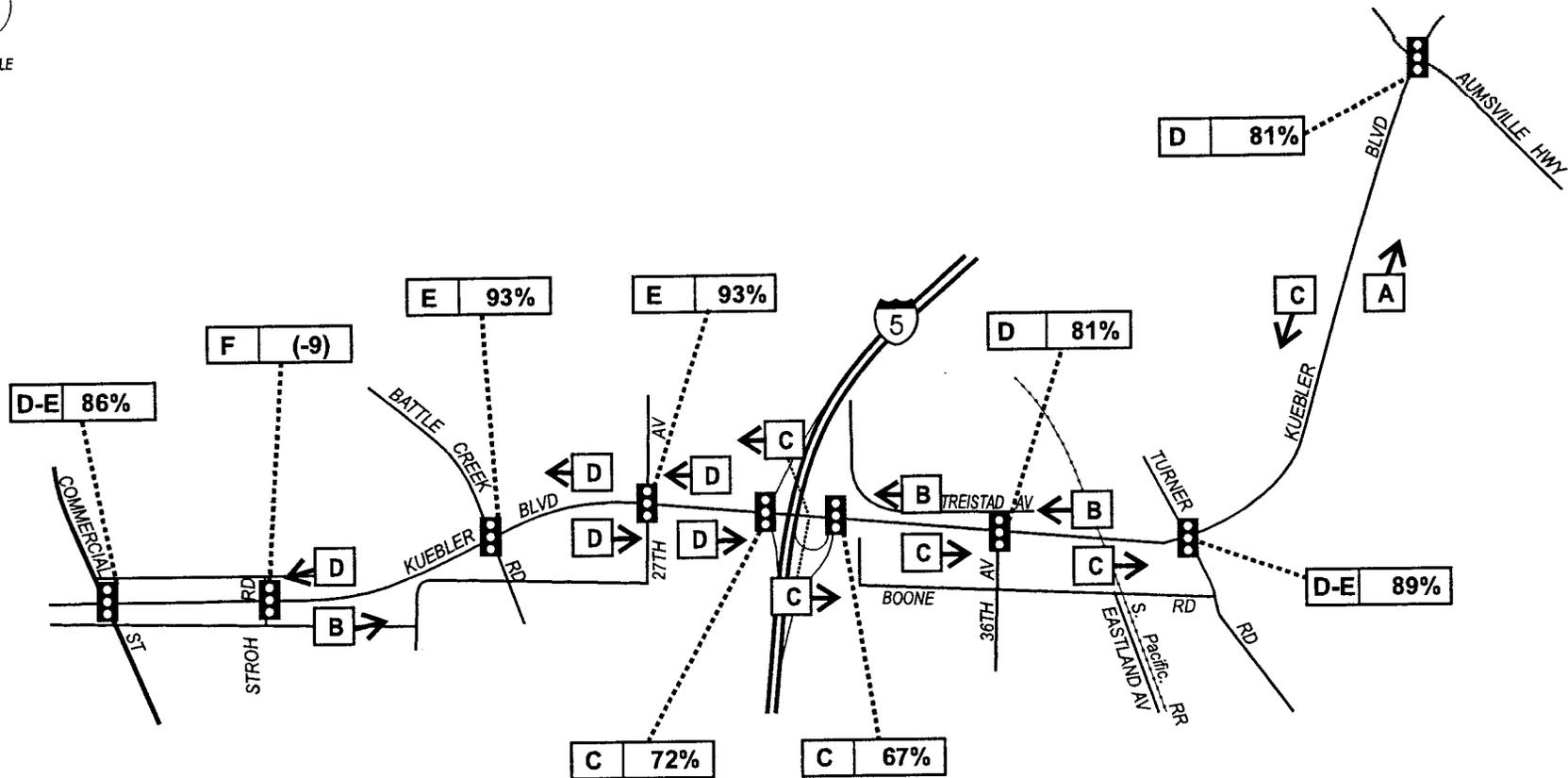
2015 PROPOSED PLAN SCENARIO

In addition to the four-lane widening and signalization improvements for Kuebler Boulevard, cost estimates were developed for the turn lane improvements at the intersections of Battlecreek Road, 36th Avenue, and Turner Road. The cost categories for the turn lanes included grading, pavement, and curbs, gutters and sidewalks. The cost of right-of-way, if required, was not included. Variable cost items such as traffic control, design and administration, and contingency were included as 80% of the total fixed cost of the projects. The Kuebler Boulevard cost estimates are shown in Table 6.

The cost categories used for the additional I-5 southbound off-ramp lane and auxiliary lane at Kuebler Boulevard included grading, pavement, retaining wall, structures, guardrail, lighting, drainage, erosion control, clear and grub, and signing and striping. Right-of-way costs and utility relocation costs were not assumed. In addition, it was assumed that no modifications other than widening would be required for the existing structures at the Turner Road, Southern Pacific Railroad, and Marietta Street overpasses.

²⁶ Salem/Keizer Area Transportation Study (SKATS).

²⁷ City of Salem.



LEGEND

Intersections

- Signalized Study Intersection

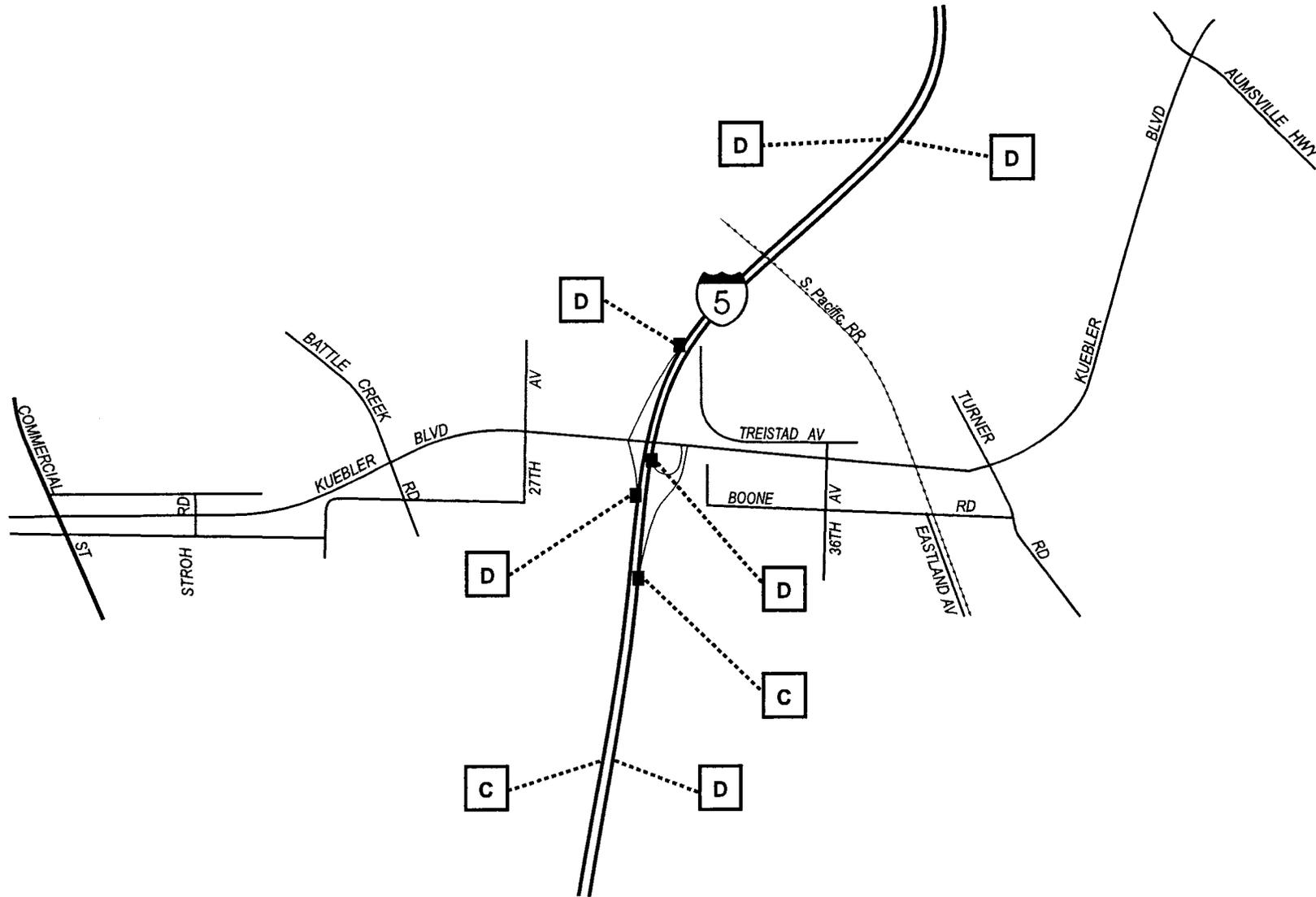
00% - Saturation Level

(000) - Reserve Capacity

Arterial Segments

← **A** - Segments Occur Between Signalized Intersections

Figure 26
2006 PROPOSED PLAN
LEVEL OF SERVICE WITH MITIGATION
Kuebler Boulevard



LEGEND

■ - Ramp Junction

Figure 27
2006 PROPOSED PLAN
LEVEL OF SERVICE WITH MITIGATION
Interstate-5

Mitigation

A cost for modification of the existing traffic signal at the Kuebler Boulevard ramp terminal was also included. The estimated total cost for this improvement, as shown in Table 6, would be \$3,259,000.

Table 6
2015 Proposed Plan Scenario Improvement Cost Estimates

Location	Improvement(s)	Cost
<i>Kuebler Boulevard</i>		
I-5 to Commercial Street	Widen to four lanes, divided, with bike lanes and sidewalks	\$4,250,000 ²⁸
Stroh Road	Signalization	\$150,000 ²⁹
Battlecreek Road	Add 150' southbound right turn lane with sidewalk	\$90,000
27 th Avenue	Signalization	\$150,000
36 th Avenue	Signalization	\$150,000
	Add 200' westbound right turn lane	\$126,000
Turner Road	Add 200' westbound right turn lane	\$180,000
Subtotal		\$5,096,000
<i>I-5</i>		
Southbound off-ramp terminal at Kuebler Boulevard to 37 th Avenue overcrossing	Add second ramp lane with 2,300' auxiliary lane	\$3,259,000
Total		\$8,355,000

²⁸ City of Salem, Salem Transportation System Plan, August 1998.

²⁹ Peter Fernandez, City of Salem Public Works Department, Telephone conversation, April 1998.

Mitigation

Mitigation Without I-5 Widening

KUEBLER BOULEVARD

There would be no additional intersections along Kuebler Boulevard that would require mitigation for the network alternative with no I-5 widening improvements. For the intersections requiring mitigation with the original network, the mitigation improvements would remain the same.

I-5

As a part of the network definition, it was assumed that there would be no improvements for any of the freeway components. Therefore, improvements for the ramp junctions were not investigated.

VI. Additional Analysis

Subsequent to the identification of transportation impacts and mitigation improvements for the 2015 Proposed Plan scenario, an issue was raised by the project management team that the traffic volumes may have been underrepresented because they did not reflect the additional traffic that would use Kuebler Boulevard with the recommended capacity improvements. Therefore, it was suggested that a new traffic forecast should be prepared using a network that included the improvements. The new traffic volumes would be used in performing an analysis to determine the revised levels of service along Kuebler Boulevard and if any additional mitigation improvements would be required.

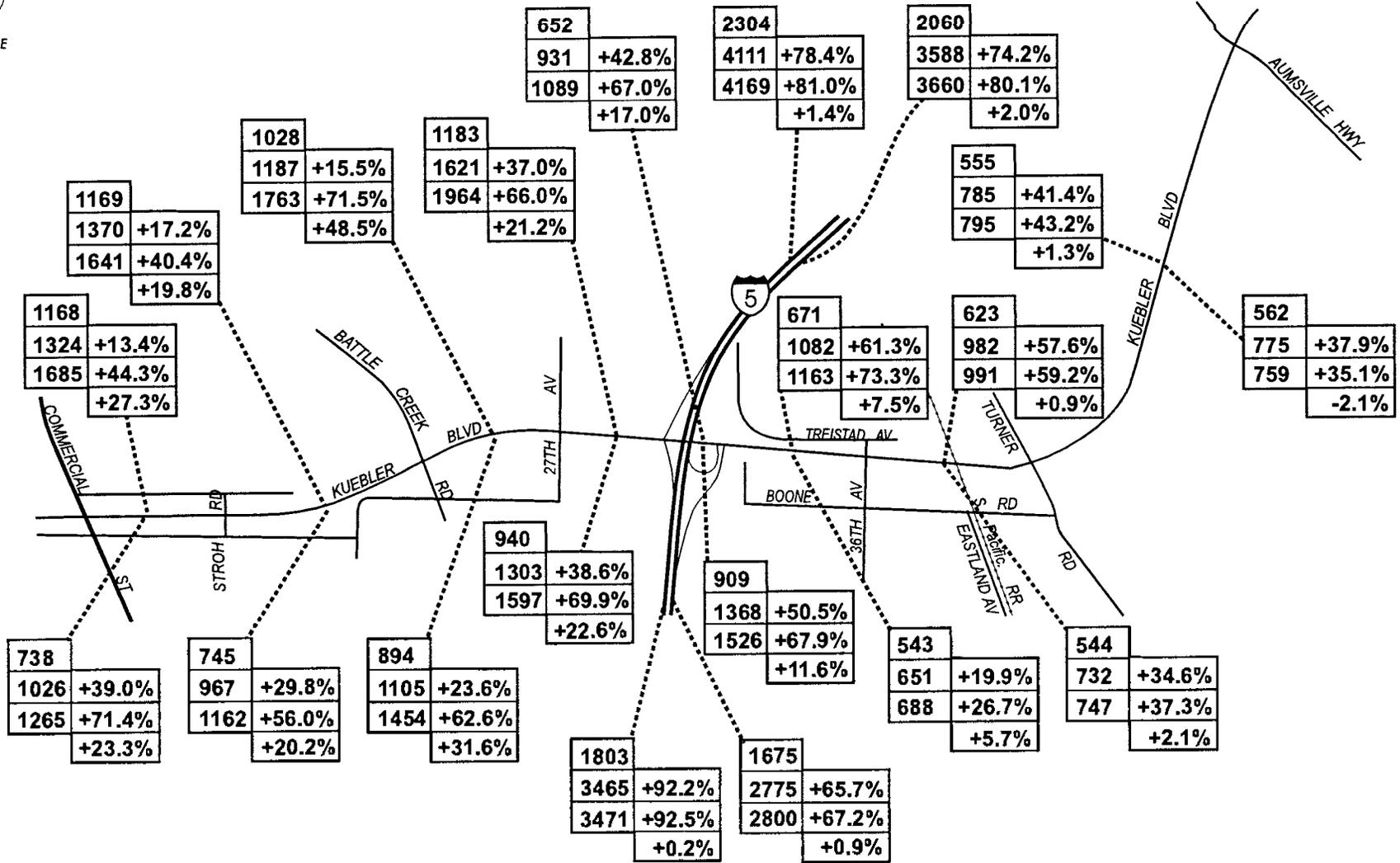
Preparation of Traffic Forecasts

Although a number of improvements (lane additions and signalization) were recommended along Kuebler Boulevard, the key improvement related to the traffic forecasts was the addition of a through travel lane in each direction between the I-5 southbound ramps intersection and Commercial Street, resulting in a continuous four-lane section. This improvement was reflected in the study area focus model by increasing the coded capacity for Kuebler Boulevard from 800 vph to 1,900 vph in each direction. This was consistent with the coding for similar facilities in the regional model network and was considered to be a reasonable value. The focus model was rerun with the revised network using the same trip table that was applied for the original 2015 Proposed Plan model run.

Transportation Impacts

TRAFFIC VOLUME IMPACTS

The absolute and relative traffic volume impacts of Proposed Plan scenario with the revised volumes are shown in Figure 28. To the west of I-5, directional p.m. peak hour volumes along Kuebler Boulevard would increase significantly compared to existing conditions, ranging from roughly 40 - 70% higher. These volumes are from 20 - 50% higher than the original volumes for the Proposed Plan scenario, reflecting the fairly high degree of excess demand along this section of Kuebler Boulevard without the recommended widening improvement. To the east of I-5, the revised volumes are roughly 25 - 80% higher than existing volumes and 0 - 10% higher than the original volumes. The increase in traffic from the original forecast indicates that the greater attractiveness of Kuebler Boulevard to the west of I-5 would, to some extent, carry over to the east of I-5. Traffic volume increases along I-5 relative to existing conditions



LEGEND

Existing Conditions -	0000	
Proposed Plan Scenario - (Original Volumes)	0000	+00.0% (% Change vs. Existing Conditions)
Proposed Plan Scenario - (Revised Volumes)	0000	+00.0% (% Change vs. Existing Conditions)
		+00.0% (% Change vs. Original Proposed Plan Volumes)

Figure 28
2015 PM PEAK HOUR
TRAFFIC VOLUME IMPACTS
Kuebler Boulevard and I-5

Additional Analysis

would be nearly identical to those for the original forecast, ranging from 65 – 90% higher.

The revised total volumes for other study area roadways are somewhat lower than the original volumes, reflecting the lower level of traffic diversion with the increased capacity along Kuebler Boulevard to the west of I-5. A comparison of these volumes to the Baseline scenario volumes is provided in Table B-1 of Appendix B.

The percentages of local and regional traffic along Kuebler Boulevard and I-5 with the revised volumes are very similar to those with the original volumes (see Figures B-1 and B-2 of Appendix B). The similarity in these percentages indicates that with the additional through lane capacity along Kuebler Boulevard, the proportional increases in regional and local traffic using Kuebler Boulevard would be roughly the same.

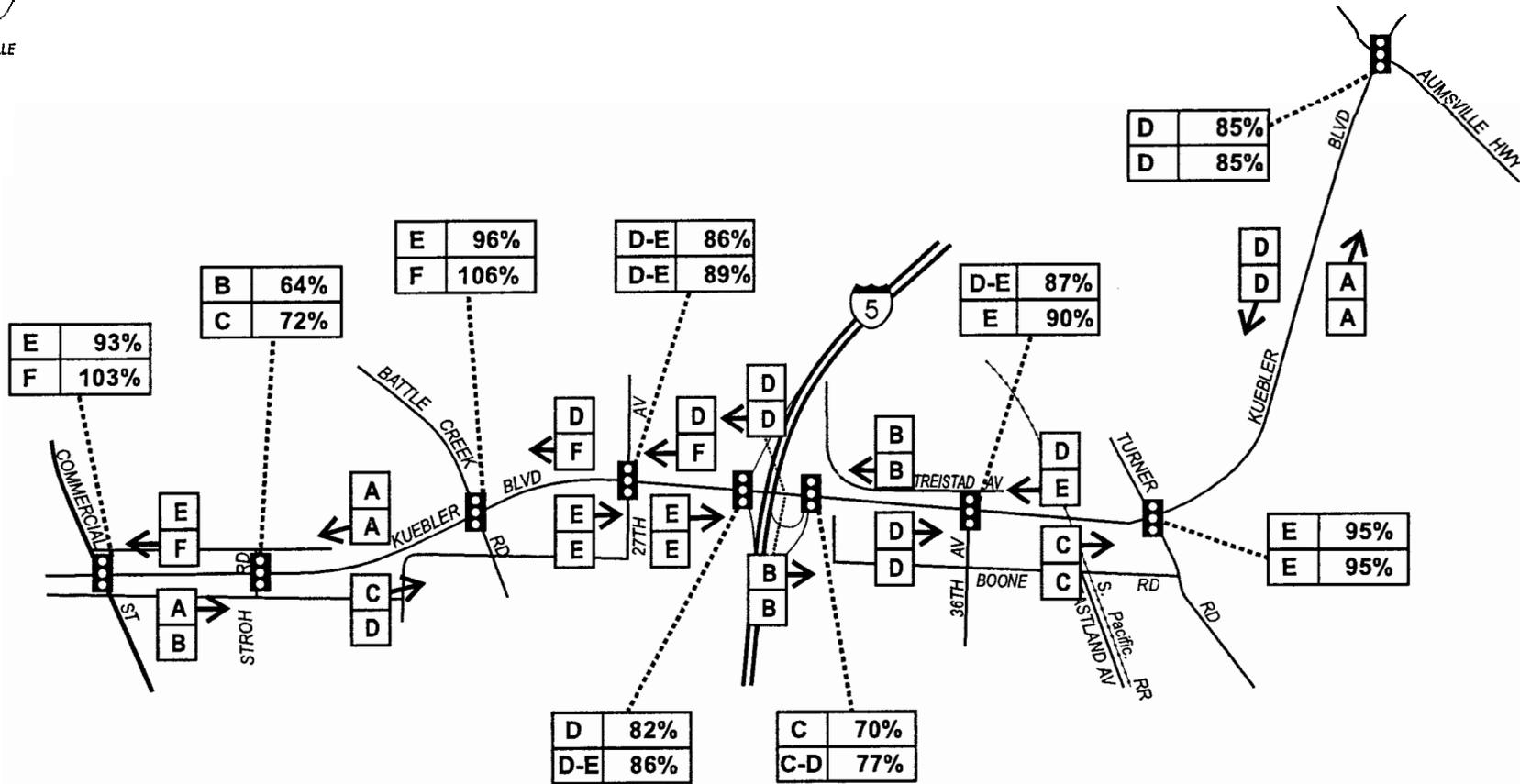
Even with the higher revised volumes, modeled volume-to-capacity (v/c) ratios along Kuebler Boulevard to the west of I-5 are significantly lower compared to the original forecast (see Figure B-3 of Appendix B). This indicates that the increase in traffic volumes resulting from the greater attractiveness of Kuebler Boulevard would be more than offset by the increase in capacity. To the east of I-5, v/c ratios are slightly higher, reflecting the effects of the higher revised volumes with no capacity increases.

LEVEL OF SERVICE IMPACTS

Level of service estimates were developed for Kuebler Boulevard to determine how the mitigated network (based on the original Proposed Plan volumes) would function with the revised volumes. All of the intersections along Kuebler Boulevard would be signalized in the mitigated network. A complete list of the original improvements is provided in Table 5 on page 52.

As shown in Figure 29, levels of service are lower at all intersections west of I-5, with the exception of Kuebler Boulevard/27th Avenue. At two locations, Kuebler Boulevard/Commercial Street and Kuebler Boulevard/Battle Creek Road, the level of service falls below the standard to LOS “F”. To the east of I-5, the level of service drops at two of the intersections (I-5 northbound ramps and 36th Avenue), but remains at an adequate level.

Arterial segment LOS is adequate in the eastbound direction of Kuebler Boulevard, ranging from LOS “A” to LOS “E”. In the westbound direction, the level of service to the east of I-5 is good, but becomes undefined for three of the segments to the west of I-5 because the intersection level of service for the through movement at the end of the segments is LOS “F”. The overall arterial level of service is “C” in the eastbound direction and undefined in the westbound direction.



LEGEND

Intersections

 - Signalized Study Intersection

A	00%	- 2015 Proposed Plan with Original Mitigation (Original Vols.)
B	00%	- 2015 Proposed Plan with Original Mitigation (Revised Vols.)
00%		- Saturation Level

Arterial Segments

 - 2015 Proposed Plan with Original Mitigation (Original Vols.)
 - 2015 Proposed Plan with Original Mitigation (Revised Vols.)
 (Segments Occur Between Signalized Intersections)

Figure 29
2015 PROPOSED PLAN
LEVEL OF SERVICE WITH MITIGATION
Kuebler Boulevard

Additional Analysis

Levels of service were not estimated for I-5 because the volume differences were insignificant.

TRAFFIC OPERATIONS IMPACTS

Potential traffic operations problems associated with excessive queue lengths at signalized intersection approaches along Kuebler Boulevard were investigated. For the 27th Avenue, Battle Creek Road, and Stroh Lane intersections, it was assumed that adequate turn lane lengths would be constructed at the time Kuebler Boulevard is widened to four lanes. Therefore, no future operational problems were identified at these locations.

For the remaining intersections, turning lane queue lengths of greater than 250 feet would occur for the westbound left-turn lane at Commercial Street (380 feet), the westbound left-turn lane at the I-5 southbound ramps (290 feet), the eastbound right-turn lane at the northbound ramps (300 feet), and the eastbound left-turn lane at Turner Road (350 feet). At Commercial Street, the westbound left-turn queue would likely result in vehicles backing up into the inside through lane. A similar condition may exist at the I-5 northbound ramps intersection, where eastbound right-turning vehicles could back up into the outside through lane. At the I-5 southbound ramps and Turner Road, the median length would be adequate for storage of left-turning vehicles.

Locations with excessive through movement queue lengths (i.e., greater than 400 feet) are shown in Table 7.

Table 7
2015 Proposed Plan Scenario (Revised Volumes)
Excessive Queue Lengths - Through Movement

Location	Direction(s)	Queue Length (ft)	Number of Vehicles
Kuebler Boulevard/Commercial Street	WB	560*	22*
Kuebler Boulevard/Battle Creek Road	EB/WB	600/770*	24/31*
Kuebler Boulevard/27 th Avenue	EB/WB	610/660	24/26
Kuebler Boulevard/I-5 SB ramps	EB	630	25
Kuebler Boulevard/36 th Avenue	EB/WB	530/630	21/25
Kuebler Boulevard/Turner Road	EB/WB	470/630*	19/25*
Kuebler Boulevard/Aumsville Highway	NB	600	24

* Queue length and number of vehicles based on saturation conditions and therefore not reliable.

Additional Analysis

Although the through vehicle queues are extensive, significant operational problems would be unlikely because there would be adequate distance between the intersections and there would be no driveway blockages due to the restricted access along Kuebler Boulevard. Left-turning vehicles may be impeded by through vehicles in reaching the left-turn lane at these locations, however.

Because of the small differences in the revised volumes along I-5, operational impacts would be very similar to those with the original volumes.

Mitigation

Mitigation improvements in addition to those for the original Proposed Plan traffic impacts were identified for those locations along Kuebler Boulevard where the level of service would drop below LOS "E" with the revised volumes. As described above, this would occur at the intersections of Kuebler Boulevard/Commercial Street and Kuebler Boulevard/Battle Creek Road.

At Kuebler Boulevard/Commercial Street, an additional southbound left-turn lane would be required to achieve LOS "E". At Kuebler Boulevard/Battle Creek Road, a westbound right-turn lane would have to be added, as well as a northbound right-turn lane to achieve LOS "E". With these improvements, the arterial segment level of service would also improve to "D" in the westbound direction between 27th Avenue and Battle Creek Road and between Stroh Lane and Commercial Street.

In addition to these improvements, a second northbound left-turn lane would also be required at Kuebler Boulevard/36th Avenue. Although the overall intersection level of service would be adequate without this improvement, the northbound left-turn volume of 410 vph would be excessive with the existing single left-turn lane, resulting in queue lengths of over 500 feet. This condition could cause driveway blockages along 36th Avenue.

The configurations of the intersections with the additional mitigation improvements are shown in Figure 30.

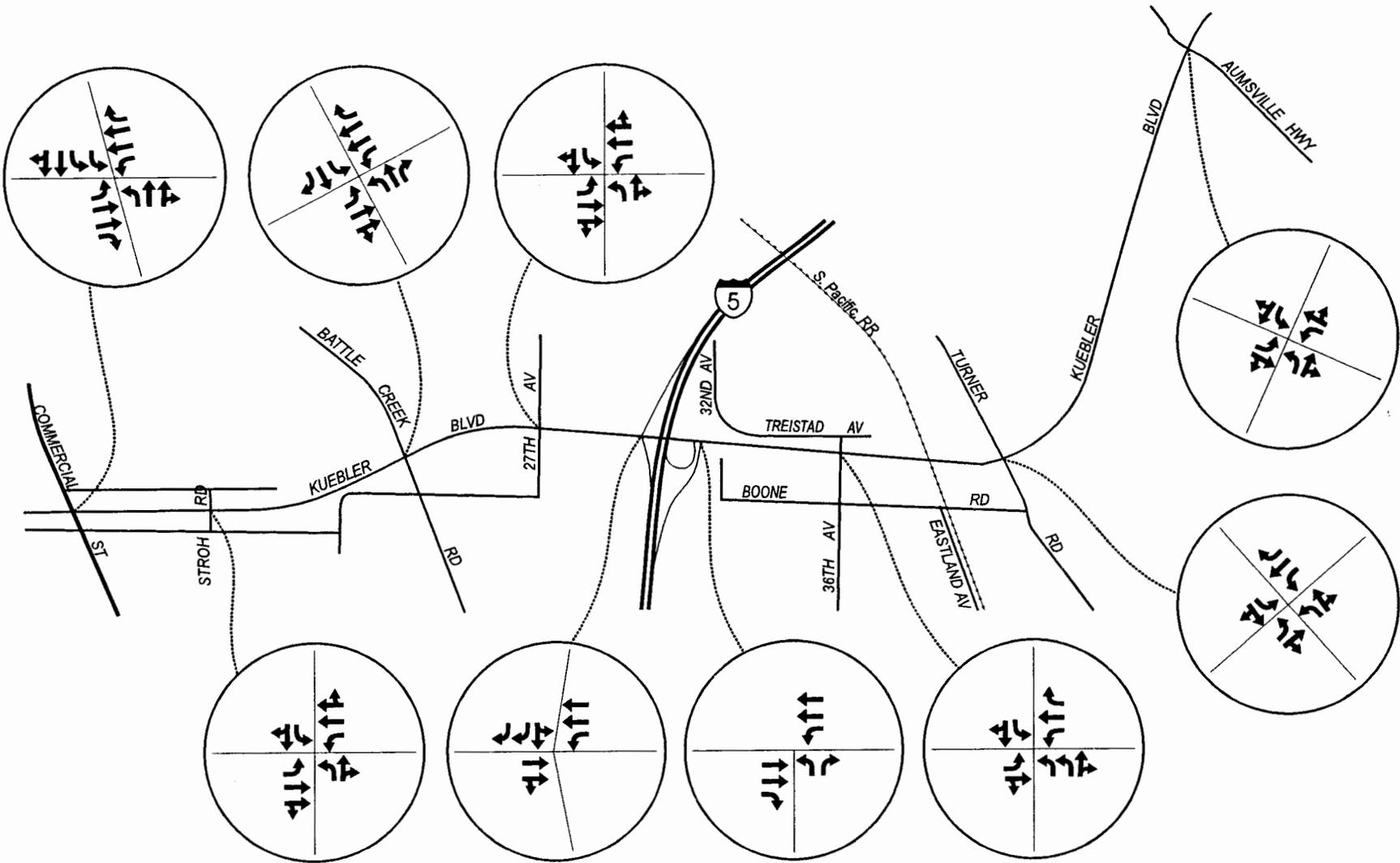


Figure 30
2015 INTERSECTION CONFIGURATION
WITH MITIGATION
(Revised Volumes)

VII. Capacity Allocation Mechanism

A capacity allocation mechanism was developed for allocating future interchange roadway capacity to specific development projects within the Proposed Plan area. This included a trip allocation method, a Supplemental Transportation System Development Charge (STSDC) that will be used to partially fund the mitigation improvements, and an implementation framework for allocating capacity and administering the STSDC. The allocation mechanism was based upon the original Proposed Plan scenario analysis and not the analysis reflecting the revised Proposed Plan traffic volumes.

Trip Allocation Method

The total interchange area roadway capacity to be allocated for the Proposed Plan development is, by definition, the maximum number of Proposed Plan area trips that can be accommodated by the interchange area roadway network within level of service standards, assuming that the recommended mitigation improvements are in place. A two-step allocation mechanism will be used, in which total capacity is first allocated to individual TAZs within the Proposed Plan area. The TAZs for the Proposed Plan area are shown in Figure 9 on page 28. The capacity allocated to each TAZ is equal to the number of modeled p.m. peak hour interzonal trips assigned to/from the TAZs for the 2015 Proposed Plan scenario. This allocation is shown in Table 8.

**Table 8
Capacity Allocation for Proposed Plan Area**

Focus Area TAZ	Land Use (acres)							PM Peak Trips	% of Trips
	SF Res.	MF Res.	Gen. Comm.	Comm. Office	Mixed Use	Public	Indus.		
124	15.0	12.74	0	0	24.94	0	0	504	13.2%
125	63.22	11.17	0	0	0	0	0	271	7.1%
130	44.11	22.68	0	2.55	0	3.63	0	543	14.2%
131	0	0	0	0	0	0	64.55	204	5.3%
412	23.98	0	0	0	0	0	19.43	195	5.1%
414	0	0	0	0	0	0	29.09	162	4.2%
420	0	0	0	0	0	0	34.12	105	2.7%
421	0	0	0	0	0	0	47.77	229	6.0%
422	0	9.99	3.97	14.52	0	0	0	375	9.8%
423	0	3.95	7.37	13.84	0	0	0	478	12.5%
424	0	0	0	0	0	0	29.75	104	2.7%
425	0	0	0	0	0	0	29.55	103	2.7%
427	20.04	0	0	0	0	0	0	51	1.3%

Capacity Allocation Mechanism

Focus Area TAZ	Land Use (acres)							PM Peak Trips	% of Trips
	SF Res.	MF Res.	Gen. Comm.	Comm. Office	Mixed Use	Public	Indus.		
428	5.22	0	0	0	0	0	92.0	307	8.0%
429	0	0	0	0	0	0	48.67	23	0.6%
430	0	0	0	0	0	0	9.16	29	0.8%
436	0	0	0	0	0	0	46.59	146	3.8%
Total	171.57	60.53	11.34	30.91	24.94	3.63	450.68	3,829	100.0%

Development of STSDC

The STSDC will supplement the city's existing Transportation System Development Charge (TSDC), which is used to fund citywide transportation system improvements identified in the *Salem Transportation System Plan*.³⁰ It will fund an additional portion of the TSP improvements identified for the Proposed Plan area, as well as several other improvements not identified in the TSP.

CALCULATION OF STSDC

Calculation of the STSDC was based upon the cost of improvements required to accommodate 2015 p.m. peak hour traffic volumes within the interchange area, including traffic generated by the city's Proposed Land Use Plan. These improvements, as described earlier, are listed in Table 9. It was decided that the STSDC should include not only the improvements for city streets, but those for I-5 as well.³¹

The process for determining the cost of improvements used in calculating the STSDC is outlined in Table 9. This consisted of:

1. Determining the portion of total cost for each improvement eligible for funding through the STSDC;
2. Estimating the percentage of total future trips for each improvement having one or both ends in the Proposed Plan area;
3. Applying the Proposed Plan area trip percentages to the STSDC-eligible portion of the improvement costs; and
4. Converting the STSDC improvement costs from 1998 to 2003 dollars.

³⁰ City of Salem.

³¹ Peter Fernandez, City of Salem Public Works Department, Conversation, June 1998.

Table 9
STSDC Improvements Cost Estimate

Location	Improvement	Included in TSP (?)	Total Cost (1998 dollars)	TSDC % of Cost	STSDC-Eligible Portion of Cost ³²	% of Trips to/from Proposed Plan Area	STSDC Cost (1998 dollars)	STSDC Cost (2003 dollars)	STSDC % of Cost
<i>Kuebler Boulevard.</i>									
1. I-5 and Commercial St.	Widen to four lanes, divided, with bike lanes, sidewalks	Y	\$4,250,000	0%	\$4,250,000	24%	\$1,020,000	\$1,240,985	24%
2. Stroh Lane	Signalization	N	\$150,000	17%	\$124,500	22%	\$27,390	\$33,325	18%
3. Battle Creek Road	SB RT lane with sidewalk	N	\$90,000	0%	\$90,000	8%	\$7,200	\$8,760	8%
4. 27th Ave.	Signalization	Y	\$150,000	17%	\$124,500	35%	\$43,575	\$53,015	29%
5. 36th Ave.	Signalization	Y	\$150,000	17%	\$124,500	59%	\$73,455	\$89,370	49%
	WB RT lane	N	\$126,000	0%	\$126,000	39%	\$49,140	\$59,785	39%
6. Turner Road	WB RT lane	N	\$180,000	0%	\$180,000	30%	\$54,000	\$65,700	30%
Subtotal			\$5,096,000		\$5,019,500		\$1,274,760	\$1,550,940	
<i>I-5</i>									
1. Southbound off-ramp terminal at Kuebler Blvd. to 37th Ave. overxing	Additional ramp lane with freeway auxiliary lane	N	\$3,259,000	0%	\$3,259,000	23%	\$749,570	\$911,965	23%
Subtotal			\$3,259,000		\$3,259,000		\$749,570	\$911,965	
Total			\$8,355,000		\$8,278,500		\$2,024,330	\$2,462,905	

³² Calculated as:

$$\text{Total Cost} \times (1 - \text{TSDC \% of Cost})$$

Capacity Allocation Mechanism

The portion of total cost for each improvement eligible for funding through the STSDC was determined by multiplying the total cost of the improvement by the percentage of cost that would not be covered by the existing TSDC. This was done in order to avoid “double assessment” for that portion of the total cost that would already be assessed under the TSDC. These percentages, shown in column 5 of Table 9, were derived from information contained in the Salem Transportation Systems Development Charge Methodology Report.³³ The value of 17% shown for the signalization improvements represents the estimated overall percentage of total future street capacity improvements for the City of Salem that would be covered by the TSDC.³⁴ A value of zero percent is shown for the Kuebler Boulevard widening improvement because although it was included an TSDC-eligible project in the TSDC Methodology Report, it was not selected for funding under the recommended Decision Package. The remaining improvements are not eligible for TSDC funding because they were not identified as project needs in the Methodology Report.

The percentage of total future trips for each improvement having one or both ends in the Proposed Plan area was estimated using the focus area travel forecasting model developed for the study. These percentages, shown in column 7 of Table 9, were developed in order to determine the portion of total improvement costs shown in column 6 of Table 9 attributable to Proposed Plan area development. Select link traffic assignments showing the number of Proposed Plan area trips using each improvement were used as the basis for calculating the percentages. For the intersection improvements and the I-5 southbound ramp widening and auxiliary lane, the percentages were based on the number of Proposed Plan area trips. For the Kuebler Boulevard widening, a weighted average percentage of vehicle miles traveled for Proposed Plan area trips was calculated, since this improvement spanned multiple segments of Kuebler Boulevard, with each segment each having different lengths and different numbers of Proposed Plan area trips. The STSDC-eligible portion of total cost for each improvement (column 6) was multiplied by the percentage of Proposed Plan area trips (column 7), to obtain the portion of cost to be funded by the STSDC (column 8).

The final step in the process was to convert the STSDC improvement costs from 1998 to 2003 dollars using a four percent annual compound growth rate, consistent with the approach followed in the TSDC Methodology Report. This was done to encourage stability in the STSDC charges over the next five years, so that annual rate changes to account for inflation in improvement costs will not be necessary.

Once the total STSDC-funded improvements cost had been identified, the STSDC was calculated as:

³³ City of Salem, Salem Transportation Systems Development Charge Methodology Report, August 1994.

³⁴ City of Salem, 14.

Capacity Allocation Mechanism

$$\begin{aligned} \text{STSDC} &= \frac{\text{Total Cost of Improvements}}{\text{Total P.M. Peak Hour Trips}} \\ &= \frac{\$2,462,905}{3,829} \\ &= \$643 \end{aligned}$$

Where:

STSDC	=	Cost (charge) per p.m. peak hour trip
Total Cost of Improvements	=	Total cost of interchange area improvements to be funded by STSDC (2003 dollars)
Total P.M. Peak Hour Trips	=	Total p.m. peak hour trips ³⁵ with one or both ends in Proposed Plan area

One difference in the methodologies used to calculate the STSDC and the TSDC is that p.m. peak hour trips, rather than Equivalent Length New Daily Trips, were used as the unit of assessment for the STSDC. The p.m. peak hour was used because the traffic forecasts and mitigation analysis that the STSDC was based upon were developed for this time period. In addition, p.m. peak hour traffic volumes provide a better measure of the size of facilities required to accommodate future peak traffic demands. Equivalent Length New Daily Trips, as described in the TSDC Methodology Report, reflect differences in trip length and the frequency of linked (pass-by) trips for various land use categories. Adjustments are made to the number of generated trips for each land use category that are intended to equalize the differences in these characteristics. For the Proposed Plan area, however, the trip length adjustment is not necessary because of the small size of the area. Similarly, the adjustment for pass-by trips is not needed because the percentage of these trips would be very small for nearly all of the Proposed Plan area development (industrial, residential, and office commercial uses).

Implementation Framework

TRIP "RIGHTS"

Trip "rights" is the maximum number of p.m. hour trips that each parcel within the interchange area will be allowed to generate. The roadway capacities (trips) allocated to

³⁵ For assessable uses. Assessable uses include all land use types except those listed in SRC 41.150. All land uses within current Proposed Plan are assessable.

Capacity Allocation Mechanism

the interchange area TAZs shown in Table 8 will be distributed to the individual parcels within the TAZs based on the relative trip generation potential of each parcel. This is represented in the following formula:

$$\text{Trip Rights}_i = \frac{\text{Potential Trip Generation}_i}{\sum_j \text{Potential Trip Generation}_{jk}} * \text{Capacity Allocation}_k$$

Where:

Trip Rights_{*i*} = Trip rights for parcel “*i*”

Potential Trip Generation_{*i*} = P.M. peak hour trip generation for parcel “*i*”³⁶

$\sum_j \text{Potential Trip Generation}_{jk}$ = P.M. peak hour trip generation for all parcels within TAZ “*k*”

Capacity Allocation_{*k*} = Capacity allocation for TAZ “*k*” from Table 8

Trip rights may be transferred between property owners in any manner acceptable to the owners (e.g., bought and sold at an agreed upon price). Transfers can only occur between parcels within the same TAZ, however. This is because transfers between parcels in different TAZs could alter the basic distribution of future Proposed Plan area traffic that was assumed in identifying the mitigation improvements, so that these improvements may no longer be appropriate.

STSDC ASSESSMENT

Assessment of the STSDC for specific development proposals will be based upon the estimated number of p.m. peak hour trips to be generated by the development. P.M. peak hour trip generation will be estimated following the same methodology³⁷ used for the TSDC. All land uses will be assessable, with the exception of those listed in SRC 41.150.

Similar to the TSDC, exceptions may be made in cases where the trip generation characteristics of the proposed development would not be accurately reflected in the standard trip generation methodology. In these cases, two alternative approaches may be followed:

³⁶ Potential trip generation calculated using trip generation rates contained in *ITE Trip Generation Manual, 6th Edition*.

³⁷ Procedure based upon information contained in the *ITE Trip Generation Manual, 6th Edition*.

Capacity Allocation Mechanism

1. The City of Salem will determine the land use category within the *ITE Trip Generation Manual*³⁸ that is most appropriate for the proposed use.
2. Observed data from trip generation studies for other similar developments may be used. The project proponent will be responsible for furnishing the studies to City of Salem staff, who will review the adequacy of the information. These may be existing studies or studies conducted by the proponent in connection with the proposed development. The studies may be for developments within or outside the Salem area. City staff will establish the type and amount of data required to accurately assess the trip generation potential of the proposed development on a case-by-case basis.

STSDC fees for specific developments will be calculated as:

$$\text{Total Fee} = \text{STSDC} * \text{P.M. Peak Hour Trip Generation}$$

Where:

$$\text{STSDC} = \$643$$

$$\text{P.M. Peak Hour Trip Generation} = \text{Estimated P.M. peak hour trip ends} \\ \text{("ins" + "outs")}$$

In accordance with SRC 41.160, credits will be allowed for the cost of qualified public improvements constructed by the project proponent, as well as implementation of transportation demand management (TDM) programs. For TDM programs, a credit of up to 15 percent of the STSDC fee may be granted. The project proponent must apply for the TDM credit and submit a TDM plan as part of the building permit application. TDM plans must include an annual reporting element. Following the approval of the TDM plan by the city, 15 percent of the STSDC fee will be placed in a TDM credit account where it will be held for two years. At the end of the two-year period, the annual report for the second year will be reviewed by the city to determine the effectiveness of the plan in reducing trips. Based on the review, a percentage of the TDM credit amount will be reimbursed to the project proponent. The reimbursement amount will be directly related to the effectiveness of the plan, ranging from 0% of the total fee for a 0% trip reduction to 15% of the total fee for a 15% trip reduction. The unreimbursed portion of the credit will be placed in the STSDC account. This will be the final disposition of the TDM credit.

³⁸ Institute of Transportation Engineers (ITE), Trip Generation (Washington D.C.: Institute of Transportation Engineers, 1997).

Capacity Allocation Mechanism

STSDC ADMINISTRATION

Administration of the STSDC will be similar to that for the TSDC. The STSDC fee will be collected at the time the building permit is issued or the applicant may defer payment by using the Bancroft approach. This approach allows residential property owners to pay system development charges in installments as an alternative to absorbing these charges into the long-term financing of their homes. At the time the development is approved for occupancy, the city will have the right to determine if the land use category that was used to calculate the STSDC fee is still appropriate. If the development is substantially different than that which was originally proposed, the STSDC fee may be recalculated and reassessed.

STSDC funds will be placed in the city's Extra Capacity Facilities Fund Transportation Account and will be segregated from TSDC and other SDC revenues. Funds that may be eligible for reimbursement through TDM credits will also be segregated from other SDC revenues. STSDC funds and any interest earned on these funds may only be used for the projects listed in Table 9. Funding percentages may not exceed those shown in column 10 of Table 9.

Approval of any exceptions or credits described in the previous section will be at the discretion of the City of Salem.

The STSDC program will need to be monitored to determine if the estimated improvements and costs reflect current conditions. The required improvements may change if future traffic volumes vary significantly from the traffic forecasts used to identify the improvements. This may result in a higher or lower future STSDC rate than the one identified above. Improvement costs will also likely be higher for the 12-year period beyond 2003. As a guide, the STSDC program should be updated every five years, with more frequent updates if conditions change more rapidly than expected. The updates will ensure that the amount of fees collected are not too high or low to fund the improvements needed to mitigate the impacts of the Proposed Plan area development. Changes in the program will require a public hearing. The program should be extended beyond 2015 if the rate of development for the Proposed Plan area is slower than that anticipated in the *I-5/Kuebler Boulevard Interchange Management Plan Final Reconnaissance Report*.³⁹

REVISIONS TO DEVELOPMENT CODE

Revisions to the city's development code will be necessary in order to implement the proposed capacity allocation mechanism. These may be accomplished as a part of the

³⁹ Oregon Department of Transportation.

Capacity Allocation Mechanism

city's current process in which regulations are being developed to implement the city's TSP. Within the regulations that describe the requirements of traffic impact studies, the city should authorize an option that would allow the development of subarea capacity allocation mechanisms, similar to the one proposed for the I-5/Kuebler Boulevard interchange area, in which the amount of allowed development and the associated mitigation costs are equitably distributed among subarea property owners. These mechanisms would be required to be based upon traffic studies that identify the long-range traffic impacts and required mitigation measures for all anticipated development within the subarea. The subarea **traffic** studies should be adopted by resolution, which would allow them to be amended in the future.

The purpose of subarea capacity allocation mechanisms is two-fold. First, they allocate roadway capacity in an equitable manner among all property owners, ensuring that projects developed first do not use all of the available capacity. Second, they provide an opportunity to streamline the development review process for all projects within the subarea. Under this arrangement, project proponents would submit a simplified traffic study that would only be required to demonstrate that the expected project trip generation would be less than or equal to the trip allocation for the parcel. This is because the other standard traffic study requirements such as the identification of traffic impacts, mitigation, and improvement costs would have already been comprehensively addressed in the subarea traffic study.

Analysis of Additional Impacts

The STSDC covers only the cost of improvements that will be required along Kuebler Boulevard and I-5 within the interchange area. Consideration should be given to whether project proponents will be required to identify project impacts and mitigation improvements for facilities other than Kuebler Boulevard and I-5. These facilities would be in addition to the linking streets and streets abutting the property boundaries described in SRC 66.100. Impacts may include level of service, safety, and operational impacts. If mitigation is needed, an additional assessment should be considered for funding a fair share portion of the required improvements.

VIII. Conclusions

This study was undertaken to determine if the long-range transportation impacts of a proposed land use plan for the interchange area developed by the City of Salem could be accommodated within a reasonable set of transportation system improvements. If it was determined that this would not be possible, an additional objective of the study was to identify refinements to the city's Proposed Land Use Plan that would be necessary to achieve a balance between future transportation system capacity and travel demand. Once the appropriate mix of land use and transportation system improvements was identified, the final two objectives of the study were to estimate the cost of the improvements and to establish a method for equitably allocating future interchange area capacity to individual parcels within the Proposed Plan area.

The study was organized according the following basic tasks:

- I. Identification of Existing Land Use and Transportation Conditions
- II. Estimation of Future Land Use and Transportation Conditions
- III. Identification of Required Mitigation Improvements
- IV. Additional Analysis of Proposed Plan Scenario
- V. Development of Capacity Allocation Mechanism

Transportation impacts for the Proposed Plan scenario were identified for both the 2015 and 2006 time frames. The intent of the 2006 analysis was to obtain a "snapshot" of conditions for an intermediate time period prior to 2015 when the ultimate impacts of the Proposed Plan would be realized. For comparison purposes, transportation impacts were also identified for a Baseline land use scenario that reflects the development assumptions contained in the Comprehensive Plan for the interchange area. Impacts for this scenario were analyzed for the 2015 time frame only.

The findings produced from each of the study tasks are summarized below.

Existing Conditions

Existing transportation conditions were defined for traffic volumes, levels of service, traffic operations, and safety for I-5 and Kuebler Boulevard.

FINDINGS

1. Existing development within the Proposed Plan area is sparse, consisting primarily of single family residential and agricultural uses, with a limited amount of industrial use in the northeast quadrant.

Conclusions

2. With the exception of the Battle Creek Road intersection, there are no significant existing traffic problems along Kuebler Boulevard or I-5 within the study area. Battle Creek Road is the only signalized intersection where substandard level of service (LOS "F") occurs during the p.m. peak hour. This results in occasional backups of westbound traffic to the 27th Avenue intersection.

Future Conditions

The land use estimates for the Baseline scenario reflect the land use assumptions contained in the city's Comprehensive Plan for the interchange area. A description of the process for developing the 2015 Proposed Plan land use estimates, including densities and specific development types, is included in the *I-5/Kuebler Boulevard Interchange Management Plan Final Reconnaissance Report*.⁴⁰ The 2006 Proposed Plan land use forecast was developed by establishing assumptions regarding the proportion of 2015 development that would occur by 2006 for each land use type within the interchange quadrants, then applying the percentages to the 2015 development totals to obtain 2006 development estimates by land use type.

Future transportation conditions were identified for traffic volumes, level of service, and traffic operations for I-5 and Kuebler Boulevard. The analysis was based on future traffic volume estimates produced by a "focused" traffic forecasting model developed specifically for the study area. The model was derived from the SKATS regional travel forecasting model, in which the regional model zone system and network were refined within and near the study area. Adjustments were also made to the focus model trip matrix within the study area.

FINDINGS

1. Land use for the 2015 Baseline scenario will consist of roughly 280 acres of developing residential use and 475 acres of industrial use. A majority of the residential development will be located in the northwest quadrant of the interchange and a majority of the industrial development will be located in the southeast quadrant.
2. The 2015 Proposed Plan scenario will contain the same number of developed acres as the Baseline scenario, but will have a greater variety of uses, including commercial office, public use, mixed use, and general commercial. Similar to the Baseline scenario, however, a majority of the developed acres will be comprised of residential and industrial uses.

⁴⁰ Oregon Department of Transportation.

Conclusions

3. Development for the 2006 Proposed Plan scenario may be somewhat limited due to the large up-front costs that developers would have to pay for infrastructure improvements, in particular, a water reservoir that would cost an estimated \$4 – 6 million. It is estimated that 270 acres of the Proposed Plan area will be developed by 2006, representing approximately 35 percent of the 2015 Proposed Plan scenario development total. Most of this development (roughly 210 acres) will be industrial uses.
4. For the 2015 Baseline scenario, levels of service along Kuebler Boulevard would deteriorate compared to existing conditions, but would still be adequate at all signalized intersections except Battle Creek Road. Levels of service at the unsignalized intersections of Stroh Road, 27th Avenue, and 36th Avenue would be LOS F, however, and signals would be warranted at all of these locations. In addition to the existing backup problem at Battlecreek Road, minor operational problems may be caused by backups of westbound left-turning vehicles into inside through lane at Commercial Street. Assuming the three-lane widening improvement along I-5 to the north and south of Kuebler Boulevard, adequate levels of service would be maintained at all freeway locations except the southbound off-ramp junction at Kuebler Boulevard, where the level of service would drop to LOS E.
5. Level of service impacts of the 2015 Proposed Plan scenario along Kuebler Boulevard would be similar, but somewhat worse, compared to those of the Baseline scenario. In addition to Battlecreek Road, the level of service for the Turner Road intersection would decrease to LOS F. As with the Baseline scenario, the level of service for all of the unsignalized intersections would be LOS F, and signals would be warranted at each of these locations. Traffic operations would be similar to those for the Baseline scenario, with westbound through lane backups at Battlecreek Road and, possibly, minor westbound left-turn lane backups at Commercial Street. One reason for the similarities between the impacts of the Baseline and Proposed Plan scenarios is that a portion of the traffic that would otherwise use Kuebler Boulevard for the Proposed Plan scenario would be unable to do so, because v/c ratios would be near 1.0 for the Baseline scenario even without the additional traffic from the Proposed Plan area development. This would result in the diversion of traffic to other study area roads. Levels of service along I-5 would be the same as for the Baseline scenario, with the exception of the southbound segment south of Kuebler Boulevard, which would operate at LOS D.
6. Without the three-lane widening improvement along I-5, LOS E and LOS F conditions would occur for several freeway segments and ramp junctions for the Proposed Plan scenario. This would result in at-capacity or breakdown

Conclusions

operational conditions. There would be no significant differences in the impacts along Kuebler Boulevard with no I-5 widening.

7. Total trip generation for the 2006 Proposed Plan scenario would be significantly lower (-70%) than for the 2015 Proposed Plan scenario. Volume increases compared to existing conditions would be in the range of +10% to +30% along Kuebler Boulevard and roughly +40% along I-5. Local traffic percentages would generally range from 10% to 25% along Kuebler Boulevard and the I-5 ramps and from 2% to 6% along I-5. These percentages are significantly lower than those for the 2015 Proposed Plan scenario, reflecting the lower level of interchange area development with the 2006 scenario.
8. Adequate levels of service would occur for the 2006 Proposed Plan scenario at all existing signalized intersections along Kuebler Boulevard, with the exception of Kuebler Boulevard/Battle Creek Road, which would operate at LOS "F". LOS "F" would also occur at the unsignalized intersections of Kuebler Boulevard/Stroh Lane, Kuebler Boulevard/27th Avenue, and Kuebler Boulevard/36th Avenue. Levels of service would be adequate along I-5 except at the southbound Kuebler Boulevard off-ramp junction (LOS "F") and the southbound mainline segment south of Kuebler Boulevard (LOS "E"). Proposed Plan area traffic would contribute very little to the degradation in level of service along I-5, with LOS conditions remaining the same with or without this traffic.
9. Queue lengths for turning vehicles on Kuebler Boulevard for the 2006 Proposed Plan scenario would be greater than 250 feet at the Commercial Street and I-5 northbound ramps intersections, resulting in possible backups into the adjacent through lane. Through vehicle queues on westbound Kuebler Boulevard at Battle Creek Road would also be excessive, extending close to the 27th Avenue intersection.

Mitigation Improvements

Mitigation improvements were determined for locations along Kuebler Boulevard and I-5 where LOS standards would not be met with the Proposed Plan scenario. An LOS standard of "E" was used for Kuebler Boulevard and a standard of "D" was used for I-5. In addition, mitigation improvements were identified for a roadway network alternative in which no widening improvements were assumed for I-5 south of Highway 22.

Conclusions

FINDINGS

1. With mitigation, adequate levels of service could be attained for the 2015 Proposed Plan scenario at all locations along Kuebler Boulevard and I-5. The major improvements would be the widening of Kuebler Boulevard to four travel lanes between I-5 and Commercial Street and the addition of a second lane on the I-5 southbound off-ramp at Kuebler Boulevard. The off-ramp improvement would include an auxiliary lane along I-5, extending north of the Turner Road overcrossing. Other improvements would include signalization of the Stroh Road, 27th Avenue, and 36th Avenue intersections along Kuebler Boulevard and the addition of **turning lanes at several of the intersections**. The estimated total cost of the improvements is \$8,355,000 (current dollars).
2. Based on the above finding, it does not appear that any refinements to the 2015 Proposed Plan scenario will be necessary. The development levels assumed in the Proposed Plan can be accommodated with a reasonable set of mitigation improvements. The Kuebler Boulevard widening is identified in the *Salem Transportation System Plan*⁴¹ as a high priority improvement item that will be needed within the next ten years.
3. Findings 1. and 2., together with implementation of Recommendation 1. – Transportation contained in the following section (Section IX.), will establish conformity of the city's Proposed Land Use Plan with the requirements of OAR 660-012-0060 relating to plan and land use regulation amendments. Specifically, amendment of the *Salem Transportation System Plan*⁴¹ to include the mitigation improvements identified earlier in this report addresses OAR 660-012-0060(1)(b), which states that "amendments to comprehensive plans that significantly affect a transportation facility shall assure that the allowed uses are consistent with the identified function, capacity, and level of service of the facility, and that this may be accomplished by amending the TSP to provide transportation facilities adequate to support the proposed land uses." Further, coordination of the plan development between ODOT, the city, Marion County, and the Mid-Willamette Valley Council of Governments satisfies the requirement contained in OAR 660-12-0060(3) that "determinations under sections (1) and (2) of this rule shall be coordinated with affected facility and service providers and other affected local governments."
4. Required mitigation improvements along Kuebler Boulevard for the 2006 Proposed Plan scenario would consist of an additional through lane in each direction at Battle Creek Road and signalization at the intersections of 27th

⁴¹ City of Salem.

Conclusions

Avenue and 36th Avenue. Along I-5, an additional freeway lane would be required to mitigate the LOS "F" conditions at the southbound off-ramp junction at Kuebler Boulevard and the southbound freeway segment south of Kuebler Boulevard. This indicates that the planned three-lane widening improvement along I-5 would have to be accelerated in order to achieve adequate levels of service at these locations.

5. The total cost of the mitigation improvements along Kuebler Boulevard for the 2006 Proposed Plan scenario would be roughly \$1,124,000. Cost estimates for the I-5 improvements were not developed because these are a part of the 2015 base case network.

Additional Analysis

Subsequent to the identification of transportation impacts and mitigation improvements for the 2015 Proposed Plan scenario, an issue was raised by the project management team that the traffic volumes may have been underrepresented because they did not reflect the additional traffic that would use Kuebler Boulevard with the recommended capacity improvements. Therefore, it was suggested that a new traffic forecast should be prepared using a network that included the improvements. The key improvement related to the traffic forecasts was the addition of a through travel lane in each direction between the I-5 southbound ramps intersection and Commercial Street, resulting in a continuous four-lane section. This improvement was reflected in the study area focus model by increasing the coded capacity for Kuebler Boulevard from 800 vph to 1,900 vph in each direction. The focus model was rerun with the revised network using the same trip table that was applied for the original 2015 Proposed Plan model run. The new traffic volumes were used in performing an analysis to determine the revised levels of service along Kuebler Boulevard and if any additional mitigation improvements would be required.

FINDINGS

1. Traffic volumes along Kuebler Boulevard to the west of I-5 for the revised forecast were significantly higher (20 – 50%) than the original forecast. To the east of I-5, the increases were much smaller, ranging from 0 – 10%. The percentage increase is roughly the same for regional vs. local (Proposed Plan area) traffic. Even with the higher volumes, acceptable levels of service would be maintained along Kuebler Boulevard, with the exception of Kuebler Boulevard/Commercial Street and Kuebler Boulevard/Battle Creek Road, where LOS "F" would occur. LOS "E" could be attained at these locations with the addition of turning lanes on specific intersection approaches.

Conclusions

2. Excessive turning lane queues (greater than 250 feet) would occur at six intersections. This could result in vehicle back-ups into the adjacent through lane at two of the intersections (Kuebler Boulevard/Commercial Street and Kuebler Boulevard/I-5 northbound ramps). Excessive through lane queues (greater than 400 feet) may also occur at most of the intersections, but likely would not result in significant operational problems.
3. Levels of service and operational impacts for I-5 were not examined due to the close similarities between the original and revised I-5 volumes.

Capacity Allocation Mechanism

A capacity allocation mechanism was developed for allocating future interchange roadway capacity to specific development projects within the Proposed Plan area. This included a trip allocation method, a Supplemental Transportation System Development Charge (STSDC) that will be used to partially fund the mitigation improvements, and an implementation framework for allocating capacity and administering the STSDC. The allocation mechanism was based upon the original Proposed Plan scenario analysis and not the analysis reflecting the revised Proposed Plan traffic volumes.

FINDINGS

1. Total future interchange area roadway capacity to be allocated for the Proposed Plan development is 3,830 p.m. peak hour vehicle trips. The capacity allocated to each TAZ within the Proposed Plan area is equal to the number of modeled p.m. peak hour interzonal trips assigned to/from the TAZs for the 2015 Proposed Plan scenario.
2. In order to fund the interchange area roadway improvements, a Supplemental Transportation System Development Charge (STSDC) of \$643 per p.m. peak hour trip was developed. This includes a widening improvement for the southbound I-5 off-ramp at Kuebler Boulevard, together with a southbound auxiliary lane along I-5. The STSDC will be in addition to the city's existing Transportation System Development Charge (TSDC), which is used to fund transportation improvements identified in the *Salem Transportation System Plan*.⁴² The portion of total cost for each improvement to be funded by the STSDC was determined based on the percentage of Proposed Plan area trips using the improvements.
3. An implementation framework for the STSDC was developed, including a "trip rights" allocation method, fee assessment and administration procedures,

⁴² City of Salem.

Conclusions

and recommended revisions to the city's development code for implementation of the STSDC. Trip rights is the maximum number of p.m. hour trips that each parcel within the interchange area will be allowed to generate. They will be allocated to the individual parcels within the TAZs based on the relative trip generation potential of each parcel. Trip rights may be transferred between owners of property within the same TAZ in any manner acceptable to the owners.

4. Assessment of the STSDC for specific development proposals will be based upon the estimated number of p.m. peak hour trips to be generated by the development. Credits will be allowed for the cost of qualified public improvements constructed by the project proponent, as well as implementation of transportation demand management (TDM) programs.
5. Administration of the STSDC will be similar to that for the TSDC. The STSDC fee will be collected at the time the building permit is issued, or the applicant may defer payment by using the Bancroft approach. At the time the development is approved for occupancy, the city will have the right to determine if the land use category used to calculate the STSDC fee is still appropriate. STSDC funds will be placed in the city's Extra Capacity Facilities Fund Transportation Account and will be segregated from TSDC and other SDC revenues.
6. The STSDC program will need to be monitored to determine if the estimated improvements and costs reflect current conditions. The required improvements may change if future traffic volumes vary significantly from the traffic forecasts used in identifying the improvements. This may result in a higher or lower future STSDC rate. Improvement costs will also likely be higher for the 12-year period beyond 2003. The program should be extended beyond 2015 if the rate of development for the Proposed Plan area is slower than that anticipated in the *I-5/Kuebler Boulevard Interchange Management Plan Final Reconnaissance Report*.⁴³

⁴³ Oregon Department of Transportation.

IX. Recommendations

The recommendations listed below are based upon the study conclusions as well as input received from the project management team.

Land Use

The first two land use recommendations relate to the total amount of development that will be allowed to occur within the interchange area by 2015. The latter three **recommendations** are alternatives describing the timing of development relative to the implementation of interchange area roadway improvements. A decision on which alternative to be carried forward by the city in the plan adoption process will be made once the plan has been circulated for comment among interchange area property owners and other interested persons.

1. If the improvements already planned within the study area (as identified in *Salem Transportation System Plan*⁴⁴) and the Proposed Plan mitigation improvements will be implemented within the planning horizon (2015), no refinements to the proposed land uses are recommended in order to achieve balance between transportation system supply (capacity) and demand along Kuebler Boulevard and I-5 within the study area.
2. If the improvements already planned within the study area (as identified in *Salem Transportation System Plan*⁴⁴) and the Proposed Plan mitigation improvements will not be implemented within the planning horizon (2015), refinements to the proposed land uses should be identified, if necessary, in order to achieve balance between transportation system supply (capacity) and demand along Kuebler Boulevard and I-5 within the study area.
3. If property owners within the Proposed Plan area: 1) pay their “fair share” of the cost of mitigation improvements through a Supplemental Transportation System Development Charge (STSDC) or similar funding mechanism; and 2) construct any project-specific mitigation measures, if required; development should be allowed to occur whether or not the improvements required to maintain adequate levels of service on Kuebler Boulevard and I-5 are implemented concurrently with the development. This includes improvements already planned as well as mitigation improvements.

or

⁴⁴ City of Salem.

Recommendations

4. If property owners within the Proposed Plan: 1) pay their “fair share” of the cost of mitigation improvements through a Supplemental Transportation System Development Charge (STSDC) or similar funding mechanism; and 2) construct any project-specific mitigation measures, if required; development should be allowed to occur only if the improvements required to maintain adequate levels of service on Kuebler Boulevard only are implemented concurrently with the development. This includes improvements already planned as well as mitigation improvements.

or

5. If property owners within the Proposed Plan area: 1) pay their “fair share” of the cost of mitigation improvements through a Supplemental Transportation System Development Charge (STSDC) or similar funding mechanism; and 2) construct any project-specific mitigation measures, if required; development should be allowed to occur only if the improvements required to maintain adequate levels of service on Kuebler Boulevard and I-5 are implemented concurrently with the development. This includes improvements already planned (including widening of I-5 to three lanes in each direction between Highway 22 and Kuebler Boulevard and between Kuebler Boulevard and Delaney Road) as well as mitigation improvements.

Transportation

1. If the Proposed Plan is adopted, the *Salem Transportation System Plan*⁴⁵ should be amended to include the mitigation improvements within the study area described earlier in this report.
2. If the Proposed Plan is implemented, all of the improvements already planned as well as the mitigation improvements described earlier should be constructed within the planning horizon (2015).
3. Funding for the state and local portions of the improvement costs described earlier should be obtained in a timely manner so that the improvements required to maintain adequate levels of service may be provided concurrently with increased future development levels.
4. Funding and construction of the planned three-lane widening of I-5 south of Highway 22 should be accelerated, since without this improvement, inadequate levels of service (LOS “E” or worse) would occur at two locations along I-5 by 2006, with or without the Proposed Plan development.

⁴⁵ City of Salem.

Recommendations

5. Consideration should be given to mitigation of traffic impacts along other study area roadways due to the significant increases in volume that may occur for some of these roadways with the Proposed Plan development. (Specific roadways and impacts will be identified at the time of project proposals). Consideration should also be given to partial funding of improvements for other roadways through a supplemental development charge.
6. The *I-5/Kuebler Boulevard Interchange Management Plan* will define future required transportation system improvements within the study area related to I-5 and Kuebler Boulevard. However, the city may require additional analysis of impacts and required improvements for other study area roadways at the time of project proposals.
7. If changes are made to the Proposed Plan land uses or to Comprehensive Plan land uses outside of the interchange area during the 2015 planning period that would result in significant changes in local and/or regional traffic volumes within the study area, the appropriate elements of the *I-5/Kuebler Boulevard Interchange Management Plan* should be updated.

Capacity Allocation Mechanism

1. Interchange area capacity should be allocated first by traffic analysis zone, according to the number of modeled interzonal trips for each TAZ, and then by parcel within each TAZ, in proportion to the potential trip generation of each parcel.
2. A supplemental funding mechanism (such as an STSDC) should be established to partially fund the Proposed Plan mitigation improvements for Kuebler Boulevard and I-5.
3. If an STSDC or similar mechanism is established to fund the portions of improvement costs to be paid for by interchange area property owners, the following are recommended:
 - The portion of total cost for each improvement eligible for funding through the STSDC should be equal to the total cost of the improvement less the portion of cost to be funded through the existing Transportation System Development Charge (TSDC);
 - The portion of total cost for each improvement to be funded by the STSDC should be equal to the STSDC-eligible portion of the cost multiplied by the percentage of total future trips using the improvement that have one or both ends in the Proposed Plan area;

Recommendations

- The STSDC should be equal to the sum of the STSDC-funded portions of all improvement costs divided by the sum of trips using the improvements with one or both ends in the Proposed Plan area;
- “Trip rights” should be equal to the maximum number of trips that each interchange area parcel will be allowed to generate, as determined by the parcel-level capacity allocation method described above;
- “Trip rights” should be transferable between property owners within the same TAZ in any manner acceptable to the owners and the city;
- STSDC fees for specific developments should be calculated as the number of p.m. peak hour trip ends for development, as estimated using the *ITE Trip Generation Manual*⁴⁶ methodology, multiplied by the STSDC;
- STSDC credits should be provided for the construction of qualified public improvements and the implementation of approved TDM plans;
- The STSDC program should be updated every five years and monitored more frequently to determine if adjustments are needed to reflect current required improvements and construction costs.

⁴⁶ Institute of Transportation Engineers.