# TH 169/CSAH 4 INTERCHANGE IMPROVEMENT PROJECT
# SHERBURNE COUNTY - CITY OF ZIMMERMAN

## LAYOUT HISTORY

PURPOSE AND NEED
TH 169/CSAH 4 THROUGH THE CITY OF ZIMMERMAN IS A PRINCIPAL ARTERIAL HIGHWAY THAT LINKS THE MINNEAPOLIS-ST. PAUL AREA WITH ITS NORTHWEST SUBURBS, ST. CLOUD, AND REGIONAL DESTINATIONS BEYOND, INCLUDING THE LAKES/RECREATION REGION IN NORTHWESTERN MINNESOTA. IT IS CLASSIFIED AS TIER 2 IN THE METROPOLITAN COUNCIL'S HIGHWAY TRUCK CORRIDOR STUDY (JUNE 2017) AND IS DESIGNATED AS PART OF THE NATIONAL TRUCK NETWORK AS A HIGH PRIORITY INTERREGIONAL CORRIDOR. THIS PORTION OF THE HIGHWAY IN THE PROJECT AREA IS NOW A FOUR-LANE EXPRESSWAY THAT INCLUDES ONE GRADE-SEPARATED INTERCHANGE, TWO SIGNALIZED INTERSECTIONS, THREE UNSIGNALIZED LOCAL STREET CONNECTIONS, AND SIX PRIVATE DRIVEWAYS. HWY 10/169 DIRECTLY EAST OF THE PROJECT AREA IS A LIMITED ACCESS FREEWAY THAT ABRUPTLY TRANSITIONS TO AN EXPRESSWAY AT THE SIGNALIZED FAIROAK AVE INTERSECTION. CORRIDOR AREA ISSUES THAT WILL BE ADDRESSED WITH THIS PROJECT INCLUDE MOBILITY BY EXTENDING THE FREEWAY SECTION, CLOSING THE CLOSELY SPACED ACCESS POINTS, AND INCREASING SAFETY WITH GRADE SEPARATIONS AND INTERSECTION IMPROVEMENTS.

OCTOBER 27, 2022 - LAYOUT NO. 1 WAS SUBMITTED TO GDSU AND MNDOT D3 FOR CONCEPTUAL APPROVAL AND INITIAL LAYOUT REVIEW.

LAYOUT No. 1 COPY No.____
TH 169 VICINITY OF ZIMMERMAN, SHERBURNE COUNTY, MN
FROM 900'N OF 253RD TO 2100'S OF 273RD ON TH 169
FROM MAIN ST NW TO FREEMONT DRIVE ON CSAH 4
Prepared OCTOBER 2022 Scale: Hor. 1 inch = 100 ft.
Vert. 1 inch = 20 ft.
By BOLTON & MENK, INC.

| | | |
|---|---|---|
| The alignment and grades shown on this map are tentative and subject to change without notice. | Staff Approval<br>Date: | The traffic volumes shown are estimated for year 2045<br>Prepared OCTOBER 2022 |

S.P. 7106-92 T.H. 169 A.J.____ PPMS Activity____
S.P.____ T.H.____ A.J.____ PPMS Activity____
S.A.P.____ T.H.____ A.J.____ PPMS Activity____
Copy To:____ For:____

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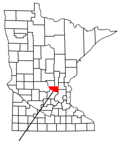
10/27/2022

## LAYOUT NOTES

- PEDESTRIAN ACCOMMODATIONS WILL MEET ADA/PROWAG REQUIREMENTS
- TH 10/169 IS AN APPROVED HOUSE MOVING ROUTE
- TH 10/169 IS AN OSOW / SUPER LOAD CORRIDOR
- THERE ARE NO EXISTING AND PROPOSED DESIGN EXCEPTIONS IN THE PROJECT AREA.



PROJECT LOCATION
SHERBURNE COUNTY,
CITY OF ZIMMERMAN,
LIVONIA TOWNSHIP

## Level 1 LAYOUT APPROVAL

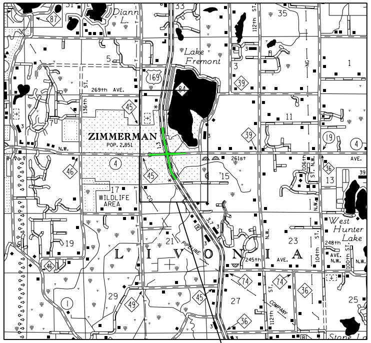
Programmed Letting Date JANUARY 2024
Reviewed By ____ 20__ Metro District Preliminary Design Engineer
Reviewed By ____ 20__ Metro District Maintenance Operations Engineer
Reviewed By ____ 20__ Metro District Traffic Engineer
Reviewed By ____ 20__ State Geometrics Engineer
Approved By ____ 20__ Metro District Engineer
Approved By ____ 20__ State Design Engineer

I HEREBY CERTIFY THAT THIS LAYOUT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MINNESOTA.

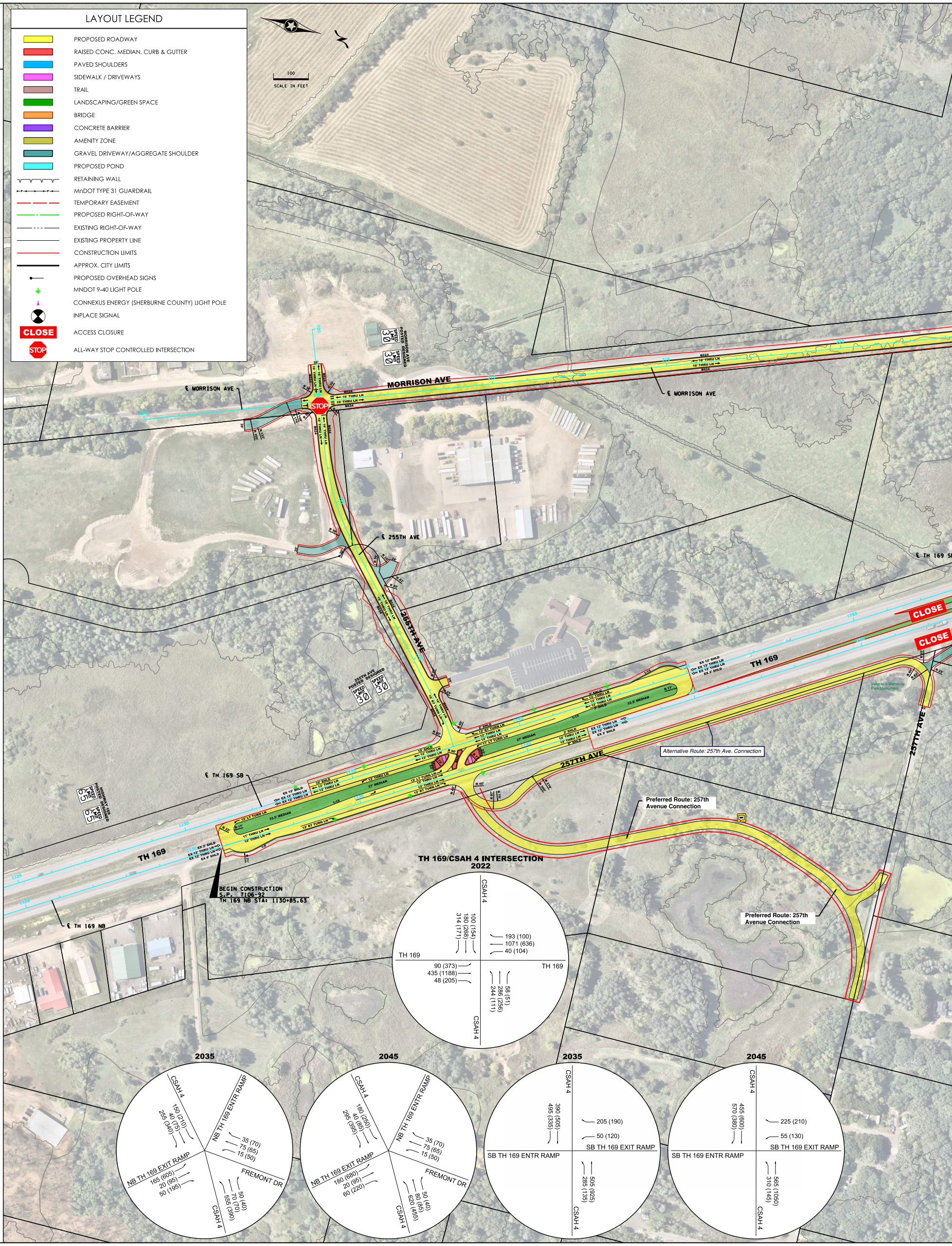
NAME: DEREK J. ARENS LIC. NO. 52673 DATE: XX-XX 20 22

NOTE:
WHEN FUNDING IS REQUIRED AND/OR PROJECT IS PROGRAMMED, THE LAYOUT MAY REQUIRE RE-APPROVAL FOR CHANGES TO POLICY OR DESIGN STANDARDS

STAFF APPROVAL IS GOOD FOR 3 YEARS, THEN SUBJECT TO REVIEW.


Lake Fremont
ZIMMERMAN
POP. 2,851
269th AVE.
261st
WILDLIFE AREA
L I V O N I A
West Hunter Lake
245th AVE.
169
45
4
39
19
Stone L.

PROJECT LOCATION



### LAYOUT LEGEND

| | |
|---|---|
| 🟨 | PROPOSED ROADWAY |
| 🟥 | RAISED CONC. MEDIAN, CURB & GUTTER |
| 🟦 | PAVED SHOULDERS |
| 🟪 | SIDEWALK / DRIVEWAYS |
| 🟫 | TRAIL |
| 🟩 | LANDSCAPING/GREEN SPACE |
| 🟧 | BRIDGE |
| 🟪 | CONCRETE BARRIER |
| 🟨 | AMENITY ZONE |
| 🟦 | GRAVEL DRIVEWAY/AGGREGATE SHOULDER |
| 🟦 | PROPOSED POND |
| | RETAINING WALL |
| | MnDOT TYPE 31 GUARDRAIL |
| | TEMPORARY EASEMENT |
| | PROPOSED RIGHT-OF-WAY |
| | EXISTING RIGHT-OF-WAY |
| | EXISTING PROPERTY LINE |
| | CONSTRUCTION LIMITS |
| | APPROX. CITY LIMITS |
| | PROPOSED OVERHEAD SIGNS |
| | MNDOT 9-40 LIGHT POLE |
| | CONNEXUS ENERGY (SHERBURNE COUNTY) LIGHT POLE |
| | INPLACE SIGNAL |
| CLOSE | ACCESS CLOSURE |
| STOP | ALL-WAY STOP CONTROLLED INTERSECTION |

100
SCALE IN FEET
MORRISON AVE
℄ MORRISON AVE
STOP
℄ 255TH AVE
255TH AVE
255TH AVE POSTED DESIGNED
SPEED LIMIT 30
CLOSE
TH 169
℄ TH 169 SB
℄ TH 169 NB
257TH AVE
257TH AVE
Alternative Route: 257th Ave. Connection
Preferred Route: 257th Avenue Connection
33.5' MEDIAN
27' MEDIAN
12' THRU LN
12' LT TURN LN
12' RT TURN LN
EX 12' THRU LN
EX 12' SHLD
EX 2' SHLD
BEGIN CONSTRUCTION
S.P. 7106-92
TH 169 NB STA: 1130+85.63
TH 169/CSAH 4 INTERSECTION
2022
CSAH 4
TH 169
100 (154)
180 (268)
314 (171)
193 (100)
1071 (636)
40 (104)
90 (373)
435 (1188)
48 (205)
58 (51)
286 (256)
244 (111)
2035
CSAH 4
NB TH 169 ENTR RAMP
NB TH 169 EXIT RAMP
FREMONT DR
150 (210)
40 (75)
255 (340)
35 (70)
75 (65)
15 (50)
165 (605)
20 (95)
50 (195)
50 (40)
70 (70)
555 (390)
2045
CSAH 4
NB TH 169 ENTR RAMP
NB TH 169 EXIT RAMP
FREMONT DR
180 (250)
40 (85)
295 (395)
35 (70)
75 (65)
15 (50)
180 (680)
20 (95)
60 (220)
50 (40)
80 (85)
620 (455)
2035
CSAH 4
SB TH 169 ENTR RAMP
SB TH 169 EXIT RAMP
390 (505)
495 (335)
205 (190)
50 (120)
505 (925)
285 (135)
2045
CSAH 4
SB TH 169 ENTR RAMP
SB TH 169 EXIT RAMP
455 (600)
570 (380)
225 (210)
55 (130)
565 (1050)
310 (145)

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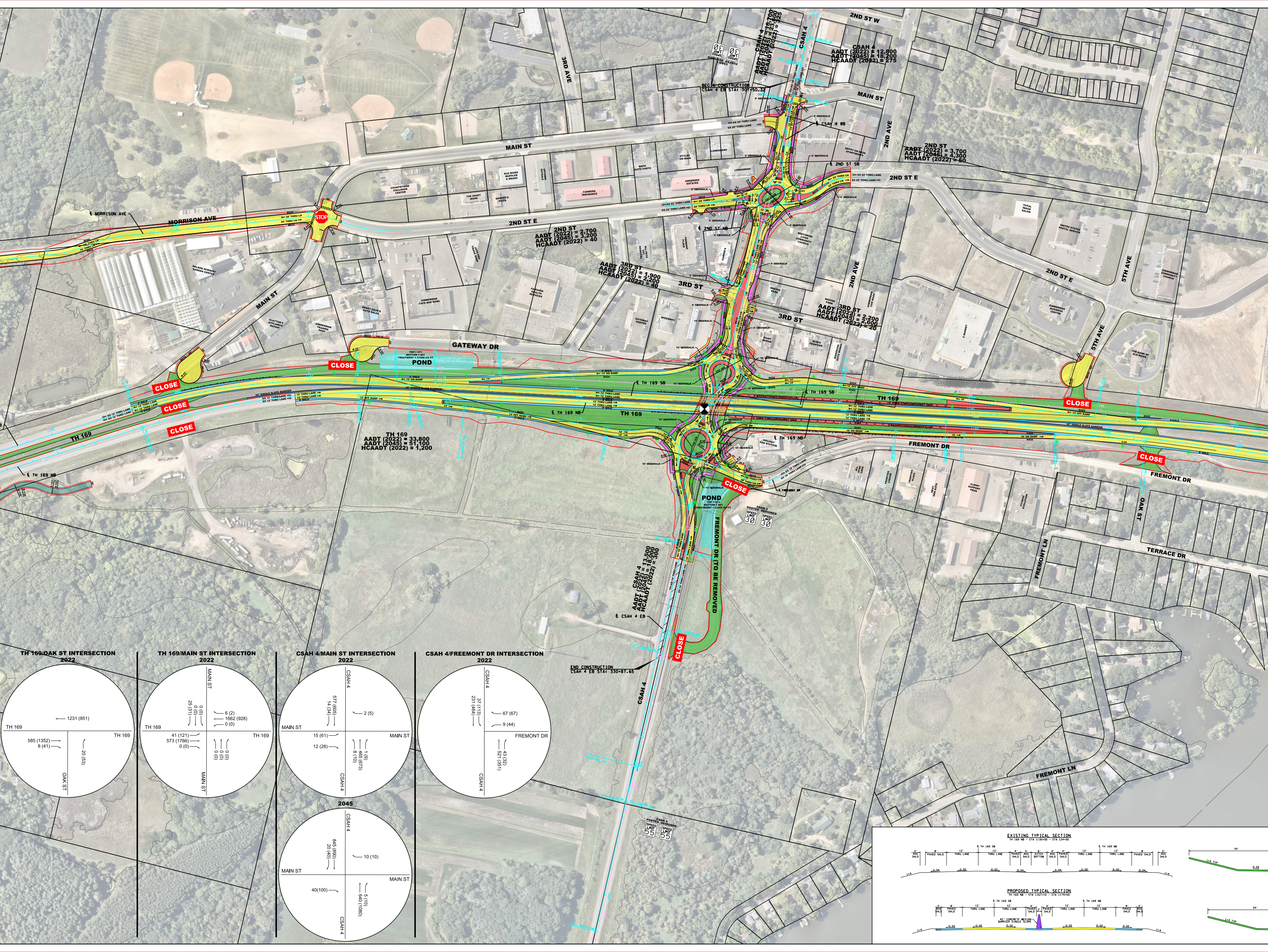
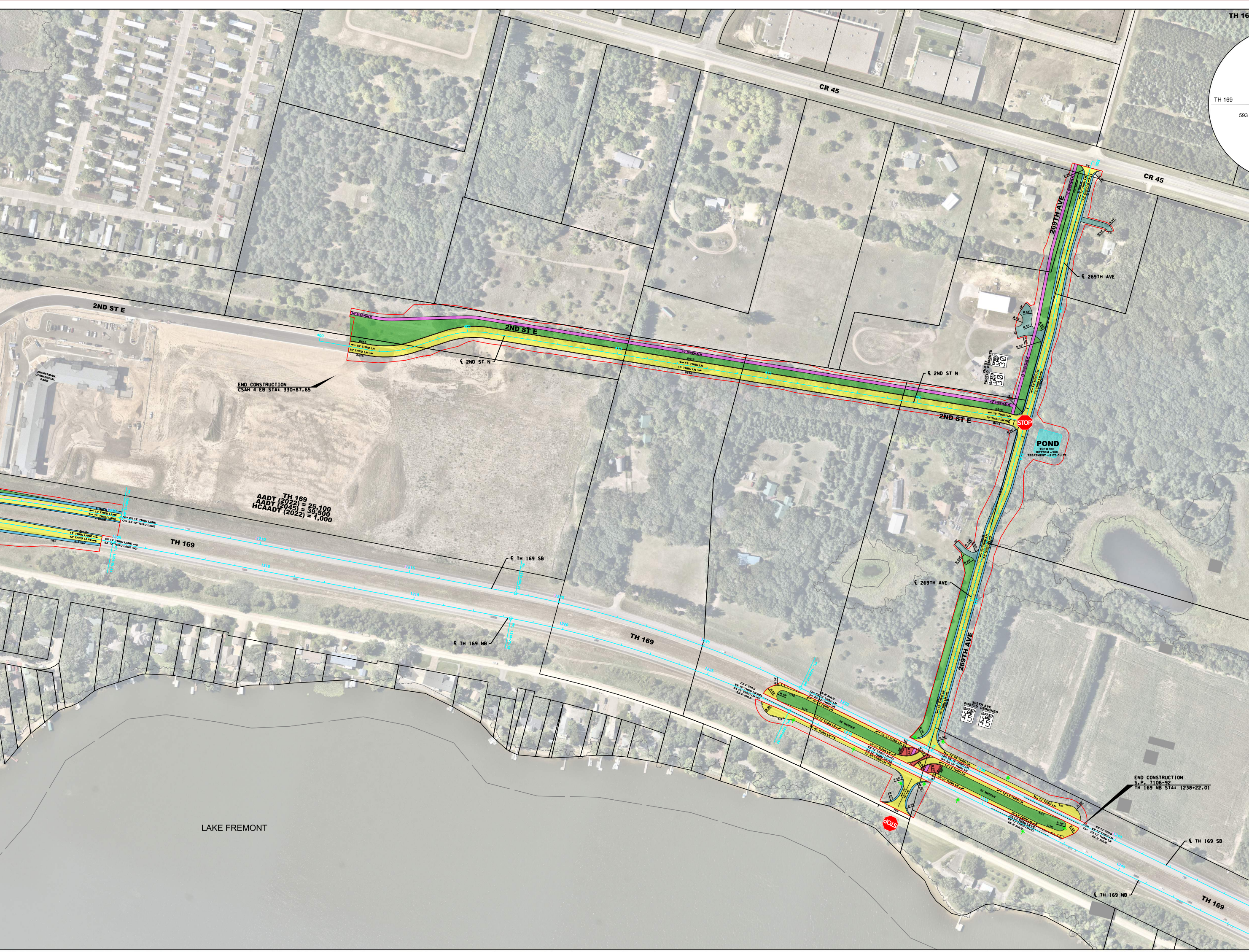
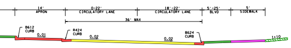

CSAH 4
AADT (2022) = 16,700
AADT (2045) = 23,600
HCAADT (2022) = 325
CSAH 4
AADT (2022) = 12,800
AADT (2045) = 18,200
HCAADT (2022) = 275
CSAH 4 POSTED DESIGNED
SPEED LIMIT 30
SPEED LIMIT 30
BEGIN CONSTRUCTION
CSAH 4 EB STA: 307+50.32
2ND ST W
MAIN ST
3RD AVE
2ND AVE
℄ CSAH 4 WB
2ND ST
AADT (2022) = 3,700
AADT (2045) = 4,300
HCAADT (2022) = 50
℄ 2ND ST SB
2ND ST E
℄ 2ND ST NB
MORRISON AVE
℄ MORRISON AVE
STOP
2ND ST
AADT (2022) = 2,700
AADT (2045) = 3,200
HCAADT (2022) = 40
3RD ST
AADT (2022) = 1,900
AADT (2045) = 2,200
HCAADT (2022) = 40
3RD ST
AADT (2022) = 2,200
AADT (2045) = 2,600
HCAADT (2022) = 20
3RD ST
5TH AVE
GATEWAY DR
POND
TOP = 971
BOTTOM = 967
TREATMENT = 27500 CU FT
CLOSE
CLOSE
CLOSE
CLOSE
CLOSE
CLOSE
CLOSE
TH 169
℄ TH 169 SB
℄ TH 169 NB
TH 169
AADT (2022) = 33,800
AADT (2045) = 51,100
HCAADT (2022) = 1,200
FREMONT DR
℄ FREMONT DR
POND
TOP = 973
BOTTOM = 967
TREATMENT = 23250 CU FT
FREMONT DR (TO BE REMOVED)
CSAH 4
AADT (2022) = 13,500
AADT (2045) = 18,000
HCAADT (2022) = 300
℄ CSAH 4 EB
END CONSTRUCTION
CSAH 4 EB STA: 330+87.65
CSAH 4
CSAH 4 POSTED DESIGNED
SPEED LIMIT 55
SPEED LIMIT 55
OAK ST
TERRACE DR
FREMONT LN
FREMONT LN
TH 169/OAK ST INTERSECTION
2022
TH 169
TH 169
OAK ST
1231 (851)
585 (1352)
8 (41)
20 (53)
TH 169/MAIN ST INTERSECTION
2022
MAIN ST
TH 169
TH 169
MAIN ST
25 (31)
0 (0)
0 (0)
6 (2)
1662 (928)
0 (0)
41 (121)
573 (1766)
0 (0)
0 (0)
0 (0)
0 (0)
CSAH 4/MAIN ST INTERSECTION
2022
CSAH 4
MAIN ST
MAIN ST
CSAH 4
577 (605)
14 (34)
2 (5)
15 (61)
12 (28)
1 (9)
465 (673)
8 (10)
2045
CSAH 4
MAIN ST
MAIN ST
CSAH 4
845 (890)
20 (40)
10 (10)
40(100)
5 (10)
640 (1080)
CSAH 4/FREMONT DR INTERSECTION
2022
CSAH 4
FREMONT DR
CSAH 4
37 (113)
231 (464)
67 (67)
9 (44)
43 (32)
521 (351)
EXISTING TYPICAL SECTION
TH 169 NB - STA 1130+00 - STA 124+00
℄ TH 169 SB
℄ TH 169 NB
2' AGG SHLD
8' PAVED SHLD
12' THRU LANE
12' THRU LANE
4' PAVED SHLD
4' AGG SHLD
6' DITCH BOTTOM
4' AGG SHLD
4' PAVED SHLD
12' THRU LANE
12' THRU LANE
8' PAVED SHLD
2' AGG SHLD
1:4
0.04
0.02
0.02
0.04
0.04
0.02
0.02
0.04
1:4
PROPOSED TYPICAL SECTION
TH 169 NB - STA 1167+10 - STA 1179+50
℄ TH 169 SB
℄ TH 169 NB
2' AGG SHLD
8' PAVED SHLD
12' THRU LANE
12' THRU LANE
4' PAVED SHLD
2'
4' PAVED SHLD
12' THRU LANE
12' THRU LANE
8' PAVED SHLD
2' AGG SHLD
42" CONCRETE MEDIAN BARRIER SINGLE SLOPE
1:4
0.02
0.02
0.02
0.02
0.02
0.02
1:4
34'
1:4 TYP
0.04
34'
1:4 TYP


TH 16
TH 169
593
CR 45
CR 45
269TH AVE
℄ 269TH AVE
2ND ST E
2ND ST E
10' SIDEWALK
B618
19' THRU LN
℄ 2ND ST N
℄ 2ND ST N
ZIMMERMAN COMMERCIAL PARK
END CONSTRUCTION
CSAH 4 EB STA: 330+87.65
2ND ST POSTED SPEED LIMIT 30
DESIGNED SPEED LIMIT 30
STOP
POND
TOP = 986
BOTTOM = 980
TREATMENT = 9175 CU FT
TH 169
AADT (2022) = 25,100
AADT (2045) = 39,500
HCAADT (2022) = 1,000
TH 169
℄ TH 169 SB
℄ TH 169 NB
TH 169
12' THRU LANE
EX 12' THRU LANE
℄ 269TH AVE
12' THRU LN
269TH AVE POSTED SPEED LIMIT 45
DESIGNED SPEED LIMIT 45
EX 2' SHLD
EX 12' THRU LN
EX 8' SHLD
12' LT TURN LN
12' RT TURN LN
32' MEDIAN
R 50'
124'
STOP
END CONSTRUCTION
S.P. 7106-92
TH 169 NB STA: 1238+22.01
℄ TH 169 SB
℄ TH 169 NB
TH 169
LAKE FREMONT

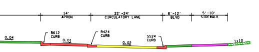
## TYPICAL SECTIONS

**NOT TO SCALE**
**ALL SLOPES IN FT/FT**

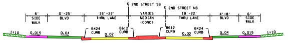
PROPOSED ROUNDABOUT TYPICAL SECTION
CSAH 4/2ND ST


14' APRON
0-22' CIRCULATORY LANE
18'-22' CIRCULATORY LANE
5'-25' BLVD
5' SIDEWALK
36' MAX
B612 CURB
R424 CURB
B624 CURB
0.01
0.02
0.02
1:10

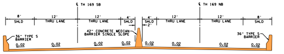
PROPOSED ROUNDABOUT TYPICAL SECTION
NB TH 169 RAMPS/CSAH 4/FREEMONT DR & SB TH 169 RAMPS/CSAH 4 ROUNDABOUTS


14' APRON
22'-24' CIRCULATORY LANE
8'-12' BLVD
5'-10' SIDEWALK
B612 CURB
R424 CURB
S524 CURB
0.04
0.01
0.02
1:10

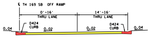
PROPOSED TYPICAL SECTION
2ND STREET - STA 12+60 - STA 16+50


℄ 2ND STREET SB
℄ 2ND STREET NB
6' SIDE WALK
0'-25' BLVD
18'-22' THRU LANE
VARIES MEDIAN (CONC)
18'-22' THRU LANE
4'-8' BLVD
6' SIDE WALK
B424 CURB
B612 CURB
B612 CURB
B424 CURB
1:10
0.015
0.04
0.02
0.02
0.04
0.015
1:10

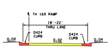
PROPOSED TYPICAL SECTION
T.H. 169 - STA 1179+50 - STA 1180+75
BRIDGE


℄ TH 169 SB
℄ TH 169 NB
8' SHLD
12' THRU LANE
12' THRU LANE
4' SHLD
4' SHLD
12' THRU LANE
12' THRU LANE
8' SHLD
2'
36" TYPE S BARRIER
42" CONCRETE MEDIAN BARRIER SINGLE SLOPE
36" TYPE S BARRIER
0.02

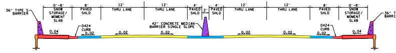
PROPOSED TYPICAL SECTION
TH 169 SB TO CSAH 4 RAMP - STA 1180+20 - STA 1184+80


℄ TH 169 SB OFF RAMP
0'-16' THRU LANE
14'-16' THRU LANE
D424 CURB
D424 CURB
0.04
0.02
0.02
0.04

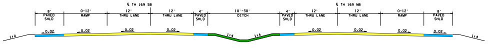
PROPOSED TYPICAL SECTION
TH 169 SB TO CSAH 4 RAMP - STA 1184+80 - STA 1191+55
CSAH 4 TO TH 169 NB RAMP - STA 1180+00 - STA 1193+05

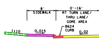

℄ TH 169 RAMP
18'-22' THRU LANE
D424 CURB
D424 CURB
0.04
0.02
0.04

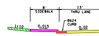
PROPOSED TYPICAL SECTION
TH 169 NB - STA 1180+75 - STA 1191+30

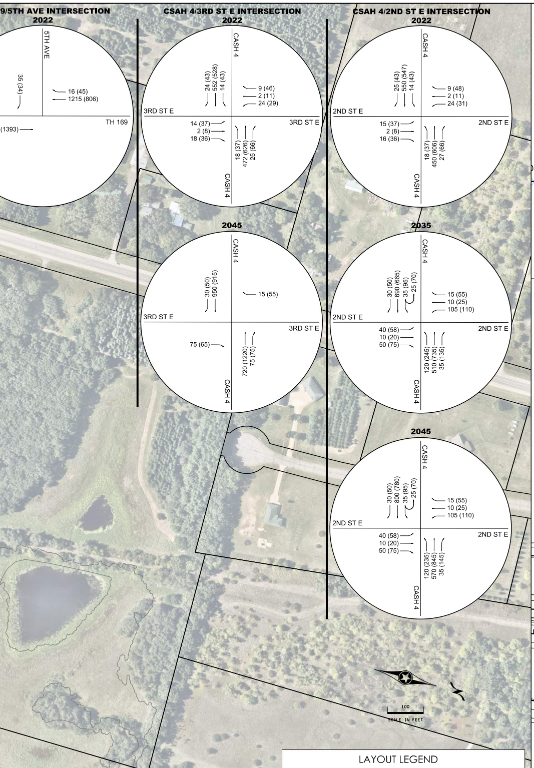

℄ TH 169 SB
℄ TH 169 NB
36" TYPE S BARRIER
0'-8' SNOW STORAGE/ MOMENT SLAB
8' PAVED SHLD
12' THRU LANE
12' THRU LANE
4' PAVED SHLD
2'
4' PAVED SHLD
12' THRU LANE
12' THRU LANE
8' PAVED SHLD
0'-8' SNOW STORAGE/ MOMENT SLAB
36" TYPE S BARRIER
D424 CURB
42" CONCRETE MEDIAN BARRIER SINGLE SLOPE
D424 CURB
0.04
0.02

PROPOSED TYPICAL SECTION
TH 169 NB - STA 1186+20 - STA 1205+33
TH 169 NB - STA 1158+17 - STA 1162+35


℄ TH 169 SB
℄ TH 169 NB
8' PAVED SHLD
0-12' RAMP
12' THRU LANE
12' THRU LANE
4' PAVED SHLD
10'-30' DITCH
4' PAVED SHLD
12' THRU LANE
12' THRU LANE
0-12' RAMP
8' PAVED SHLD
1:4
0.02


8' SIDEWALK
0'-16' RT TURN LANE/ THRU LANE/ GORE AREA
B624 CURB
1:10
0.015
0.02

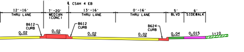

8' SIDEWALK
13' THRU LANE
B624 CURB
1:10
0.015
0.02


9/5TH AVE INTERSECTION
2022
5TH AVE
35 (34)
16 (45)
1215 (806)
TH 169
(1393)
CSAH 4/3RD ST E INTERSECTION
2022
CASH 4
24 (43)
552 (528)
14 (43)
9 (46)
2 (11)
24 (29)
3RD ST E
14 (37)
2 (8)
18 (36)
18 (37)
472 (626)
25 (66)
3RD ST E
CASH 4
CSAH 4/2ND ST E INTERSECTION
2022
CASH 4
25 (43)
550 (547)
14 (43)
9 (48)
2 (11)
24 (31)
2ND ST E
15 (37)
2 (8)
16 (36)
18 (37)
450 (606)
27 (66)
2ND ST E
CASH 4
2045
CASH 4
30 (50)
950 (915)
15 (55)
3RD ST E
75 (65)
720 (1220)
75 (75)
3RD ST E
CASH 4
2035
CASH 4
30 (50)
690 (665)
35 (95)
25 (70)
15 (55)
10 (25)
105 (110)
2ND ST E
40 (58)
10 (20)
50 (75)
120 (245)
510 (735)
35 (135)
2ND ST E
CASH 4
2045
CASH 4
30 (50)
800 (780)
35 (95)
25 (70)
15 (55)
10 (25)
105 (110)
2ND ST E
40 (58)
10 (20)
50 (75)
120 (235)
570 (845)
35 (145)
2ND ST E
CASH 4
100
SCALE IN FEET

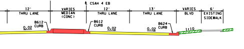
## LAYOUT LEGEND

| | |
|---|---|
| 🟨 | PROPOSED ROADWAY |
| 🟥 | RAISED CONC. MEDIAN, CURB & GUTTER |
| 🟦 | PAVED SHOULDERS |
| 🟪 | SIDEWALK / DRIVEWAYS |
| 🟫 | TRAIL |
| 🟩 | LANDSCAPING/GREEN SPACE |
| 🟧 | BRIDGE |
| 🟪 | CONCRETE BARRIER |
| 🟨 | AMENITY ZONE |
| 🟦 | GRAVEL DRIVEWAY/AGGREGATE SHOULDER |
| 🟦 | PROPOSED POND |
| ⌄⌄⌄ | RETAINING WALL |
| •-P-•-•-P-• | MnDOT TYPE 31 GUARDRAIL |
| — — — | TEMPORARY EASEMENT |
| —·— | PROPOSED RIGHT-OF-WAY |
| — - - - — | EXISTING RIGHT-OF-WAY |
| —— | EXISTING PROPERTY LINE |
| —— | CONSTRUCTION LIMITS |
| ━━ | APPROX. CITY LIMITS |
| •— | PROPOSED OVERHEAD SIGNS |
| ✳ | MNDOT 9-40 LIGHT POLE |
| ⍿ | CONNEXUS ENERGY (SHERBURNE COUNTY) LIGHT POLE |
| ⊗ | INPLACE SIGNAL |
| CLOSE | ACCESS CLOSURE |
| STOP | ALL-WAY STOP CONTROLLED INTERSECTION |

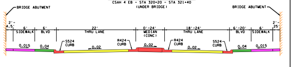
**PROPOSED TYPICAL SECTION**
CSAH 4 EB - STA 308+17 - STA 313+90


℄ CSAH 4 WB
℄ CSAH 4 EB
12'-16' THRU LANE
7'-20' MEDIAN (CONC)
13'-16' THRU LANE
0'-16' THRU LANE
5' BLVD
6' SIDEWALK
B612 CURB
B612 CURB
B624 CURB
0.02
0.02
0.02
0.02
0.04
0.015
1:10

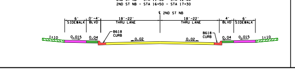
**PROPOSED TYPICAL SECTION**
CSAH 4 EB - STA 313+90 - STA 315+95

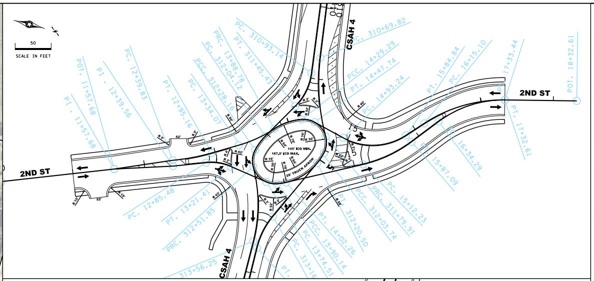

℄ CSAH 4 WB
℄ CSAH 4 EB
12' THRU LANE
VARIES MEDIAN (CONC)
12' THRU LANE
13' THRU LANE
VARIES BLVD
6' EXISTING SIDEWALK
B612 CURB
B612 CURB
B624 CURB
0.02
0.02
0.02
1:10

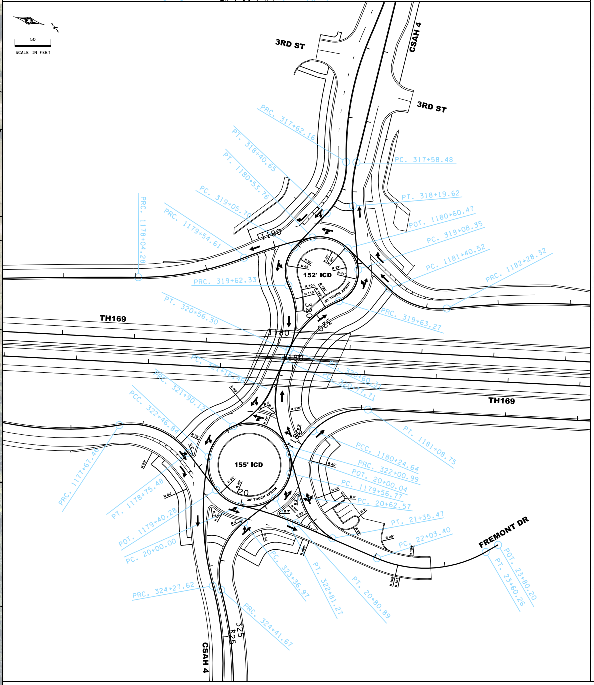
**PROPOSED TYPICAL SECTION**
CSAH 4 EB - STA 320+20 - STA 321+40
(UNDER BRIDGE)


BRIDGE ABUTMENT
BRIDGE ABUTMENT
2'-4.5'
6' SIDEWALK
6' BLVD
22' THRU LANE
0'-24' MEDIAN (CONC)
18'-24' THRU LANE
6'-20' BLVD
6' SIDEWALK
2'-25'
S524 CURB
R424 CURB
R424 CURB
S524 CURB
0.015
0.04
0.02
0.02
0.02
0.04
0.015
1:10

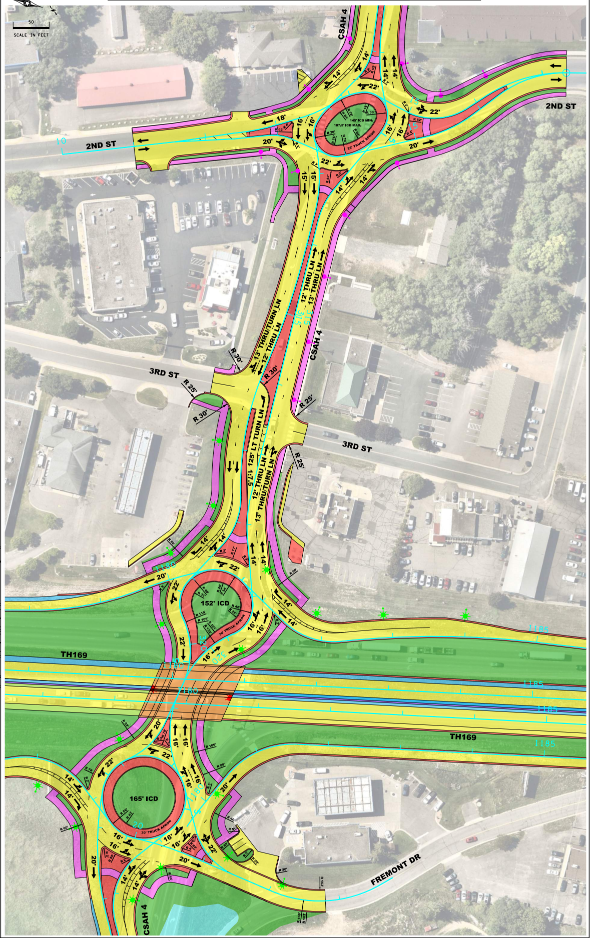
**PROPOSED TYPICAL SECTION**
2ND ST NB - STA 11+00 - STA 12+60
2ND ST NB - STA 16+50 - STA 17+30


℄ 2ND ST NB
6' SIDEWALK
0'-4' BLVD
18'-22' THRU LANE
18'-22' THRU LANE
4' BLVD
6' SIDEWALK
B618 CURB
B618 CURB
1:10
0.015
0.04
0.02
0.02
0.04
0.015
1:10


50
SCALE IN FEET
2ND ST
2ND ST
CSAH 4
CSAH 4
145' ICD MIN.
30' TRUCK APRON


50
SCALE IN FEET
3RD ST
3RD ST
CSAH 4
CSAH 4
TH169
TH169
152' ICD
30' TRUCK APRON
155' ICD
30' TRUCK APRON
FREMONT DR

## FUTURE MULTI-LANE ROUNDABOUT INSET


50
SCALE IN FEET
CSAH 4
2ND ST
2ND ST
3RD ST
3RD ST
CSAH 4
12' THRU LN
13' THRU LN
12' THRU/TURN LN
12' THRU LN
12.5' LT TURN LN
12' THRU/TURN LN
13' THRU LN
152' ICD
30' TRUCK APRON
TH169
TH169
165' ICD
30' TRUCK APRON
FREMONT DR
CSAH 4

## ALIGNMENT CURVE DATA

| CURVE | TH169.NB1 | TH169.NB2 | TH169.NB3 | TH169.SB1 | TH169.SB2 | TH169.SB3 |
|---|---|---|---|---|---|---|
| PI | 1163+52.65 | 1196+91.55 | 1223+13.07 | 1162+48.47 | 1200+81.50 | 1223+54.84 |
| X | 577,204.597 | 576,502.607 | 576,308.245 | 577,197.292 | 576,392.144 | 576,223.653 |
| Y | 268,407.530 | 271,683.048 | 274,299.873 | 268,279.368 | 272,036.228 | 274,304.730 |
| Δ | 20° 23' 29.05" (RT) | 7° 50' 54.66" (RT) | 15° 04' 04.38" (RT) | 20° 23' 29.05" (RT) | 7° 50' 54.66" (RT) | 15° 04' 04.38" (RT) |
| D | 1° 58' 57.19" | 0° 29' 22.95" | 1° 33' 15.90" | 2° 23' 14.37" | 0° 52' 05.22" | 1° 31' 11.22" |
| T | 519.77' | 802.60' | 487.49' | 431.64' | 452.75' | 498.60' |
| L | 1,028.54' | 1,602.70' | 969.36' | 854.15' | 904.08' | 991.45' |
| R | 2,890.00' | 11,700.00' | 3,686.00' | 2,400.00' | 6,600.00' | 3,770.00' |
| PC | 1158+32.88 | 1188+88.95 | 1218+25.58 | 1158+16.83 | 1196+28.75 | 1218+56.24 |
| PT | 1168+61.42 | 1204+91.64 | 1227+94.94 | 1166+70.98 | 1205+32.84 | 1228+47.69 |

| CURVE | RAMP.NB.ENT1 | RAMP.NB.ENT2 | RAMP.NB.ENT3 | RAMP.NB.ENT4 | RAMP.NB.EXT1 | RAMP.NB.EXT2 | RAMP.NB.EXT4 |
|---|---|---|---|---|---|---|---|
| PI | 1179+91.67 | 1180+69.36 | 1188+30.94 | 1194+75.73 | 1167+63.32 | 1173+39.13 | 1178+27.42 |
| X | 576,960.091 | 576,890.903 | 576,729.558 | 576,572.932 | 577,134.094 | 577,051.139 | 576,967.607 |
| Y | 270,061.484 | 270,100.893 | 270,850.644 | 271,476.142 | 268,824.646 | 269,394.527 | 269,871.458 |
| Δ | 32° 57' 19.94" (RT) | 48° 11' 22.87" (RT) | 1° 54' 47.31" (LT) | 5° 40' 39.13" (RT) | 3° 52' 40.07" (RT) | 3° 53' 50.83" (RT) | 61° 53' 20.25" (RT) |
| D | 48° 33' 20.68" | 57° 17' 44.81" | 0° 44' 40.85" | 1° 38' 55.68" | 1° 59' 31.93" | 0° 42' 58.95" | 57° 17' 44.81" |
| T | 34.90' | 44.72' | 128.47' | 172.31' | 97.36' | 272.13' | 59.95' |
| L | 67.87' | 84.11' | 256.91' | 344.34' | 194.65' | 544.05' | 108.02' |
| R | 118.00' | 100.00' | 7,694.00' | 3,475.00' | 2,876.00' | 7,998.00' | 100.00' |
| PC | 1179+56.77 | 1180+24.64 | 1187+02.48 | 1193+03.41 | 1166+65.96 | 1170+67.00 | 1177+67.46 |
| PT | 1180+24.64 | 1181+08.75 | 1189+59.38 | 1196+47.76 | 1168+60.61 | 1176+11.05 | 1178+75.48 |

| CURVE | RAMP.NB.EXT3 | RAMP.SB.ENT1 | RAMP.SB.ENT2 | RAMP.SB.ENT3 | RAMP.SB.ENT4 |
|---|---|---|---|---|---|
| PI | 1176+90.04 | 1171+00.48 | 1175+15.50 | 1178+80.34 | 1180+04.30 |
| X | 577,024.296 | 576,996.130 | 576,860.694 | 576,767.551 | 576,693.080 |
| Y | 269,744.612 | 269,116.797 | 269,509.266 | 269,862.294 | 269,963.624 |
| Δ | 19° 41' 43.81" (LT) | 5° 00' 18.43" (LT) | 4° 15' 31.24" (RT) | 21° 31' 59.60" (LT) | 9° 28' 06.67" (RT) |
| D | 12° 35' 32.92" | 1° 59' 07.08" | 0° 44' 13.26" | 14° 19' 26.20" | 9° 32' 57.47" |
| T | 78.98' | 126.13' | 289.05' | 76.06' | 49.69' |
| L | 156.41' | 252.11' | 577.83' | 150.33' | 99.15' |
| R | 455.00' | 2,886.00' | 7,774.00' | 400.00' | 600.00' |
| PC | 1176+11.05 | 1169+74.34 | 1172+26.45 | 1178+04.28 | 1179+54.61 |
| PT | 1177+67.46 | 1172+26.45 | 1178+04.28 | 1179+54.61 | 1180+53.76 |

| CURVE | RAMP.SB.EXT1 | RAMP.SB.EXT2 | CSAH4.EB1 | CSAH4.EB2 | CSAH4.EB3 | CSAH4.EB4 |
|---|---|---|---|---|---|---|
| PI | 1181+87.47 | 1183+66.43 | 306+59.55 | 309+15.51 | 311+20.25 | 312+16.24 |
| X | 576,734.360 | 576,667.654 | 575,475.328 | 575,731.277 | 575,934.401 | 576,019.347 |
| Y | 270,169.947 | 270,342.578 | 270,014.491 | 270,017.179 | 270,044.338 | 269,995.619 |
| Δ | 50° 18' 19.29" (LT) | 12° 50' 40.87" (RT) | 0° 54' 20.20" (RT) | 7° 00' 50.51" (LT) | 37° 27' 04.67" (RT) | 17° 13' 06.97" (LT) |
| D | 57° 17' 44.81" | 4° 40' 10.50" | 1° 25' 56.62" | 4° 46' 14.42" | 71° 37' 11.01" | 71° 37' 11.01" |
| T | 46.96' | 138.11' | 31.61' | 73.60' | 27.12' | 12.11' |
| L | 87.80' | 275.07' | 63.22' | 147.02' | 52.29' | 24.04' |
| R | 100.00' | 1,227.00' | 4,000.00' | 1,201.00' | 80.00' | 80.00' |
| PC | 1181+40.52 | 1182+28.32 | 306+27.93 | 308+41.90 | 310+93.14 | 312+04.12 |
| PT | 1182+28.32 | 1185+03.39 | 306+91.16 | 309+88.93 | 311+45.43 | 312+28.16 |

| CURVE | CSAH4.EB5 | CSAH4.EB6 | CSAH4.EB7 | CSAH4.EB8 | CSAH4.EB9 | CSAH4.EB10 |
|---|---|---|---|---|---|---|
| PI | 312+40.58 | 313+05.21 | 314+98.92 | 316+73.38 | 318+03.55 | 319+37.93 |
| X | 576,043.284 | 576,100.358 | 576,296.379 | 576,469.298 | 576,596.772 | 576,718.976 |
| Y | 269,990.261 | 270,022.945 | 270,025.071 | 269,999.461 | 270,037.855 | 269,972.316 |
| Δ | 42° 24' 54.30" (LT) | 29° 10' 36.08" (RT) | 9° 02' 46.06" (RT) | 25° 11' 12.45" (LT) | 44° 58' 01.75" (RT) | 68° 18' 57.79" (LT) |
| D | 179° 02' 57.52" | 27° 56' 56.98" | 5° 27' 24.27" | 13° 57' 07.88" | 57° 17' 44.81" | 120° 37' 21.70" |
| T | 12.42' | 53.35' | 83.06' | 91.74' | 41.39' | 32.23' |
| L | 23.69' | 104.39' | 165.78' | 180.52' | 78.48' | 56.64' |
| R | 32.00' | 205.00' | 1,050.00' | 410.66' | 100.00' | 47.50' |
| PC | 312+28.16 | 312+51.85 | 314+15.86 | 315+81.64 | 317+62.16 | 319+05.70 |
| PT | 312+51.85 | 313+56.25 | 315+81.64 | 317+62.16 | 318+40.65 | 319+62.33 |

| CURVE | CSAH4.EB11 | CSAH4.EB12 | CSAH4.EB13 | CSAH4.EB14 | CSAH4.EB15 |
|---|---|---|---|---|---|
| PI | 320+12.52 | 321+55.05 | 322+20.98 | 323+38.79 | 325+33.69 |
| X | 576,782.010 | 576,928.805 | 576,971.616 | 577,094.108 | 577,265.856 |
| Y | 270,025.417 | 270,000.221 | 269,945.532 | 269,954.278 | 270,052.837 |
| Δ | 49° 51' 00.84" (RT) | 42° 12' 24.80" (RT) | 56° 01' 47.76" (LT) | 25° 45' 58.13" (LT) | 27° 50' 20.11" (RT) |
| D | 53° 03' 05.93" | 57° 17' 44.81" | 98° 47' 08.98" | 14° 15' 09.65" | 13° 23' 12.71" |
| T | 50.19' | 38.59' | 30.86' | 91.95' | 106.07' |
| L | 93.97' | 73.66' | 56.72' | 180.78' | 207.96' |
| R | 108.00' | 100.00' | 58.00' | 402.00' | 428.00' |
| PC | 319+62.33 | 321+16.46 | 321+90.12 | 322+46.84 | 324+27.62 |
| PT | 320+56.30 | 321+90.12 | 322+46.84 | 324+27.62 | 326+35.58 |

| CURVE | CSAH4.WB1 | CSAH4.WB2 | CSAH4.WB3 | CSAH4.WB4 | CSAH4.WB5 | CSAH4.WB6 | CSAH4.WB7 |
|---|---|---|---|---|---|---|---|
| PI | 308+94.47 | 311+25.56 | 311+92.40 | 312+12.15 | 313+41.87 | 317+89.32 | 319+40.15 |
| X | 575,710.027 | 575,939.126 | 575,998.193 | 576,018.595 | 576,136.579 | 576,584.775 | 576,727.172 |
| Y | 270,022.956 | 270,054.801 | 270,088.966 | 270,084.399 | 270,030.332 | 270,040.461 | 270,091.812 |
| Δ | 7° 18' 42.02" (LT) | 22° 07' 56.35" (LT) | 42° 39' 45.56" (RT) | 12° 00' 11.24" (RT) | 25° 54' 53.32" (LT) | 18° 32' 07.25" (LT) | 72° 20' 16.91" (RT) |
| D | 4° 46' 28.73" | 20° 06' 13.62" | 179° 02' 57.52" | 71° 37' 11.01" | 52° 33' 53.77" | 30° 18' 54.82" | 131° 42' 51.97" |
| T | 76.67' | 55.74' | 12.50' | 8.41' | 25.08' | 30.84' | 31.80' |
| L | 153.14' | 110.09' | 23.83' | 16.76' | 49.30' | 61.14' | 54.92' |
| R | 1,200.00' | 285.00' | 32.00' | 80.00' | 109.00' | 189.00' | 43.50' |
| PC | 308+17.79 | 310+69.82 | 311+79.91 | 312+03.74 | 313+16.79 | 317+58.48 | 319+08.35 |
| PT | 309+70.93 | 311+79.91 | 312+03.74 | 312+20.50 | 313+66.09 | 318+19.62 | 319+63.27 |

| CURVE | CSAH4.WB8 | CSAH4.WB9 | CSAH4.WB10 | CSAH4.WB11 | CSAH4.WB12 | CSAH4.WB13 |
|---|---|---|---|---|---|---|
| PI | 320+14.18 | 321+44.03 | 322+49.06 | 323+96.15 | 325+66.42 | 332+49.73 |
| X | 576,777.511 | 576,910.192 | 576,994.412 | 577,125.028 | 577,284.419 | 577,972.331 |
| Y | 270,026.189 | 270,003.416 | 270,080.814 | 269,983.388 | 270,075.182 | 270,098.230 |
| Δ | 42° 46' 07.40" (LT) | 52° 19' 19.79" (LT) | 79° 18' 06.47" (RT) | 66° 39' 23.68" (LT) | 28° 01' 07.39" (RT) | 1° 12' 48.60" (RT) |
| D | 44° 04' 25.24" | 42° 26' 28.75" | 98° 47' 08.98" | 63° 39' 43.12" | 11° 27' 32.96" | 0° 13' 51.38" |
| T | 50.91' | 66.31' | 48.07' | 59.18' | 124.75' | 262.74' |
| L | 97.04' | 123.28' | 80.28' | 104.70' | 244.51' | 525.46' |
| R | 130.00' | 135.00' | 58.00' | 90.00' | 500.00' | 24,810.00' |
| PC | 319+63.27 | 320+77.71 | 322+00.99 | 323+36.97 | 324+41.67 | 329+86.99 |
| PT | 320+60.31 | 322+00.99 | 322+81.27 | 324+41.67 | 326+86.18 | 335+12.45 |

| CURVE | 2ND.ST.NB1 | 2ND.ST.NB2 | 2ND.ST.NB3 | 2ND.ST.NB4 | 2ND.ST.NB5 | 2ND.ST.SB1 |
|---|---|---|---|---|---|---|
| PI | 13+03.85 | 13+82.48 | 13+96.21 | 15+50.20 | 16+85.28 | 12+67.57 |
| X | 576,059.280 | 576,070.982 | 576,066.291 | 575,993.529 | 575,886.389 | 576,065.000 |
| Y | 269,948.796 | 270,027.373 | 270,040.611 | 270,176.356 | 270,260.396 | 269,912.172 |
| Δ | 29° 24' 55.39" (RT) | 27° 58' 56.24" (LT) | 8° 40' 49.07" (LT) | 23° 41' 50.74" (LT) | 37° 33' 20.25" (RT) | 10° 42' 37.52" (LT) |
| D | 81° 51' 04.01" | 179° 02' 57.52" | 71° 37' 11.01" | 31° 39' 18.46" | 38° 11' 49.87" | 19° 21' 24.06" |
| T | 18.37' | L 12.12' | 6.07' | 37.97' | 51.00' | 27.75' |
| L | 35.94' | 15.63' | T 7.97' | 74.86' | 98.32' | 55.33' |
| R | 70.00' | 32.00' | 80.00' | 181.00' | 150.00' | 296.00' |
| PC | 12+85.48 | 13+74.51 | 13+90.14 | 15+12.23 | 16+34.29 | 12+39.83 |
| PT | 13+21.41 | 13+90.14 | 14+02.26 | 15+87.09 | 17+32.61 | 12+95.16 |

| CURVE | 2ND.ST.SB2 | 2ND.ST.SB3 | 2ND.ST.SB4 | 2ND.ST.SB5 | 2ND.ST.SB6 | FREMONT.NB1 |
|---|---|---|---|---|---|---|
| PI | 13+61.63 | 14+09.48 | 14+38.78 | 15+44.06 | 16+76.06 | 20+40.57 |
| X | 576,016.316 | 575,980.149 | 575,970.067 | 575,994.793 | 575,888.854 | 577,054.224 |
| Y | 269,992.842 | 270,024.809 | 270,053.263 | 270,156.142 | 270,250.751 | 270,048.925 |
| Δ | 17° 24' 56.35" (LT) | 29° 00' 53.06" (RT) | 33° 01' 33.37" (RT) | 61° 44' 51.57" (LT) | 33° 53' 58.64" (RT) | 11° 02' 05.98" (RT) |
| D | 31° 49' 51.56" | 71° 37' 11.01" | 179° 02' 57.52" | 67° 24' 24.48" | 28° 38' 52.40" | 13° 38' 30.67" |
| T | 27.57' | 20.70' | 9.49' | 50.82' | 60.95' | 40.57' |
| L | 54.71' | 40.51' | 18.45' | 91.60' | 118.33' | 80.89' |
| R | 180.00' | 80.00' | 32.00' | 85.00' | 200.00' | 420.00' |
| PC | 13+34.07 | 13+88.78 | 14+29.29 | 14+93.24 | 16+15.10 | 20+00.00 |
| PT | 13+88.78 | 14+29.29 | 14+47.74 | 15+84.84 | 17+33.44 | 20+80.89 |

| CURVE | FREMONT.NB2 | FREMONT.SB1 | 255TH.AVE1 | 255TH.AVE2 | MORR.AVE1 | MORR.AVE2 |
|---|---|---|---|---|---|---|
| PI | 22+88.01 | 21+00.92 | 104+84.74 | 112+01.59 | 225+65.91 | 227+54.58 |
| X | 577,089.758 | 577,056.487 | 577,918.489 | 578,449.630 | 576,923.247 | 576,817.609 |
| Y | 270,294.057 | 270,106.334 | 265,689.267 | 266,175.672 | 267,515.811 | 267,672.617 |
| Δ | 53° 15' 33.52" (LT) | 43° 58' 12.49" (LT) | 21° 31' 41.18" (LT) | 9° 59' 41.66" (RT) | 13° 02' 40.79" (LT) | 13° 00' 37.50" (RT) |
| D | 33° 57' 15.37" | 60° 18' 40.85" | 7° 38' 21.97" | 11° 27' 32.96" | 14° 19' 26.20" | 14° 19' 26.20" |
| T | 84.61' | 38.35' | 142.58' | 43.72' | 45.73' | 45.61' |
| L | 156.86' | 72.91' | 281.80' | 87.22' | 91.07' | 90.83' |
| R | 168.74' | 95.00' | 750.00' | 500.00' | 400.00' | 400.00' |
| PC | 22+03.40 | 20+62.57 | 103+42.16 | 111+57.87 | 225+20.18 | 227+08.97 |
| PT | 23+60.26 | 21+35.47 | 106+23.96 | 112+45.09 | 226+11.25 | 227+99.80 |

| CURVE | MORR.AVE3 | MORR.AVE4 | 2ND.ST.N1 | 2ND.ST.N2 | 2ND.ST.N3 |
|---|---|---|---|---|---|
| PI | 235+53.94 | 237+60.73 | 402+41.26 | 404+99.58 | 423+13.74 |
| X | 576,531.562 | 576,548.513 | 575,606.487 | 575,463.564 | 575,280.249 |
| Y | 268,419.461 | 268,627.835 | 273,207.502 | 273,426.419 | 275,234.081 |
| Δ | 25° 36' 28.64" (RT) | 24° 27' 30.64" (LT) | 28° 23' 17.94" (LT) | 27° 20' 54.82" (RT) | 6° 13' 37.63" (RT) |
| D | 19° 05' 54.94" | 8° 48' 53.05" | 19° 05' 54.94" | 19° 05' 54.94" | 11° 27' 32.96" |
| T | 68.18' | 140.88' | 75.88' | 72.99' | 27.20' |
| L | 134.08' | 277.47' | 148.64' | 143.20' | 54.34' |
| R | 300.00' | 650.00' | 300.00' | 300.00' | 500.00' |
| PC | 234+85.76 | 236+19.84 | 401+65.38 | 404+26.60 | 422+86.54 |
| PT | 236+19.84 | 238+97.32 | 403+14.02 | 405+69.79 | 423+40.88 |

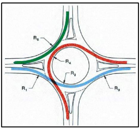
| CURVE | 269TH.AVE1 | 269TH.AVE2 | 269TH.AVE3 | 269TH.AVE4 | 269TH.AVE5 | TH169.NB.E1 |
|---|---|---|---|---|---|---|
| PI | 503+19.15 | 505+70.33 | 511+16.09 | 512+58.28 | 519+61.95 | 163+52.65 |
| X | 574,712.700 | 574,963.330 | 575,509.089 | 575,650.175 | 576,353.866 | 577,204.597 |
| Y | 275,267.178 | 275,284.136 | 275,279.977 | 275,261.902 | 275,256.540 | 268,407.530 |
| Δ | 4° 38' 02.48" (LT) | 4° 18' 26.13" (RT) | 6° 51' 51.04" (RT) | 6° 51' 51.02" (LT) | 10° 23' 00.74" (RT) | 20° 23' 29.05" (RT) |
| D | 11° 27' 32.96" | 11° 27' 32.96" | 19° 05' 54.94" | 19° 05' 54.94" | 11° 27' 32.96" | 1° 58' 57.19" |
| T | 20.23' | 18.80' | 17.99' | 17.99' | 45.43' | 519.77 |
| L | 40.44' | 37.59' | 35.94' | 35.94' | 90.61' | 1,028.54 |
| R | 500.00' | 500.00' | 300.00' | 300.00' | 500.00' | 2,890.00 |
| PC | 502+98.92 | 505+51.53 | 510+98.09 | 512+40.29 | 519+16.52 | 158+32.88 |
| PT | 503+39.36 | 505+89.12 | 511+34.04 | 512+76.23 | 520+07.13 | 168+61.42 |

| CURVE | TH169.NB.E2 | TH169.NB.E3 | TH169.SB.E1 | TH169.SB.E2 | TH169.SB.E3 | CSAH4.EB.E1 |
|---|---|---|---|---|---|---|
| PI | 196+91.55 | 223+13.07 | 163+91.97 | 197+25.20 | 223+63.58 | 216+90.85 |
| X | 576,502.607 | 576,308.245 | 577,120.215 | 576,419.265 | 576,223.653 | 576,500.952 |
| Y | 271,683.048 | 274,299.873 | 268,400.412 | 271,671.080 | 274,304.730 | 270,038.435 |
| Δ | 7° 50' 54.66" (RT) | 15° 04' 04.38" (RT) | 20° 23' 29.05" (RT) | 7° 50' 54.66" (RT) | 15° 04' 04.38" (RT) | 1° 35' 54.40" (RT) |
| D | 0° 29' 22.95" | 1° 33' 15.90" | 1° 51' 45.62" | 0° 29' 10.38" | 1° 31' 11.22" | 0° 28' 38.87" |
| T | 802.60 | 487.49 | 553.22 | 808.37 | 498.60 | 167.40 |
| L | 1,602.70 | 969.36 | 1,094.74 | 1,614.20 | 991.45 | 334.78 |
| R | 11,700.00 | 3,686.00 | 3,076.00 | 11,784.00 | 3,770.00 | 12,000.00 |
| PC | 188+88.95 | 218+25.58 | 158+38.75 | 189+16.84 | 218+64.97 | 215+23.45 |
| PT | 204+91.64 | 227+94.94 | 169+33.49 | 205+31.04 | 228+56.42 | 218+58.23 |

# TH 169 RAMPS/CSAH 4/FREEMONT DR (EAST END) ROUNDABOUT DESIGN SPEED SUMMARY

## FASTEST DRIVABLE PATH COMPARISON CHART

| APPROACH | CURVE | RADIUS (FT) | e (FT/FT) | SPEED (MPH) | RELATIVE SPEED DIFFERENCE (MPH) (1) | ENTRY ANGLE (PHI) |
|---|---|---|---|---|---|---|
| (SOUTH LEG) TH 169 EXIT RAMP | R1 | 135 | 0.02 | 23 | 7 | 20° |
| | R2 | 441 | -0.02 | 32 | 17 | |
| | R3 | 4746 | 0.02 | N/A | N/A | |
| | R4 | 61 | 92 | 16 | 0 | |
| | R5 | 146 | 0.02 | 24 | 8 | |
| (NORTHEAST LEG) FREMONT DR | R1 | N/A | 0.02 | N/A | N/A | 14° |
| | R2 | N/A | -0.02 | N/A | N/A | |
| | R3 | N/A | 0.02 | N/A | N/A | |
| | R4 | 61 | -0.02 | 16 | 0 | |
| | R5 | 220 | 0.02 | 28 | 12 | |
| (WEST LEG) CSAH 4 | R1 | 173 | 0.02 | 25 | 10 | 20° |
| | R2 | 169 | -0.02 | 23 | 7 | |
| | R3 | 776 | 0.02 | N/A | N/A | |
| | R4 | 61 | -0.02 | 16 | 0 | |
| | R5 | N/A | N/A | N/A | N/A | |
| (EAST LEG) CSAH 4 | R1 | 82 | 0.02 | 19 | 3 | 19° |
| | R2 | 122 | -0.02 | 20 | 5 | |
| | R3 | 150 | 0.02 | N/A | N/A | |
| | R4 | 61 | -0.02 | 16 | 0 | |
| | R5 | 78 | 0.02 | 19 | 0 | |
| (EAST LEG) CSAH 4 TO EXIT RAMP | R1 | 99 | 0.02 | 20 | 5 | 19° |
| | R2 | 549 | -0.02 | 35 | 19 | |
| | R3 | 101 | 0.02 | N/A | N/A | |
| | R4 | 61 | -0.02 | 16 | 0 | |
| | R5 | N/A | N/A | N/A | N/A | |

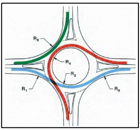

R5
R4
R2
R1
R3

(1) RELATIVE SPEED DIFFERENCE IS FROM THE MINIMUM SPEED IN ROUNDABOUT, USUALLY R4

# TH 169 RAMPS/CSAH 4 (WEST END) ROUNDABOUT DESIGN SPEED SUMMARY

## FASTEST DRIVABLE PATH COMPARISON CHART

| APPROACH | CURVE | RADIUS (FT) | e (FT/FT) | SPEED (MPH) | RELATIVE SPEED DIFFERENCE (MPH) (1) | ENTRY ANGLE (PHI) |
|---|---|---|---|---|---|---|
| (NORTH LEG) TH 169 EXIT RAMP | R1 | 136 | 0.02 | 23 | 8 | 21° |
| | R2 | 178 | -0.02 | 23 | 9 | |
| | R3 | 461 | 0.02 | N/A | N/A | |
| | R4 | 51 | -0.02 | 15 | 0 | |
| | R5 | 163 | 0.02 | 25 | 10 | |
| (WEST LEG) CSAH 4 | R1 | 156 | 0.02 | 24 | 10 | 24° |
| | R2 | 167 | -0.02 | 23 | 8 | |
| | R3 | 139 | 0.02 | N/A | N/A | |
| | R4 | 51 | -0.02 | 15 | 0 | |
| | R5 | 217 | 0.02 | 27 | 13 | |
| (EAST LEG) CSAH 4 | R1 | 164 | 0.02 | 25 | 9 | N/A |
| | R2 | 120 | -0.02 | 20 | 5 | |
| | R3 | 244 | 0.02 | N/A | N/A | |
| | R4 | 60 | -0.02 | 16 | 0 | |
| | R5 | N/A | N/A | N/A | N/A | |

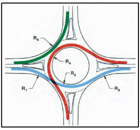

R5
R4
R2
R1
R3

(1) RELATIVE SPEED DIFFERENCE IS FROM THE MINIMUM SPEED IN ROUNDABOUT, USUALLY R4

# CSAH 4/2ND ST ROUNDABOUT DESIGN SPEED SUMMARY

## FASTEST DRIVABLE PATH COMPARISON CHART

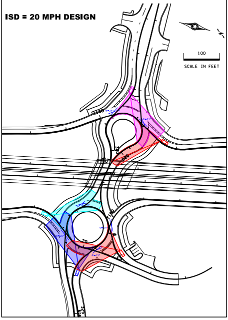
| APPROACH | CURVE | RADIUS (FT) | e (FT/FT) | SPEED (MPH) | RELATIVE SPEED DIFFERENCE (MPH) (1) | ENTRY ANGLE (PHI) |
|---|---|---|---|---|---|---|
| (SOUTH LEG) 2ND ST | R1 | 123 | 0.02 | 22 | 5 | 29° |
| | R2 | 273 | -0.02 | 27 | 10 | |
| | R3 | 419 | 0.02 | N/A | N/A | |
| | R4 | 83 | -0.02 | 18 | 0 | |
| | R5 | 82 | 0.02 | 19 | 1 | |
| (NORTH LEG) 2ND ST | R1 | 86 | 0.02 | 19 | 2 | 31° |
| | R2 | 171 | -0.02 | 23 | 5 | |
| | R3 | 219 | 0.02 | N/A | N/A | |
| | R4 | 83 | -0.02 | 18 | 0 | |
| | R5 | 83 | 0.02 | 19 | 1 | |
| (WEST LEG) CSAH 4 | R1 | 210 | 0.02 | 27 | 14 | 26° |
| | R2 | 300 | -0.02 | 28 | 15 | |
| | R3 | 610 | 0.02 | N/A | N/A | |
| | R4 | 35 | -0.02 | 13 | 0 | |
| | R5 | 228 | 0.02 | 28 | 15 | |
| (EAST LEG) CSAH 4 | R1 | 241 | 0.02 | 29 | 16 | 14° |
| | R2 | 292 | -0.02 | 28 | 15 | |
| | R3 | 934 | 0.02 | N/A | N/A | |
| | R4 | 35 | -0.02 | 13 | 0 | |
| | R5 | 241 | 0.02 | 29 | 16 | |


R5
R4
R2
R1
R3

(1) RELATIVE SPEED DIFFERENCE IS FROM THE MINIMUM SPEED IN ROUNDABOUT, USUALLY R4

## PHI ANGLE DIAGRAM AND INTERSECTION SIGHT DISTANCE

**ISD = 20 MPH DESIGN**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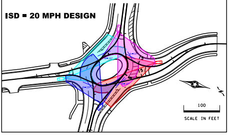
SCALE IN FEET

## PHI ANGLE DIAGRAM AND INTERSECTION SIGHT DISTANCE

**ISD = 20 MPH DESIGN**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SCALE IN FEET

# PLAN VIEW LAYOUT

BOLTON & MENK

DEPARTMENT OF TRANSPORTATION

SHERBURNE COUNTY

City of Zimmerman