

36TH AVENUE WEST IMPROVEMENT PROJECT

OVERVIEW OF TRAFFIC FINDINGS

(Preliminary for Discussion Only)

MARCH 25, 2009

TRAFFIC FORECASTING AND ANALYSIS

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2025 Land Use

- Interpolated between 2005 and 2032 land use, including:
 - 9.1 million square foot development in city center
 - 250 hotel rooms
 - 500 parking stalls



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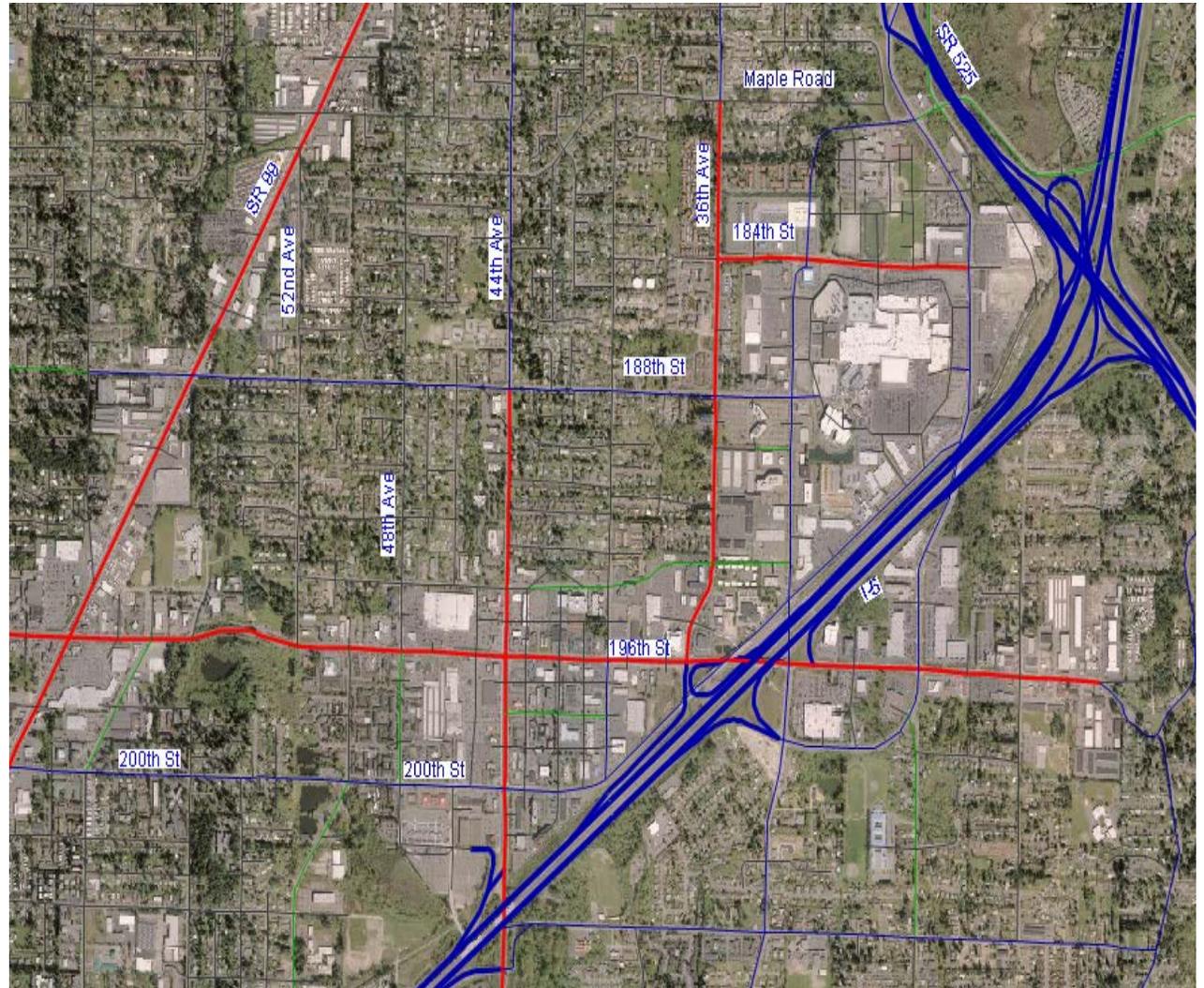
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2025 Roadway Major Improvements

- 5-lane on 33rd Ave Bypass
- 5-lane on 33rd Ave extension to Poplar
- 7-lane on 196th between 48th Ave and 37th Ave
- 7-lane on 44th Ave between I-5 and 194th St
- Maple Rd extension
- Ash Way extension
- 194th extension to 33rd Ave
- Braided ramp on I-5/196th/ SR 525
- 204th extension to 68th Ave
- City Center Grid System
- Improvement on 36th Ave and 200th St



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2025 Intersection Major Improvements

- Include Comprehensive Plan of Improvements
- Install 14 traffic signals
- Right-in / Right-out control in the City Center Grid System
- Right-in / Right-out control around the High School Development

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2025 PM Peak Hour Test Scenarios

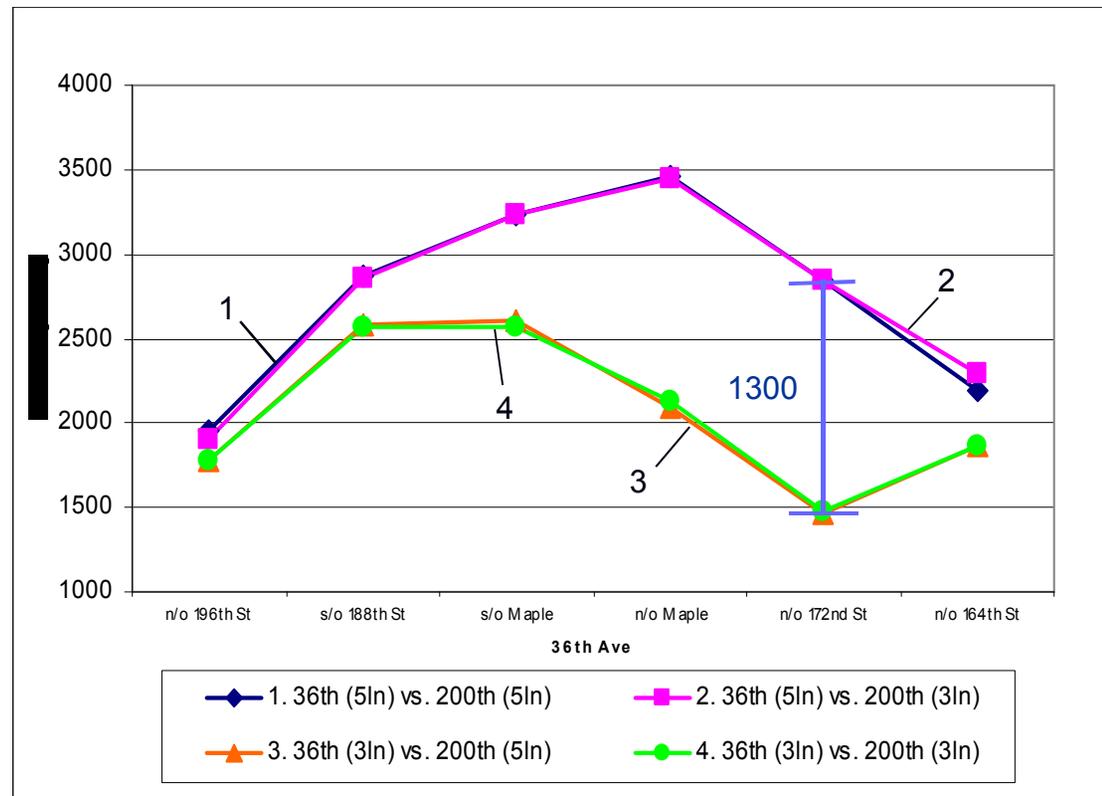
Scenarios	36th Ave North of Maple Rd	200th St West of 48th Ave
1	5 lanes	5 lanes
2	5 lanes	3 lanes
3	3 lanes	5 lanes
4	3 lanes	3 lanes

TRAFFIC FORECASTING AND ANALYSIS

36th Ave Volumes (2025 PM Peak)

- 5-lane roadway on 36th Ave attracts more traffic, maximum 1300 veh/hr difference
- Number of lanes on 200th St has negligible effect on 36th Ave

Two-Way 2025 PM Peak Hour Volumes on 36th Ave

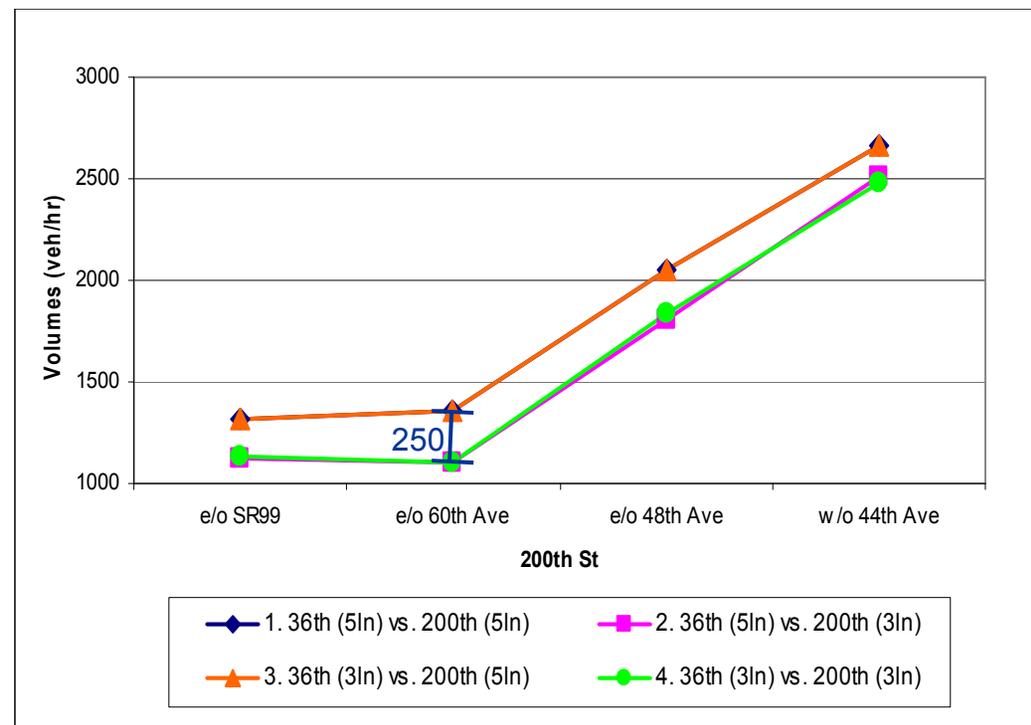


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200th St Volumes (2025 PM Peak)

- 5-lane roadway on 200th St attracts additional 250 veh/hr
- Number of lanes on 36th Ave has negligible effect on 200th St

Two-Way 2025 PM Peak Hour Volumes on 200th St

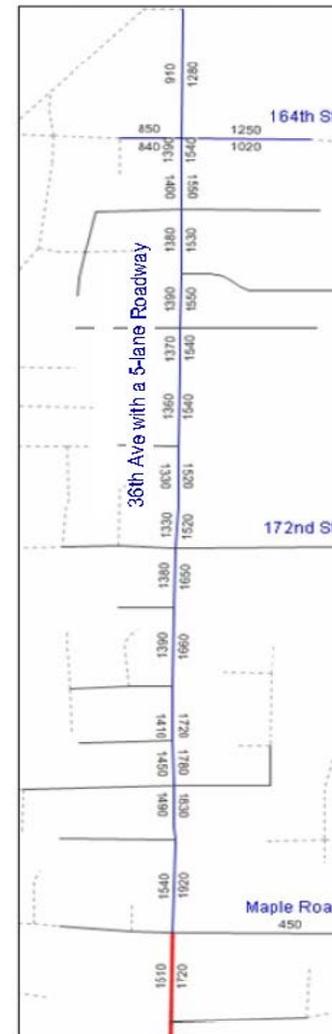


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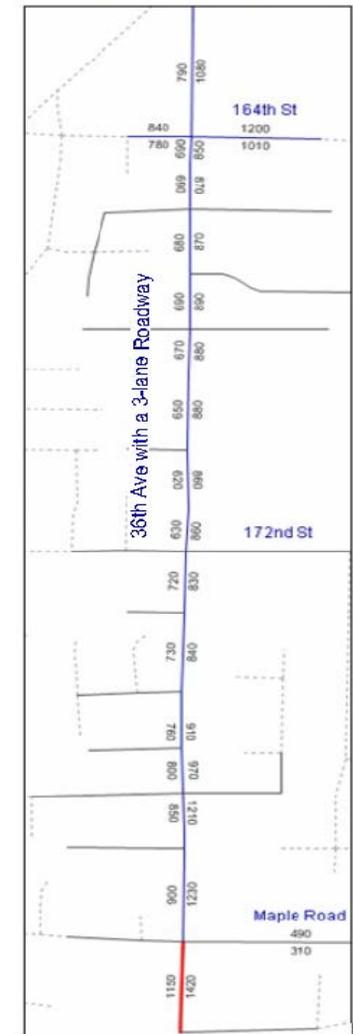
Directional volumes on 36th Ave between Maple Rd and 164th St (2025 PM Peak)

- 5-lane Roadway
 - NB: 1500-1900 Veh/hr
 - SB: 1400-1500 Veh/hr
- 3-lane Roadway
 - NB: 800-1200 Veh/hr
 - SB: 600-900 Veh/hr

(5-lane Roadway)



(3-lane Roadway)



TRAFFIC FORECASTING AND ANALYSIS

Corridors Highly Affected by 5-lane Option

- Delay (vehicle-hour) = intersection delay x approach volumes
- Corridor Delay = sum of all intersection delay in the corridor
- Corridor Delay Increase on:
 - 36th Ave
 - 188th St
 - 196th St
- Corridor Delay Decrease on:
 - 194th St
 - 168th St
 - 44th Ave
 - Alderwood Mall Pkwy

Corridor	Scenario 1: 36th -5 lanes vs. 200th -5 lanes	Scenario 3: 36th -3 lanes vs. 200th -5 lanes	Difference between Scenario 1 and Scenario 3	Percent change over 3-lane option on 36th Avenue W
	Delay (Vehicle-Hour)	Delay (Vehicle-Hour)	Delay (Vehicle-Hour)	
SR 99	1421.2	1410.2	11.0	1%
44th Avenue W	1081.1	1130.4	-49.3	-4%
36th Avenue W n/o 180th Street SW	83.5	69.4	14.1	20%
36th Avenue W s/o 180th Street SW	350.2	217.0	133.2	61%
Alderwood Mall Parkway	611.5	641.7	-30.2	-5%
168th Street SW	66.0	77.8	-11.8	-15%
188th Street SW	64.2	57.1	7.0	12%
194th Street SW	51.9	62.6	-10.6	-17%
196th Street SW	1127.7	1084.5	43.2	4%
200th Street SW	97.8	100.2	-2.4	-2%
Others	401.7	416.4	-14.7	-4%
City-wide	5356.7	5267.2	89.4	2%

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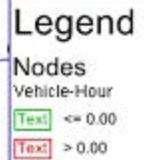
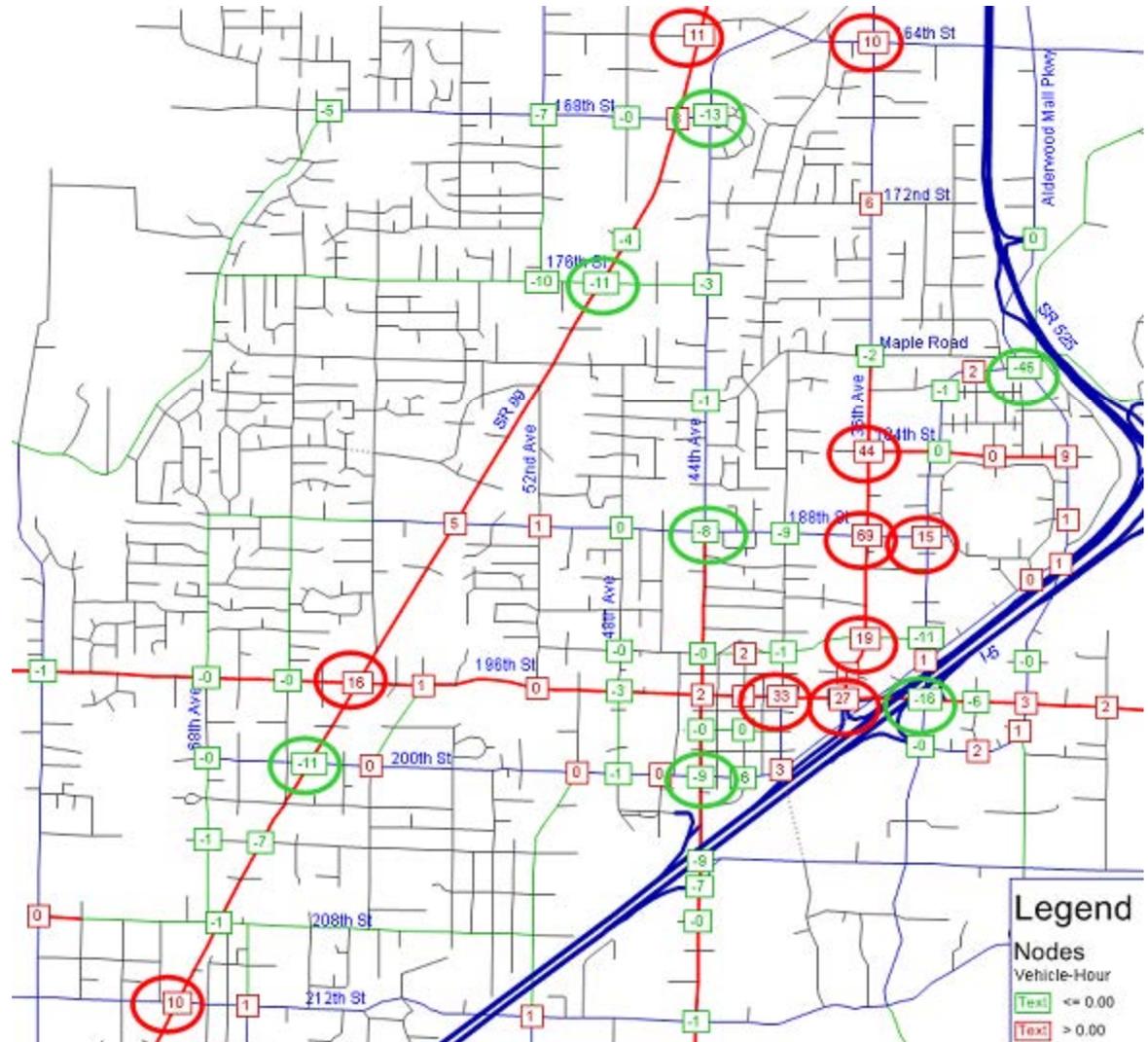
Intersection Delay due to 5-lane Option

■ Intersections adversely affected:

- 164th St and SR 99
- 196th St and SR 99
- 212th St and SR 99
- 164th St and 36th Ave
- 184th St and 36th Ave
- 188th St and 33rd Ave
- 188th St and 33rd Ave
- 194th St and 36th Ave
- 196th St and 36th Ave
- 196th St and 40th Ave

■ Intersections favorably affected:

- Alderwood Mall Pkwy and 30th Pl
- 196th St and 33rd Ave
- Intersection along 44th Ave
- Some intersections on SR 99



TRAFFIC FORECASTING AND ANALYSIS

Signalized Intersection LOS

- With Optimized configurations and signal timings
- The LOS Standard for 36th Ave: LOS D
- Both 5-lane and 3-lane options meet the City’s LOS standard of LOS D or better
- Further analysis needed if the existing configuration at 164th St & 36th Ave remains unchanged

Intersection LOS 2025 PM (a 3-lane roadway on 36th Avenue)

Name	Type	LOS	Delay	V/C	95th percentile queue (ft)
164th Street SW and 36th Avenue W	Signal	D	41.3	0.87	635 (NB) 429 (SB)
172nd Street and 36th Avenue W	Signal	B	14.1	0.68	540 (NB) 331 (SB)
179th Street and 36th Avenue W	Signal	B	26.2	0.79	567 (NB) 274 (SB)

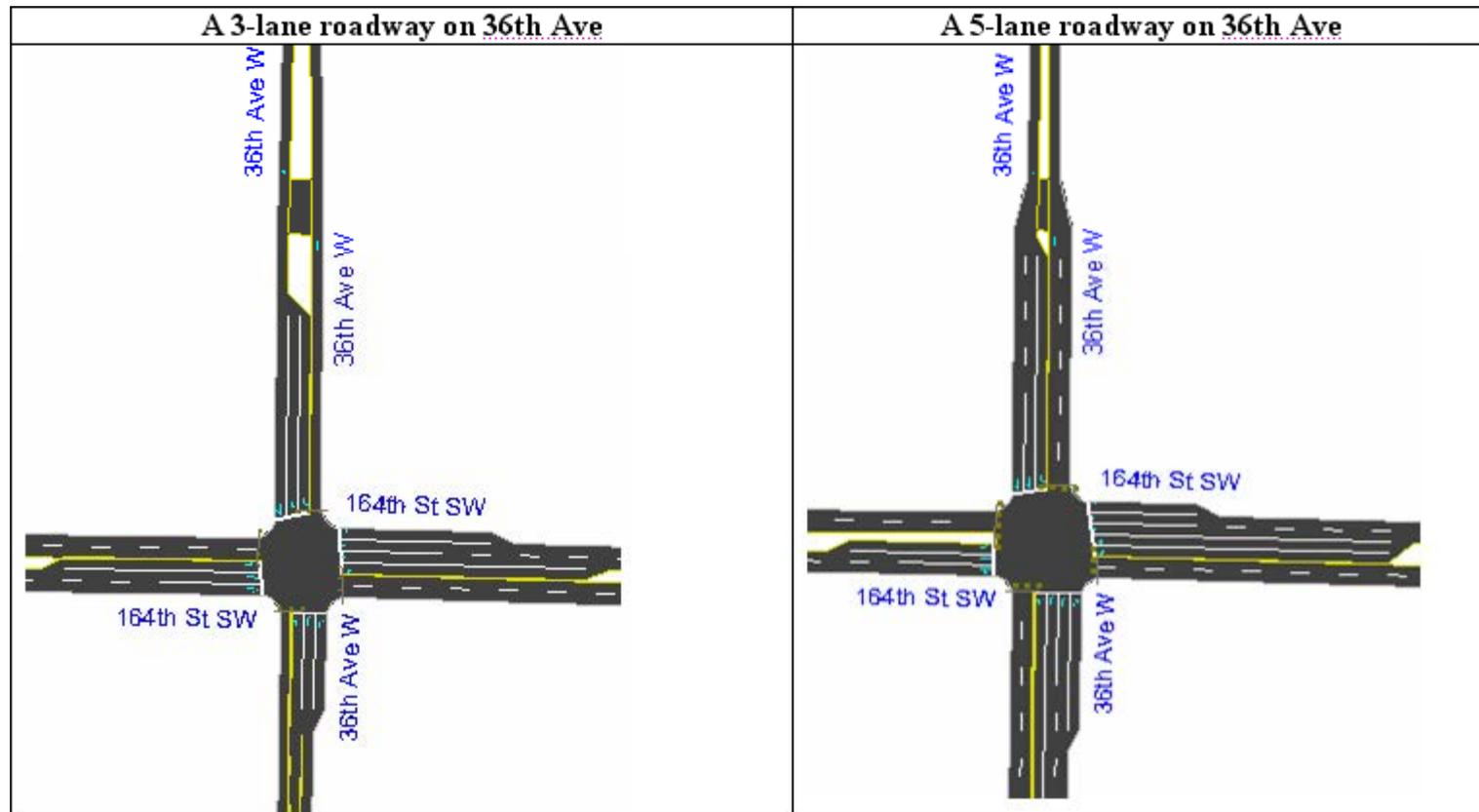
Intersection LOS 2025 PM (a 5-lane roadway on 36th Avenue)

Name	Type	LOS	Delay	V/C	95th percentile queue (ft)
164th Street SW and 36th Avenue W	Signal	D	44.9	0.92	447 (NB) 352 (SB)
172nd Street and 36th Avenue W	Signal	B	16.4	0.72	480 (NB) 413 (SB)
179th Street and 36th Avenue W	Signal	B	17.2	0.78	583 (NB) 427 (SB)

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Optimized Configuration at 164th St and 36th Ave



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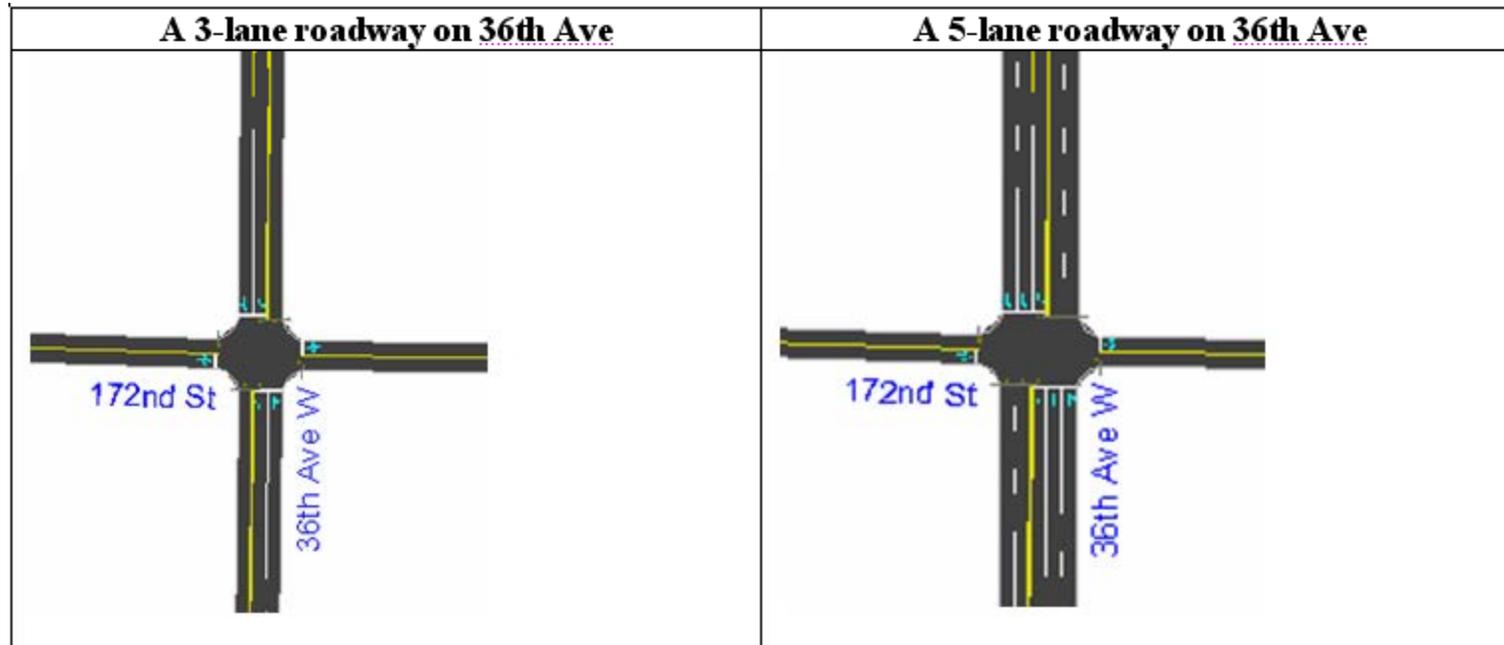
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Optimized Configuration at 172nd St and 36th Ave



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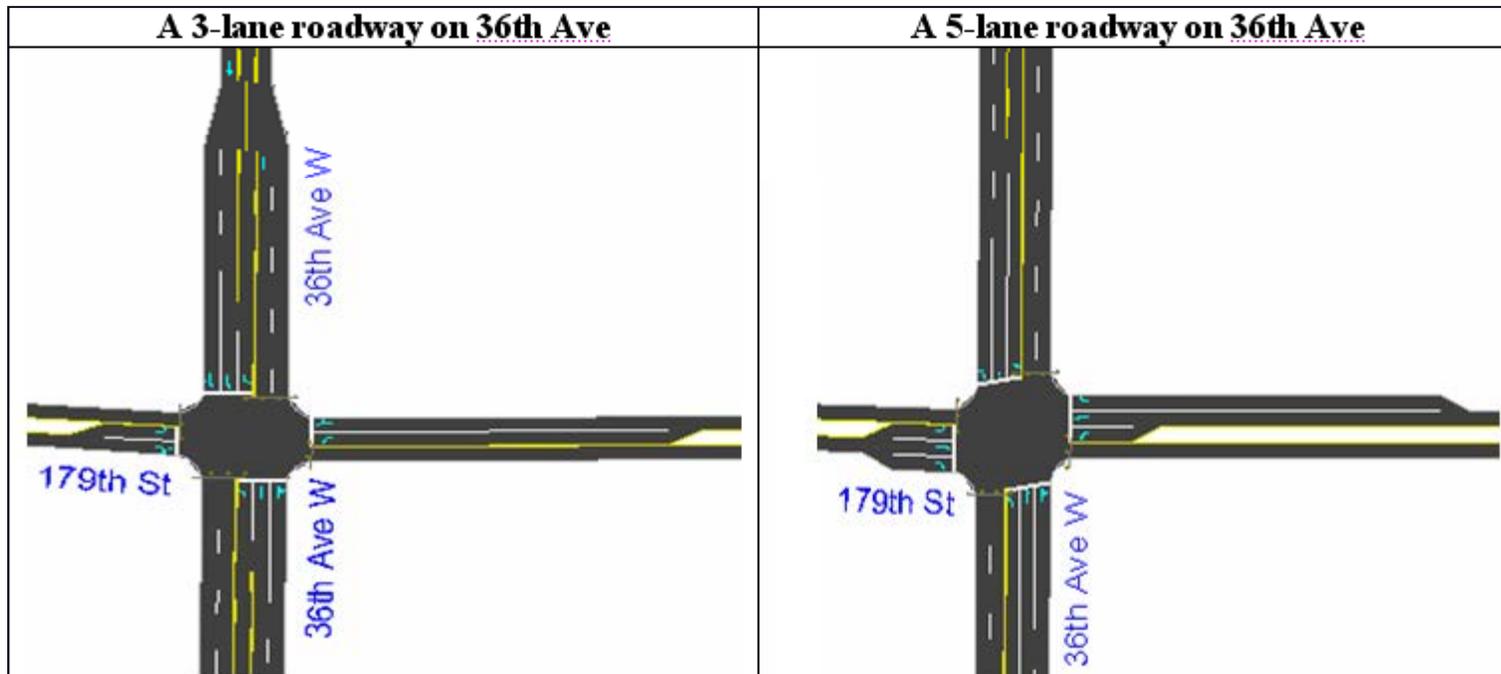
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Optimized Configuration at 179th St and 36th Ave



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Queue Lengths on 36th Ave

- EB, WB, and NB approach queue lengths are slightly shorter with 5-lane option

Maximum Approach Queue Lengths



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Queue Lengths at 164th and 36th Ave and 172nd St and 36th Ave

- EB, WB, and NB approach queue lengths are slightly shorter with 5-lane option



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Queue Lengths at 172nd St and 36th Ave and 179th and 36th Ave

- EB and WB queue lengths are slightly shorter with 5-lane option
- SB approach queue lengths are slightly longer with 5-lane option



TRAFFIC FORECASTING AND ANALYSIS

Roundabout LOS and Queue Length

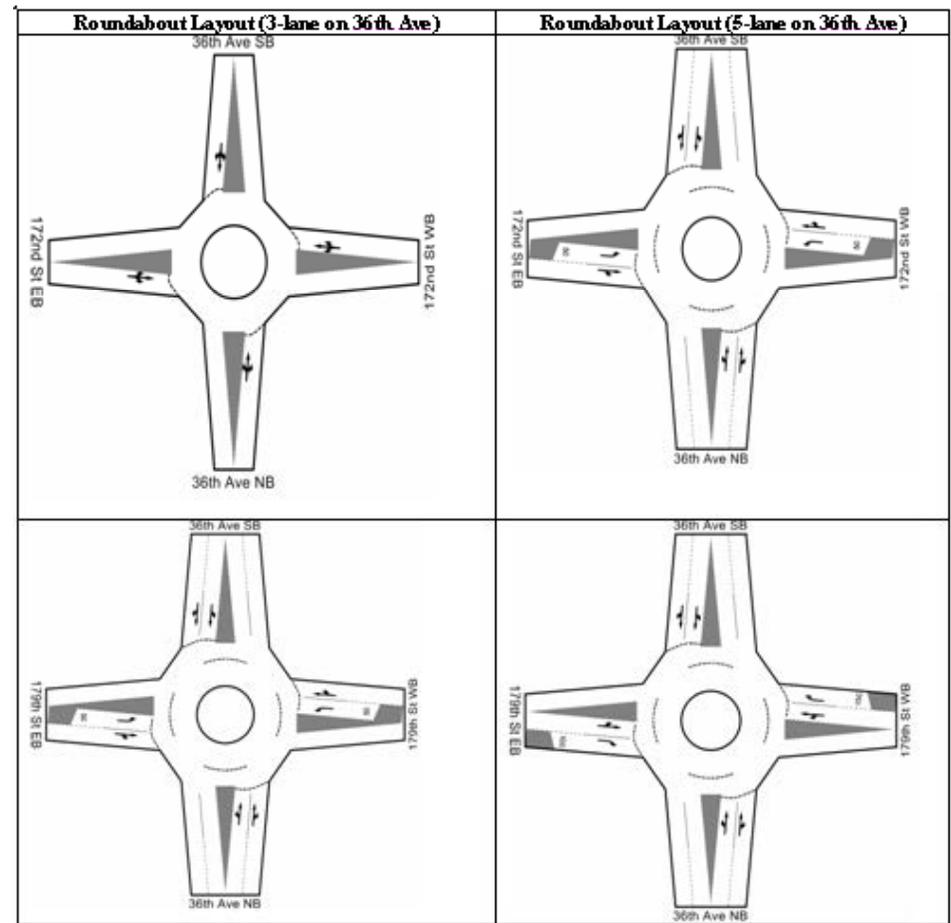
- Standard for 36th Ave: LOS D
- 5-lane and 3-lane options both meet the standard of LOS D or better
- Queue lengths are acceptable

Roundabout LOS and Queue Length 2025 PM (a 3-lane roadway on 36th Avenue)					
Name	Type	LOS	Delay	V/C	95th Percentile Queue (ft)
172nd Street and 36th Avenue W	Single-Lane Roundabout	A	9.0	0.73	268 (NB) 173 (SB)
179th Street and 36th Avenue W	Two-Lane Roundabout	A	6.8	0.60	258 (NB) 105 (SB)
Roundabout LOS and Queue Length 2025 PM (a 5-lane roadway on 36th Avenue)					
Name	Type	LOS	Delay	V/C	95th Percentile Queue (ft)
172nd Street and 36th Avenue W	Two-lane Roundabout	A	5.3	0.65	185 (NB) 132 (SB)
179th Street and 36th Avenue W	Two-lane Roundabout	A	6.9	0.75	248 (NB) 227 (SB)

TRAFFIC FORECASTING AND ANALYSIS

Roundabout Configuration

- Environment factor: 1.0
- Single-lane diameters:
 - Island: 70 ft
 - Inscribed circle (**ICD**): 100 ft
- 2-lane diameters:
 - Island: 90 ft
 - Inscribed circle (**ICD**): 150 ft
- 179th / Maple Rd = 2 circulating lanes with both options
- 172nd lanes vary with corridor option:
 - * 2-lane roundabout with 5-lane option
 - * single-lane roundabout OK 3-lane option
 - * but 2-lane gives better performance and future flexibility



TRAFFIC FORECASTING AND ANALYSIS

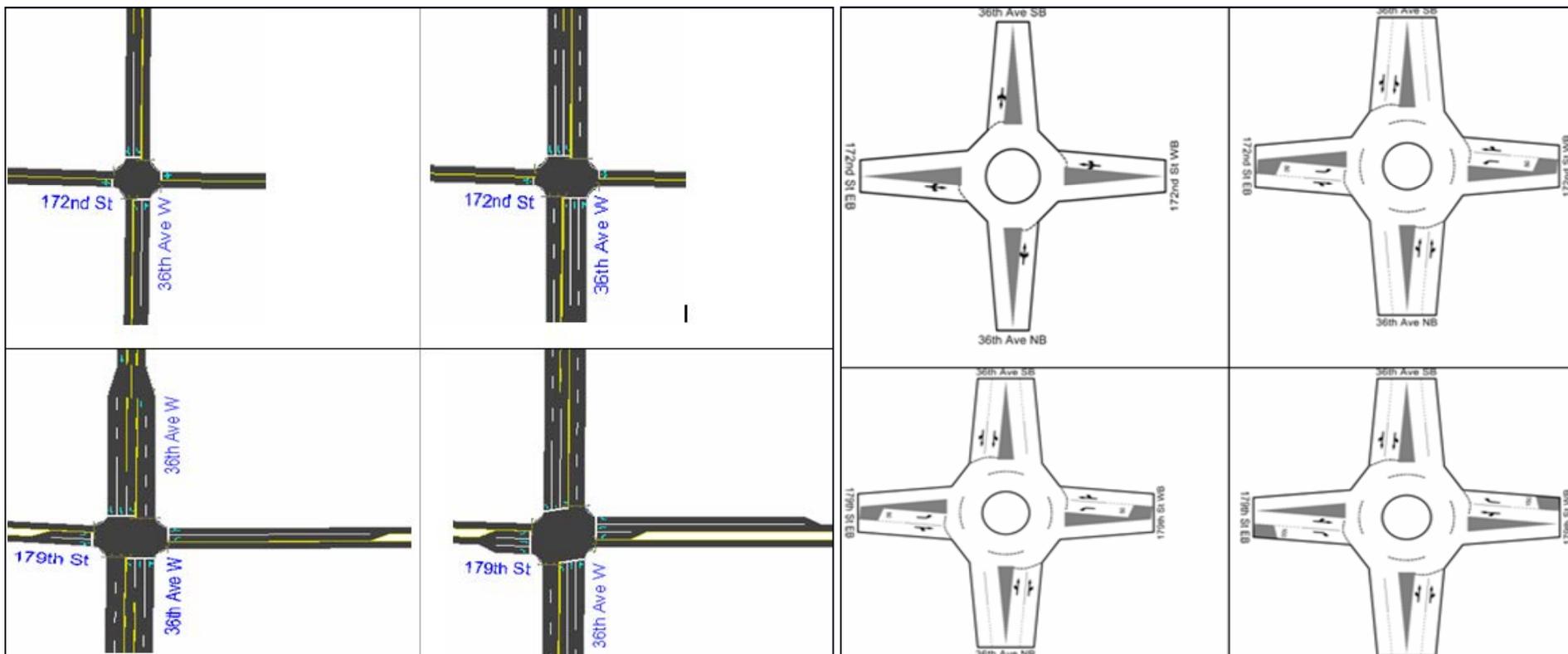
Signalized Intersection vs. Roundabout Configuration

3-lane Option

5-lane Option

3-lane Option

5-lane Option



TRAFFIC FORECASTING AND ANALYSIS

Safety Analysis

Collisions by Year

- Total 141 collisions
- 36th Ave and SR 524: 48% or 67 collisions
- 188th St and 36th Ave: 21% or 30 collisions
- 184th St and 36th Ave: 12% or 17 collisions
- 172nd St and 36th Ave: 9% or 12 collisions
- Above four Intersections total: 90% or 126 collisions

Collisions by Year

Location	2006	2007	2008	Total	Total Percent
Within the Study Area					
36th Avenue, 55 ft s/o of 165th Place (6,017 ft. n/o 184th Street)			1	1	0.7%
166th Place at 36th Avenue			1	1	0.7%
170th Street at 36th Avenue			1	1	0.7%
172nd Street at 36th Avenue	3	3	6	12	8.5%
175th Street at 36th Avenue	1			1	0.7%
177th Place at 36th Avenue	1	1		2	1.4%
179th Street at 36th Avenue	1		1	2	1.4%
Sub total	6	4	10	20	14.1%
Outside of the Study Area					
180th Place at 36th Avenue	1			1	0.7%
36th Avenue, 180 ft s/o 180th Place, (990 ft. n/o 184th Street)			1	1	0.7%
36th Avenue, 370 ft s/o 180th Place, (800 ft. n/o 184th Street)			1	1	0.7%
184th Street at 36th Avenue	3	7	7	17	12.1%
188th Street at 36th Avenue	10	10	10	30	21.3%
36th Avenue, 600 ft. s/o 188th Street	1			1	0.7%
191st Place at 36th Avenue			1	1	0.7%
36th Avenue, 200 ft s/o 191st Place, (1,300 ft. s/o 188th Street)			1	1	0.7%
192nd Place at 36th Avenue			1	1	0.7%
36th Avenue at SR 524 (196th Street)	22	32	13	67	47.5%
Sub total	37	49	35	121	85.8%
Total on Entire 36th Avenue	43	53	45	141	
Total Percent on Entire 36th Avenue	30%	38%	32%		100%

TRAFFIC FORECASTING AND ANALYSIS

Collision Type

- Sideswipe: 30% or 43 collisions
- Right-Angle: 17% or 24 collisions
- Approach turn: 12% or 17 collisions
- Rear-end: 12% or 17 collisions

Collisions by Type

Location	Sideswipe	Right-Angle	Approach Turn	Rear-End	Fixed Object /Parked Vehicle	Other	Total
Within the Study Area							
36th Avenue, 55 ft s/o of 165th Place (6,017 ft. n/o 184th Street)			1				1
166th Place at 36th Avenue						1	1
170th Street at 36th Avenue		1					1
172nd Street at 36th Avenue	2	4	1	2	1	2	12
175th Street at 36th Avenue					1		1
177th Place at 36th Avenue						2	2
179th Street at 36th Avenue		1			1		2
Sub total	2	6	2	2	3	5	20
Outside of the Study Area							
180th Place at 36th Avenue					1		1
36th Avenue ,180 ft s/o 180th Place, (990 ft. n/o 184th Street)						1	1
36th Avenue, 370 ft s/o 180th Place, (800 ft. n/o 184th Street)		1					1
184th Street at 36th Avenue	5	4	4		1	3	17
188th Street at 36th Avenue	6	5	6	3	4	6	30
36th Avenue, 600 ft. s/o 188th Street						1	1
191st Place at 36th Avenue	1						1
36th Avenue, 200 ft s/o 191st Place, (1,300 ft. s/o 188th Street)	1						1
192nd Place at 36th Avenue		1					1
36th Avenue at SR 524 (196th Street)	28	7	5	12	4	11	67
Sub total	41	18	15	15	10	22	121
Total on Entire 36th Avenue	43	24	17	17	13	27	141
Total Percent on Entire 36th Avenue	30%	17%	12%	12%	9%	19%	100%

TRAFFIC FORECASTING AND ANALYSIS

Collision Severity

- Fatal: zero
- Injury: 26% or 37 collisions
- PDO: 74% or 103 collisions

Collisions by Severity

Location	Fatal	Injury	PDO
Within the Study Area			
36th Avenue, 55 ft s/o of 165th Place (6,017 ft. n/o 184th Street)			1
166th Place at 36th Avenue			1
170th Street at 36th Avenue			1
172nd Street at 36th Avenue		3	7
175th Street at 36th Avenue			1
177th Place at 36th Avenue			2
179th Street at 36th Avenue		1	1
Outside of the Study Area			
180th Place at 36th Avenue			1
36th Avenue ,180 ft s/o 180th Place, (990 ft. n/o 184th Street)		1	
36th Avenue, 370 ft s/o 180th Place, (800 ft. n/o 184th Street)		2	
184th Street at 36th Avenue		4	13
188th Street at 36th Avenue		7	23
36th Avenue, 600 ft. s/o 188th Street			1
191st Place at 36th Avenue			1
36th Avenue, 200 ft s/o 191st Place, (1,300 ft. s/o 188th Street)		1	
192nd Place at 36th Avenue			1
36th Avenue at SR 524 (196th Street)		18	49
Sub total		33	89
Total on Entire 36th Avenue		37	103
Total Percent on Entire 36th Avenue		26%	74%

TRAFFIC FORECASTING AND ANALYSIS

Intersection Collision Rate (MEV*)

- General “threshold of concern” collision rate: 1.0
- SR 524 and 36th Avenue: 1.33
- 188th St and 36th Ave: 1.03
- 184th St and 36th Ave: 0.92
- 172nd St and 36th Ave: 0.98

* Collisions per million entering vehicles (MEV)

Intersection Collision Rate

Location	2006	2007	2008	Total	AADT ¹	Collisions per MEV
Within the Study Area						
166th Place and 36th Avenue			1	1		NC ²
170th Street and 36th Avenue			1	1		NC ²
172nd Street and 36th Avenue	3	3	6	12	11,180	0.98
175th Street and 36th Avenue	1			1		NC ²
177th Place and 36th Avenue	1	1		2		NC ²
179th Street and 36th Avenue	1		1	2	14,340	0.13
Outside of the Study Area						
180th Place and 36th Avenue	1			1		NC ²
184th Street and 36th Avenue	3	7	7	17	16840	0.92
188th Street and 36th Avenue	10	10	10	30	26720	1.03
191st Place and 36th Avenue			1	1		NC ²
192nd Place and 36th Avenue			1	1		NC ²
SR 524 and 36th Avenue	22	32	13	67	46100	1.33

¹ AADT - Estimated Annual Average Daily Traffic

² NC - Not calculated

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Conclusions (part 1) - Traffic Operations Perspective

- Lane Choice on 200th St has negligible effect on 36th Ave
- 5-lane option on 36th Ave:
 - 36th Ave Corridor volumes increase significantly
 - Queue lengths slightly shorter on most EB, WB, and NB approaches
 - Beneficial reductions widely dispersed elsewhere
 - Adverse impact on 36th Ave between Maple Rd and 196th St
 - Adverse impact on 196th St between 44th Ave and 36th Ave
 - Adverse impact on some intersections on SR 99
- 3-lane option on 36th Ave:
 - Widen N-S legs with 2 through lanes each way at the intersections of 164th St / 36th Ave and 179th St / 36th Ave
 - Single-lane roundabout is OK at 172nd St and 36th Ave
 - 2-lane roundabout gives added flexibility

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Conclusions (part 2) - Traffic Operations Perspective

- Signal vs. Roundabout Options:
 - At 172nd St & 36th Ave, and at 179th St & 36th Ave
 - Both are feasible from traffic operations perspective
 - Roundabout option appears to have shorter queues and better LOS
 - Limiting EB and WB to Right-Turn-Only at 172nd might be considered
- 5-lane vs. 3-lane Options:
 - LOS and queues at the major intersections can be managed with proposed configurations
 - If 3-lane option is selected, use larger intersection configurations of 5-lane option in case higher volumes occur
 - Case for modifying existing configuration at 164th St warrants further discussion with Snohomish County
 - Decision can be based on considerations other than traffic findings
- Safety Considerations:
 - Collision rate at 172nd St & 36th Ave is at threshold of concern
 - A traffic signal or roundabout should improve safety

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Questions?