Highway 213
Urban Corridor Design Study

June 2000

LONG TERM
- "System" connections between I-205 and Hwy 213
- "Service" connections between I-205/Hwy 213 and End of Oregon Trail area
- Interchanges overlap

SHORT TERM
- Capacity improvements on Hwy 213 - I-205 to Holcomb

Match Divided Highway Section

HIGHWAY 213

Adequate Long Term Capacity

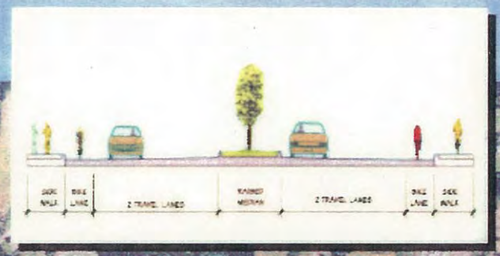
PHASE I - At-grade improvements

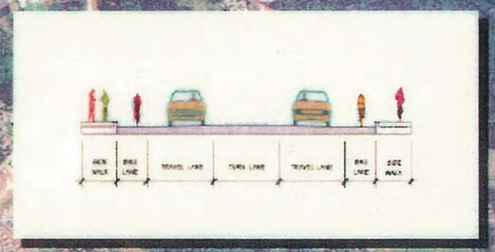
PHASE II - Grade separation improvements if needed

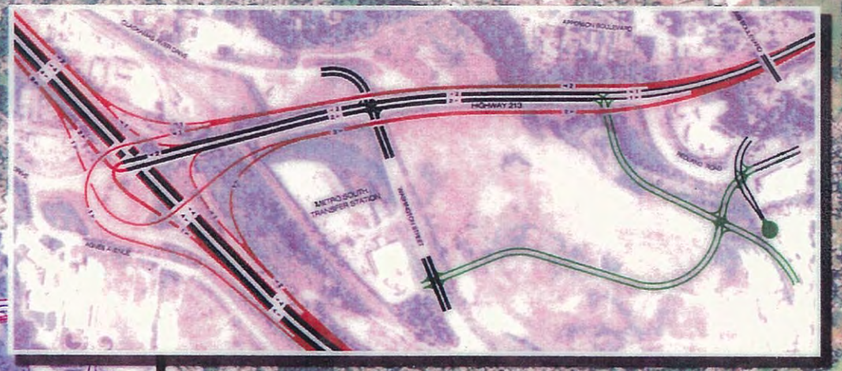
At-grade improvements

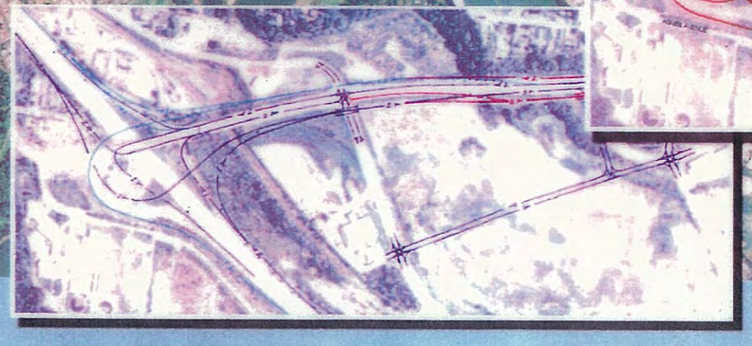
Signalize intersection

Match Rural Section









Connectivity needs between Gladstone and End of Oregon Trail area

Connectivity needs between Clackamette Cove and End of Oregon Trail area

Long term I-205 operations and design needs

I-205

CLACKAMAS RIVER DRIVE

WASHINGTON

ABERNETHY

MOLALLA

HENRICI

City of Oregon City, Oregon

Kittelson & Associates, Inc.

Final Report

Highway 213 Urban Corridor Design Study

Oregon City, Oregon

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Project No.: 2561
June 2000

Acknowledgments

The Highway 213 Urban Corridor Design Study was funded by Metro and sponsored by the City of Oregon City. ODOT, Metro, and the City of Oregon City worked diligently to create a successful plan to satisfy future travel demand on the Highway 213 Corridor. The project Technical Advisory Committee and Citizen Advisory Committee also contributed significantly to the success of this project. The Project Team thanks the City of Oregon City, Metro, ODOT the Technical Advisory Committee and Citizen Advisory Committee for all of their hard work and valuable contributions.

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Summary of Project, Findings and Recommendations

Purpose

The Highway 213 Urban Corridor Design Study was conducted to evaluate existing and future congestion on the Highway 213 corridor between Henrici Road and I-205 and to identify immediate and long-term transportation system improvements to mitigate this congestion.

Findings

Highway 213 between Henrici Road and I-205 changes from a high order facility, with limited pedestrian and bicycle facilities near I-205, to a rural two lane high access facility in the vicinity of Henrici Road. Under existing p.m. peak hour conditions, there is congestion and delay on the Highway 213 corridor between I-205 and Henrici Road at the key intersections of Washington Street, Redland Road, and Beavercreek Road. Motorists on I-205 between the Gladstone and the Highway 99E interchanges also experience p.m. peak hour congestion, particularly in the southbound direction.

Traffic volumes in this area are expected to continue to grow. The forecast increase in traffic comes from residential and commercial development in Oregon City and surrounding communities, as well as potential Urban Growth Boundary expansion to the south of Oregon City. With this growth in traffic volumes, peak hour congestion experienced by motorists today is expected to worsen.

The City of Oregon City is currently completing its Transportation System Plan (TSP). The City identified a need for more specific analysis along the Highway 213 corridor to develop the appropriate improvements for adoption into the TSP. This report documents the analysis and findings of the Highway 213 Urban Corridor Design Study. The study considered Highway 213 between I-205 and Henrici Road and, to assure system integration, I-205 between the Gladstone and Highway 99E interchanges.

Scope

In this study, the project team, Citizens Advisory Committee (CAC) and Technical Advisory Committee (TAC) completed the following significant tasks:

- Evaluated existing facilities, traffic operations, land uses, and environmental opportunities and constraints along the Highway 213 corridor between I-205 and Henrici Road, and on I-205 between the Gladstone Interchange and the Highway 99E Interchange,
- Forecasted and evaluated future travel demand in the study area,
- Evaluated forecast traffic operations and identified forecast future deficiencies,
- Identified alternative solution concepts to address the existing and future deficiencies, and
- Assisted the project Citizens Advisory Committee (CAC) and Technical Advisory Committee (TAC) with refining, evaluating, and identifying a most promising solution concept for the corridor.

Recommendations

To address the existing geometric and operational deficiencies as well as to serve forecast travel demand, the TAC and CAC recommended the solution concepts shown in Figures 1, 2, 3 and 4A through 4C. Figure 1 shows the solution concept preferred by the TAC and CAC at the north end of the project corridor. Considering the estimated construction costs and the current regional funding availability, Figure 2 was identified by the TAC and CAC as a preferred and financially feasible first phase of the larger solution concept shown in Figure 1. Additional I-205 corridor planning, environmental and engineering analysis will be required prior to adopting this specific solution concept. Metro and ODOT have plans for an I-205 corridor study. The future study will incorporate technical elements and recommendations from the Highway 213 Urban Corridor Design Study.

Figures 3, and 4A through 4C show the TAC and CAC preferred improvements for Highway 213 from Beavercreek Road south to Henrici Road. In this area, the City of Oregon City, the CAC and the TAC recommend pursuing at-grade improvements that:

- Expand capacity,
- Provide for pedestrian and bicycle accessibility,
- Serve future transit needs
- Safely transition from an urban facility to a rural facility, and
- Allow for continued direct, but managed access onto Highway 213.

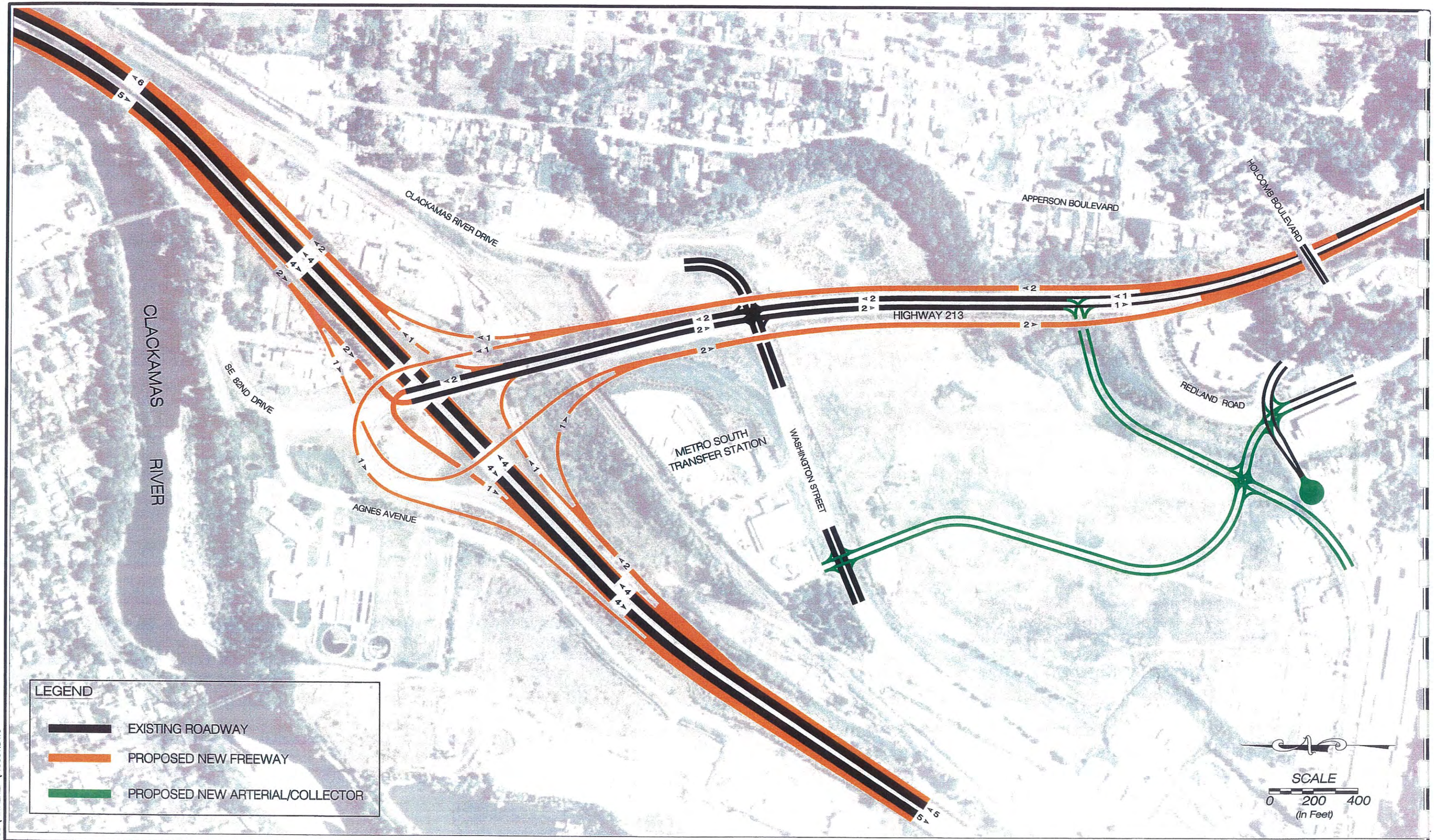
Implementation

Alternative 3 Phase 1 (Figure 2) will cost in the magnitude of $10 Million. This does not include right-of-way or environmental issues related to construction in a landfill. Metro has suggested that Alternative 3 Phase 1 is feasible from a financial perspective; however contributions would most likely be required from public agencies as well as from future public/private funding partnerships. However, no definitive funding plan has been outlined and, as any other identified improvement solution, this project would have to compete for MTIP support and to be listed on the Metro Regional Transportation Plan. Metro, the Oregon Department of Transportation (ODOT) and the City of Oregon City are planning to continue to develop the implementation strategy for Alternative 3 Phase 1.

The City of Oregon City has been awarded Metro Regional Transportation (Federal TEA-21) funds for an improvement project at Beavercreek Road/Highway 213, intersection. The City is planning to design and construct the at-grade improvement concept shown in Figure 3. It is estimated that the at-grade intersection will cost approximately $5.45 Million to construct (not including right-of-way acquisition and environmental factors).

South of Beavercreek Road, the City of Oregon City needs to pursue further refinement to the solution concept presented in Figures 4A through 4C. Traffic signals at Henrici Road/Highway 213 and Glen Oak Road/Highway 213 intersections will be required to maintain traffic operations at an acceptable level of service and should be included in the City's planning efforts. Further, access to Highway 213 south of Molalla will ultimately be more formally controlled than as existing. The amount and location of access onto the highway will need to be developed as part of an access management plan with a significant amount of public involvement. This effort should be undertaken with consideration of the possible UGB expansion in the south part of Oregon City.

Detailed documentation of the study process and findings is included in the following sections of this report.



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HIGHWAY 213 URBAN CORRIDOR DESIGN STUDY

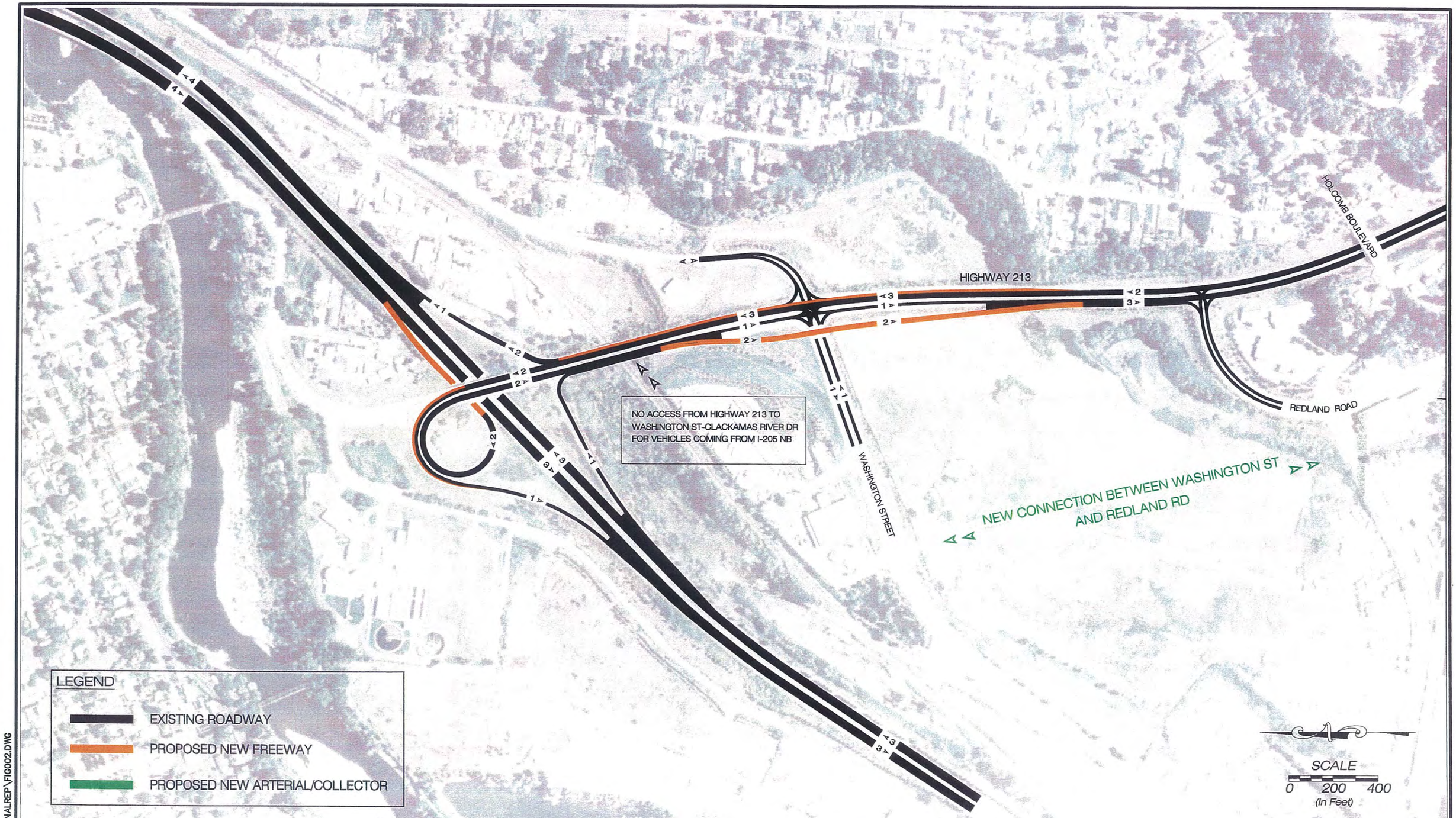
OREGON CITY, OREGON
JUNE 2000

HIGHWAY 213/I-205 INTERCHANGE CONCEPT ALTERNATIVE 3

FIGURE NO. 1

PROJECT NO. 2561

h: \PROJFILE\2561\DWGS\FINALREP\FIG001.DWG



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HIGHWAY 213 URBAN CORRIDOR DESIGN STUDY

OREGON CITY, OREGON
JUNE 2000

HIGHWAY 213/I-205 INTERCHANGE CONCEPT ALTERNATIVE 3 - PHASE 1 IMPROVEMENT

FIGURE NO. 2

PROJECT NO. 2561

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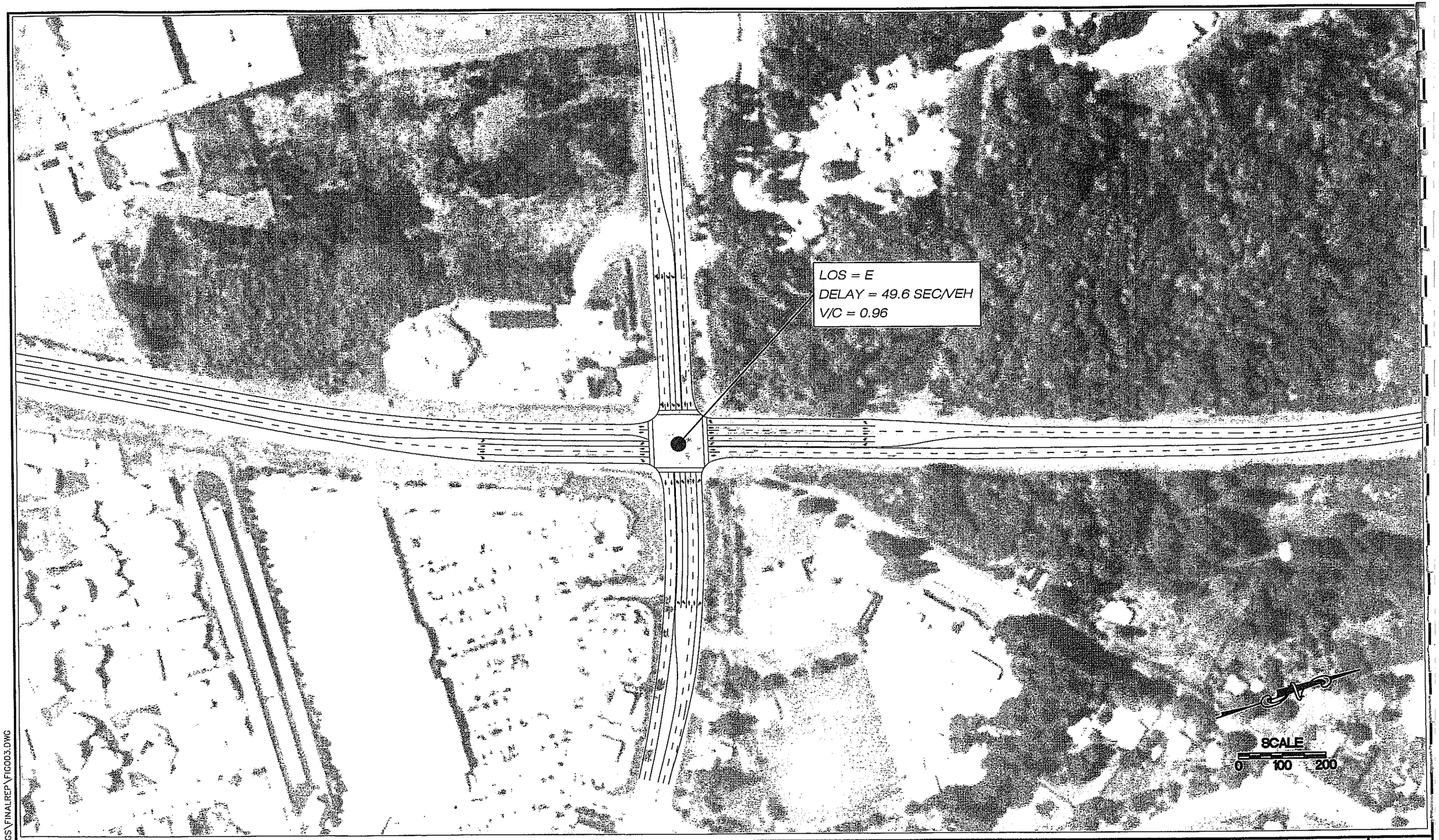

h:\PROJFILE\2561\DWGS\FINALREP\FIG003.DWG

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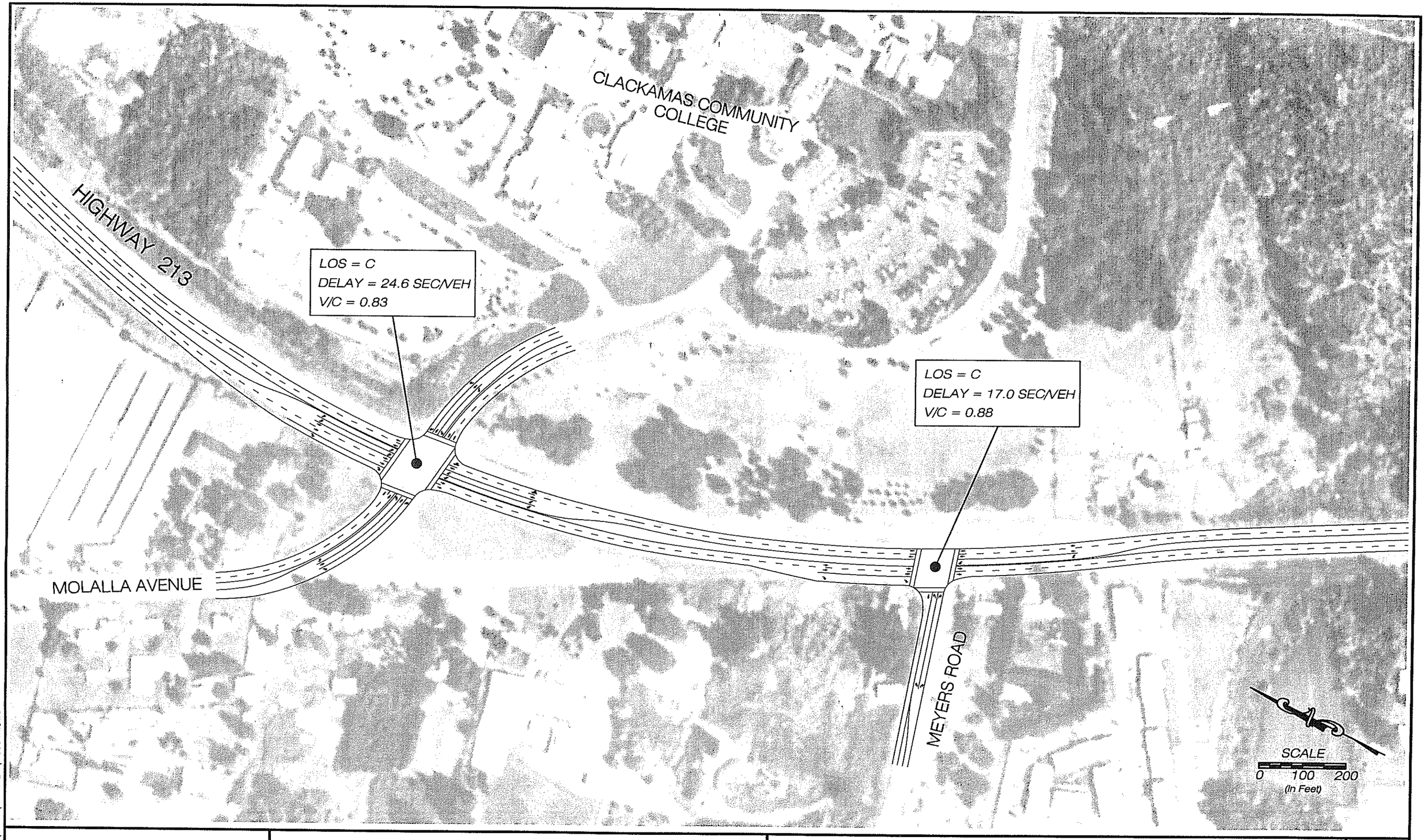
HIGHWAY 213 URBAN CORRIDOR DESIGN STUDY

OREGON CITY, OREGON
JUNE 2000

BEAVERCREEK/HIGHWAY 213 IMPROVEMENT PLAN IMPROVED AT-GRADE INTERSECTION CONCEPT 2018 WEEKDAY PM PEAK LEVELS OF SERVICE

FIGURE NO.
3

PROJECT NO.
2561



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HIGHWAY 213 URBAN CORRIDOR DESIGN STUDY

OREGON CITY, OREGON
JUNE 2000

HIGHWAY 213 IMPROVEMENT PLAN CONCEPT
MOLALLA AVENUE TO HENRICI ROAD
2018 WEEKDAY PM PEAK LEVELS OF SERVICE

FIGURE NO. 4A

PROJECT NO. 2561

h:\PROJFILE\2561\DWGS\FINALREP\FIG004A.DWG

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OREGON CITY, OREGON
JUNE 2000

HIGHWAY 213 IMPROVEMENT PLAN CONCEPT
MOLALLA AVENUE TO HENRICI ROAD
2018 WEEKDAY PM PEAK LEVELS OF SERVICE

FIGURE NO. 4B

PROJECT NO. 2561

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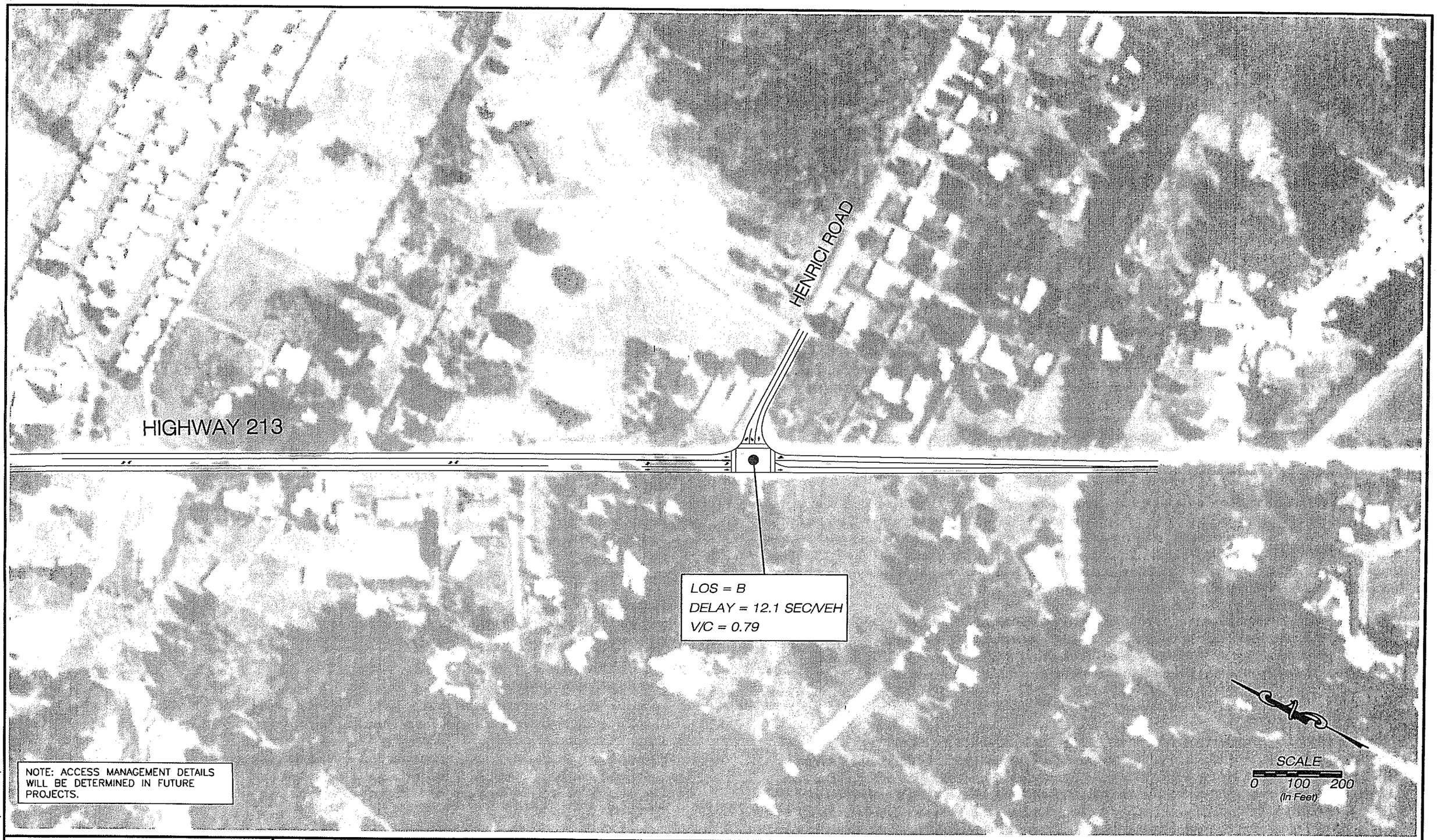

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HIGHWAY 213 URBAN CORRIDOR DESIGN STUDY

OREGON CITY, OREGON
JUNE 2000

HIGHWAY 213 IMPROVEMENT PLAN CONCEPT
MOLALLA AVENUE TO HENRICI ROAD
2018 WEEKDAY PM PEAK LEVELS OF SERVICE

FIGURE NO. 4C

PROJECT NO. 2561

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Introduction

Project Need

The Highway 213 facility between I-205 and Henrici Road has different characteristics and needs. At the north end of the study corridor, the I-205 interchange and the intersection of Washington Street/Highway 213 dominate the landscape. These are large, high-order facilities serving high volumes, with limited pedestrian and bicycle accessibility. The intersection of Washington Street/Highway 213 provides access to Oregon City and possible future development to the south and access to residential development to the north along the Clackamas River. Redland Road also provides access to residential development, Oregon City, and possible future development.

South of Redland Road to Beavercreek Road, Highway 213 is a high-speed, access-controlled facility through Newell Canyon. It is a four-lane facility with freeway characteristics. Beavercreek Road/Highway 213 is a high volume intersection providing access to and from Highway 213 from Beavercreek Road residential and retail development.

Between Beavercreek Road and Molalla Avenue, Oregon City would like Highway 213 to provide accessibility for pedestrian and bicyclists traveling along and across the roadway. However, the high traffic volumes and associated environment are not currently conducive to non-auto modes of transportation.

South of Newell Canyon, Highway 213 transitions from an urban arterial type facility in the vicinity of Beavercreek Road and Molalla Avenue to a rural two-lane highway in the vicinity of Henrici Road. This is a problematic transition in that under existing conditions the transition is abrupt and does not control travel speeds nor provide for pedestrians or bicyclists.

Under existing traffic volumes, there is significant congestion along the Highway 213 corridor. In the p.m. peak period (study design-volume period) the intersections of Washington Street/Highway 213, Redland Road/Highway 213, and Beavercreek Road/Highway 213 all operate under congested conditions. In the a.m. peak period, queues in the northbound direction from the northbound I-205 on-ramp at Highway 213 spill congestion back through the Highway 213/Washington Street intersection. As traffic volumes continue to grow in the future, congestion will worsen at these locations.

In addition, p.m. peak hour traffic volumes on I-205 currently exceed the facility capacity causing congestion and queuing along the freeway and at the Highway 213/I-205 interchange. In the future as traffic volumes continue to grow, congestion on I-205 will worsen. Without any modifications to I-205 in the study area, there will be unacceptable operational conditions during the forecast 20-year p.m. peak hour.

Planning Framework

The City of Oregon City is currently completing their Transportation System Plan (TSP). This project identified Highway 213 as a critical link in the City's transportation system. The City identified a need for this facility to provide mobility for motorists traveling within and to/from Oregon City. The TSP analysis showed existing congestion along the corridor and forecast future congestion as well. Therefore, for the TSP to be successfully implemented, the City of Oregon City needed to identify improvement concepts for the Highway 213 corridor and incorporate them into the TSP. The conceptual corridor improvements were to be developed in this Highway 213 Urban Corridor Design Study. This report documents the process, results and recommendations from this study.

Study Area

Figure 5 depicts the project study area, and the intersection traffic control at the key study intersections. The study primarily focuses on the Highway 213 corridor (principal study area). However, Interstate 205 between the Gladstone interchange and the Highway 99E interchange (secondary study area) was included to ensure that improvements identified at the Highway 213/I-205 interchange were compatible with the existing Interstate 205 and possible future improvements along the I-205 corridor.

Scope and Approach

The purpose of the study was to identify near-term and long-term solution concepts for existing and future transportation system deficiencies identified in the study area. The existing deficiencies were identified based on existing p.m. peak hour traffic operations analyses, field reviews and input from the project Technical Advisory Committee (TAC) and Citizen's Advisory Committee (CAC). 20-Year future p.m. peak hour traffic conditions were forecast from Metro's travel demand model, refined to more accurately reflect local conditions within Oregon City. Forecast p.m. peak hour operational deficiencies were identified based on traffic operations analyses and discussions with representatives from the City of Oregon City, Clackamas County, the Oregon Department of Transportation, Metro and the CAC.

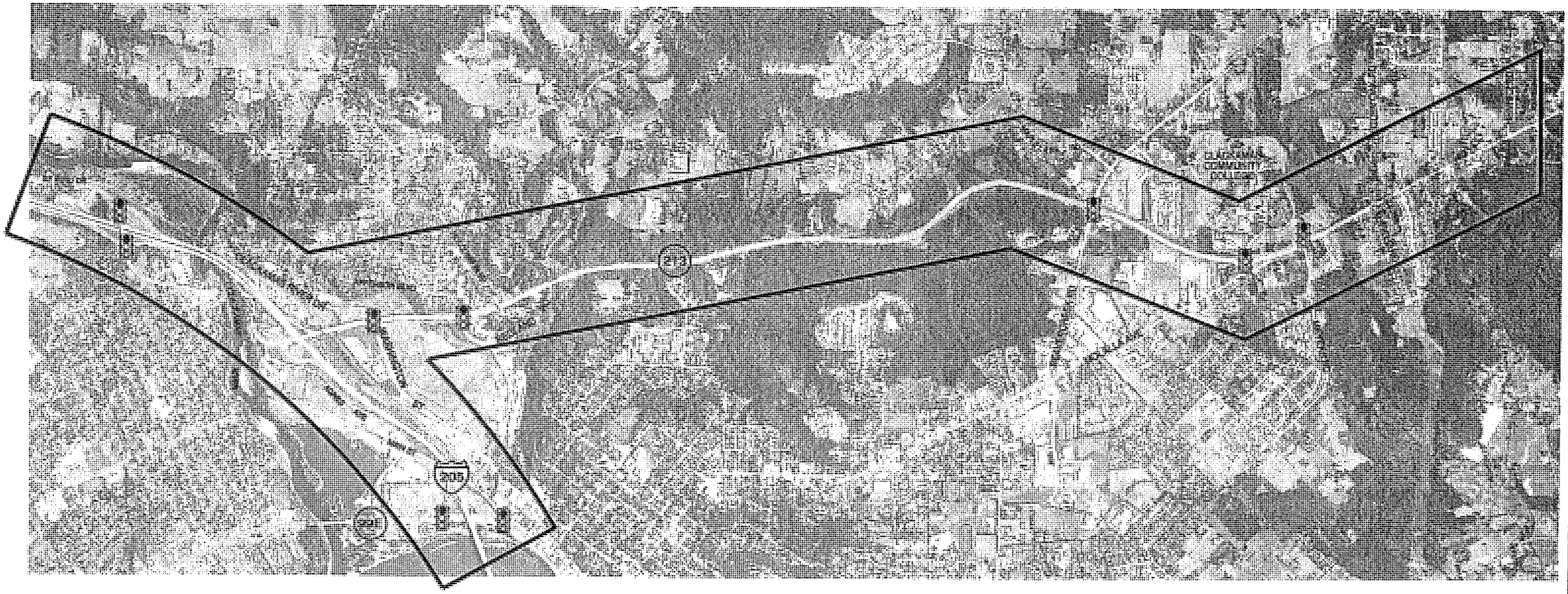
Solution concepts were developed using single-line techniques on aerial photography (see Figure 1) to efficiently generate a number of improvement alternatives. The concepts were refined with input from City of Oregon City, Clackamas County, the Oregon Department of Transportation, Metro, Tri-Met, the TAC, and the CAC. Functional plans of the most promising solution concepts between Beavercreek Road and Henrici Road, and single-line solution concepts in the vicinity of the I-205/Hwy 213 interchange document these efforts. In addition to the design considerations, traffic operations analyses and qualitative land use and environmental analyses were also conducted to verify that the solution concepts being generated were consistent with State and local policies.

The project process relied on close coordination between the TAC, CAC and the City of Oregon City to review project analysis, findings, concept development and recommendations as the project evolved. A brief overview of each of the project tasks follows:

Existing Conditions Analysis

Initial project activities focused on understanding the constraints and opportunities along the Highway 213 corridor. Surrounding land uses and environmental features were studied, as well as the traffic flow characteristics, roadway safety characteristics, and the roadway geometric features of the corridor. The Project Team relied on field visits, previously collected data and reports from the Oregon Department of Transportation (ODOT), the City of Oregon City, and Metro, and input from the City of Oregon City, TAC and CAC to complete these analyses. The findings from this task formed the basis and direction of the concept development phases of the project.

NORTH
(NOT TO SCALE)



LEGEND

STUDY AREA

TRAFFIC SIGNAL

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HIGHWAY 213 URBAN CORRIDOR DESIGN STUDY

OREGON CITY, OREGON
JUNE 2000

PROJECT STUDY AREA

FIGURE NO. 5

PROJECT NO. 2561

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Future No-Build Analysis

Future p.m. peak hour traffic volumes applied in this project are the same as those developed for the City of Oregon City Transportation System Plan. The forecast was developed using the Metro travel demand model. The Metro transportation analysis zones (TAZs) were refined in the local Oregon City area to better reflect existing and anticipated land use, and the land use inputs to the model are based on Oregon City's existing Comprehensive Plan. No significant modifications were made to the existing transportation network in the study area. These inputs yielded a 20-year no-build p.m. peak hour traffic volume forecast. Details of this process are included in the documentation for the TSP project.

A future conditions traffic operations analysis was performed on the 20-year future p.m. peak hour traffic volumes. The results provided an understanding of how significant future deficiencies would be with no improvements to existing conditions. Based on this analysis, forecast future traffic operations in the study corridor were evaluated and preliminary solution concepts were identified. This information was reported to the TAC and CAC.

Concept Development and Refinement

City of Oregon City, TAC and CAC input and assessment of the results of the existing conditions and future no-build conditions analysis led the development of single-line and double-line solution concepts to the identified corridor deficiencies. The concepts ranged from expanded at-grade intersections, to access management, to full interchanges at Beavercreek Road, and the Highway 213: I-205 to Redland Road corridor. Concept development included operational and design evaluations.

The City of Oregon City, TAC and CAC reviewed the preliminary solution concepts and provided input as to the financial, political, operational and engineering feasibility of each of the solution concepts. Given this input, the concepts were refined and revised. The most promising solution concepts throughout the corridor were identified as an outcome of this process.

Functional Plans

Functional plans of the most promising solution concepts were developed from Beavercreek Road to Henrici Road following final concept input from the TAC and CAC. Single-line exhibits were developed for the Highway 213 corridor between I-205 and Redland Road. The concepts plans are of sufficient detail to determine traffic operations and design features, estimate planning level order of magnitude cost estimates, and preliminary land use and environmental impacts. More detailed environmental and design analyses and public involvement activities will be required before a preferred alternative can be chosen.

Cost Proportionality

Highway 213 is a district-level state facility used by motorists making local, county and regional trips. Modifications to improve and maintain traffic operations will be almost exclusively on the state roadway. However, financial responsibility for these improvements should be shared among jurisdictions contributing to congestion on the Highway. The final step of the project was an assessment the City of Oregon City's, and ODOT's proportionate share financial responsibility for improvements on the corridor.

Organization of Report

This Highway 213 Urban Corridor Design Study Final Report is a compilation of technical memoranda and presentations prepared throughout the project. The document is intended to be a summary of the analysis and findings from the project. It is also intended to highlight key recommendations made as an outcome of project analyses and meetings. These recommendations should form the basis for future engineering and environmental planning activities. The report is organized into the following sections:

- Introduction
- Existing Conditions Analysis,
- Future Conditions Analysis,
- Concept Development and Preferred Solutions,
- Summary

Existing Conditions Analysis

The existing conditions analysis was conducted to develop an understanding of the opportunities and constraints in the study area. To complete the analysis, the project team evaluated existing land use and environmental constraints as well as the existing features and traffic operations of the transportation system. The results of this assessment formed the foundation of problem identification and preliminary solution concepts. The Project Team relied on input from the TAC and CAC to review the preliminary results of the analysis and provide context for the identified issues. The specific analyses performed include: geometrics, traffic operations, safety and a qualitative land use/environmental analyses.

Geometric/Operations Evaluation

As-built plans, aerial photography, and field observations were used to evaluate the existing geometric characteristics of Highway 213 and I-205 within the study area. The geometric evaluation was performed based on the criteria rating summarized in Appendix A. These criteria are based on American Association of State Highway and Transportation Officials (AASHTO) policy. Like many transportation departments, ODOT uses AASHTO criteria as the basis for its own design standards.

Each feature was assigned a Good, Fair, or Poor rating based on the how closely the facilities met the AASHTO guidelines for design speed. The features analyzed were grouped into three categories:

- Geometric (G): horizontal alignment, vertical alignment, stopping sight distance, cross section, decision sight distance, exit and entrance ramp design;
- Operational (O): lane and route continuity, lane balance, ramp sequence; and
- Performance Measure (PM): level of service, accident rates.

The geometric analysis is based on roadway design speeds. A roadway feature that met or exceeded the design speed was rated good. Features that were within 10 mph of the design speed were rated fair. Features that were more than 10 mph below the design speed were rated poor. Research indicates accidents increase when speed differentials exceed 10 mph. Operational features were based on AASHTO guidelines, while level-of-service and accident rates were compared to ODOT and Oregon City standards, respectively.

This exercise was performed for the sections of both northbound and southbound I-205 and Highway 213 in the study area. Figures 6A through 6H consist of an aerial photograph of the study area overlaid with a directional grid matrix that lists each performance measure and roadway feature evaluation result. For each direction of traffic, the matrix is shaded to reflect whether a criteria rating of "good" (single hatch), "fair" (cross-hatch), or "poor" (solid) was designated to the evaluation feature at that particular location along the facility.

With a few exceptions, the existing configuration and geometric conditions of I-205 and Highway 213 in the study area conforms to AASHTO criteria with regards to the majority of geometric and operational features. The exceptions are:

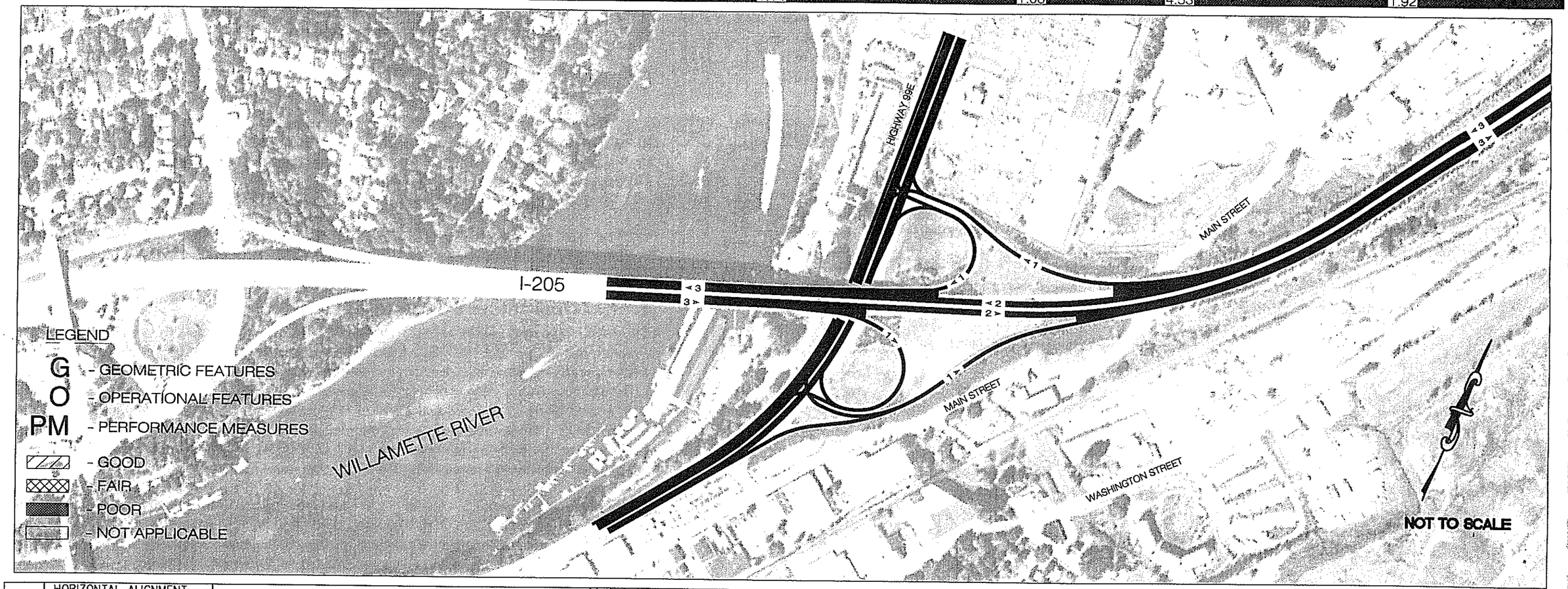
- The geometric design of both the I-205 SB/Highway 213 and I-205 NB/Highway 99E off-ramps provides insufficient deceleration distance for the controlling curvature of those ramp loops, requiring vehicles to decelerate on the freeway mainline.
- The cross-section of I-205 from the Gladstone-SE 82nd Drive interchange across the Clackamas River Bridge provides inadequate right shoulder width.
- True lane balance is not maintained at three locations along I-205 (I-205 Southbound/Highway 99E off-ramp, I-205
- At the Northbound/Highway 99E off-ramp, I-205 Northbound/Gladstone off-ramp), however, brief recovery areas are provided after the lane drop at these locations to allow vehicles in the drop lane to merge with mainline traffic after the off-ramp.
- The existing cross-section of Highway 213 between the Redland Road and Beavercreek Road intersections provide inadequate left shoulder width.

Traffic Operations Evaluation

The *1997 Highway Capacity Manual* (HCM) analysis methodology was used for all freeway operations evaluations. As per the 1997 HCM, the vehicle capacity for a freeway lane of traffic in the basic freeway segment and ramp merge/diverge sections was assumed to be 2,300 vehicles per hour per lane; in the weaving sections the vehicle capacity was assumed to be 2,000 vehicles per hour per lane. For I-205, a state highway of *Interstate Level of Importance*, the ODOT operational standard is level of service (LOS) "D" in urban regions of metropolitan areas. Because of limitations in the Highway Capacity Manual weaving methodology, the Joel E. Leisch methodology for weaving analysis was applied on Highway 213 between I-205 and Washington Street.

The operational performance of Highway 213 and Interstate 205 were rated based on the City of Oregon City, Clackamas County, and ODOT standards. These standards indicate that Level-of-Service (LOS) "A" through "D" are acceptable for existing signalized intersection operations, and LOS "E" and "F" are unacceptable. For unsignalized intersections, the City of Oregon City, Clackamas County, and ODOT standards outline operational LOS "A" though "D" as acceptable, LOS "E" as marginally acceptable, and LOS "F" as unacceptable.

G	HORIZONTAL ALIGNMENT	
	VERTICAL ALIGNMENT	
	STOPPING SIGHT DISTANCE	
	CROSS SECTION	
	DECISION SIGHT DISTANCE	
	EXIT & ENTRANCE DESIGN	
O	LANE & ROUTE CONTINUITY	
	LANE BALANCE	
	RAMP SEQUENCE	
PM	LEVEL OF SERVICE	D, E, E
	ACCIDENT RATES	1.14, 1.08, 4.53, 1.92



G	HORIZONTAL ALIGNMENT	
	VERTICAL ALIGNMENT	
	STOPPING SIGHT DISTANCE	
	CROSS SECTION	
	DECISION SIGHT DISTANCE	
	EXIT & ENTRANCE DESIGN	
O	LANE & ROUTE CONTINUITY	
	LANE BALANCE	
	RAMP SEQUENCE	
PM	LEVEL OF SERVICE	D, E, D
	ACCIDENT RATES	0.53, 2.22, 1.63, 0.76

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HIGHWAY 213 URBAN CORRIDOR DESIGN STUDY

OREGON CITY, OREGON
JUNE 2000

EVALUATION OF EXISTING CONDITIONS SUMMARY

FIGURE NO. 6A

PROJECT NO. 2561

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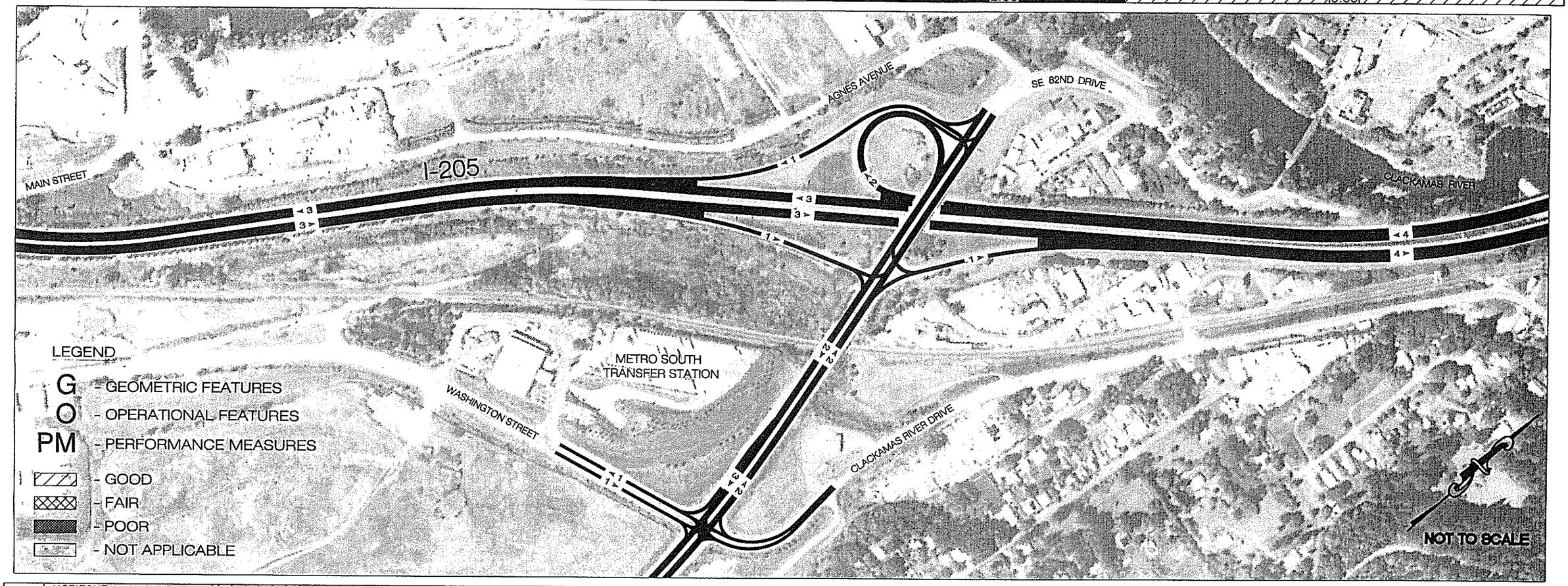
G	HORIZONTAL ALIGNMENT	
	VERTICAL ALIGNMENT	
	STOPPING SIGHT DISTANCE	
	CROSS SECTION	
	DECISION SIGHT DISTANCE	
	EXIT & ENTRANCE DESIGN	
O	LANE & ROUTE CONTINUITY	
	LANE BALANCE	
	RAMP SEQUENCE	
PM	LEVEL OF SERVICE	E | D | E
	ACCIDENT RATES	1.92 | 0.52 | 1.20 | 2.66 | 0.09



LEGEND

G - GEOMETRIC FEATURES

O - OPERATIONAL FEATURES

PM - PERFORMANCE MEASURES

- GOOD
- FAIR
- POOR
- NOT APPLICABLE

G	HORIZONTAL ALIGNMENT	
	VERTICAL ALIGNMENT	
	STOPPING SIGHT DISTANCE	
	CROSS SECTION	
	DECISION SIGHT DISTANCE	
	EXIT & ENTRANCE DESIGN	
O	LANE & ROUTE CONTINUITY	
	LANE BALANCE	
	RAMP SEQUENCE	
PM	LEVEL OF SERVICE	D | D | D | C | E
	ACCIDENT RATES	0.76 | 0.98 | 3.27 | 1.48 | 0.07

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JUNE 2000

EVALUATION OF EXISTING CONDITIONS SUMMARY

FIGURE NO. 6B

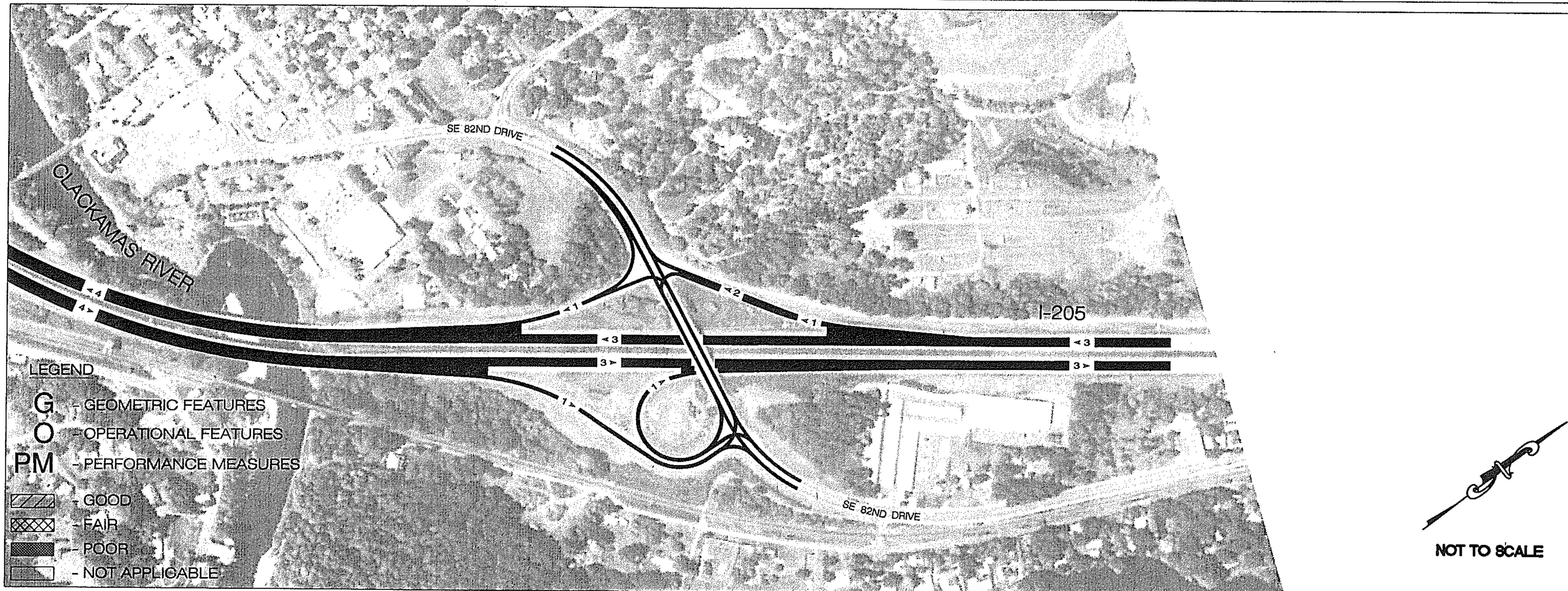
PROJECT NO. 2561

h:\PROJFILE\2561\DWGS\FINALREP\FIG006B.DWG

G
- HORIZONTAL ALIGNMENT
- VERTICAL ALIGNMENT
- STOPPING SIGHT DISTANCE
- CROSS SECTION
- DECISION SIGHT DISTANCE
- EXIT & ENTRANCE DESIGN

O
- LANE & ROUTE CONTINUITY
- LANE BALANCE
- RAMP SEQUENCE

PM
- LEVEL OF SERVICE: E, D, E, E
- ACCIDENT RATES: 0.09, 1.28, 0.58, 0.70



G
- HORIZONTAL ALIGNMENT
- VERTICAL ALIGNMENT
- STOPPING SIGHT DISTANCE
- CROSS SECTION
- DECISION SIGHT DISTANCE
- EXIT & ENTRANCE DESIGN

O
- LANE & ROUTE CONTINUITY
- LANE BALANCE
- RAMP SEQUENCE

PM
- LEVEL OF SERVICE: E, D, C, D
- ACCIDENT RATES: 1.04, 0.82, 0.52

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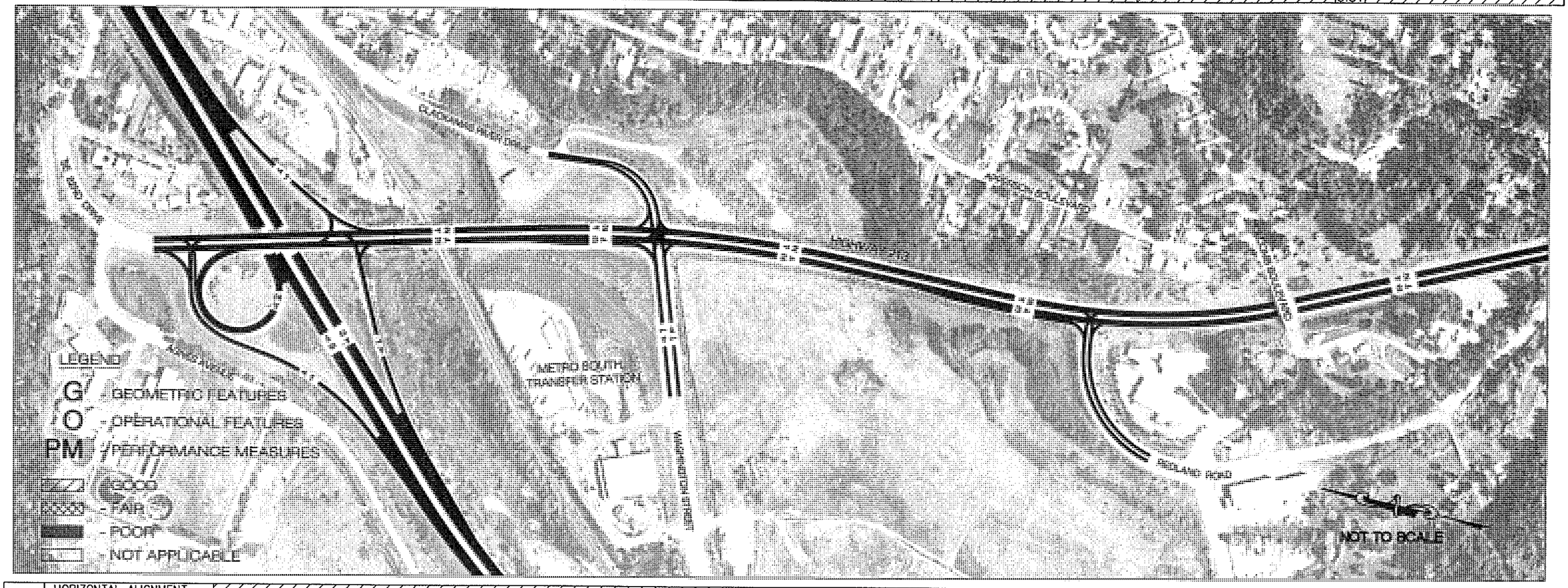
EVALUATION OF EXISTING CONDITIONS SUMMARY

FIGURE NO. 6C

PROJECT NO. 2561

h:\PROJFILE\2561\DWGS\FINALREP\FIG006.DWG

G	HORIZONTAL ALIGNMENT	
	VERTICAL ALIGNMENT	
	STOPPING SIGHT DISTANCE	
	CROSS SECTION	
	DECISION SIGHT DISTANCE	
	EXIT & ENTRANCE DESIGN	
O	LANE & ROUTE CONTINUITY	
	LANE BALANCE	
	RAMP SEQUENCE	
PM	LEVEL OF SERVICE	[B] F [C] [B] [B]
	ACCIDENT RATES	3.37 2.21 10.31



G	HORIZONTAL ALIGNMENT	
	VERTICAL ALIGNMENT	
	STOPPING SIGHT DISTANCE	
	CROSS SECTION	
	DECISION SIGHT DISTANCE	
	EXIT & ENTRANCE DESIGN	
O	LANE & ROUTE CONTINUITY	
	LANE BALANCE	
	RAMP SEQUENCE	
PM	LEVEL OF SERVICE	[B] F [C] [B] [C]
	ACCIDENT RATES	6.39 2.48 0.46

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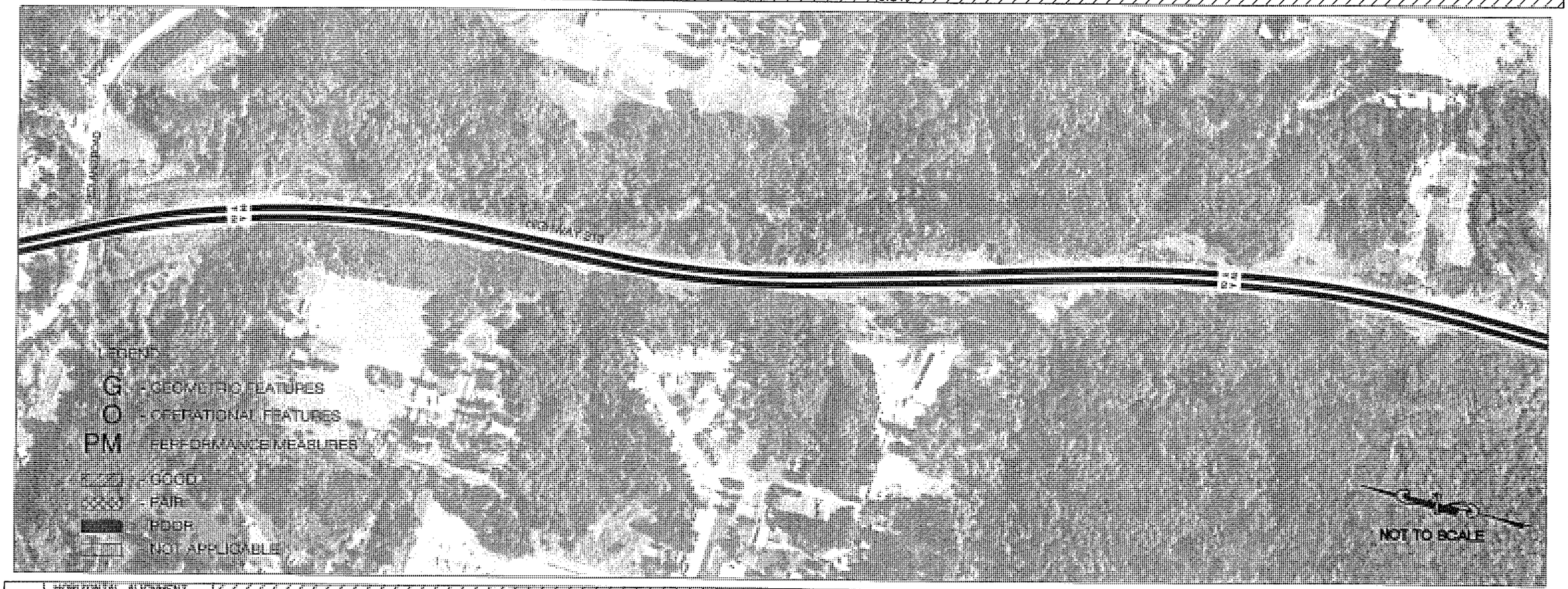
EVALUATION OF EXISTING CONDITIONS SUMMARY

FIGURE NO. 6D

PROJECT NO. 2561

h:\PROJFILE\2561\DWGS\FINALREP\FIG006.DWG

G	HORIZONTAL ALIGNMENT	
	VERTICAL ALIGNMENT	
	STOPPING SIGHT DISTANCE	
	CROSS SECTION	
	DECISION SIGHT DISTANCE	
	EXIT & ENTRANCE DESIGN	
O	LANE & ROUTE CONTINUITY	
	LANE BALANCE	
	RAMP SEQUENCE	
PM	LEVEL OF SERVICE	
	ACCIDENT RATES	[B] 0.31



G	HORIZONTAL ALIGNMENT	
	VERTICAL ALIGNMENT	
	STOPPING SIGHT DISTANCE	
	CROSS SECTION	
	DECISION SIGHT DISTANCE	
	EXIT & ENTRANCE DESIGN	
O	LANE & ROUTE CONTINUITY	
	LANE BALANCE	
	RAMP SEQUENCE	
PM	LEVEL OF SERVICE	
	ACCIDENT RATES	[C] 0.46

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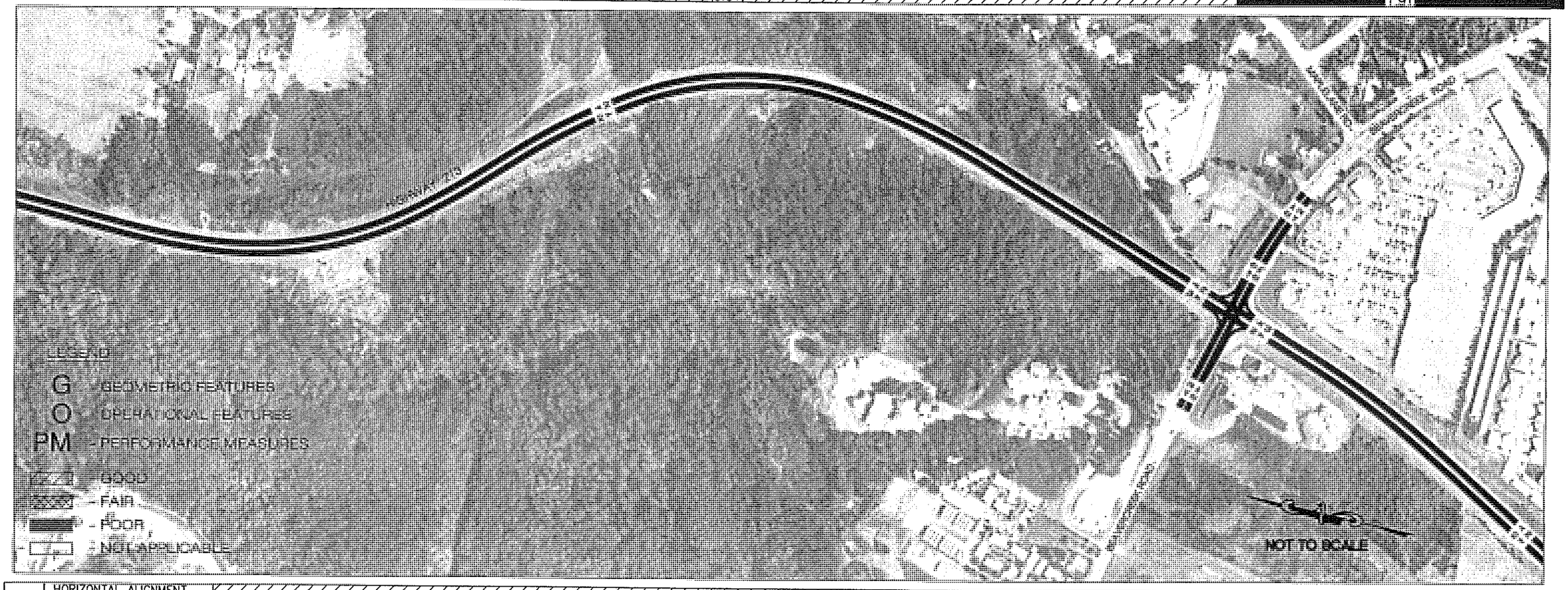
EVALUATION OF EXISTING CONDITIONS SUMMARY

FIGURE NO. 6E

PROJECT NO. 2561

h:\PROJFILE\2561\DWGS\FINALREP\FIG006.DWG

G	HORIZONTAL ALIGNMENT	
	VERTICAL ALIGNMENT	
	STOPPING SIGHT DISTANCE	
	CROSS SECTION	
	DECISION SIGHT DISTANCE	
	EXIT & ENTRANCE DESIGN	
O	LANE & ROUTE CONTINUITY	
	LANE BALANCE	
	RAMP SEQUENCE	
PM	LEVEL OF SERVICE	B 0.31 F 1.91
	ACCIDENT RATES	



G	HORIZONTAL ALIGNMENT	
	VERTICAL ALIGNMENT	
	STOPPING SIGHT DISTANCE	
	CROSS SECTION	
	DECISION SIGHT DISTANCE	
	EXIT & ENTRANCE DESIGN	
O	LANE & ROUTE CONTINUITY	
	LANE BALANCE	
	RAMP SEQUENCE	
PM	LEVEL OF SERVICE	C 0.46 F 1.70
	ACCIDENT RATES	

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JUNE 2000

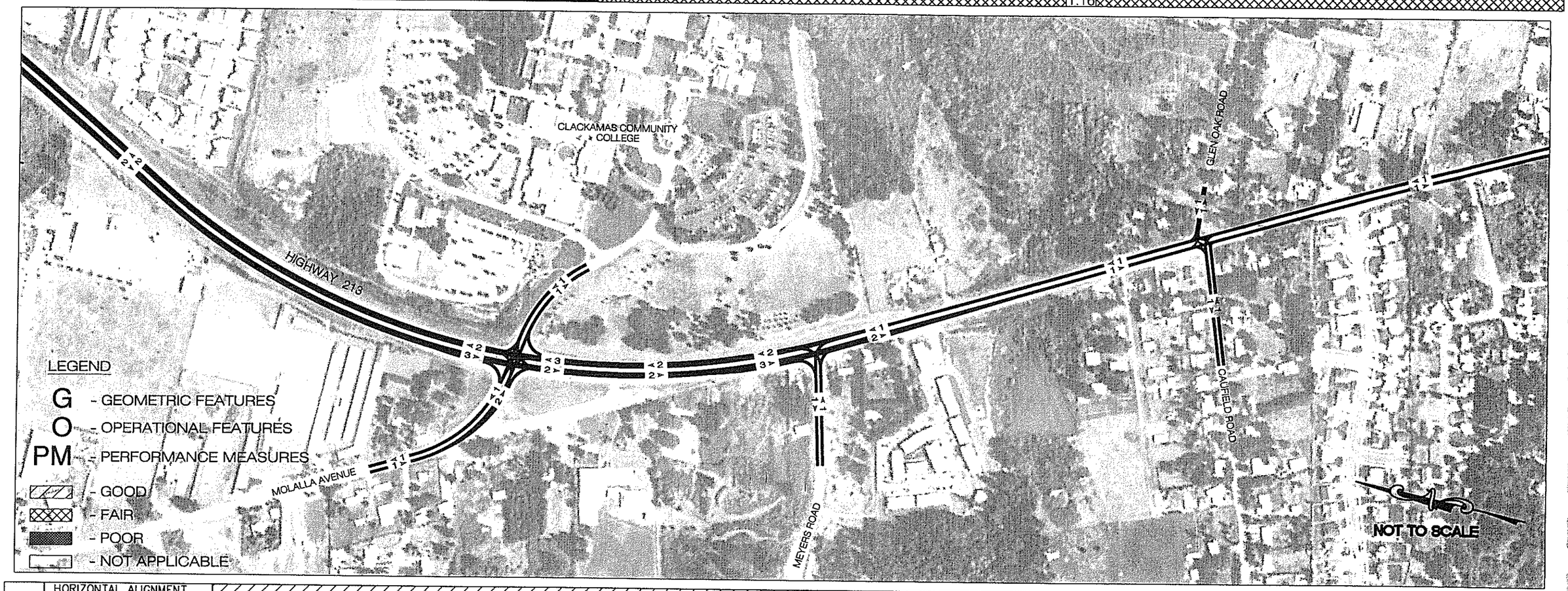
EVALUATION OF EXISTING CONDITIONS SUMMARY

FIGURE NO. 6F

PROJECT NO. 2561

h:\PROJFILE\2561\DWGS\FINALREP\FIG006.DWG

G	HORIZONTAL ALIGNMENT	
	VERTICAL ALIGNMENT	
	STOPPING SIGHT DISTANCE	
	CROSS SECTION	
	DECISION SIGHT DISTANCE	
	EXIT & ENTRANCE DESIGN	
O	LANE & ROUTE CONTINUITY	
	LANE BALANCE	
	RAMP SEQUENCE	
PM	LEVEL OF SERVICE	C / B / F
	ACCIDENT RATES	1.91 / 1.16



G	HORIZONTAL ALIGNMENT	
	VERTICAL ALIGNMENT	
	STOPPING SIGHT DISTANCE	
	CROSS SECTION	
	DECISION SIGHT DISTANCE	
	EXIT & ENTRANCE DESIGN	
O	LANE & ROUTE CONTINUITY	
	LANE BALANCE	
	RAMP SEQUENCE	
PM	LEVEL OF SERVICE	C / B / F
	ACCIDENT RATES	1.70 / 0.75

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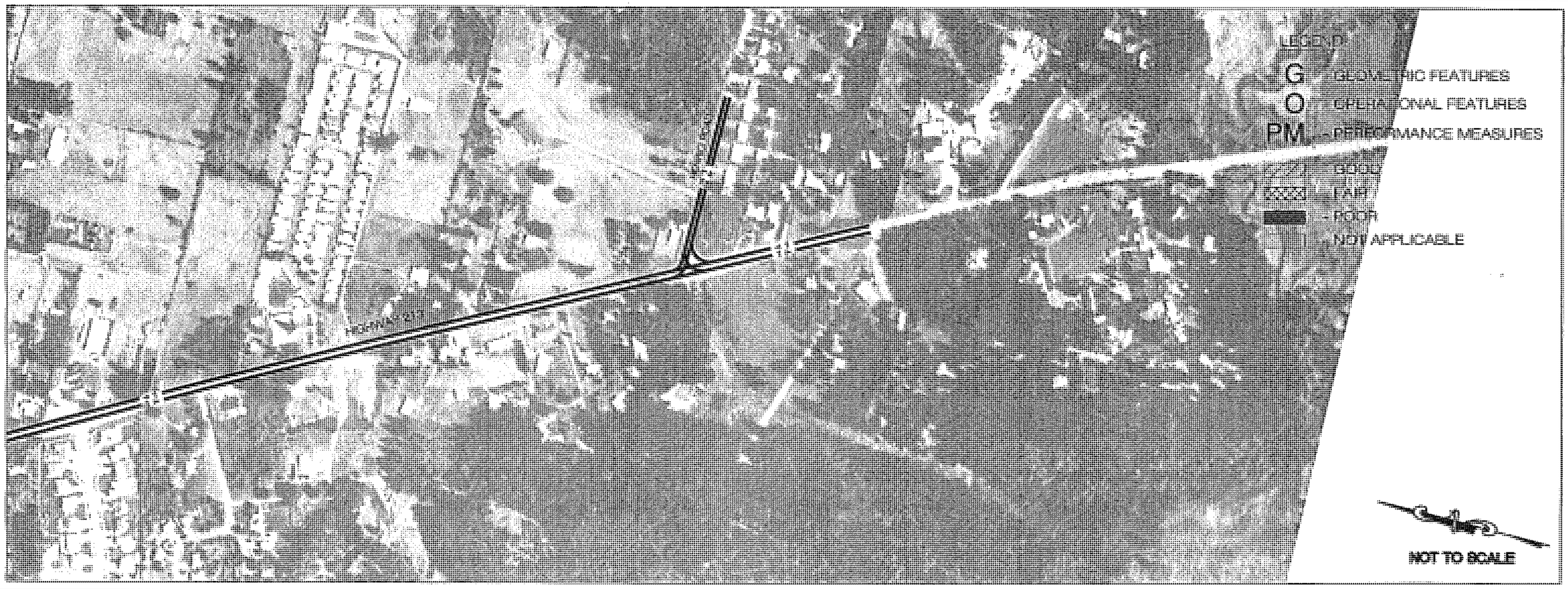
EVALUATION OF EXISTING CONDITIONS SUMMARY

FIGURE NO. 6G

PROJECT NO. 2561

h:\PROJFILE\2561\DWGS\FINALREP\FIG006.DWG

G	HORIZONTAL ALIGNMENT		
	VERTICAL ALIGNMENT		
	STOPPING SIGHT DISTANCE		
	CROSS SECTION		
	DECISION SIGHT DISTANCE		
	EXIT & ENTRANCE DESIGN		
O	LANE & ROUTE CONTINUITY		
	LANE BALANCE		
	RAMP SEQUENCE		
PM	LEVEL OF SERVICE	JCI	
	ACCIDENT RATES	1.16	



G	HORIZONTAL ALIGNMENT		
	VERTICAL ALIGNMENT		
	STOPPING SIGHT DISTANCE		
	CROSS SECTION		
	DECISION SIGHT DISTANCE		
	EXIT & ENTRANCE DESIGN		
O	LANE & ROUTE CONTINUITY		
	LANE BALANCE		
	RAMP SEQUENCE		
PM	LEVEL OF SERVICE	JCI	
	ACCIDENT RATES	0.75	

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EVALUATION OF EXISTING CONDITIONS SUMMARY

FIGURE NO. 6H

PROJECT NO. 2561

h:\PROJFILE\2561\DWGS\FINALREP\FIG006.DWG

Existing PM Peak Intersection Operations

Several of the principal intersections in the study area are operating under congested conditions. The intersections of Washington Street/Highway 213, and Beavercreek/Highway 213 are both operating near or over capacity. The weaving movement between the northbound I-205 to southbound Highway 213 to Clackamas River Drive further exacerbates the capacity constraints at the Washington Street/Highway 213 intersection. In addition, the northbound I-205 ramp terminal intersection is also operating over capacity.

Figures 7A and 7B show the existing p.m. peak hour traffic volumes. Figure 8 shows the existing intersection lane configurations and traffic control devices. Figures 9 and 10 show the existing traffic operations along Highway 213 and I-205, respectively. Appendix B contains a detailed, tabular summary of the traffic operations analysis.

Existing PM Peak Hour Freeway Operations

Under existing conditions, traffic operations in the study corridor are congested during the p.m. peak hour. On I-205, queuing regularly occurs in the southbound direction between the Gladstone and the Highway 99E interchange. The weaving sections on SB I-205 between the Gladstone on-ramp and the Hwy 213 off-ramp, and the between the Hwy 213 on-ramp to the Highway 99E off-ramp operate at LOS E. The northbound weaving section between the Highway 213 on-ramp and the Gladstone interchange off-ramp operates at LOS D.

The basic freeway segments other than the above weaving segments operate in the LOS E and LOS D range. Northbound I-205 between the Highway 213 off-ramp and the Highway 213 on-ramp operates at LOS C due to the high volume of traffic exiting from northbound I-205 to Highway 213.

Safety Evaluation

A safety analysis and accident evaluation for the study corridor was performed using data provided by ODOT. The study period for this analysis was January 1, 1993 through May 30, 1997. The safety analysis was performed to identify whether there are any crash trends that need to be specifically addressed in this project. For example, a location with a high incidence of accidents may be attributed to a specific geometric or operational feature that could be eliminated with improvements.

The detailed segment analysis revealed that, while no fatalities were reported, the majority of the I-205 freeway segments analyzed experienced accident rates higher than the statewide average. The statewide accident rate for similar type facilities is 0.91 accidents/million vehicle miles (acc/mvm). Locations below statewide averages include:

- The Gladstone interchange area,
- I-205 southbound around the Highway 213 on-ramp,
- I-205 northbound around the Highway 99E off-ramp, and
- I-205 northbound in the basic section between Highway 99E and Highway 213.

The segment of I-205 southbound around the Highway 99E off-ramp was found to have the highest accident rate, 4.52 accidents/million vehicle miles traveled. The segment of I-205 northbound in the Highway 213 interchange area was also found to experience a substantially higher than average accident rate of 3.27 accidents/million vehicle miles. These high accident rates can likely be attributed to the congested conditions that occur along I-205. In addition, the inadequate freeway off-ramp geometry at the Highway 213 and Highway 99E interchanges influences freeway mainline operations, resulting in congestion and queuing particularly during the peak hour periods.

On Highway 213, a total of 221 crashes were reported during the 53-month period under review. While 117 of these accidents involved personal injury, there were no reported fatalities. Further evaluation of the reported accident locations revealed that the majority of the accidents occurring along Highway 213 could be attributed to conflicts in or around an intersection, with rear-end accidents being the most common type of accident occurring. These observations are consistent with the congested operational conditions at the intersections as discussed in the operational analysis review. Site-specific tabular summaries of this crash information are included in Appendix C.

Environmental Evaluation

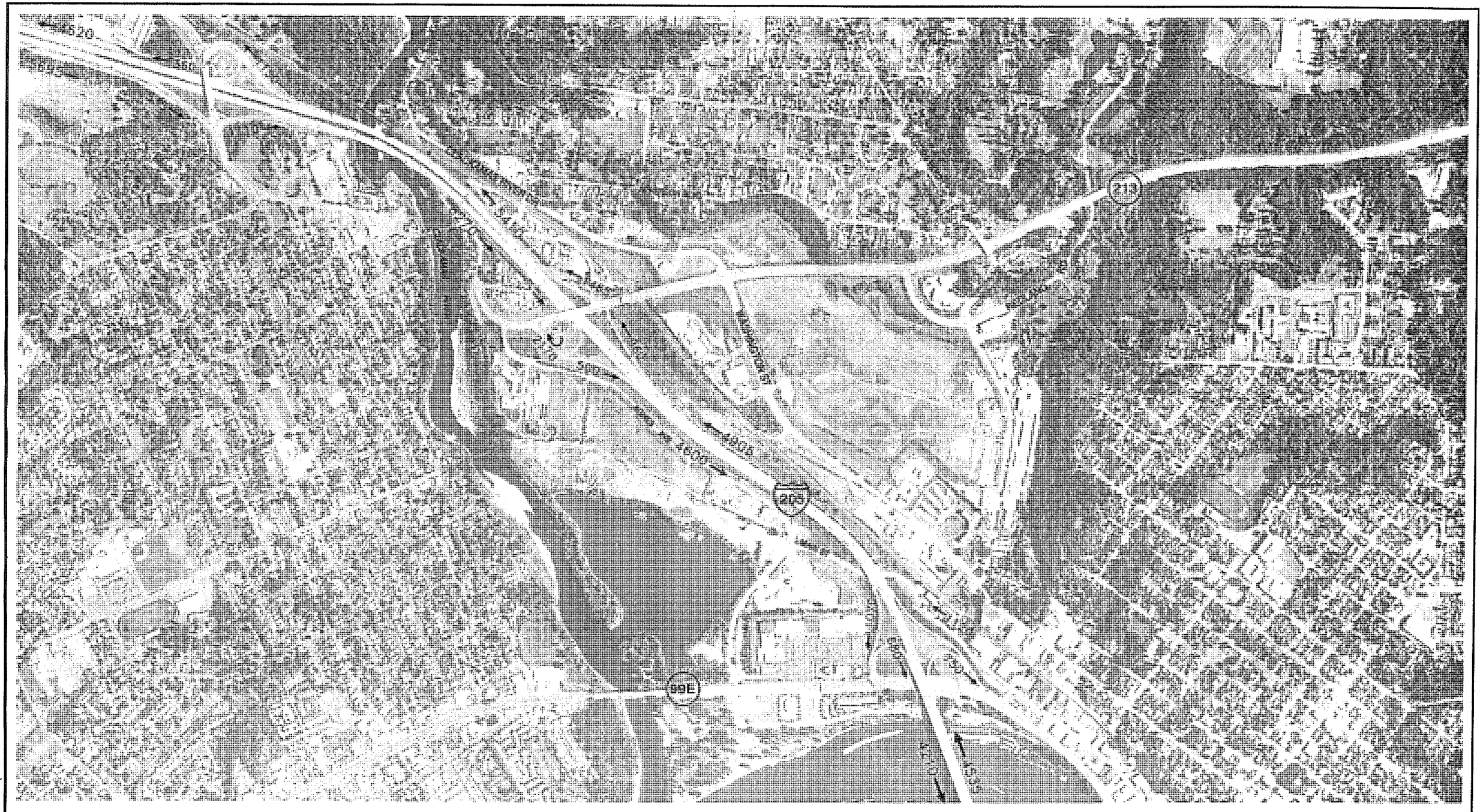
A baseline review of environmental issues and constraints identified the physical or regulatory constraints that were to be considered as part of the project planning process. The constraints include:

- Steep slopes along portions of the study corridor in the vicinity of Washington Street, the Canyon and Beavercreek Road.
- Stream crossings near Beavercreek Road and between Washington Street and Redland Road provide wildlife and potential fish habitat to be considered and protected in alternative solution concepts.
- Wetlands exist near Washington Street and I-205. These would also require protection. However, none of the identified issues represent a likely fatal flow for potential corridor improvements. Additional investigations will be required in latter phases of project development to determine the extent of jurisdictional wetlands and the presence of protected fish and wildlife species, or their critical habitat.

Summary of Existing Conditions

From the perspective of roadway geometric characteristics, Highway 213 and the I-205 corridor are in relatively good condition. There are a few geometric deficiencies on I-205 in the vicinity of the Highway 213, Highway 99E and the Clackamas River Bridge. However, these deficiencies are relatively minor and do not cause significant negative impacts.

There is insufficient capacity to meet existing southbound I-205 p.m. peak hour travel demand between the Gladstone Interchange and Highway 99E and on southbound Highway 213 between I-205 and Washington Street. Congestion also occurs at the Beavercreek/Highway 213 intersection. These congested locations cause delay and queuing for motorists and increase the propensity for traffic crashes.



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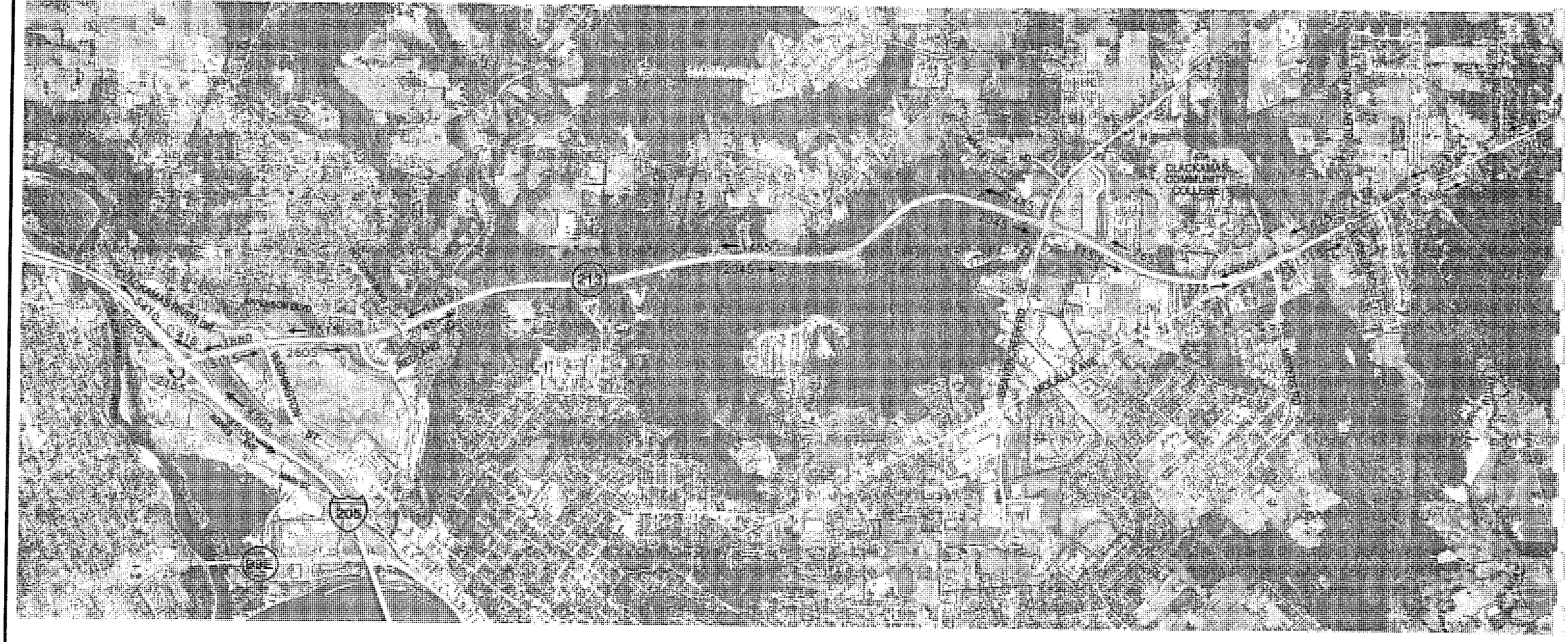
1998 EXISTING TRAFFIC VOLUMES WEEKDAY PM PEAK HOUR

FIGURE NO.
7A

PROJECT NO.
2561

h:\PROJFILE\2561\DWGS\FINALREP\FIGD7A.DWG

NORTH
(NOT TO SCALE)



h:\PROJFILE\2561\DWGS\FINALREP\FIG07B.DWG

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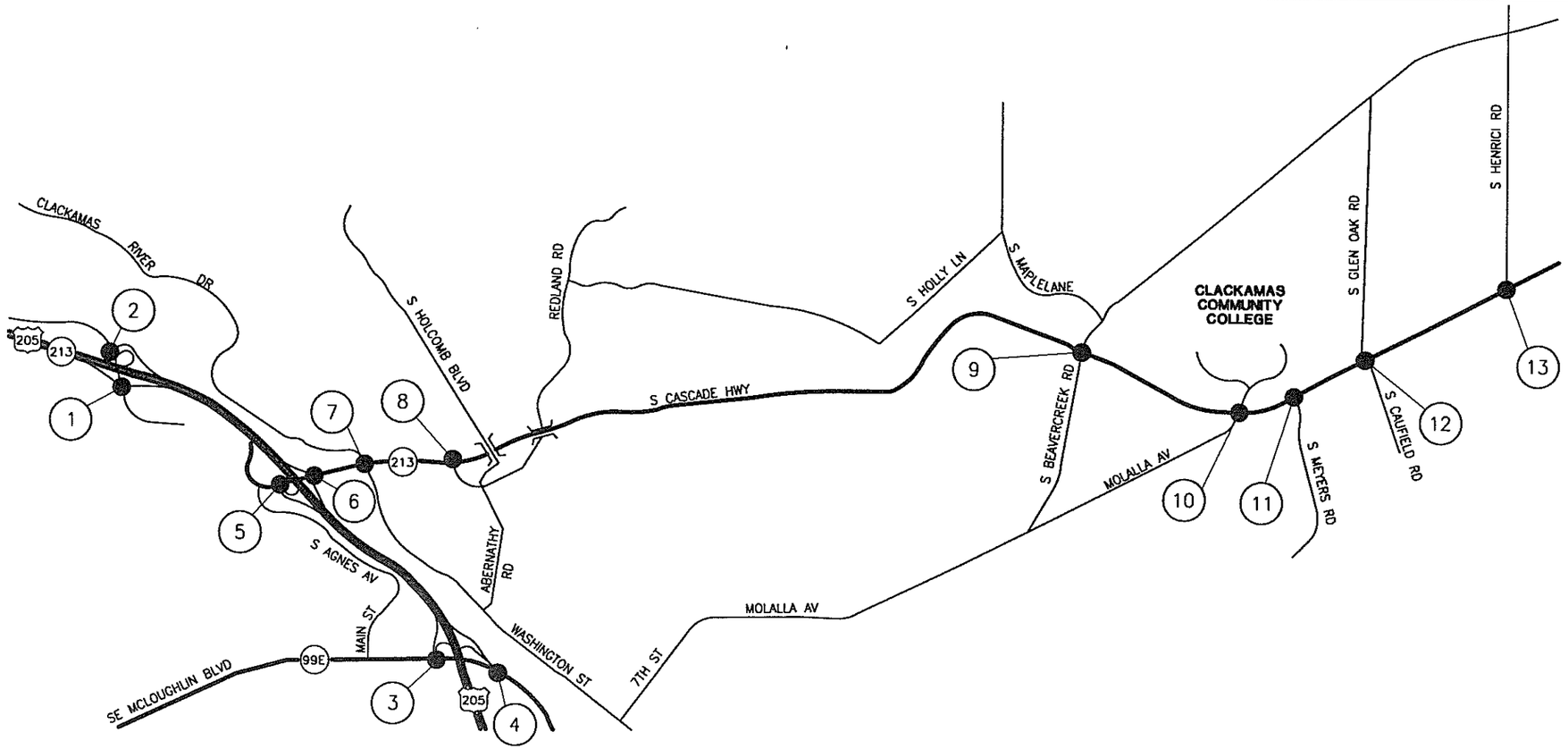
JUNE 2000

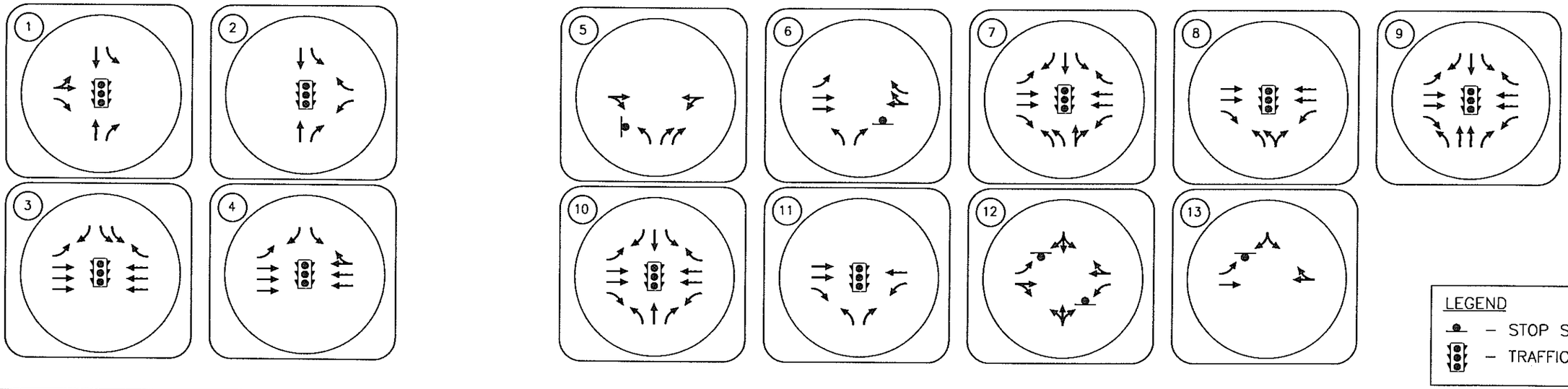
1998 EXISTING TRAFFIC VOLUMES WEEKDAY PM PEAK HOUR

FIGURE NO.
7B

PROJECT NO.
2561

NORTH
(NOT TO SCALE)





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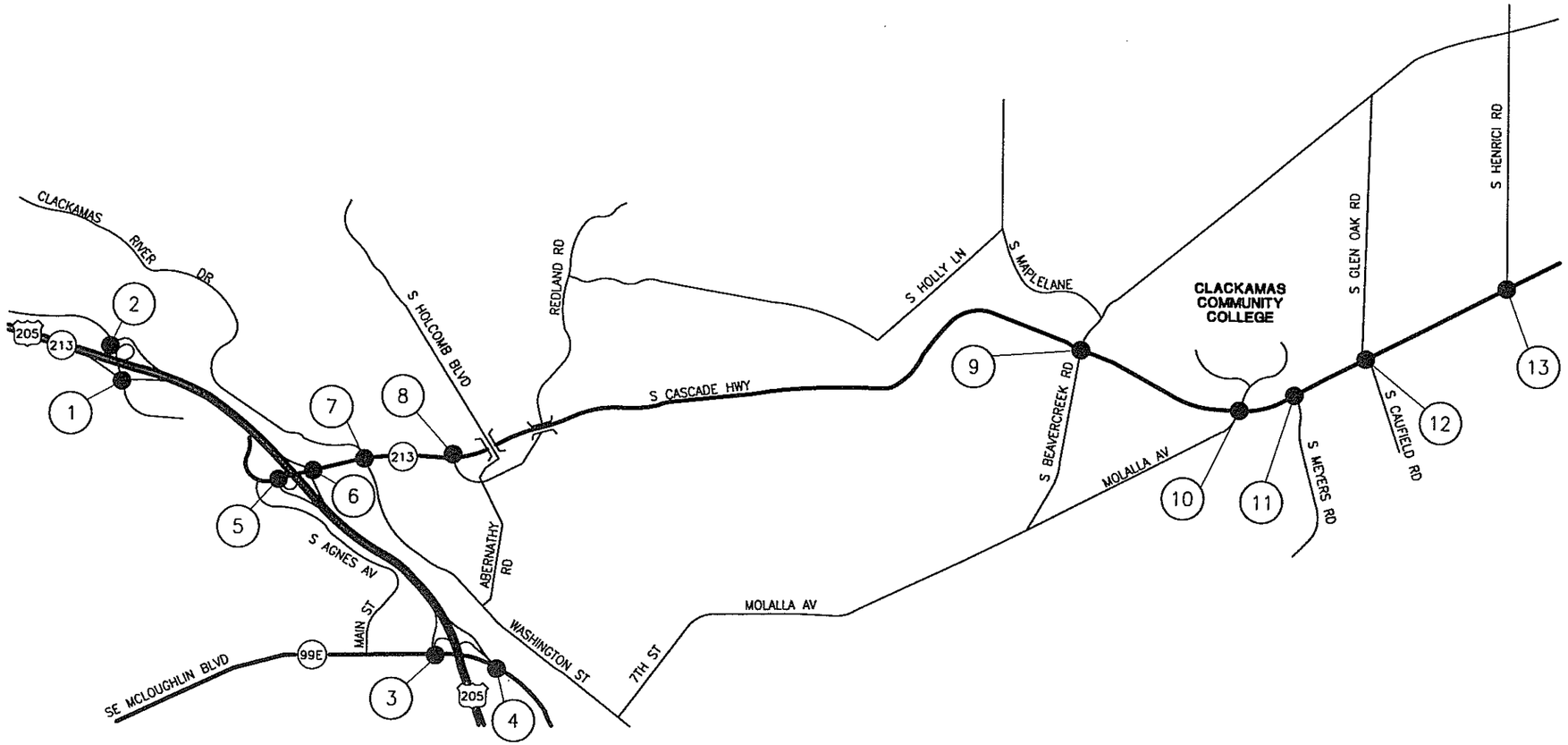
EXISTING LANE CONFIGURATIONS AND TRAFFIC CONTROL DEVICES

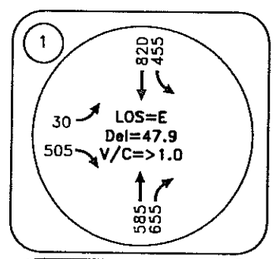
FIGURE NO. 8

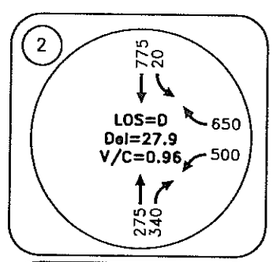
PROJECT NO. 2561

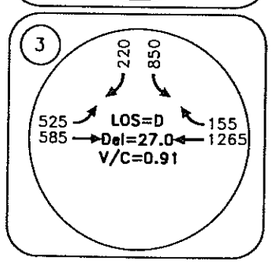
h:\PROJFILE\2561\DWGS\FINALREP\FIG008.DWG

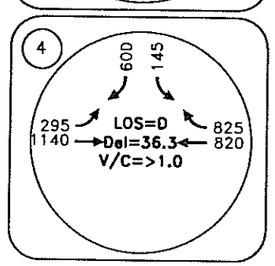
NORTH
(NOT TO SCALE)

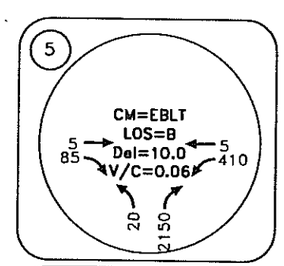


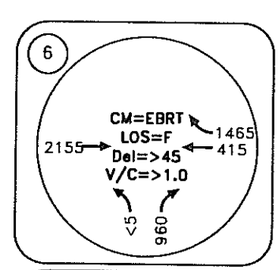


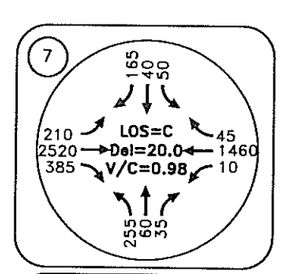


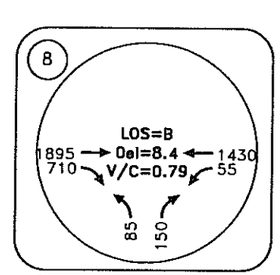


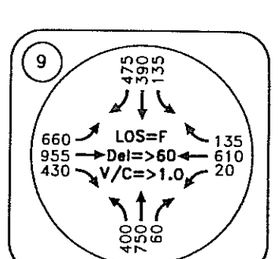


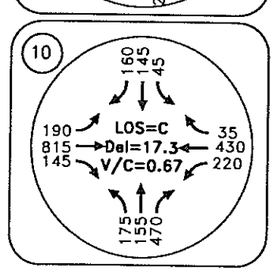


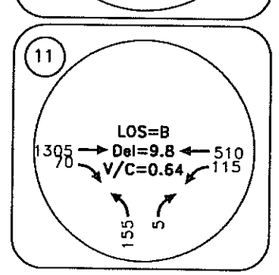


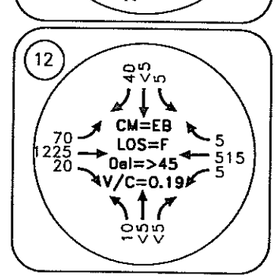


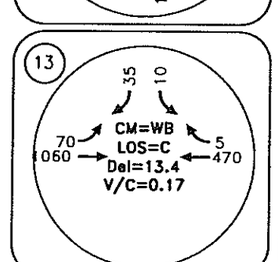












LEGEND
- CM = CRITICAL MOVEMENT (UNSIGNALIZED)
- LOS = INTERSECTION LEVEL OF SERVICE (SIGNALIZED)/ CRITICAL MOVEMENT LEVEL OF SERVICE (UNSIGNALIZED)
- Del = INTERSECTION AVERAGE DELAY (SIGNALIZED)/ CRITICAL MOVEMENT DELAY (UNSIGNALIZED)
- V/C = CRITICAL VOLUME-TO-CAPACITY RATIO

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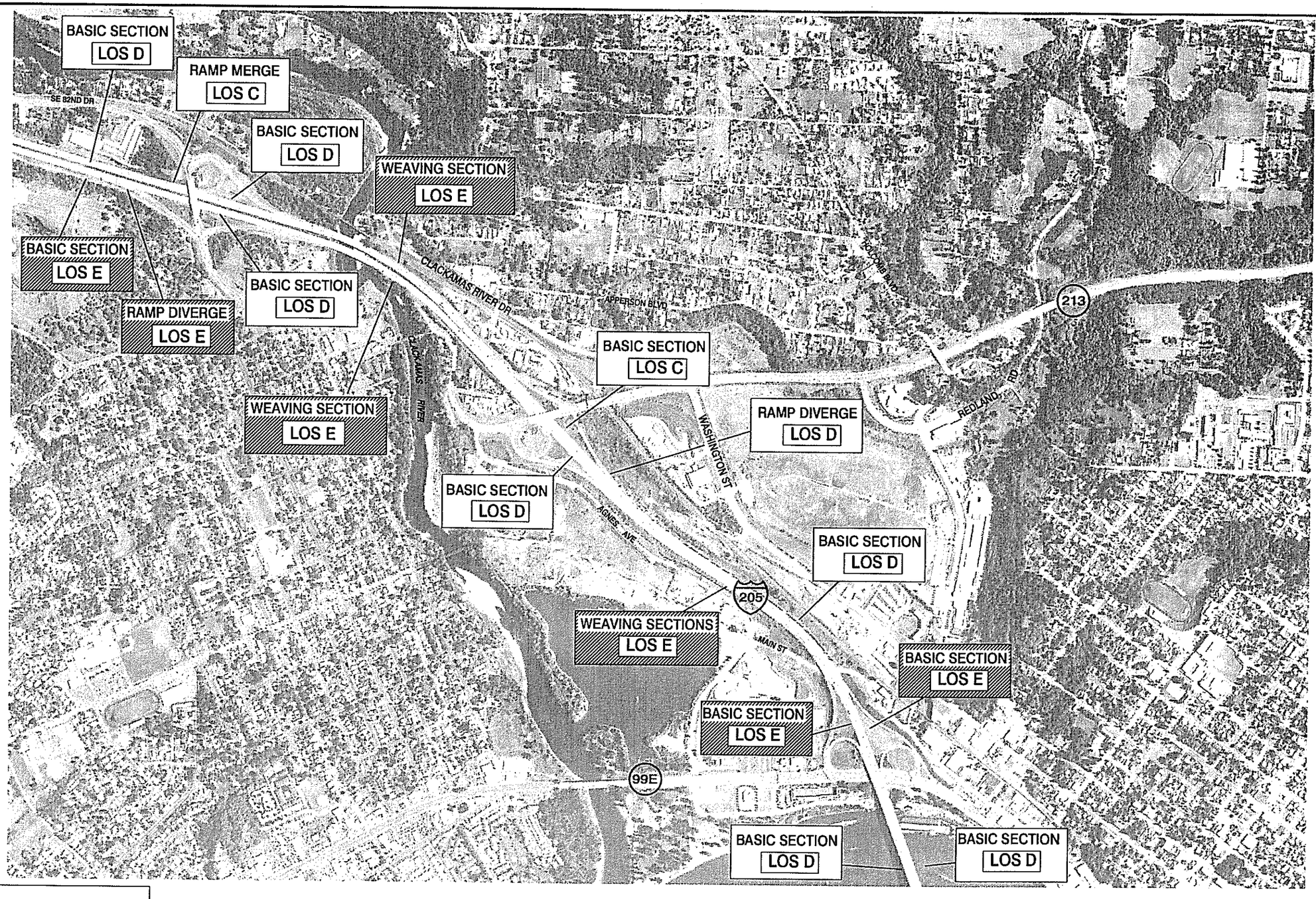
EXISTING HIGHWAY 213 TRAFFIC OPERATIONS WEEKDAY PM PEAK HOUR

FIGURE NO.
9

PROJECT NO.
2561

h:\PROJFILE\2561\DWGS\FINALREP\FIG009.DWG



NORTH
(NOT TO SCALE)

LEGEND

FAILS TO MEET ODOT LOS STANDARDS

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TRANSPORTATION PLANNING\TRAFFIC ENGINEERING

HIGHWAY 213 URBAN CORRIDOR DESIGN STUDY

OREGON CITY, OREGON
JUNE 2000

EXISTING I-205 TRAFFIC OPERATIONS WEEKDAY PM PEAK HOUR

FIGURE NO.
10

PROJECT NO.
2561

h:\PROJFILE\2561\DWGS\FINALREP\FIG010.DWG

Future Conditions "No-Build" Analysis

The future conditions "No-Build" Scenario evaluates the traffic conditions likely to exist in the year 2018. This assumes there will be growth in travel demand and no modifications to the existing roadway network. The analysis of the forecast p.m. peak hour traffic volumes serves as the basis for identifying the projected future transportation system deficiencies at the study intersections and freeway segments. This information, in combination with the deficiencies identified through the existing conditions analysis, led to the development of the future Build Alternative design concepts for the study corridor.

The Metro 2015 travel demand model was used as the basis for determining a growth rate to forecast 2018 p.m. peak hour traffic volumes. This is consistent with the City of Oregon City Transportation System Plan work. No improvements were assumed for the model network because there are no committed projects along the Highway 213 or I-205 study area corridors, or projects acknowledged in the Metro 2015 regional model network. The land use inputs to the travel demand forecast were also consistent with the inputs for the Oregon City Transportation System Plan Study. These assumptions reflect the City of Oregon City's Comprehensive Plan with refinements to the transportation analysis zones to reflect more detail along the Highway 213 corridor.

2018 PM Peak Hour Traffic Volumes and Travel Desires

All roadways in the study area are forecast to experience significant growth in traffic volumes over the 20-year planning horizon. Over the course of 20 years, traffic volumes on I-205 are forecast to grow by approximately 35 percent. The ramps from I-205 into Oregon City at the Highway 99E interchange and the Highway 213 interchange could also experience dramatic growth in traffic volumes. This increase in demand for the two Oregon City I-205 interchanges is consistent with the significant future growth and development projected for the greater Oregon City area, particularly in the southern portion of the city.

On Highway 213, traffic volumes are projected to increase an average of 30 percent in the southbound direction and 40 percent in the northbound direction over the 20-year study time period. Consistent with the dramatic demand increase of the Highway 213/I-205 interchange, the travel demand on Highway 213 in the vicinity of the interchange (i.e. the segment from north of the interchange to Washington Street) is also forecast to increase at an above average rate (45 to 65 percent). These are significant traffic volume growth rates. The 2018 forecast p.m. peak hour traffic volumes are shown in Figures 11A and 11B.

Travel desires show that 70 percent of all traffic on southbound Highway 213 north of Redland Road have traveled from southbound I-205. Of the motorists on southbound Highway 213 at Redland Road, approximately 25 percent continue southbound on Highway 213 south of Henrici Road.

Southbound Highway 213 experiences the most significant travel demand between the northbound I-205 ramp terminal intersection and Clackamas River Drive. Of the motorists exiting northbound I-205 at the Highway 213 off-ramp, 40 percent will make a left-hand turn from southbound Highway 213 to Clackamas River Drive. The high increase in traffic demand for this travel pattern is expected due to the anticipated growth assigned to the Clackamas River Drive area. This is a significant movement that needs to be accommodated in the project design concepts. Several travel desires are summarized schematically in Figures 12A through 12D.

2018 PM Peak Hour Intersection Operations

Given this significant projected growth in p.m. peak hour traffic volumes with one exception, all of the study intersections will operate over capacity in the future. The one exception is at the Meyers Road/Highway 213 intersection. This is a substantial degradation over existing conditions. A schematic of forecast p.m. peak hour intersection operations is shown in Figure 13. A tabular summary of 2018 p.m. peak hour no-build intersection operations is included in Appendix D.

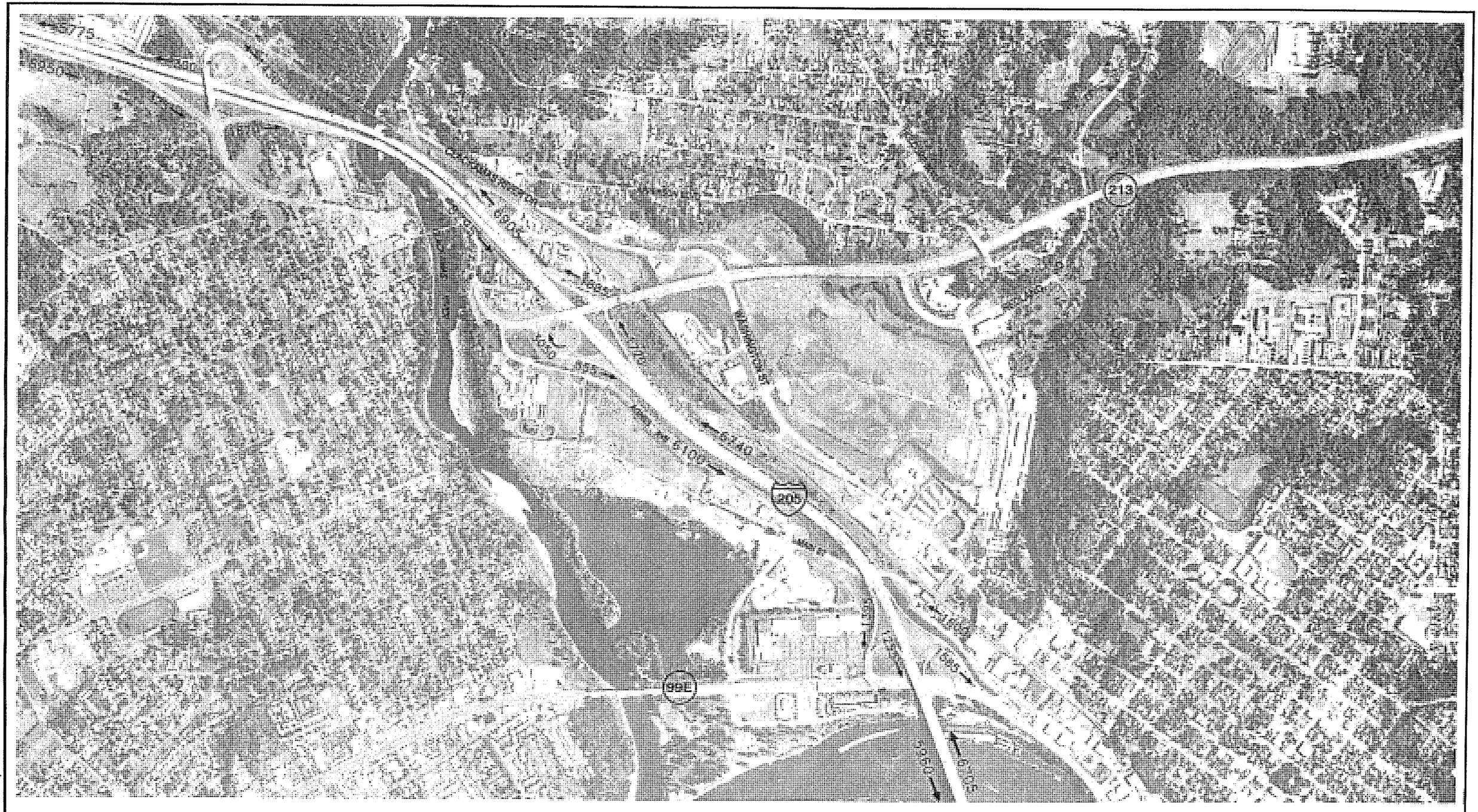
2018 PM Peak Hour Freeway Operations

On Highway 213 the two-lane freeway section between Redland Road and Beavercreek Road will have sufficient capacity to accommodate future travel demand through the corridor.

The growth in forecast p.m. peak hour traffic volumes has a significant impact on operations along I-205. All but one mainline segment of I-205 in the study corridor is forecast to operate at unacceptable levels of service. There will be significant roadway congestion and queuing. The exception is on northbound I-205 mainline between the Highway 213 off-ramp and the Highway 213 on-ramp, which will operate at level of service C.

The weaving sections on southbound I-205 between the Gladstone on-ramp and the Highway 213 off-ramp, and on southbound I-205 between the Highway 213 on-ramp to the Highway 99E off-ramp will both operate at level of service F.

Traffic operations at the merge/diverge locations will also operate below ODOT level of service standards. The exception is the I-205 northbound/Gladstone on-ramp merge. A schematic of forecast p.m. peak hour freeway operations is shown in Figure 14. A tabular summary of the 2018 p.m. peak hour freeway operations is included in Appendix D.



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TRANSPORTATION PLANNING\TRAFFIC ENGINEERING

HIGHWAY 213 URBAN CORRIDOR DESIGN STUDY

OREGON CITY, OREGON
JUNE 2000

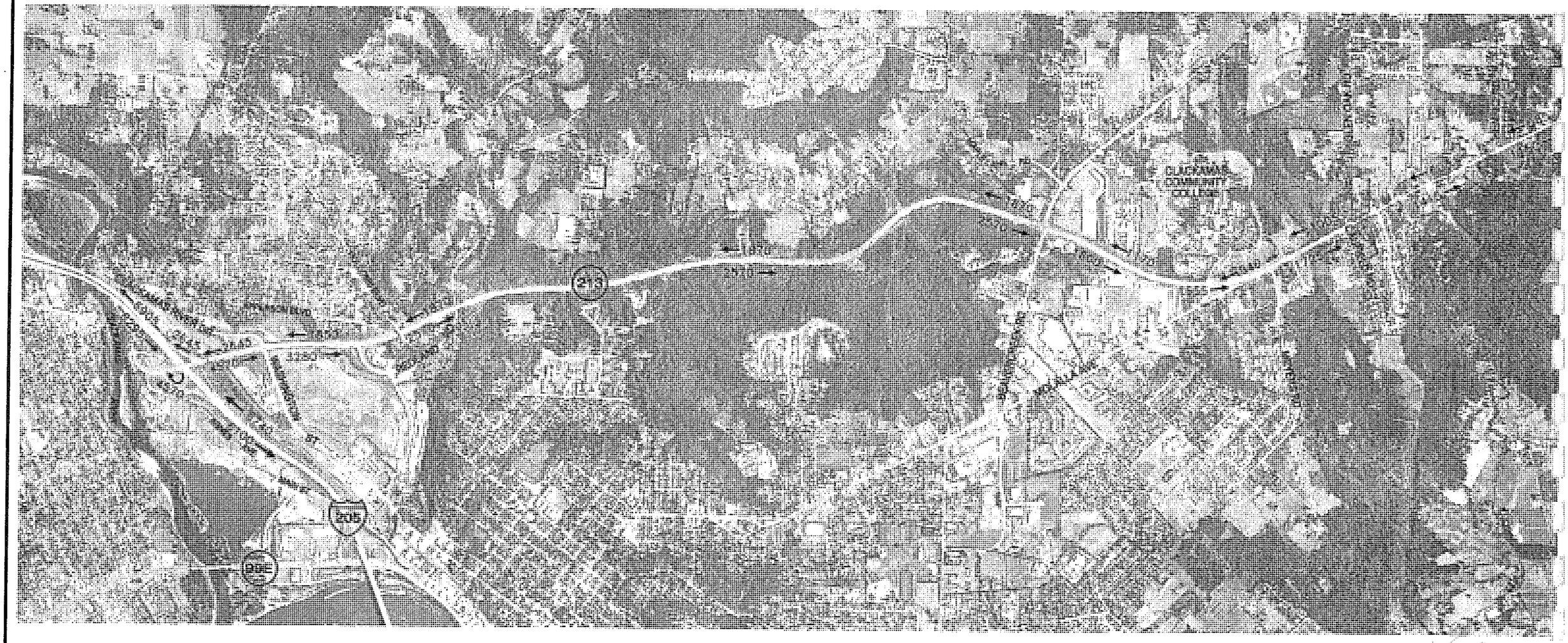
2018 FORECAST TRAFFIC VOLUMES WEEKDAY PM PEAK HOUR

FIGURE NO.
11A

PROJECT NO.
2561

h:\PROJFILE\2561\DWGS\FINALREP\FIG11A.DWG

NORTH
(NOT TO SCALE)

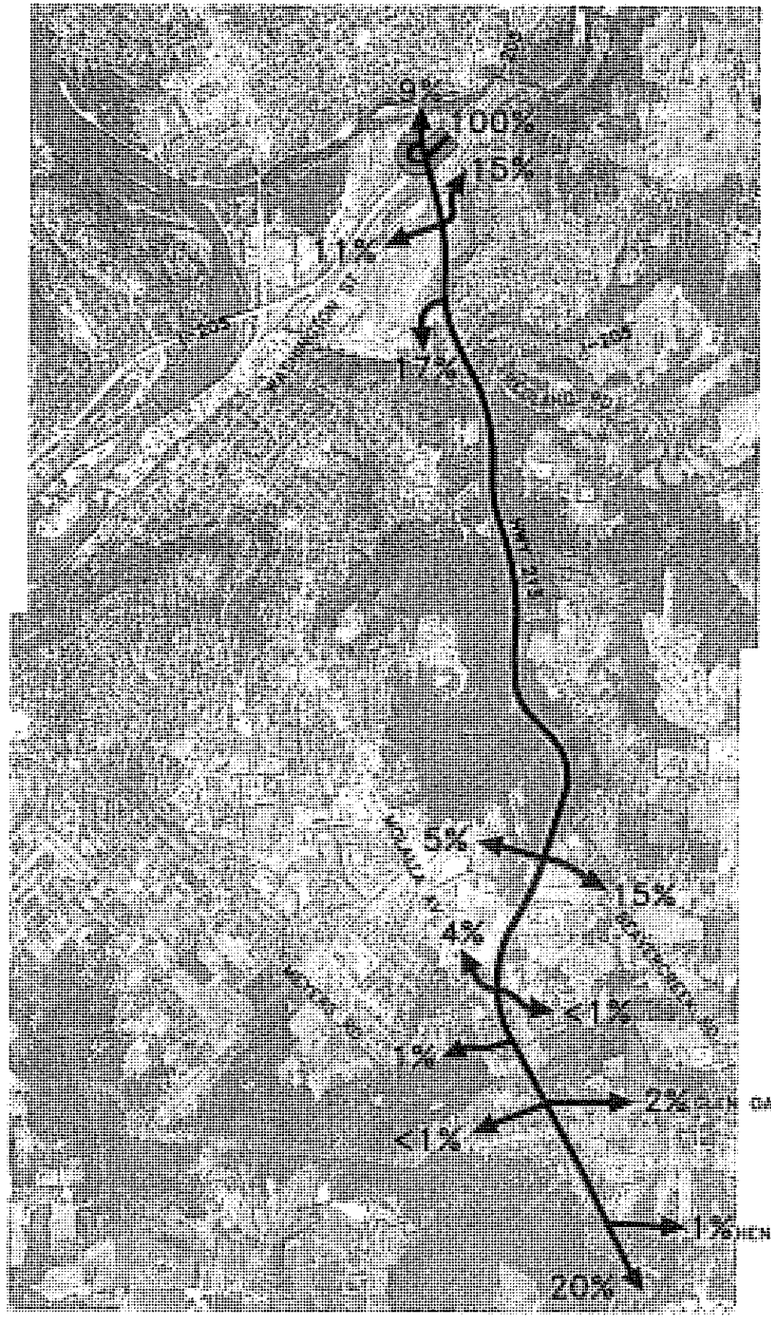


3,700

18,500 / 14,800 = X / 37,000
X = 24,300

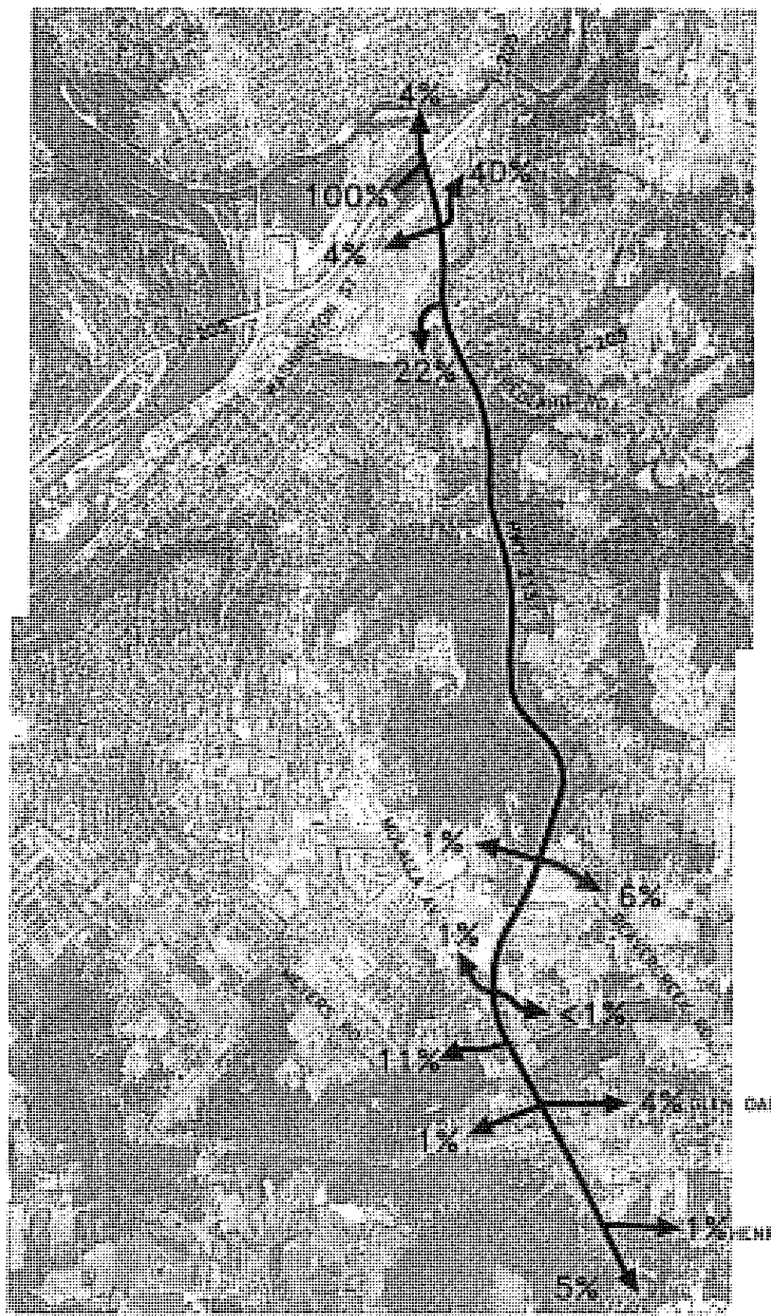
KITTELSON & ASSOCIATES, INC. 610 S.W. ALDER, SUITE 700 PORTLAND, OREGON 97205 (503) 228-5230 TRANSPORTATION PLANNING\TRAFFIC ENGINEERING	HIGHWAY 213 URBAN CORRIDOR DESIGN STUDY OREGON CITY, OREGON JUNE 2000	*2018 FORECAST TRAFFIC VOLUMES* *WEEKDAY PM PEAK HOUR*	FIGURE NO. 11B PROJECT NO. 2561

h:\PROJFILE\2561\DWGS\FINALREP\FIG11B.DWG



HWY 213 FROM I-205 SOUTHBOUND

NOT TO SCALE



HWY 213 FROM I-205 NORTHBOUND

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HIGHWAY 213 URBAN CORRIDOR DESIGN STUDY

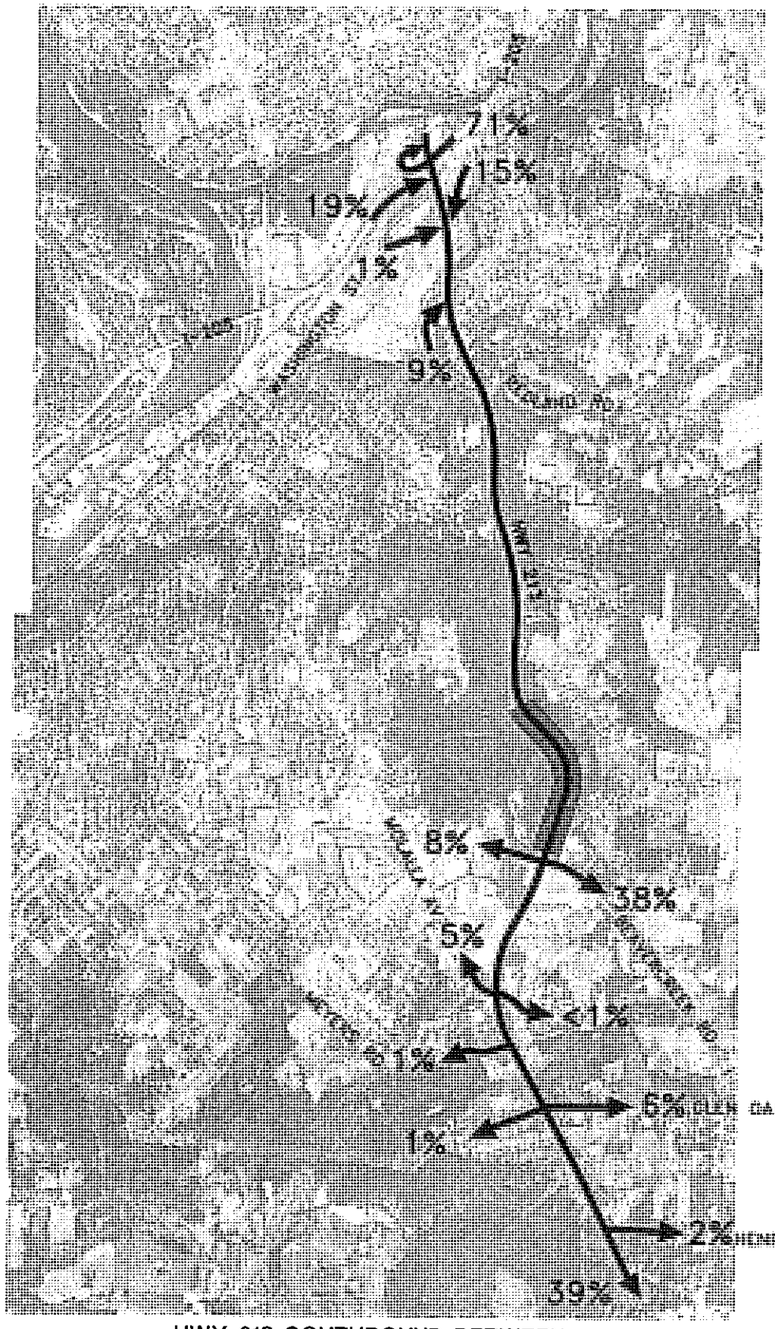
OREGON CITY, OREGON
JUNE 2000

2018 FORECAST TRAVEL DESIRES FROM I-205

FIGURE NO. 12A

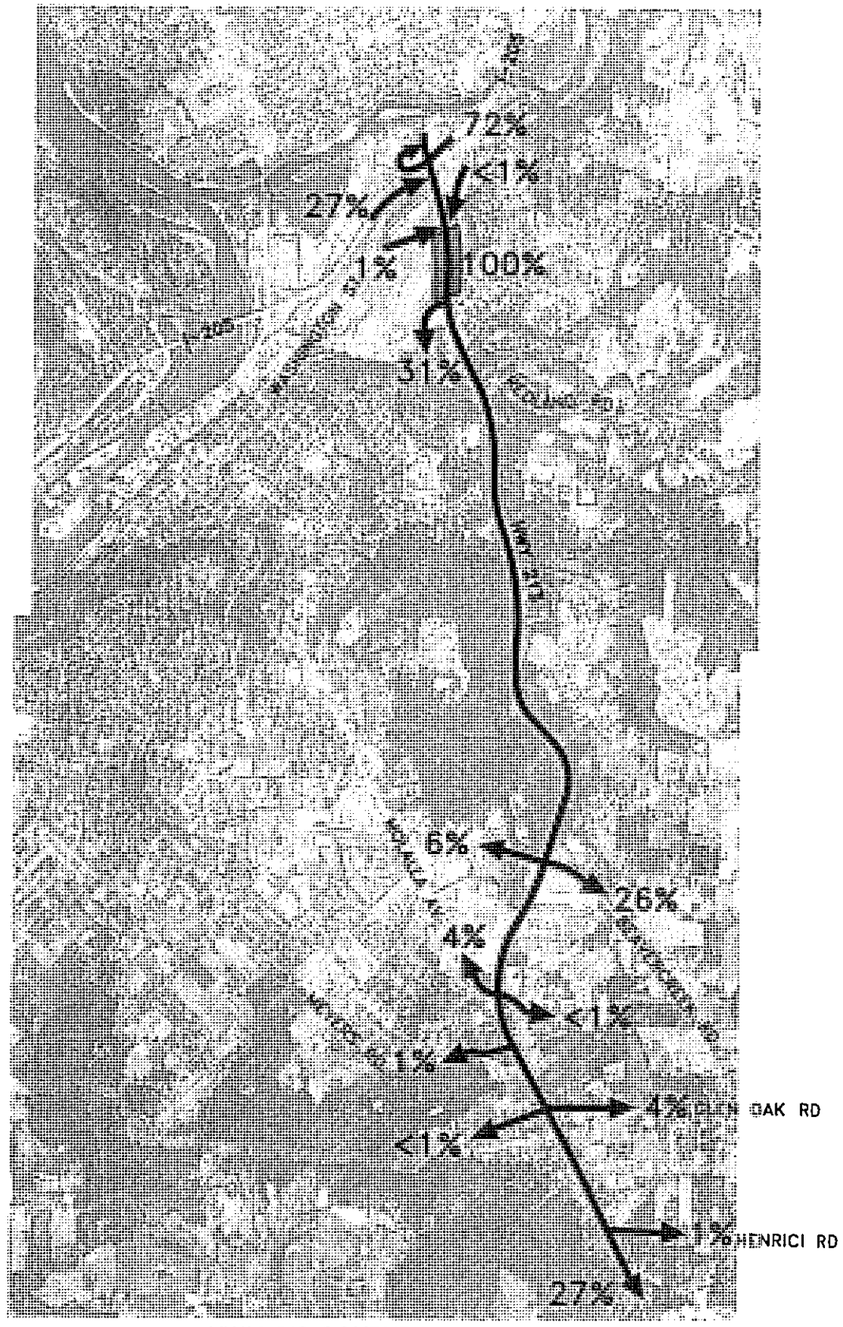
PROJECT NO. 2561

h:\PROJFILE\2561\DWGS\FINALREP\FIG12A.DWG



HWY 213 SOUTHBOUND BETWEEN
REDLAND ROAD AND BEAVERCREEK ROAD

NOT TO SCALE



HWY 213 SOUTHBOUND BETWEEN
WASHINGTON STREET AND REDLAND ROAD

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HIGHWAY 213 URBAN CORRIDOR DESIGN STUDY

OREGON CITY, OREGON
JUNE 2000

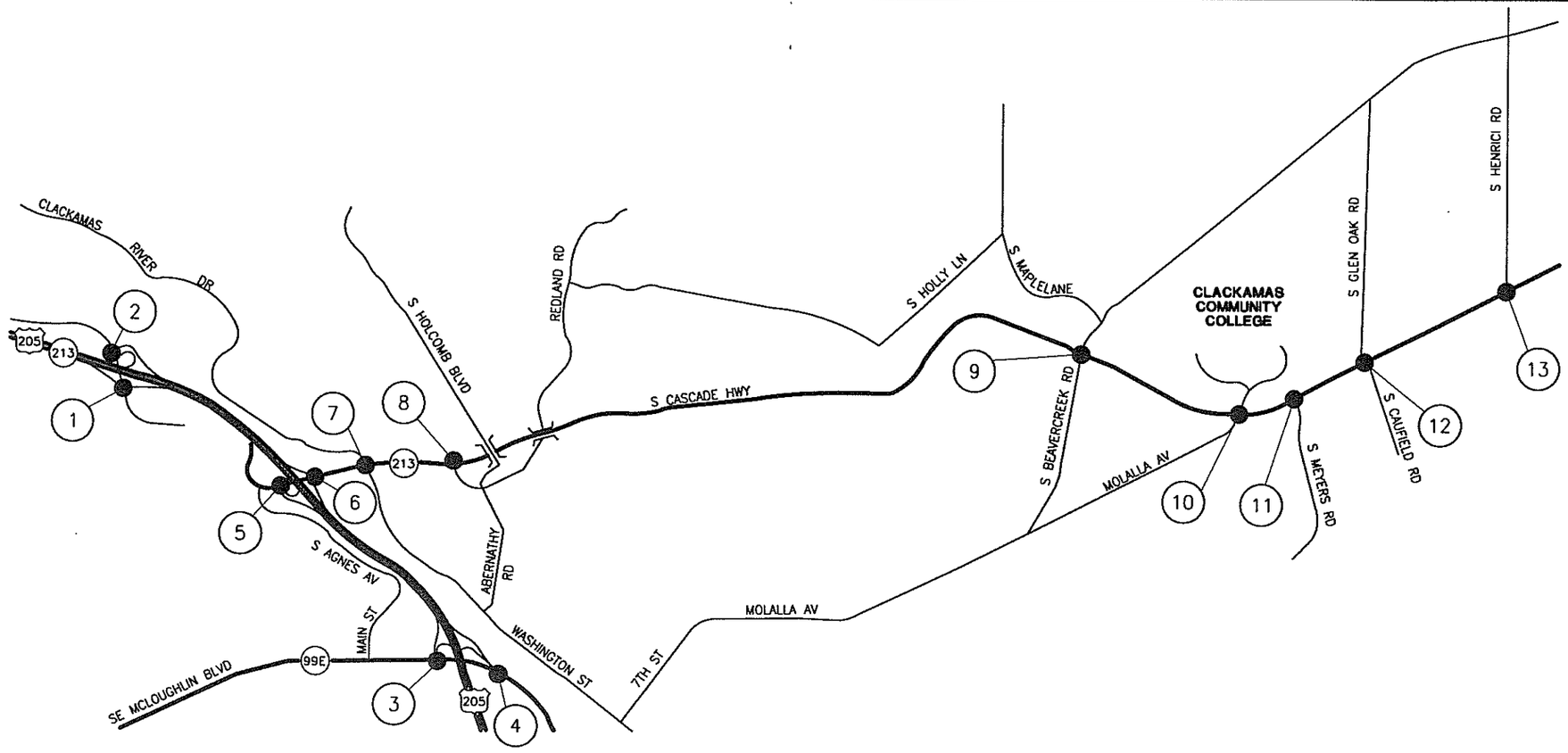
2018 FORECAST TRAVEL DESIRES ON HIGHWAY 213

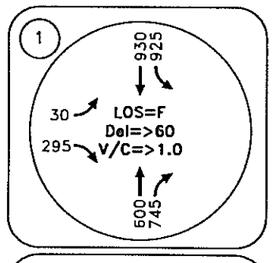
FIGURE NO. 12B

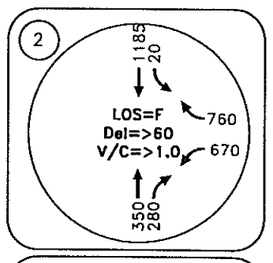
PROJECT NO. 2561

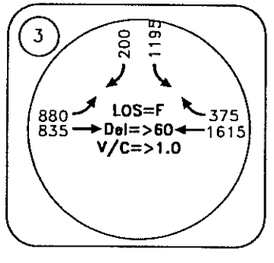
h:\PROJFILE\2561\DWGS\FINALREP\FIG12B.DWG

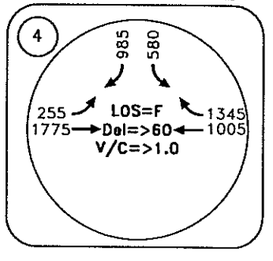
NORTH
(NOT TO SCALE)

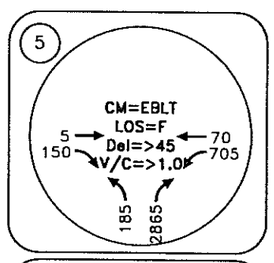


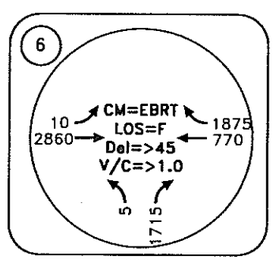


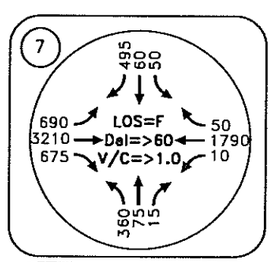


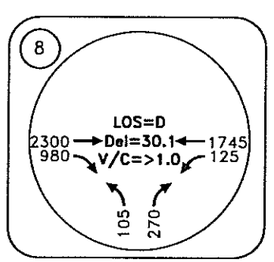


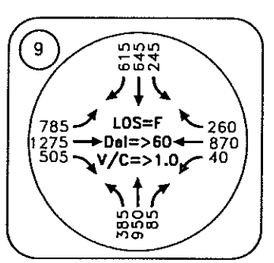


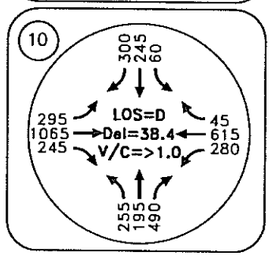


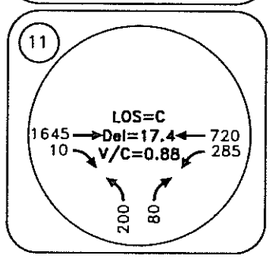


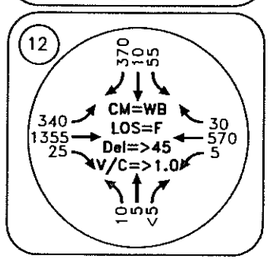


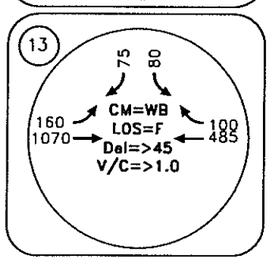












LEGEND
- CM = CRITICAL MOVEMENT (UNSIGNALIZED)
- LOS = INTERSECTION LEVEL OF SERVICE (SIGNALIZED)/ CRITICAL MOVEMENT LEVEL OF SERVICE (UNSIGNALIZED)
- Del = INTERSECTION AVERAGE DELAY (SIGNALIZED)/ CRITICAL MOVEMENT DELAY (UNSIGNALIZED)
- V/C = CRITICAL VOLUME-TO-CAPACITY RATIO

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HIGHWAY 213 URBAN CORRIDOR DESIGN STUDY

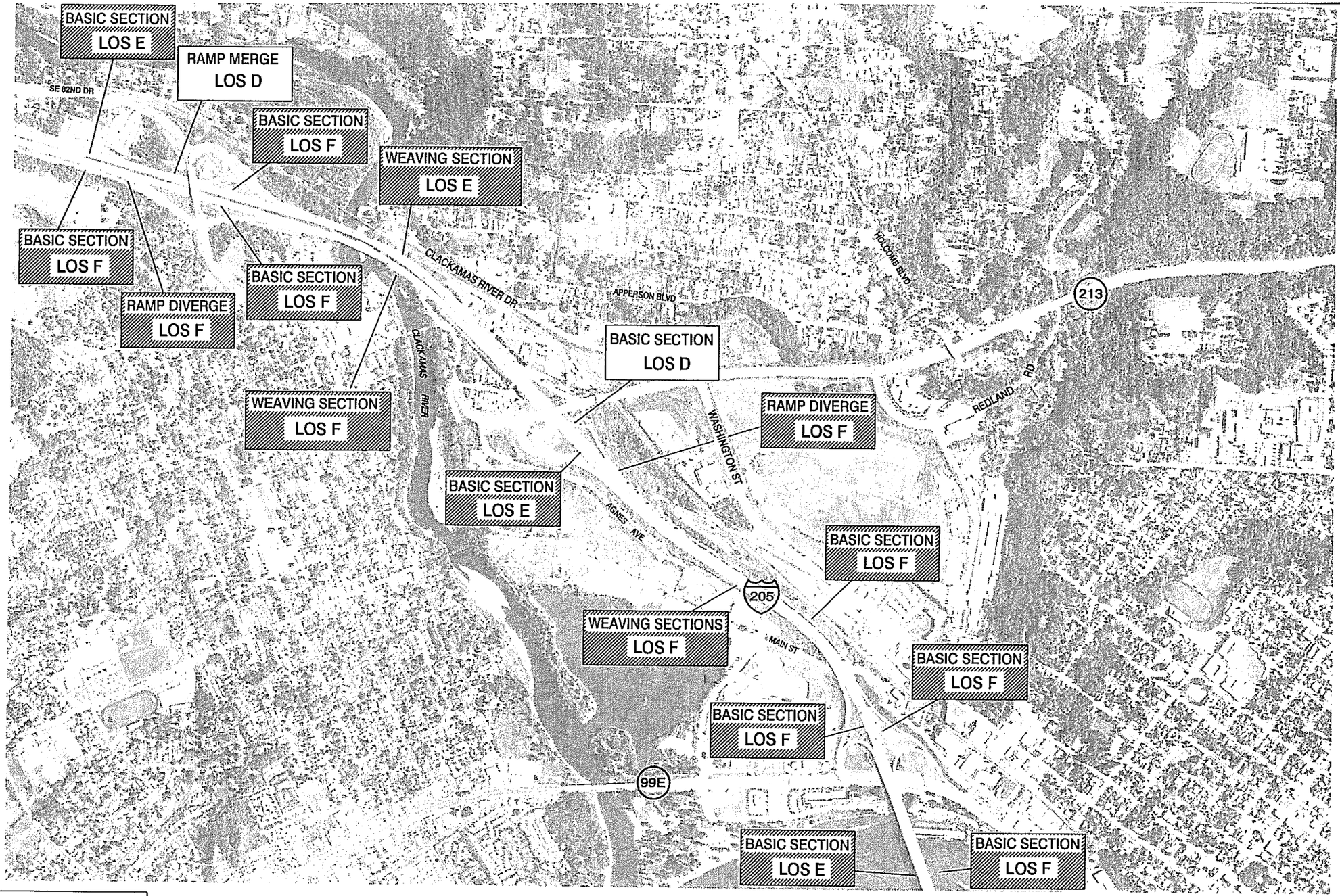
OREGON CITY, OREGON
JUNE 2000

2018 FORECAST INTERSECTION OPERATIONS WEEKDAY PM PEAK HOUR NO-BUILD ANALYSIS SCENARIO

FIGURE NO. 13

PROJECT NO. 2561

h:\PROJFILE\2561\DWGS\FINALREP\FIG013.DWG



LEGEND

FAILS TO MEET ODOT LOS STANDARDS

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TRANSPORTATION PLANNING\TRAFFIC ENGINEERING

HIGHWAY 213 URBAN CORRIDOR DESIGN STUDY

OREGON CITY, OREGON
JUNE 2000

2018 FORECAST FREEWAY LEVELS OF SERVICE WEEKDAY PM PEAK HOUR NO-BUILD ANALYSIS SCENARIO

FIGURE NO. 14

PROJECT NO. 2561

h:\PROJFILE\2561\DWGS\FINALREP\FIGD14.DWG

Concept Development and Preferred Solutions

Concept Development

The project study area was divided into three distinct areas: the north area in the vicinity of the I-205/Highway 213 interchange (including Highway 213 between I-205 and Redland Road), and the south area from the Beavercreek/Highway 213 intersection, and Molalla Avenue south to Henrici Road. For each of these areas a number of improvement concepts were developed to address existing and forecast deficiencies, and to address the corridor vision developed by the TAC and CAC.

Initial alternatives were developed using single-line and double-line sketching techniques over aerial base mapping. These alternative solution concepts were presented to the TAC and CAC for review and refinement. Based on input from the TAC and CAC, the concepts were refined and prepared in a final format. Vertical and horizontal profile checks, planning level cost estimates, and traffic operations analyses were also conducted to verify that the solution concepts could be constructed and funded and would meet the appropriate level of service standards.

The TAC and CAC comparatively evaluated the concepts based on the following evaluation criteria:

- Traffic operations
- Phased implementation and expandability
- Constructability/maintenance of traffic
- Right-of-way requirements
- Compatibility with public transportation
- Compatibility with pedestrians/bicyclists
- Local access and circulation
- Satisfies operations and design requirements
- Compatibility with surrounding land uses
- Funding feasibility
- Cost/benefit

Good, Fair, and Poor ratings for the project evaluation criteria were assigned to each of the concepts to assist with alternatives evaluation and ranking. Details of the concept alternatives by sub-area are presented below.

North End Concepts

The forecast 2018 traffic volumes on I-205 cannot be accommodated without significant improvements on the I-205 facility. The analysis showed that improvements would be required on I-205 in the study area, throughout the adjacent I-205 corridor. These improvements could include capacity expansion on the I-205 Bridges over the Willamette and Clackamas Rivers. ODOT and Metro have recognized the potential congestion issues on the I-205 corridor and are beginning to plan for a corridor study to address future plans for the I-205 corridor. The Highway 213/I-205 interchange would be one component of this larger corridor analysis.

The TAC and CAC recommended the need for developing a most promising solution concept for the Highway 213/I-205 interchange that could be integrated into a plan for the I-205 corridor. The project team, TAC and CAC, recommended developing a concept that could be developed in phases to:

- Allow Oregon City to continue to evaluate development proposals in the vicinity of Washington Street,
- Be integrated efficiently with future interchange improvements, and
- Be a feasible way to immediately address congestion issues in this part of the Highway 213 corridor.

The CAC and TAC also identified that the north end of the Highway 213 corridor should be geared to moving vehicles under relatively high operating conditions. There should be limited delay, and to the extent feasible the intersections of Washington Street/Highway 213 and Redland Road/Highway 213 should be integrated with the Highway 213/I-205 interchange.

Three alternative solution concepts were developed and evaluated at the north end of the corridor. These are shown in Figures 15, 16, and 17. In all three Figures, the black lines depict existing roadway, the orange lines depict new freeway construction, and the green lines depict new arterial/collector streets off of the state highway system. All three alternatives introduced modifications that would reduce congestion at the Washington Street intersection, and accommodate the high volume p.m. peak hour movement from southbound I-205 to southbound Highway 213. Also each alternative relies on new arterial/collector connection(s) between Abernethy Road and Washington Street.

The concepts show two basic "system interchange" forms. A system interchange connects two high-type facilities (typically freeways) without sending traffic through an at-grade signalized intersection. A system interchange form is needed here to serve the forecast travel demand without degrading operations along I-205. The interchange concepts presented are trumpet forms and directional forms. Trumpet forms can have a loop ramp in advance or beyond the crossing highway (in this case, Highway 213). These forms serve the demand for the highway to freeway movements between I-205 and Highway 213 and minimize the potential for vehicle queues to back up onto the Interstate. Alternatives 1 and 2 are trumpet forms. Alternative 3 is a directional interchange. All of these alternatives include expanding I-205 to four basic lanes in each direction, plus auxiliary lanes in some locations.

In addition to serving the I-205 to Highway 213 (freeway to freeway) traffic, local access to Washington Street and Redland Road also needs to be served. This access is provided via "service interchange" forms. Service interchanges provide access between highways and local arterials, generally via signalized ramp terminal intersections. Given that the system and service interchanges need to be placed so close, the ramps must be physically separated on bridges to allow all the movements to occur in the

limited amount of space. Potential improvement phasing concepts for each of these alternatives are shown in Appendix F.

The traffic operations analysis conducted for Alternatives 1, 2 and 3 are summarized in Figures 18, 19, and 20 respectively. For each alternative, significant operational improvements on I-205 can be achieved through developing four basic lanes on the freeway. However, the weaving section on southbound I-205 between the Gladstone and the Highway 213 interchanges will continue to operate at LOS F in all alternatives. In addition in each alternative, p.m. peak hour congestion at the intersection of Washington Street/Highway 213 can be eliminated by grade separating the Highway 213 through movements from the more local trips turning to and from Washington Street and Clackamas River Drive.

North End Preferred Solution

The CAC and TAC reviewed the quantitative and qualitative evaluation criteria and developed the summary good, fair, poor alternatives evaluation shown in Table 1. The evaluation and the consensus of both the TAC and the CAC was, that in the long-term, Alternative 3 was the most promising solution concept and was ranked as the number one preference. Among other advantages, this concept appears to have the least right-of-way and environmental impacts. The construction costs are estimated to be the lowest of the three alternatives and this concept is the most expandable and conducive to being constructed in phases. It is estimated that these interchange concepts may cost in the range of $75 Million to $100 Million; possibly more depending upon environmental mitigation. Alternative 3 will be at the lower end of this cost range, Alternative 1 in the middle, and Alternative 2 at the higher end. These costs do not include cost for right-of-way acquisition nor system level I-205 improvements.

The ability to phase Alternative 3 such that congestion relief at the Highway 213/Washington Street intersection could be achieved in the near future was critical to the City of Oregon City, the TAC and the CAC. The preliminary phasing shown in Figure 21 depicts the Washington Street overcrossing for southbound Highway 213 traffic. Eliminating this traffic from the at-grade intersection allows the intersection of Washington Street/Highway 213 to continue to operate at acceptable p.m. peak hour levels of service through the year 2015. When traffic operations do degrade below acceptable levels of service, a grade-separated intersection will likely be required to minimize traffic congestion.

In the vicinity of Washington Street, 70 percent of the motorists from I-205 to Oregon City destinations or beyond. These are regional trips and are appropriate on the State Highway system. Therefore, in this area, the cost proportionality split for roadway improvement projects between ODOT and the City of Oregon City should be 70 percent ODOT and 30 percent City of Oregon City.

Beavercreek/Highway 213 Concept Development

Highway 213 between Beavercreek Road and Molalla Avenue was identified by the CAC and TAC as an urban corridor that will need to incorporate pedestrian and bicycle travel needs along and across the highway. With the retail development, Clackamas Community College and residential development in the surrounding area, pedestrian and bicyclist needs along and across the highway should be planned for and accommodated. This amount of activity also means relatively high forecast travel demands through the Beavercreek/Highway 213 intersection.

At the intersection of Beavercreek/Highway 213, the high p.m. peak hour left turning movements from southbound Highway 213 to eastbound Beavercreek Road cause the intersection to operate over capacity. Three solution concepts were developed to address this deficiency:

- A partial cloverleaf interchange concept,
- A diamond concept, and
- An expanded at-grade intersection concept.

The diamond concept could be in the form of a single point diamond or tight urban diamond. These are shown in Figures 22 and 23, respectively.

The forecast weekday p.m. peak hour traffic operations are also shown in these Figures. Acceptable traffic operations for the 20-year planning horizon can be achieved with the partial cloverleaf concept and the diamond concepts. The at-grade solution concept may exceed the ODOT volume to capacity ratio operational requirements of 0.95 by the year 2015. At this time, the intersection would most likely need to be grade-separated to accommodate the forecast travel demand.

Beavercreek/Highway 213 Preferred Solution

The project team reviewed the evaluation criteria and developed the alternatives evaluation rating shown in Table 2.

Following the review, refinement and evaluation of the alternatives, the CAC and TAC favored the at-grade expanded intersection solution concept.

- This concept has the greatest compatibility with pedestrians and public transportation
- Initially has the lowest construction costs
- Has the greatest potential for receiving project funding
- And appears to have the least adverse environmental and community impacts. There is a possibility for other roadways to be constructed across Highway 213 (but not connecting to Highway 213) that could extend the life of the Beavercreek Road/Highway 213 intersection.

At this location, approximately 50% of the motorists have destinations in Oregon City. Therefore, the cost proportionality split for improvements is 50% ODOT and 50% City of Oregon City.

Table 1. North End Alternatives Evaluation

● GOOD ◒ FAIR ○ POOR

	Alternative 1	Alternative 2	Alternative 3
Traffic Operations	◒	●	●
Phased Implementation and Expandibility	◒	○	●
Environmental and Community Impacts	○	○	◒
Constructability/ Maintenance of Traffic	◒	○	●
Construction Costs	◒	○	●
Right of Way Requirements	○	○	◒
Compatibility with Public Transportation	○	◒	●
Compatibility with Pedestrians/Bicyclists	○	○	◒
Local Access and Circulation	○	◒	◒
Satisfies Operations and Design Requirement	◒	◒	◒
Compatibility with Surrounding Land Uses	○	○	◒
Funding Feasibility	○	○	○
Cost/Benefit	◒	◒	●

These interchange concepts may cost in the range of $75 to $100 Million; possibly more depending upon environmental mitigation. Alternative 3 will be at the lower end of this range, Alternative 1 in the middle, and Alternative 2 at the higher end. These costs do not include right-of-way nor system-level I-205 improvements.

Table 2. Beavercreek/Highway 213 Alternatives Evaluation

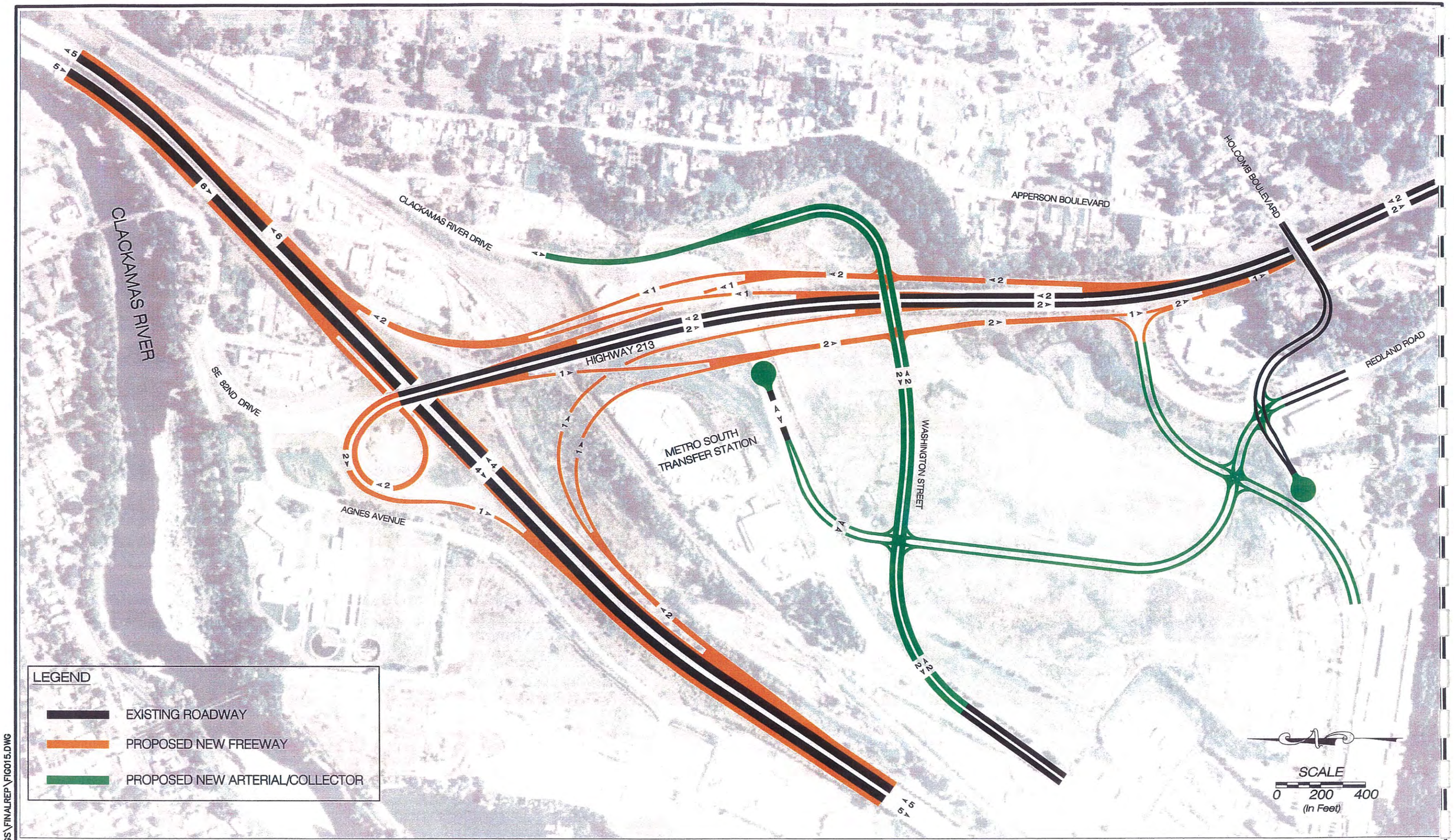
● GOOD ◒ FAIR ○ POOR

	At Grade Intersection	Partial Cloverleaf Interchange	Single Point Diamond
Traffic Operations	○	●	●
Phased Implementation and Expandibility	○	○	○
Environmental and Community Impacts	●	○	◒
Constructability/ Maintenance of Traffic	●	○	◒
Construction Costs	●	◒	○
Right of Way Requirements	●	○	◒
Compatibility with Public Transportation	●	○	○
Compatibility with Pedestrians/Bicyclists	●	○	◒
Local Access and Circulation	●	●	●
Satisfies Operations and Design Requirement	○	◒	●
Compatibility with Surrounding Land Uses	◒	○	◒
Funding Feasibility	●	○	○
Cost/Benefit	●	○	○

The alternatives may cost in the magnitude of:

At Grade Intersection = $3 Million
Partial Cloverleaf Interchange = $15 Million
Single Point Diamond = $20 Million

These costs do not incude right-of-way nor environmental mitigatons.



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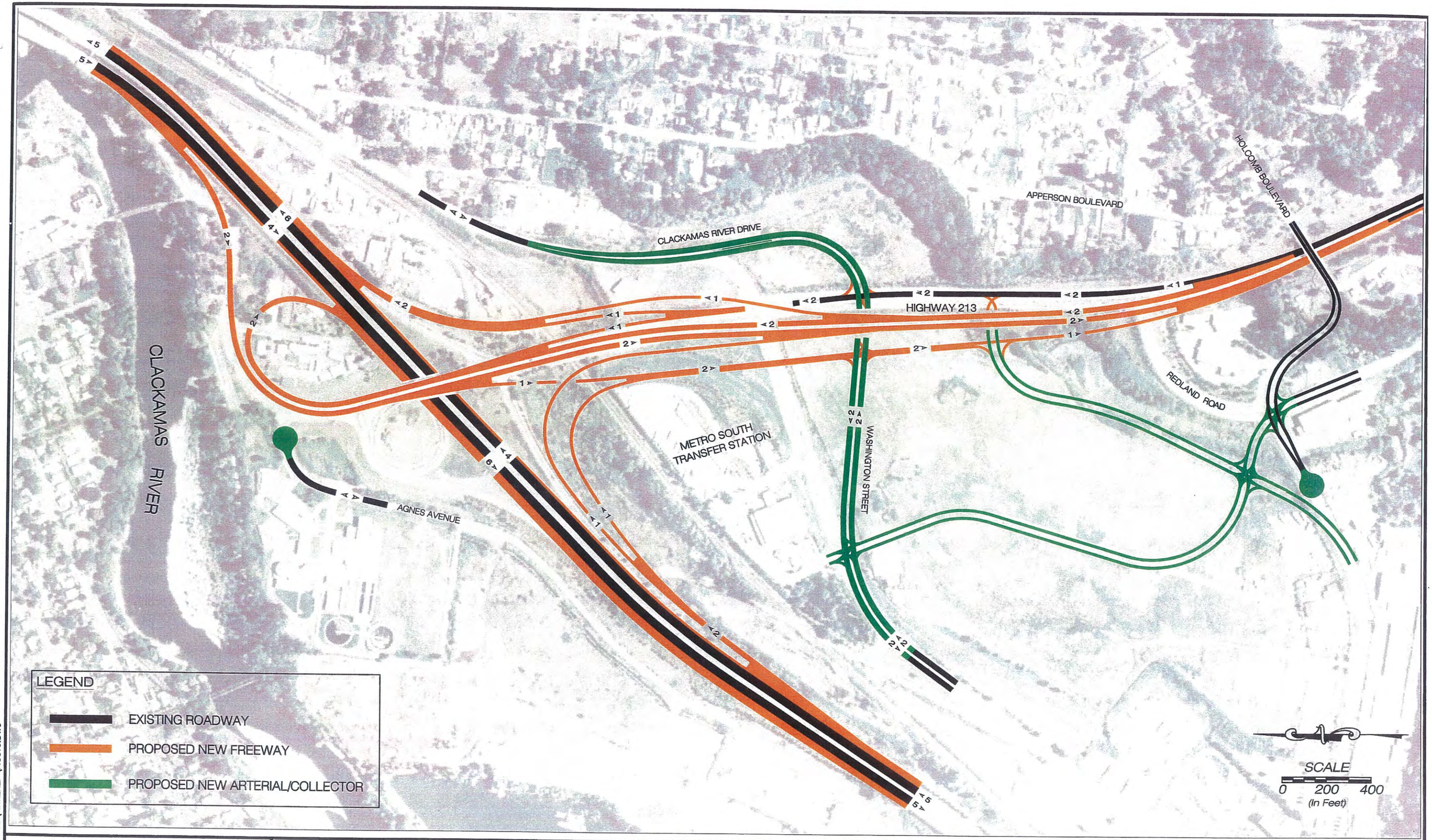
JUNE 2000

HIGHWAY 213/I-205 INTERCHANGE CONCEPT ALTERNATIVE 1

FIGURE NO. 15

PROJECT NO. 2561

h:\PROJFILE\2561\DWGS\FINALREP\FIG015.DWG



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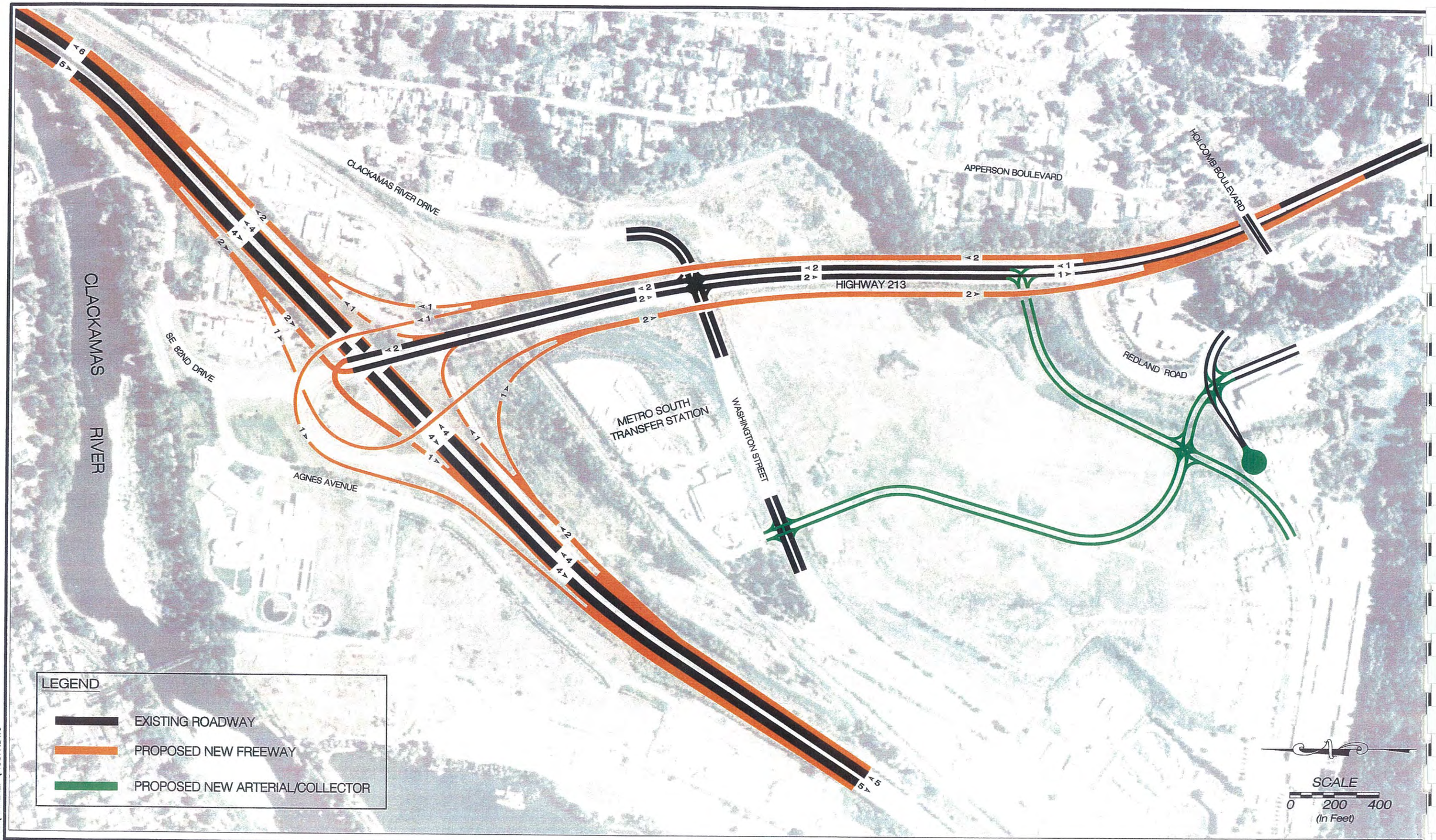
HIGHWAY 213/I-205 INTERCHANGE CONCEPT ALTERNATIVE 2

FIGURE NO. 16

PROJECT NO. 2561

h:\PROJFILE\2561\DWGS\FINALREP\FIG016.DWG



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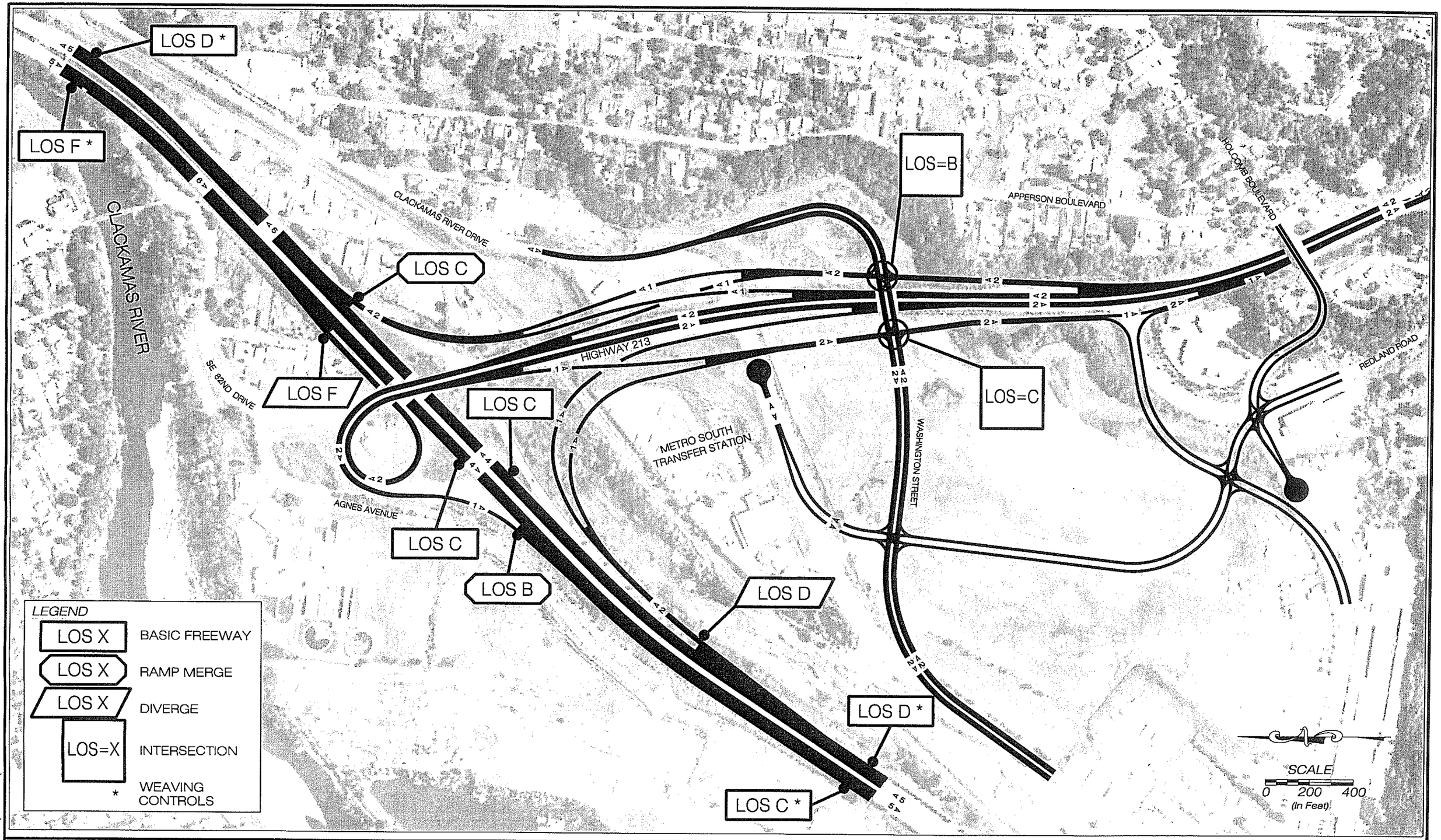
HIGHWAY 213/I-205 INTERCHANGE CONCEPT ALTERNATIVE 3

FIGURE NO. 17

PROJECT NO. 2561

h:\PROJFILE\2561\DWGS\FINALREP\FIG017.DWG



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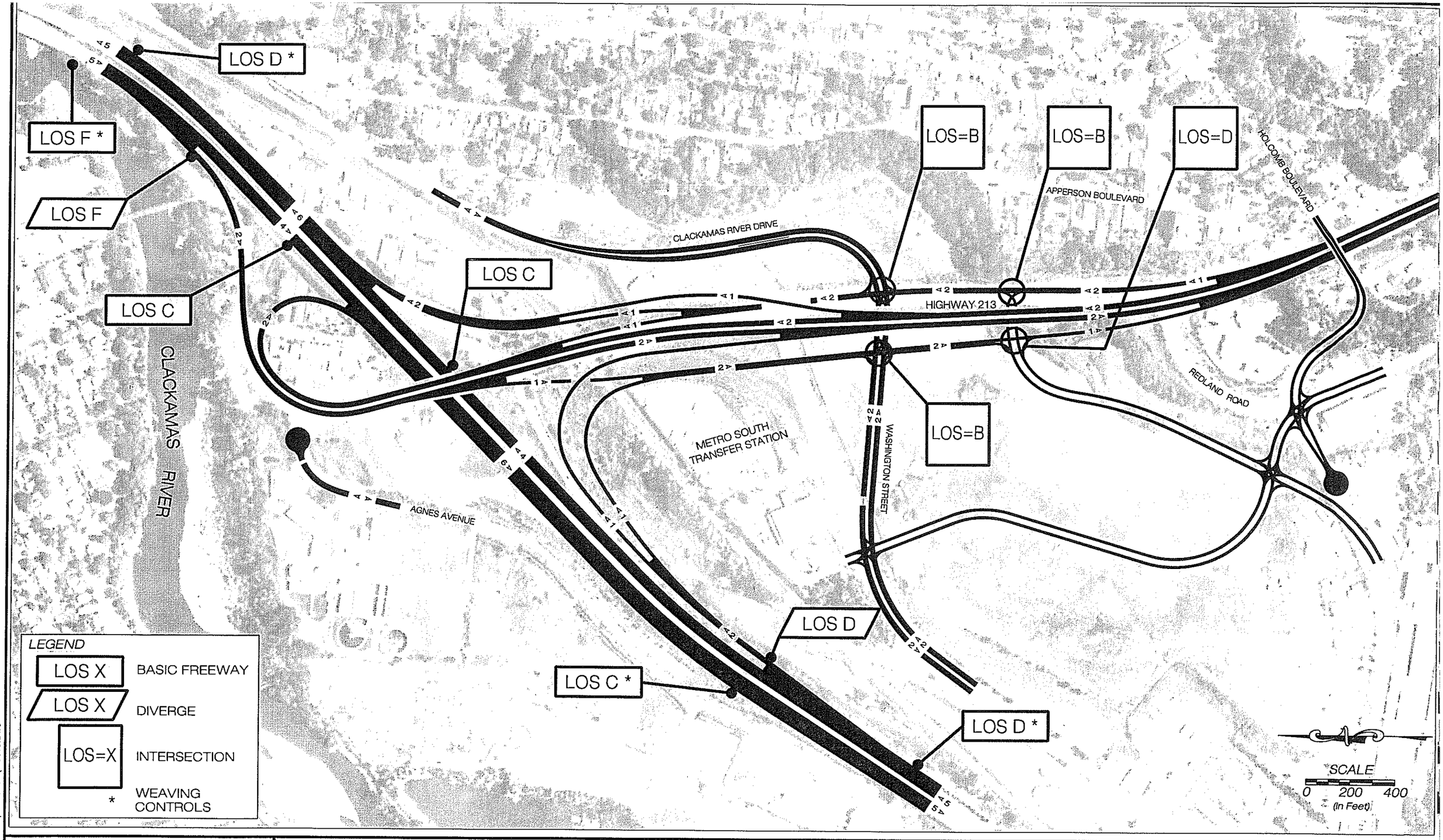
OREGON CITY, OREGON
JUNE 2000

FREEWAY LEVELS OF SERVICE
2018 WEEKDAY PM PEAK HOUR
HIGHWAY 213/I-205 ALTERNATIVE 1

FIGURE NO. 18

PROJECT NO. 2561

h:\PROJFILE\2561\DWGS\FINALREP\FIG018.DWG



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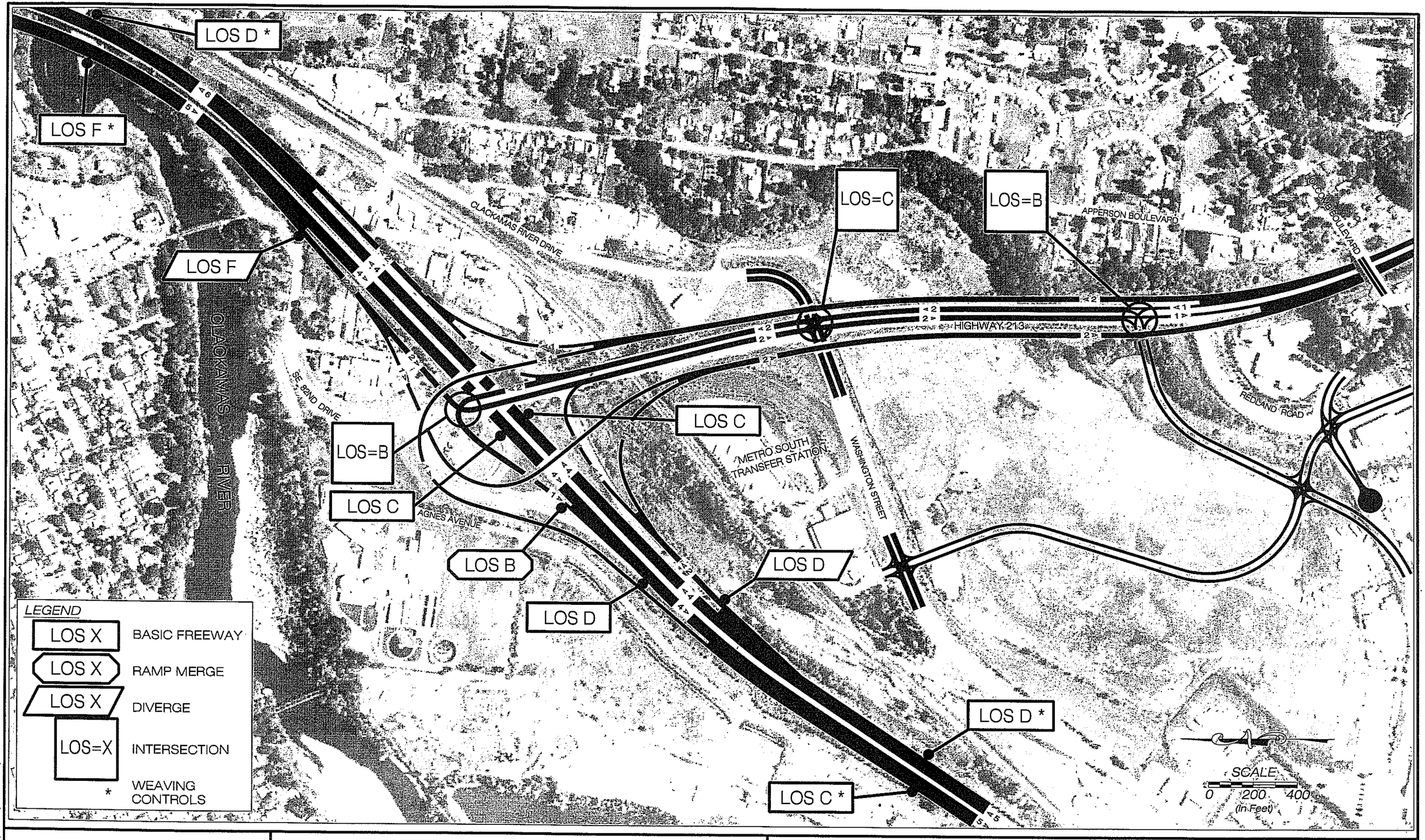
FREEWAY LEVELS OF SERVICE
2018 WEEKDAY PM PEAK HOUR
HIGHWAY 213/I-205 ALTERNATIVE 2

FIGURE NO. 19

PROJECT NO. 2561

h:\PROJFILE\2561\DWGS\FINALREP\FIG019.DWG



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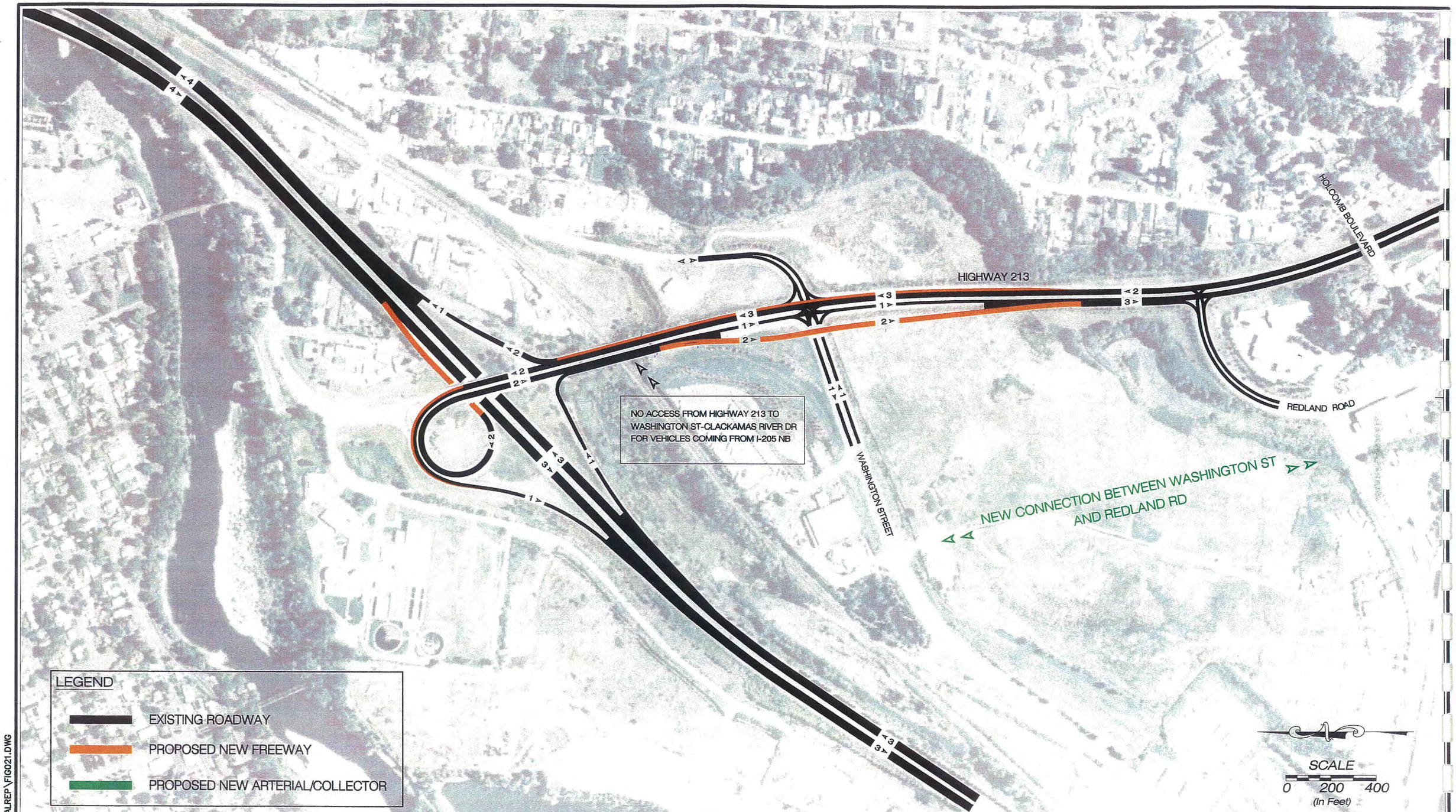
FREEWAY LEVELS OF SERVICE
2018 WEEKDAY PM PEAK HOUR
HIGHWAY 213/I-205 ALTERNATIVE 3

FIGURE NO. 20

PROJECT NO. 2561

h:\PROJFILE\2561\DWGS\FINALREP\FIG020.DWG



h: \PROJFILE\2561\DWGS\FINALREP\FIG021.DWG

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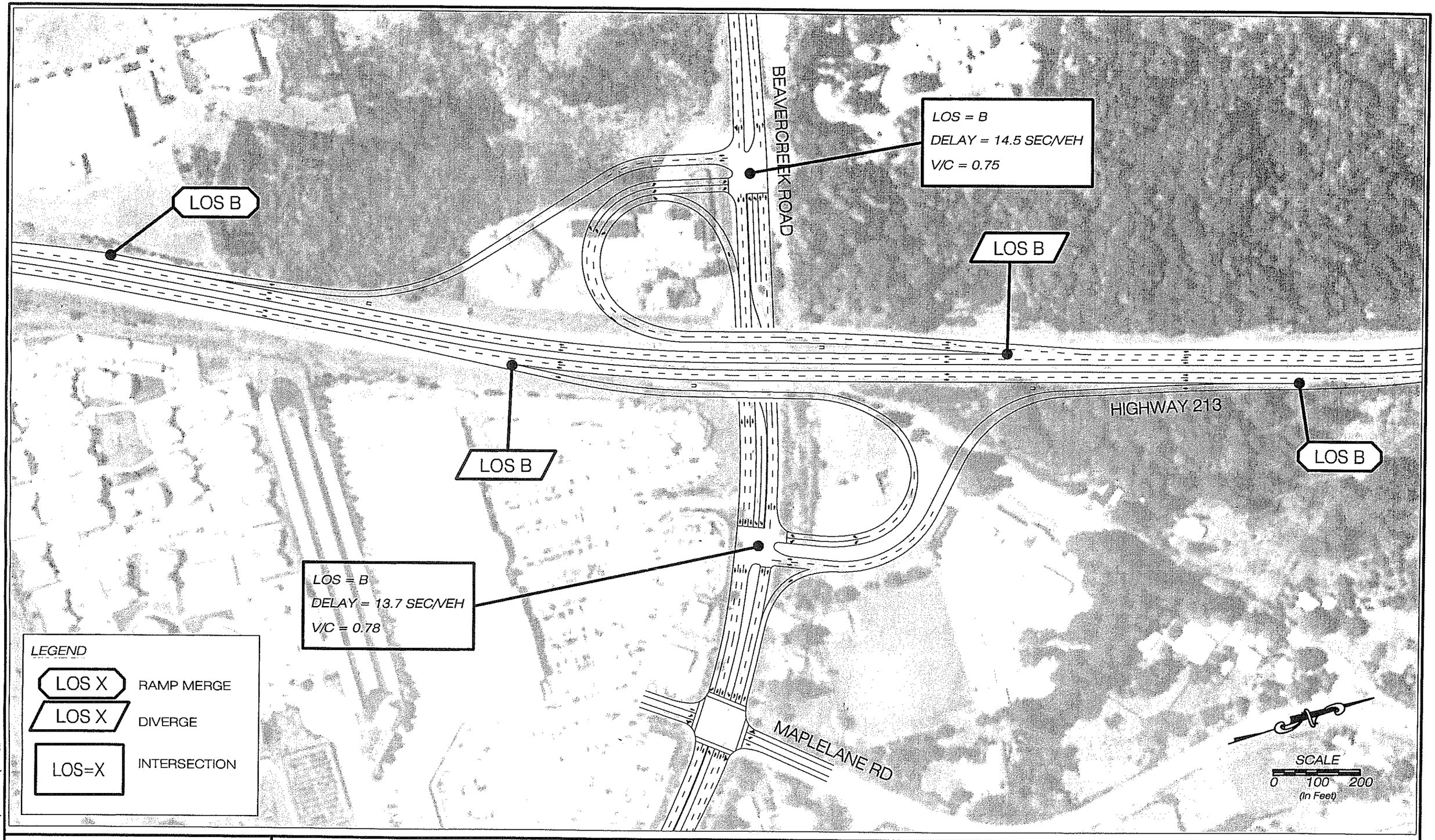
JUNE 2000

HIGHWAY 213/I-205 INTERCHANGE CONCEPT ALTERNATIVE 3 - PHASE 1 IMPROVEMENT

FIGURE NO. 21

PROJECT NO. 2561



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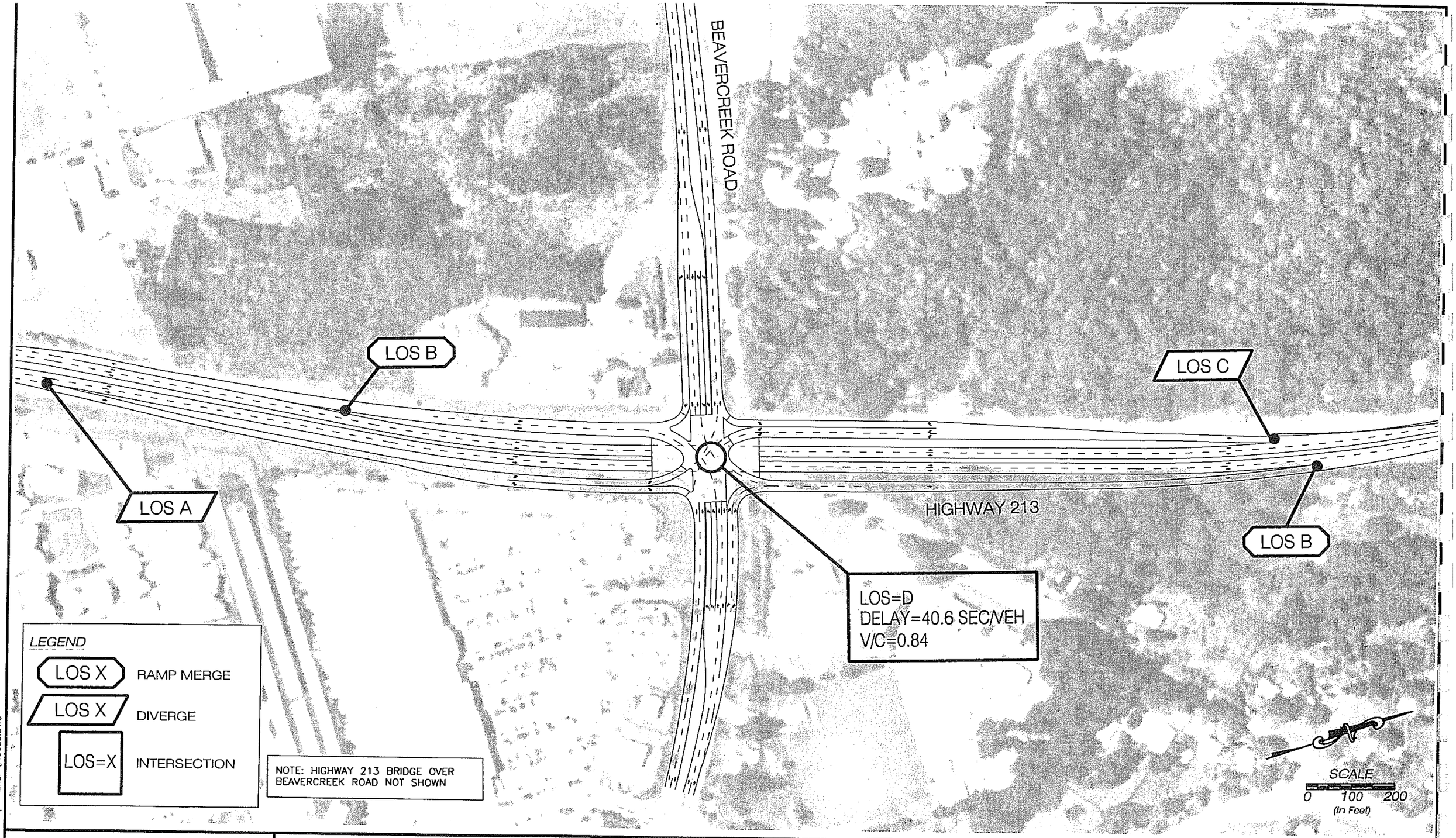
OREGON CITY, OREGON
JUNE 2000

BEAVERCREEK/HIGHWAY 213 IMPROVEMENT PLAN PARTIAL CLOVERLEAF INTERCHANGE CONCEPT

FIGURE NO. 22

PROJECT NO. 2561

h:\PROJFILE\2561\DWGS\FINALREP\FIG022.DWG



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BEAVERCREEK/HIGHWAY 213 INTERCHANGE PLAN SINGLE POINT DIAMOND CONCEPT

FIGURE NO. 23

PROJECT NO. 2561

h:\PROJFILE\2561\DWGS\FINALREP\FIG023.DWG

South End Preferred Solution Concept

From Molalla Avenue south to Henrici Road, the critical project issue was to develop a travel corridor that:

- Meets future capacity needs,
- Provides appropriate levels of direct, but managed access, and
- Safely transitions the Highway from a rural facility (Henrici Road) to an urban facility in the vicinity of Molalla Avenue and Beavercreek Road.

The concept shown in Figure 24 depicts the solution developed to meet these needs. South of Molalla Avenue, Highway 213 would be a four-lane facility with a median and turn lanes at critical intersections. At Glen Oak Road, the facility would transition to a three-lane facility with one travel lane in each direction plus a two-way median left turn lane. At Henrici Road, the facility would transition from a three-lane facility back to the rural two-lane facility. The location of direct accesses onto Highway 213 will need to be further evaluated as part of the future design and environmental evaluations.

Figures 25A, 25B and 25C also show the results of the 2018 weekday p.m. peak hour traffic operational analysis. If the improvements were implemented, all of the study intersections would operate under capacity and at LOS C or better. This concept also requires constructing traffic signals at the Henrici Road/Highway 213 and at Glen Oak/Highway 213 intersections, and re-aligning the Glen Oak Road-Caulfield Road/Highway 213 intersection.

In this area, the percentage of trips with trip ends in Oregon City decrease slightly to 45 percent. Therefore for the improvements identified in this area, the cost proportionality split should be 55 percent ODOT and 45 percent City of Oregon City.

Summary

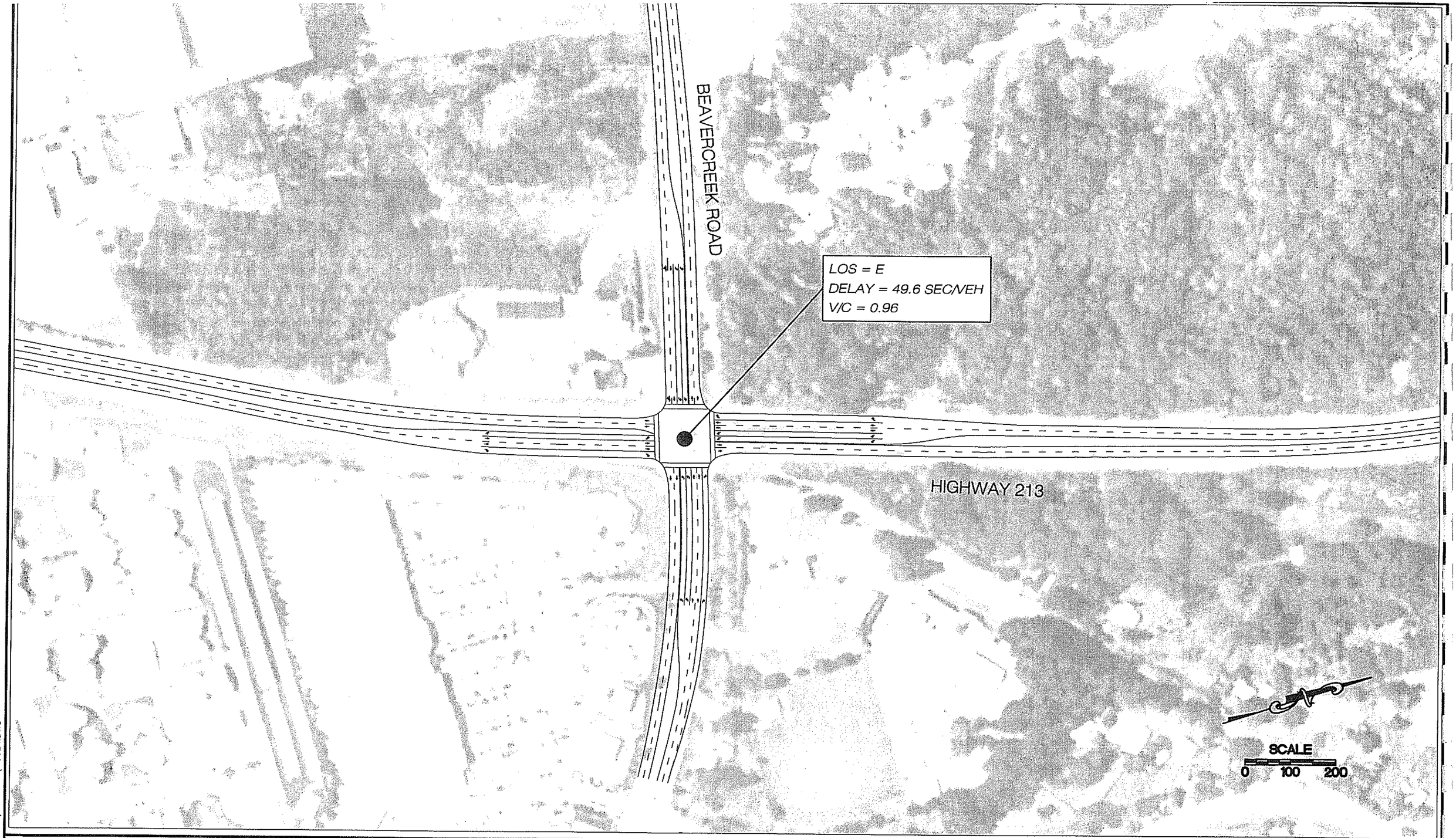
The City of Oregon City, and the project TAC and CAC voiced that congestion relief needs to be developed as soon as possible along the Highway 213 corridor. At the north end of the corridor, the project stakeholders recognized that solutions to the traffic congestion on I-205 would be developed as part of a longer-term I-205 corridor study. However, the stakeholders also strongly advocate that an interim solution, that would not preclude longer-term interchange concepts, should be implemented as soon as possible.

This interim solution is Alternative 3 Phase 1 (Figure 21). Implementing this concept provides immediate congestion relief at the intersection of Washington Street/Highway 213 and allows Oregon City to continue to plan for development in this vicinity. The construction costs associated with this facility would be shared at a local, regional, and state level, and likely also with private funding sources.

The City and ODOT will also plan to construct an expanded at-grade intersection at Beavercreek Road/Highway 213 (Figure 24). This expanded intersection will include double left-turn lanes at all intersection approaches. It requires significant expansion of Beavercreek Road to service forecast travel. Constructing this intersection provides capacity through the year 2015. At that time, ODOT and the City of Oregon City will need to consider constructing a grade-separated intersection. Other system connections under consideration may preclude the need for this. Funding has been secured for this at-grade improvement project through the Metro Regional Transportation Plan process.

South of Beavercreek Road, from Molalla Avenue to Henrici Road, the City of Oregon City and ODOT should include traffic signals at the intersections of Henrici Road/Highway 213 and Glen Oak Road/Highway 213 in their TSP and capital planning efforts. To implement this concept, an access management plan should also be developed with community input to ensure that an appropriate balance between access needs and traffic operations and safety is achieved.

The results of the Highway 213 Urban Corridor Design Study will be incorporated into the Oregon City TSP. As the TSP is adopted, so too will be the recommendations from this project. These project findings will provide direction for the City of Oregon City to proceed with community development plans in this corridor. Implementing the near-term improvements (Beavercreek Road/Highway 213 at-grade intersection expansion, Alternative 3 Phase 1), will provide mobility for today; however critical to the longer-term vitality of the Oregon City transportation system are identifying improvements on I-205 to accommodate future travel demand. In this regard, the City of Oregon City should begin working with ODOT and Metro to develop and implement a corridor study project.



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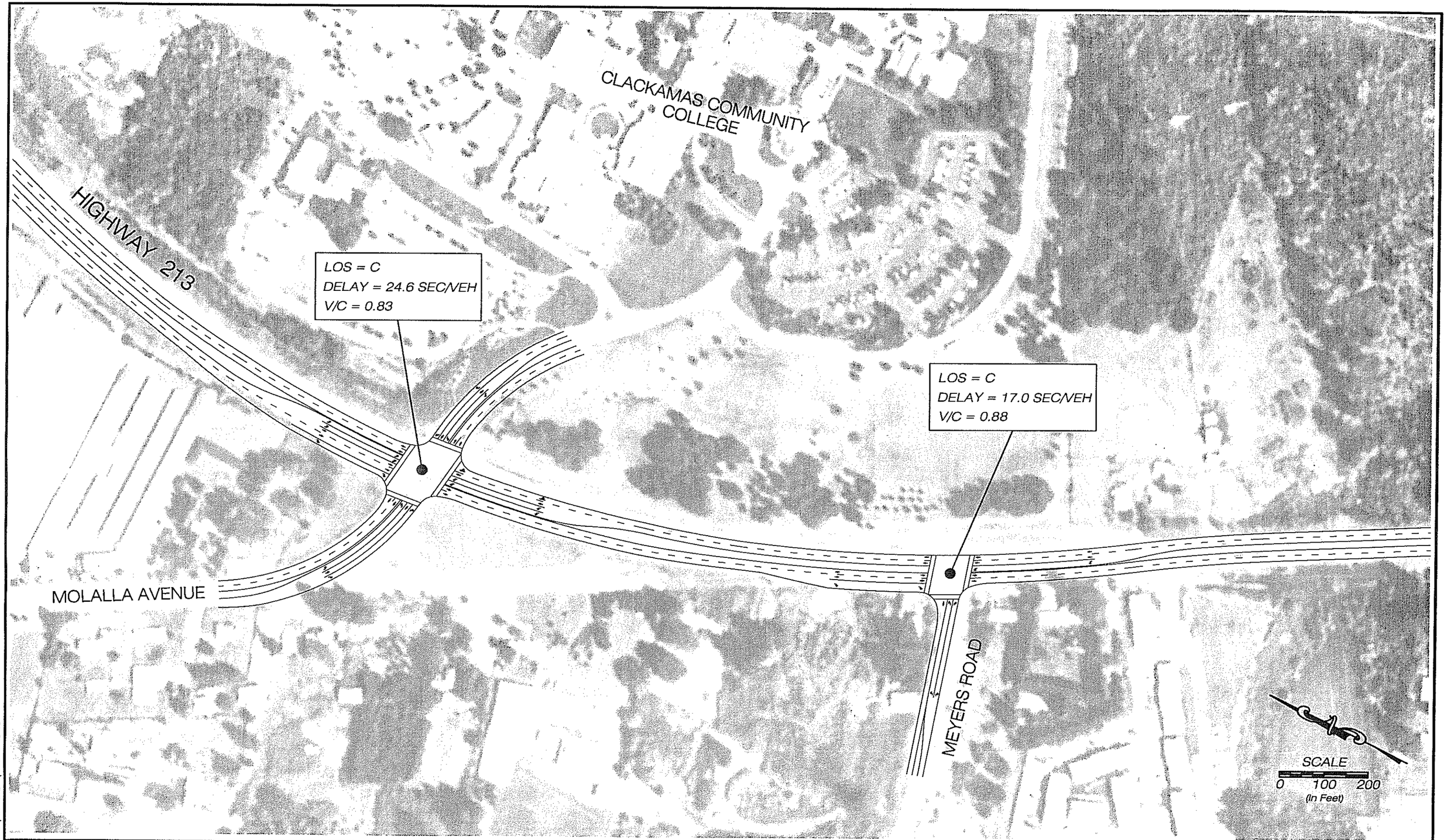
OREGON CITY, OREGON
JUNE 2000

BEAVERCREEK/HIGHWAY 213 IMPROVEMENT PLAN IMPROVED AT-GRADE INTERSECTION CONCEPT

FIGURE NO. 24

PROJECT NO. 2561

h:\PROJFILE\2561\DWGS\FINALREP\FIG024.DWG



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OREGON CITY, OREGON
JUNE 2000

HIGHWAY 213 IMPROVEMENT PLAN CONCEPT MOLALLA AVENUE TO HENRICI ROAD

FIGURE NO.
25A

PROJECT NO.
2561

h:\PROJFILE\2561\DWGS\FINALREP\FIG025A.DWG

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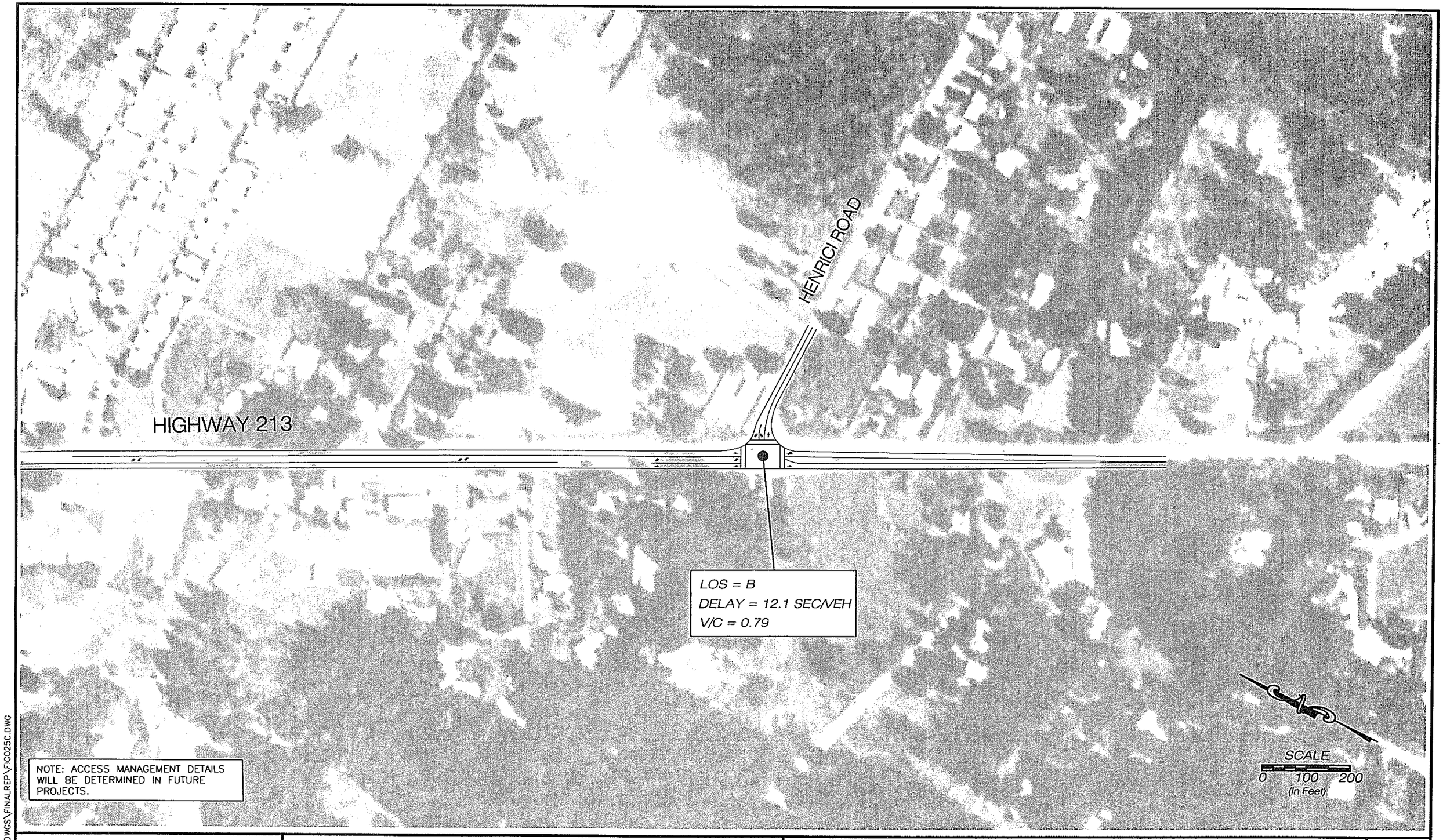
OREGON CITY, OREGON
JUNE 2000

HIGHWAY 213 IMPROVEMENT PLAN CONCEPT MOLALLA AVENUE TO HENRICI ROAD

FIGURE NO. 25B

PROJECT NO. 2561

h:\PROJFILE\2561\DWGS\FINALREP\FIG025B.DWG



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HIGHWAY 213 URBAN CORRIDOR DESIGN STUDY

OREGON CITY, OREGON
JUNE 2000

HIGHWAY 213 IMPROVEMENT PLAN CONCEPT MOLALLA AVENUE TO HENRICI ROAD

FIGURE NO. 25C

PROJECT NO. 2561

h:\PROJFILE\2561\DWGS\FINALREP\FIG025C.DWG

Appendix A
Geometric Conditions
Criteria Rating

Table A-1. Freeway & Interchange Rating Criteria (Assumed design speed= 60 mph)

Feature	Rating			1990 AASHTO Reference
	Good	Fair	Poor	
Geometric Features				
Horizontal Alignment Degree of Curvature	Less than 5°15'	5°15' to 8°15'	Greater than 8°15'	169
Vertical Alignment I-205 (level) HWY 213 (rolling)	Level to 3% Level to 4%	3% to 4% 4% to 6%	Greater than 4% Greater than 6%	585 585
Stopping Sight Distance	Greater than 525'	400' to 525'	Less than 400'	284
Cross Section	See Table A-2			
Decision Sight Distance	Greater than 1275'	1025' to 1275'	Less than 1025'	127
Exit/Entrance Design				
Entrance Taper	Greater than 50:1	40:1 to 50:1	Less than 40:1	985
Exit Diverge	Less than 4°	4° to 5°	Greater than 5°	989
Acceleration Length	Greater than 910'	500' to 910'	Less than 500'	986
Deceleration Length	Greater than 430'	315' to 430'	Less then 315'	991
Operational Features				
Lane & Route Continuity	Maintains Continuity	N/A	Lacks Continuity	938-941
Lane Balance	Maintains Balance	N/A	Lacks Balance	942-946
Ramp Spacing/Sequence				
Entrance-Entrance/Exit-Exit	Greater than 1500'	1000' to 1500'	Less than 1000'	983
Exit to Entrance	Greater than 750'	500' to 750'	Less than 500'	983
Entrance to Exit	Greater than 3000'	2000 to 3000'	Less than 2000'	983

Table A-1 continued

Feature	Rating			1990 AASHTO Reference
	Good	Fair	Poor	
Performance Measures				
Level of Service Volume-to-Capacity	A-C Less than 0.70	D 0.70 to 0.84	E-F Greater than 0.84	263
Accident Rate Million Vehicle Miles	<1.75	N/A	>1.75	ODOT Accident Rates

Table A-2. Cross Section Rating Criteria

RATING	DESIGN CRITERIA
GOOD (Each of the criteria must be met)	• Lane width of 12 feet. • Right shoulder width at least 10 feet. • Left shoulder width at least 4 feet. • Fore-slope designed to 6:1 for 0 to 5 feet of fill; and 4:1 for greater than 5 feet of fill. • Roadside Barrier designed and placed according to current AASHTO standards. • Median barrier provided for width and traffic volumes as described by current AASHTO standards.
FAIR (Each of the criteria must be met)	• Lane width of 12 feet. • Right shoulder width at least 4 feet paved. • Left shoulder width of 1 to 4 feet. • Fore-slope designed to 4:1 for 0 to 15 feet of fill; and 3:1 for greater than 15 feet of fill. • Roadside Barrier (concrete or guardrail) with only minor deficiencies relative to current AASHTO standards.
POOR (Rating warranted if any of the features has noted deficiency)	• Lane width less than 12 feet. • Right shoulder width less than 10 feet. • No left shoulder. • Unprotected fore-slope 3:1 or steeper.

Appendix B
Existing Conditions
Analysis of Operation

Table B-1.
Existing Conditions Intersection Level of Service

Intersection	Average Weekday PM Peak Hour						
	Signalized Intersection			Unsignalized Intersection			
	V/C[1]	Average Delay (sec/veh)	LOS[2]	Critical Movement	V/C[3]	Average Delay[4] (sec/veh)	LOS[5]
Hwy 213/I-205 SB Ramps				EB-LT[6]	0.06	10.0	B
Hwy 213/I-205 NB Ramps				EB-RT[7]	1.00	>45.0	F
Hwy 213/Washington Street	0.98	20.0	C				
Hwy 213/Redland Road	0.79	8.4	B				
Hwy 213/Beavercreek Road	>1.00	>60.0	F				
Hwy 213/Molalla Avenue	0.67	17.3	C				
Hwy 213/Meyers Road	0.64	9.8	B				
Hwy 213/Glen Oak Road				EB	0.19	>45.0	F
Hwy 213/Henrici Road				WB[8]	0.17	13.4	C
I-205 SB/Gladstone Ramps	>1.00	47.9	E				
I-205 NB/Gladstone Ramps	0.96	27.9	D				
I-205 SB/Hwy 99E Ramps	0.91	27.0	D				
I-205 NB/Hwy 99E Ramps	>1.00	36.3	D				

Table B-1. Legend

[1] V/C = Volume-to-Capacity ratio

[2] LOS = Level of Service

[3] Volume-to-Capacity ratio for the critical movement

[4] Average delay for the critical movement

[5] Level of Service ratio for the critical movement

[6] EB-LT = eastbound left-turn from I-205 SB off-ramp to northbound Highway 213

[7] EB-RT = eastbound right-turn from I-205 NB off-ramp to southbound Highway 213

[8] WB = westbound

Table B-2.
Existing Conditions Freeway Levels of Service – Basic Freeway Segments

Freeway Segment	Volume (veh/h)	Density (veh/mile/lane)	Speed of Traffic (mph)	Level of Service
I-205 Southbound				
North of Gladstone Off-Ramp	5695	35.6	56.1	E
Gladstone Off-Ramp to Gladstone On-Ramp	5160	30.8	58.7	D
Park Place Off-Ramp to Park Place On-Ramp	4100	24.0	60.0	D
Hwy 99E Off-Ramp to Hwy 99E On-Ramp	3530	32.0	58.1	E
South of Hwy 99E On-Ramp	4210	24.6	60.0	D
I-205 Northbound				
South of Hwy 99E Off-Ramp	4535	26.6	59.9	D
Hwy 99E Off-Ramp to Hwy 99E On-Ramp	3785	35.5	56.1	E
Hwy 99E On-Ramp to Park Place Off-Ramp	4605	27.0	59.8	D
Park Place Off-Ramp to Park Place On-Ramp	3945	23.1	60.0	C
Gladstone Off-Ramp to Gladstone On-Ramp	4260	24.9	60.0	D
North of Gladstone On-Ramp	4620	27.2	59.7	D

Table B-3.
Existing Conditions Freeway Levels of Service – Freeway Weaving Sections

Freeway Segment	Non-Weaving Volume	Weaving Volume	LOS
I-205 Southbound			
Gladstone On-Ramp to Hwy 213 Off-Ramp	3515	2755	E
Hwy 213 On-Ramp to Hwy 99E Off-Ramp	3170	1430	E
I-205 Northbound			
Hwy 213 On-Ramp to Gladstone Off-Ramp	3310	2100	E

Table B-4.
Existing Conditons Freeway Levels of Service – Ramp Merge/Diverge Segments

Freeway Segment	Ramp Volume (veh/h)	Density (veh/mile/lane)	Speed of Traffic (mph)	Level of Service
I-205 Southbound				
Gladstone Off-Ramp Diverge	535	36	54	E
I-205 Northbound				
Park Place Off-Ramp Diverge	960	30	53	D
Gladstone On-Ramp Merge	360	26	54	C

Appendix C
Crash Analysis

Table C-1.
I-205 Crash History - 1/1/93 to 5/30/97

Highway Section	Crash Severity			Crash Type				Total
	PDO[1]	Injury	Fatal	Side Swipe	Rear End	Fixed Object	Other	
I-205 Southbound								
Off-Ramp to SE 82nd Drive (MP 11.18 to 11.28)	4	1	0	3	1	1	0	5
Gladstone Interchange Area (MP 10.85 to 11.17)	7	5	0	4	4	2	2	12
On-Ramp from SE 82nd Drive (MP 10.74 to 10.84)	4	6	0	4	4	2	0	10
Basic Section (MP 10.31 to 10.73)	2	1	0	1	1	1	0	3
Off-Ramp to Highway 213 (MP 10.18 to 10.30)	14	11	0	1	16	2	6	25
Highway 213 Interchange Area (MP 10.04 to 10.17)	3	5	0	2	4	1	1	8
On-Ramp from Highway 213 (MP 9.93 to 10.03)	1	2	0	3	0	0	0	3
Basic Section (MP 9.62 to 9.92)	22	11	0	12	19	1	1	33
Off-Ramp to Highway 99E (MP 9.51 to 9.61)	12	14	0	5	16	1	4	26
Highway 99E Interchange Area (MP 9.29 to 9.50)	6	4	0	2	8	0	0	10
On-Ramp from Highway 99E (MP 9.18 to 9.28)	2	4	0	0	3	1	2	6

Table C-1. Continued

Highway Section	Crash Severity			Crash Type				Total
	PDO[1]	Injury	Fatal	Side Swipe	Rear End	Fixed Object	Other	
I-205 Northbound								
Off-Ramp to Highway 99E (MP 9.18 to 9.28)	2	1	0	1	1	1	0	3
Highway 99E Interchange Area (MP 9.29 to 9.50)	12	10	0	0	19	1	2	22
On-Ramp from Highway 99E (MP 9.51 to 9.61)	8	2	0	0	8	2	0	10
Basic Section (MP 9.62 to 9.92)	11	3	0	4	3	7	0	14
Off-Ramp to Highway 213 (MP 9.93 to 10.03)	1	5	0	3	2	1	0	6
Highway 213 Interchange Area (MP 10.04 to 10.40)	33	25	0	12	17	9	20	58
On-Ramp from Highway 213 (MP 10.41 to 10.51)	4	6	0	2	8	0	0	10
Basic Section (MP 10.52 to 10.73)	0	1	0	1	0	0	0	1
Off-Ramp to SE 82nd Drive (MP 10.74 to 10.84)	4	3	0	2	2	1	2	7
Gladstone Interchange Area (MP 10.85 to 11.17)	8	6	0	2	6	3	3	14
On-Ramp from SE 82nd Drive (MP 11.18 to 11.28)	1	2	0	0	2	1	0	3

PDO = property damage only. (2) Assumed 250 to 300 feet in each direction for ramp influence area.

Table C-2.
I-205 Crash Rates

Highway Section	Number of Crashes[1]	ADT[2]	Crash Rate (acc/mvm)[3]	Average Statewide Crash Rate (acc/mvm)[4]
I-205 Southbound				
Off-Ramp to SE 82nd Drive (MP 11.18 to 11.28)	5	56,950	0.70	0.91
Gladstone Interchange Area (MP 10.85 to 11.17)	12	51,600	0.58	0.91
On-Ramp from SE 82nd Drive (MP 10.74 to 10.84)	10	62,700	1.28	0.91
Basic Section (MP 10.31 to 10.73)	3	62,700	0.09	0.91
Off-Ramp to Highway 213 (MP 10.18 to 10.30)	25	62,700	2.66	0.91
Highway 213 Interchange Area (MP 10.04 to 10.17)	8	41,000	1.20	0.91
On-Ramp from Highway 213 (MP 9.93 to 10.03)	3	46,000	0.52	0.91
Basic Section (MP 9.62 to 9.92)	33	46,000	1.92	0.91
Off-Ramp to Highway 99E (MP 9.51 to 9.61)	26	46,000	4.53	0.91
Highway 99E Interchange Area (MP 9.28 to 9.50)	10	35,300	1.08	0.91
On-Ramp from Highway 99E (MP 9.18 to 9.28)	6	42,100	1.14	0.91

Table C-2. Continued

Highway Section	Number of Crashes[1]	ADT[2]	Crash Rate (acc/mvm)[3]	Average Statewide Crash Rate (acc/mvm)[4]
I-205 Northbound				
Off-Ramp to Highway 99E (MP 9.18 to 9.28)	3	45,350	0.53	0.91
Highway 99E Interchange Area (MP 9.28 to 9.50)	22	37,850	2.22	0.91
On-Ramp from Highway 99E (MP 9.51 to 9.61)	10	49,050	1.63	0.91
Basic Section (MP 9.62 to 9.92)	14	49,050	0.76	0.91
Off-Ramp to Highway 213 (MP 9.93 to 10.03)	6	49,050	0.98	0.91
Highway 213 Interchange Area (MP 10.04 to 10.40)	58	39,450	3.27	0.91
On-Ramp from Highway 213 (MP 10.41 to 10.51)	10	54,100	1.48	0.91
Basic Section (MP 10.52 to 10.73)	1	54,100	0.07	0.91
Off-Ramp to SE 82nd Drive (MP 10.74 to 10.84)	7	54,100	1.04	0.91
Gladstone Interchange Area (MP 10.85 to 11.17)	14	42,600	0.82	0.91
On-Ramp from SE 82nd Drive (MP 11.18 to 11.28)	3	46,200	0.52	0.91

[1]Number of accidents reported between 1/1/93 and 5/30/97
[2]ADT = average daily directional traffic volume
[3]acc/mvm = accident rate expressed in number of accidents per million vehicle miles traveled
[4]Average of 1993, 1996, 1997 average statewide accident rates for Urban Freeway Primary Highways

Table C-3.
Highway 213 Crash History - 1/1/93 to 5/30/97

Highway Section	Crash Severity			Crash Type				Total
	PDO[1]	Injury	Fatal	Turn	Rear-End	Fixed Object	Other	
I-205 (MP 0.00) to Washington Street (MP 0.14)	29	26	0	11	37	0	7	55
Washington Street (MP 0.14) to Redland Road (MP 0.48)	29	25	0	7	45	1	1	54
Redland Road (MP 0.48) to Beavercreek Road (MP 2.98)	22	33	0	5	41	4	5	55
Beavercreek Road (MP 2.98) to Molalla Avenue (MP 3.59)	15	19	0	8	17	1	8	34
Molalla Avenue (MP 3.59) to Henrici Road (MP 4.37)	9	14	0	5	14	1	3	23

[1] PDO = property damage only

Table C-4. Highway 213 Crash Rates

Highway Section	Number of Crashes[1]	ADT[2]	Crash Rate (acc/mvm)[3]	Average Statewide Crash Rate (acc/mvm)
Highway 213 Southbound				
I-205 to Washington Street (MP 0.00 – MP 0.14)	36	24,975	6.39	3.01[4]
Washington Street to Redland Road (MP 0.14 – MP 0.48)	28	20,600	2.48	3.01
Redland Road to Beavercreek Road (MP 0.48 – MP 2.98)	33	17,650	0.46	1.73[5]
Beavercreek Road to Molalla Avenue (MP 2.98 – MP 3.59)	16	9,575	1.70	1.73
Molalla Avenue to Henrici Road (MP 3.59 – MP 4.37)	9	9,590	0.75	1.73
I-205 to Washington Street (MP 0.00 – MP 0.14)	19	24,975	3.37	3.01[4]
Washington Street to Redland Road (MP 0.14 – MP 0.48)	25	20,600	2.21	3.01
Redland Road to Beavercreek Road (MP 0.48 – MP 2.98)	22	17,650	0.31	1.73[5]
Beavercreek Road to Molalla Avenue (MP 2.98 – MP 3.59)	18	9,575	1.91	1.73
Molalla Avenue to Henrici Road (MP 3.59 – MP 4.37)	14	9,590	1.16	1.73

[1]Number of accidents reported between 1/1/93 and 5/30/97
[2]ADT = average daily directional traffic volume
[3]Acc/mvm = accident rate expressed in number of accidents per million vehicle miles traveled
[4]Average of 1993, 1996, and 1997 average statewide accident rates for Urban Non-freeway Secondary Highways
[5]Average of 1993, 1996, and 1997 average statewide accident rates for Sub-urban Non-freeway Secondary Highways

Appendix D
Future Conditions
Operation Analysis

Table D-1.
2018 "No-Build" Scenario Intersection Levels of Service

Intersection	Average Weekday PM Peak Hour						
	Signalized Intersection			Unsignalized Intersection			
	V/C[1]	Average Delay (sec/veh)	LOS[2]	Critical Movement	V/C[3]	Average Delay[4] (sec/veh)	LOS[5]
Hwy 213/I-205 SB Ramps				EB-LT[6]	>1.20	>45.0	F
Hwy 213/I-205 NB Ramps				EB-RT[7]	>1.20	>45.0	F
Hwy 213/Washington Street	>1.20	>60.0	F				
Hwy 213/Redland Road	1.06	30.1	D				
Hwy 213/Beavercreek Road	>1.20	>60.0	F				
Hwy 213/Molalla Avenue	1.07	38.4	D				
Hwy 213/Meyers Road	0.88	17.4	C				
Hwy 213/Glen Oak Road				WB[8]	>1.20	>45.0	F
Hwy 213/Henrici Road				WB	>1.20	>45.0	F
I-205 SB/Gladstone Ramps	1.20	>60.0	F				
I-205 NB/Gladstone Ramps	>1.20	>60.0	F				
I-205 SB/Hwy 99E Ramps	>1.20	>60.0	F				
I-205 NB/Hwy 99E Ramps	>1.20	>60.0	F				

[1] V/C = Volume-to-Capacity ratio

[2] LOS = Level of Service

[3] Volume-to-Capacity ratio for the critical movement

[4] Average delay for the critical movement

[5] Level of Service ratio for the critical movement

[6] EB-LT = eastbound left-turn from I-205 SB off-ramp to northbound Highway 213

[7] EB-RT = eastbound right-turn from I-205 NB off-ramp to southbound Highway 213

[8] WB = westbound

Table D-2.
2018 "No-Build" Scenario Conditions Freeway Level of Service – Basic Freeway Segments

Freeway Segment	Volume (veh/h)	Density (veh/mile/lane)[1]	Speed (mph)[1]	Level of Service
I-205 Southbound				
North of Gladstone Off-Ramp	6950			F
Gladstone Off-Ramp to Gladstone On-Ramp	6625			F
Park Place Off-Ramp to Park Place On-Ramp	5245	31.5	58.4	E
Hwy 99E Off-Ramp to Hwy 99E On-Ramp	4705			F
South of Hwy 99E On-Ramp	5960	38.5	54.4	E
I-205 Northbound				
South of Hwy 99E Off-Ramp	6705			F
Hwy 99E Off-Ramp to Hwy 99E On-Ramp	5140			F
Hwy 99E On-Ramp to Park Place Off-Ramp	6740			F
Park Place Off-Ramp to Park Place On-Ramp	5020	29.8	59.1	D
Gladstone Off-Ramp to Gladstone On-Ramp	5475	33.6	57.2	E
North of Gladstone On-Ramp	5775	36.5	55.6	E

[1] Density and speed are highly variable at LOS "F".

Table D-3.
2018 "No-Build" Scenario Conditions Freeway Level of Service – Freeway Weaving Sections

Freeway Segment	Non-Weaving Volume	Weaving Volume[1]	Weaving Vehicles	
			Speed (mph)	LOS
I-205 Southbound				
Gladstone On-Ramp to Hwy 213 Off-Ramp	4645	3650	41	F
Park Place On-Ramp to Hwy 99E Off-Ramp	4205	1895	48	F
I-205 Northbound				
Hwy 213 On-Ramp to Gladstone Off-Ramp	4225	2680	42	F

[1] These volumes exceed the HCM parameters for weaving analysis; as such the Leisch Procedure for Analysis and Design of Weaving Sections was used.

Table D-4.
2018 "No-Build" Scenario Conditions Freeway Level of Service – Ramp Merge/Diverge Segments

Freeway Segment	Ramp Volume (veh/h)	Density[1] (veh/mile/lane)	Speed[1] (mph)	Level of Service
I-205 Southbound				
Gladstone Off-Ramp Diverge	325			F
I-205 Northbound				
Park Place Off-Ramp Diverge	1720			F
Gladstone On-Ramp Merge	300	31	52	D

[1] Density and Speed of Traffic are highly variable at LOS "F".

Table D-5.
Freeway Operational Analysis Comparison

Freeway Segment		Operational Level of Service	
		1998 Existing Conditions	2018 "No-Build" Scenario Conditions
Basic Freeway Segments			
I-205 SB	North of Gladstone Off-Ramp	E	F
	Gladstone Off-Ramp to Gladstone On-Ramp	D	F
	Park Place Off-Ramp to Park Place On-Ramp	D	E
	Hwy 99E Off-Ramp to Hwy 99E On-Ramp	E	F
	South of Hwy 99E On-Ramp	D	E
I-205 NB	South of Hwy 99E Off-Ramp	D	F
	Hwy 99E Off-Ramp to Hwy 99E On-Ramp	E	F
	Hwy 99E On-Ramp to Park Place Off-Ramp	D	F
	Park Place Off-Ramp to Park Place On-Ramp	C	D
	Gladstone Off-Ramp to Gladstone On-Ramp	D	E
	North of Gladstone On-Ramp	D	E
Freeway Weaving Segments			
I-205 SB	Gladstone On-Ramp to Hwy 213 Off-Ramp	E	F
I-205 SB	Hwy 213 On-Ramp to Hwy 99E Off-Ramp	E	F
I-205 NB	Hwy 213 On-Ramp to Gladstone Off-Ramp	E	F
Freeway Ramp Merge/Diverge Segments			
I-205 SB	Gladstone Off-Ramp Diverge	E	F
I-205 NB	Park Place Off-Ramp Diverge	D	F
	Gladstone On-Ramp Merge	C	D

Appendix E

Highway 213/I-205 Interchange Concept Phasing Plans

PHASE 1
PHASE 2
PHASE 3

SCALE
0 200 400
(In Feet)

KITTELSON & ASSOCIATES, INC.
610 S.W. ALDER, SUITE 700
PORTLAND, OREGON 97205
(503) 228-5230

TRANSPORTATION PLANNING\TRAFFIC ENGINEERING

HIGHWAY 213 URBAN CORRIDOR DESIGN STUDY

OREGON CITY, OREGON
JUNE 2000

HIGHWAY 213/I-205 INTERCHANGE CONCEPT ALTERNATIVE 2 -- PHASING PLAN

FIGURE NO.
E-1

PROJECT NO.
2561

h:\PROJFILE\2561\DWGS\FINALREP\FIGE_1.DWG

PHASE 1
PHASE 2
PHASE 3

SCALE
0 200 400
(In Feet)

KITTELSON & ASSOCIATES, INC. 610 S.W. ALDER, SUITE 700 PORTLAND, OREGON 97205 (503) 228-5230 TRANSPORTATION PLANNING\TRAFFIC ENGINEERING	HIGHWAY 213 URBAN CORRIDOR DESIGN STUDY OREGON CITY, OREGON JUNE 2000	*HIGHWAY 213/I-205 INTERCHANGE CONCEPT ALTERNATIVE 3 -- PHASING PLAN*	FIGURE NO. E-2 PROJECT NO. 2561

h:\PROJFILE\2561\DWGS\FINALREP\FIGE_2.DWG