

Roundabout Critical Design Parameters

Project - STA-173-1.07

PID: 121934

Design Parameters	Leg 1	Leg 2	Leg 3	Leg 4
Inscribed Circle Diameter, FT	130	130	130	130
Entry Width, FT	17.9	17.6	18.1	19.4
Entry Angle PHI ϕ , DEG	31	18	29	9
Exit Width, FT	15.7	16.4	16.6	17.2
Circulatory Roadway Width Upstream of Entry, FT	18	18	18	18

Fastest Path Speed	Leg 1		Leg 2		Leg 3		Leg 4	
R ₁ , Radius/Speed, FT/MPH	92	19.7	135	22.9	97	20.1	145	23.5
R ₂ , Radius/Speed, FT/MPH	101	18.9	110	21.1	91	18.1	71	16.6
R ₃ , Radius/Speed, FT/MPH	720	28.3	602	32.9	202	26.7	425	31.8
R ₄ , Radius/Speed, FT/MPH	55	16.2	53	15.9	52	14.8	53	14.9
R ₅ , Radius/Speed, FT/MPH	52	15.8	128	20.6	56	15.2	167	24.8
R ₅ , Bypass Radius/Speed, FT/MPH	--	--	--	--	--	--	--	--

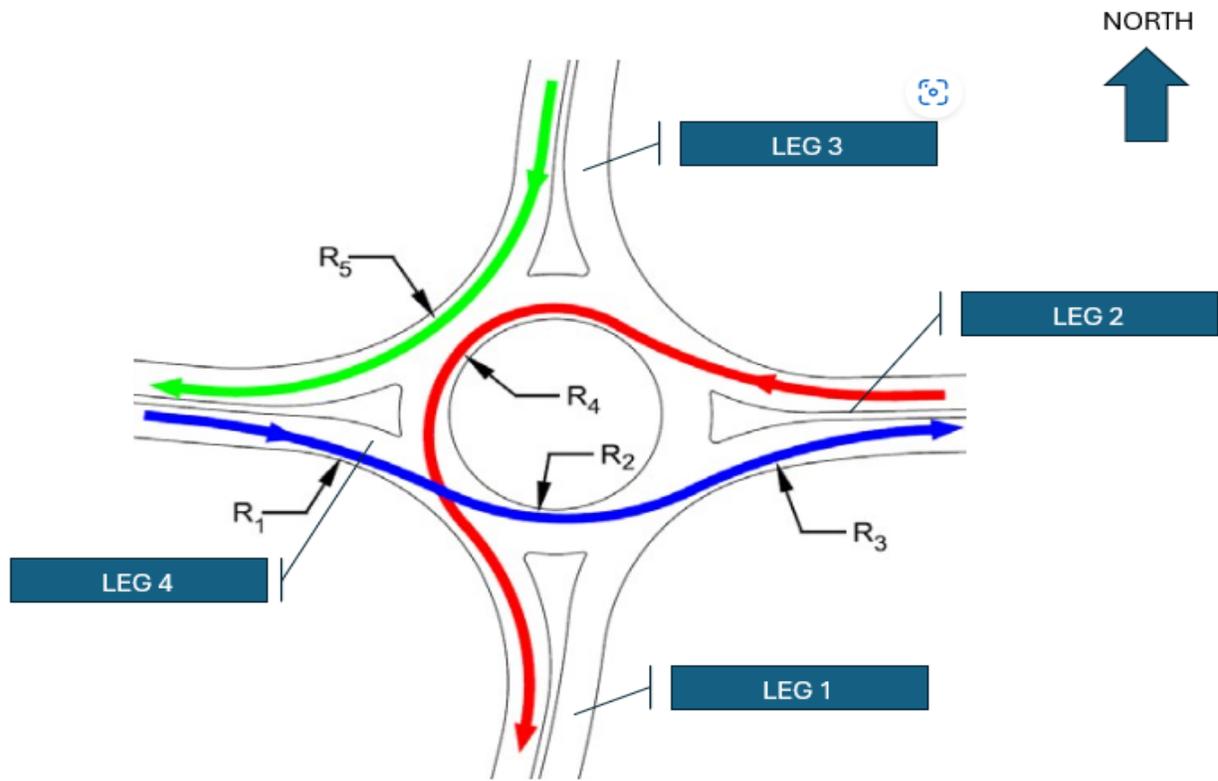
Minimum Sight Parameters	Leg 1		Leg 2		Leg 3		Leg 4	
Approach Design Speed, MPH	50		60		50		60	
Approach Stopping Sight Distance, FT/MPH	425	50	570	60	425	50	570	60
Circulatory Stopping Sight Distance, FT/MPH	84.5	16.2	83.0	15.9	75.3	14.8	75.9	14.9
Exit (Crosswalk) Stopping Sight Distance, FT/MPH	--	--	--	--	--	--	--	--
Intersection Sight Distance, FT/MPH	147	20	149	20	149	20	146	20

General	
Design Vehicle(s)	WB-62
Truck Apron Width, FT	17

Designer: Matthew E. Philips, P.E.

Signature:

Date:



Leg 1 (Northbound) Through Movement

Fastest Path Speeds (L&D Vol. 1, 403.7.1) (NCHRP 1043, Eqn. 9.3 and 9.4)	Curve	R (ft)	V_{in}	V_{out}	V_{both}	Slope	Use	Speed
	R ₁	92	19.7	18.2	19.0	IN	19.7	V_1
	R ₂	101	20.4	18.9	19.7	OUT	18.9	V_2
	R ₃	720	43.6	38.8	41.2	OUT	38.8	V_{3p}
d ₂₃ (ft)		70	V_{3a} (mph)	28.3	V_3 (mph)	28.3		

ISD Entering Stream (NCHRP 1043, Eqn. 9.11 and 9.12)	V_{enter} (mph)	19.3
	D ₁ (ft)	141.6

Equation 9.11

$$b_1 = 1.47V_{ent} t_g$$

Equation 9.12

$$b_2 = 1.47V_{circ} t_g$$

where

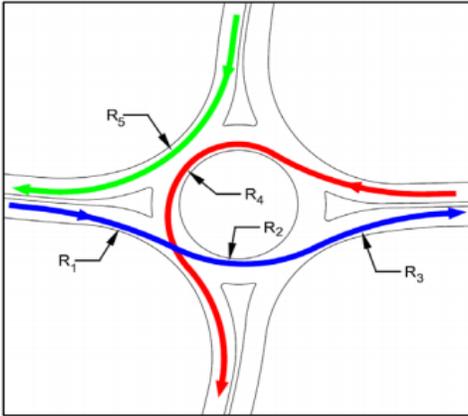
b_1 = length of entering branch of sight triangle (ft);

b_2 = length of circulating branch of sight triangle (ft);

V_{ent} = speed of vehicles from upstream entry for the conflicting through movement, assumed to be average of V_1 and V_2 (mph);

V_{circ} = speed of circulating vehicles, assumed to be V_4 (mph); and

t_g = design headway (s, assumed to be 5.0 s).



$$V=3.4415R^{0.3861}$$

$$V=3.4614R^{0.3673}$$

for e = +0.02
for e = -0.02

$$3.4415 \quad 0.3861$$

$$3.4614 \quad 0.3673$$

Use e = +0.02 for a curve sloping in toward the center, not necessarily to the right
Use e = -0.02 for a curve sloping out away from the center, not necessarily to the left

Research has shown the Exit Path Radius (R3) may not always be determined by the radius of the curve exiting the circulatory roadway. Exit Path Radius (R3) is the greater value between the minimum radius curve exiting the circulatory roadway or the speed achieved accelerating from within the circulatory roadway. This speed is derived using the following formula.

$$V_3 = \min \left\{ \begin{array}{l} V_{3p} \\ \frac{1}{1.47} \sqrt{(1.47V_2)^2 + 2a_{23}d_{23}} \end{array} \right\}$$

where

V_3 = exit speed (mph),

V_{3p} = V_3 speed predicted on basis of path radius (mph),

V_2 = circulatory speed for through vehicles predicted on basis of path radius (mph),

a_{23} = acceleration between the midpoint of V_2 path and the point of interest along V_3 path (6.9 ft/s²), and

d_{23} = distance along the vehicle path between midpoint of V_2 path and point of interest along V_3 path (ft).

Leg 2 (Westbound) Through Movement

Fastest Path Speeds (L&D Vol. 1, 403.7.1) (NCHRP 1043, Eqn. 9.3 and 9.4)	Curve	R (ft)	V _{in}	V _{out}	V _{both}	Slope	Use	Speed
	R ₁	135	22.9	21.0	21.9	IN	22.9	V ₁
	R ₂	110	21.1	19.5	20.3	IN	21.1	V ₂
	R ₃	602	40.7	36.3	38.5	IN	40.7	V _{3p}
d ₂₃ (ft)	100	V _{3a} (mph)	32.9	V ₃ (mph)	32.9			

ISD Entering Stream (NCHRP 1043, Eqn. 9.11 and 9.12)	V _{enter} (mph)	22.0
	D ₁ (ft)	161.5

Equation 9.11

$$b_1 = 1.47V_{ent} t_g$$

Equation 9.12

$$b_2 = 1.47V_{circ} t_g$$

where

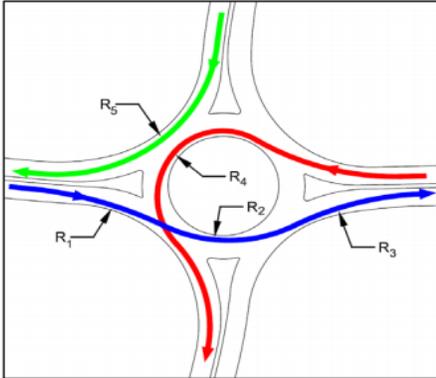
b₁ = length of entering branch of sight triangle (ft);

b₂ = length of circulating branch of sight triangle (ft);

V_{ent} = speed of vehicles from upstream entry for the conflicting through movement, assumed to be average of V₁ and V₂ (mph);

V_{circ} = speed of circulating vehicles, assumed to be V₄ (mph); and

t_g = design headway (s, assumed to be 5.0 s).



$$V=3.4415R^{0.3861}$$

$$V=3.4614R^{0.3673}$$

for e = +0.02
for e = -0.02

3.4415 0.3861
3.4614 0.3673

Use e = +0.02 for a curve sloping in toward the center, not necessarily to the right
Use e = -0.02 for a curve sloping out away from the center, not necessarily to the left

Research has shown the Exit Path Radius (R3) may not always be determined by the radius of the curve exiting the circulatory roadway. Exit Path Radius (R3) is the greater value between the minimum radius curve exiting the circulatory roadway or the speed achieved accelerating from within the circulatory roadway. This speed is derived using the following formula.

$$V_3 = \min \left\{ \begin{array}{l} V_{3p} \\ \frac{1}{1.47} \sqrt{(1.47V_2)^2 + 2a_{23}d_{23}} \end{array} \right\}$$

where

V_3 = exit speed (mph),

V_{3p} = V_3 speed predicted on basis of path radius (mph),

V_2 = circulatory speed for through vehicles predicted on basis of path radius (mph),

a_{23} = acceleration between the midpoint of V_2 path and the point of interest along V_3 path (6.9 ft/s²), and

d_{23} = distance along the vehicle path between midpoint of V_2 path and point of interest along V_3 path (ft).

Leg 3 (Southbound) Through Movement

Fastest Path Speeds (L&D Vol. 1, 403.7.1) (NCHRP 1043, Eqn. 9.3 and 9.4)	Curve	R (ft)	V_{in}	V_{out}	V_{both}	Slope	Use	Speed
	R_1	97	20.1	18.6	19.4	IN	20.1	V_1
	R_2	91	19.6	18.1	18.9	OUT	18.1	V_2
	R_3	202	26.7	24.3	25.5	IN	26.7	V_{3p}
d_{23} (ft)	99	V_{3a} (mph)	31.0	V_3 (mph)	26.7			

ISD Entering Stream (NCHRP 1043, Eqn. 9.11 and 9.12)	V_{enter} (mph)	19.1
	D_1 (ft)	140.5

Equation 9.11

$$b_1 = 1.47V_{ent} t_g$$

Equation 9.12

$$b_2 = 1.47V_{circ} t_g$$

where

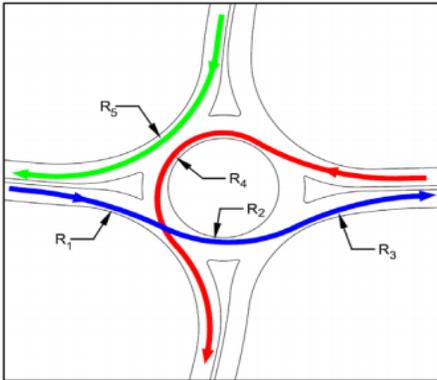
b_1 = length of entering branch of sight triangle (ft);

b_2 = length of circulating branch of sight triangle (ft);

V_{ent} = speed of vehicles from upstream entry for the conflicting through movement, assumed to be average of V_1 and V_2 (mph);

V_{circ} = speed of circulating vehicles, assumed to be V_4 (mph); and

t_g = design headway (s, assumed to be 5.0 s).



$$V=3.4415R^{0.3861}$$

$$V=3.4614R^{0.3673}$$

for e = +0.02
for e = -0.02

3.4415 0.3861
3.4614 0.3673

Use e = +0.02 for a curve sloping in toward the center, not necessarily to the right
Use e = -0.02 for a curve sloping out away from the center, not necessarily to the left

Research has shown the Exit Path Radius (R3) may not always be determined by the radius of the curve exiting the circulatory roadway. Exit Path Radius (R3) is the greater value between the minimum radius curve exiting the circulatory roadway or the speed achieved accelerating from within the circulatory roadway. This speed is derived using the following formula.

$$V_3 = \min \left\{ \begin{array}{l} V_{3p} \\ \frac{1}{1.47} \sqrt{(1.47V_2)^2 + 2a_{23}d_{23}} \end{array} \right\}$$

where

V_3 = exit speed (mph),

V_{3p} = V_3 speed predicted on basis of path radius (mph),

V_2 = circulatory speed for through vehicles predicted on basis of path radius (mph),

a_{23} = acceleration between the midpoint of V_2 path and the point of interest along V_3 path (6.9 ft/s²), and

d_{23} = distance along the vehicle path between midpoint of V_2 path and point of interest along V_3 path (ft).

Leg 4 (Eastbound) Through Movement

Fastest Path Speeds (L&D Vol. 1, 403.7.1) (NCHRP 1043, Eqn. 9.3 and 9.4)	Curve	R (ft)	V _{in}	V _{out}	V _{both}	Slope	Use	Speed
	R ₁	145	23.5	21.5	22.5	IN	23.5	V ₁
	R ₂	71	17.8	16.6	17.2	OUT	16.6	V ₂
	R ₃	425	35.6	32.0	33.8	IN	35.6	V _{3p}
d ₂₃ (ft)	115	V _{3a} (mph)	31.8	V ₃ (mph)	31.8			

ISD Entering Stream (NCHRP 1043, Eqn. 9.11 and 9.12)	V _{enter} (mph)	20.0
	D ₁ (ft)	147.1

Equation 9.11

$$b_1 = 1.47V_{ent} t_g$$

Equation 9.12

$$b_2 = 1.47V_{circ} t_g$$

where

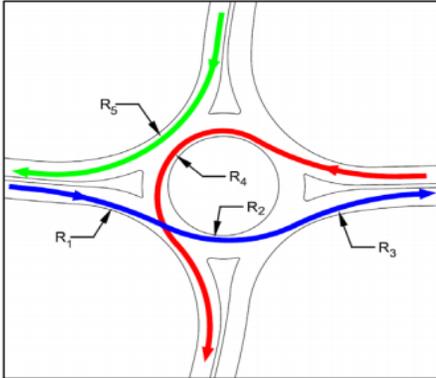
b₁ = length of entering branch of sight triangle (ft);

b₂ = length of circulating branch of sight triangle (ft);

V_{ent} = speed of vehicles from upstream entry for the conflicting through movement, assumed to be average of V₁ and V₂ (mph);

V_{circ} = speed of circulating vehicles, assumed to be V₄ (mph); and

t_g = design headway (s, assumed to be 5.0 s).



$$V=3.4415R^{0.3861}$$

$$V=3.4614R^{0.3673}$$

for e = +0.02
for e = -0.02

3.4415 0.3861
3.4614 0.3673

Use e = +0.02 for a curve sloping in toward the center, not necessarily to the right
Use e = -0.02 for a curve sloping out away from the center, not necessarily to the left

Research has shown the Exit Path Radius (R3) may not always be determined by the radius of the curve exiting the circulatory roadway. Exit Path Radius (R3) is the greater value between the minimum radius curve exiting the circulatory roadway or the speed achieved accelerating from within the circulatory roadway. This speed is derived using the following formula.

$$V_3 = \min \left\{ \begin{array}{l} V_{3p} \\ \frac{1}{1.47} \sqrt{(1.47V_2)^2 + 2a_{23}d_{23}} \end{array} \right\}$$

where

V_3 = exit speed (mph),

V_{3p} = V_3 speed predicted on basis of path radius (mph),

V_2 = circulatory speed for through vehicles predicted on basis of path radius (mph),

a_{23} = acceleration between the midpoint of V_2 path and the point of interest along V_3 path (6.9 ft/s²), and

d_{23} = distance along the vehicle path between midpoint of V_2 path and point of interest along V_3 path (ft).

Left and Right Turn Movements (All Legs)

Left Turn Fastest Path Speeds ISD Circulating RAB SSD Circulating RAB (L&D Vol. 1, 403.7.2.1 and 2) (NCHRP 1043, Eqn. and 9.4)	Leg	R ₄ (ft)	V ₄ (mph)	d ₂ (ft)	d (ft)
	Leg 1 (NB Left)	55	16.2	118.8	84.5
	Leg 2 (WB Left)	53	15.9	117.2	83.0
	Leg 3 (SB Left)	52	14.8	108.6	75.3
	Leg 4 (EB Left)	53	14.9	109.4	75.9

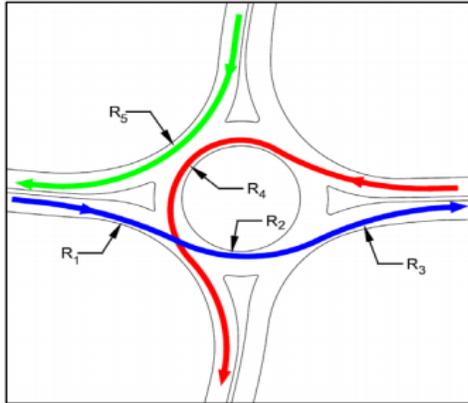
Right Turn Fastest Path Speeds (L&D Vol. 1, 403.7.1) (NCHRP 1043, Eqn. 9.3 and 9.4)	Leg	R ₅ (ft)	V _{in}	V _{out}	V _{both}	Slope	Use	Speed
	Leg 1 (NB Right)	52	15.8	14.8	15.3	IN	15.8	V ₅ NB
	Leg 2 (WB Right)	128	22.4	20.6	21.5	OUT	20.6	V ₅ WB
	Leg 3 (SB Right)	56	16.3	15.2	15.7	OUT	15.2	V ₅ SB
	Leg 4 (EB Right)	167	24.8	22.7	23.8	IN	24.8	V ₅ EB

$V=3.4415R^{0.3861}$
 $V=3.4614R^{0.3673}$

for $e = +0.02$
for $e = -0.02$

3.4415
3.4614

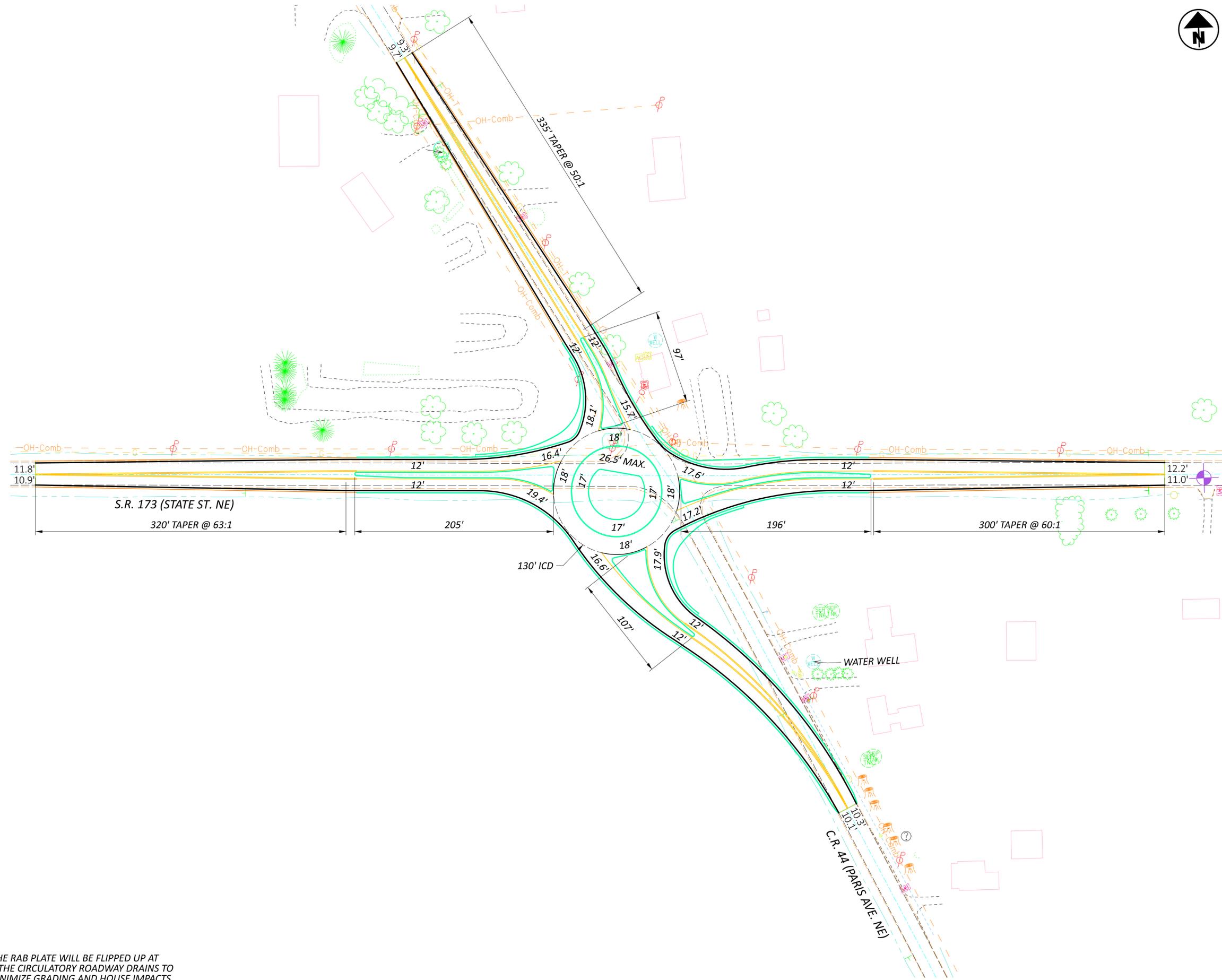
0.3861 Use $e = +0.02$ if applicable for right turn movements
0.3673 Use $e = -0.02$ for all left turn movements. Right turns should not slope only this direction.



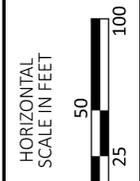
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NOTE TO REVIEWER:
 IT IS ANTICIPATED THAT THE RAB PLATE WILL BE FLIPPED UP AT THE NORTH LEG SO THAT THE CIRCULATORY ROADWAY DRAINS TO THE SOUTH. THIS WILL MINIMIZE GRADING AND HOUSE IMPACTS WHEN CORRECTING THE SOUTHBOUND PARIS AVE. NE PROFILE.



**STA-173-1.07 (S.R. 173 & PARIS RAB)
 ROUNDABOUT SCHEMATIC**



DESIGN AGENCY



DESIGNER

MEP

REVIEWER

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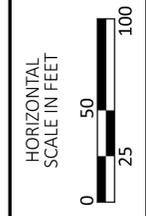
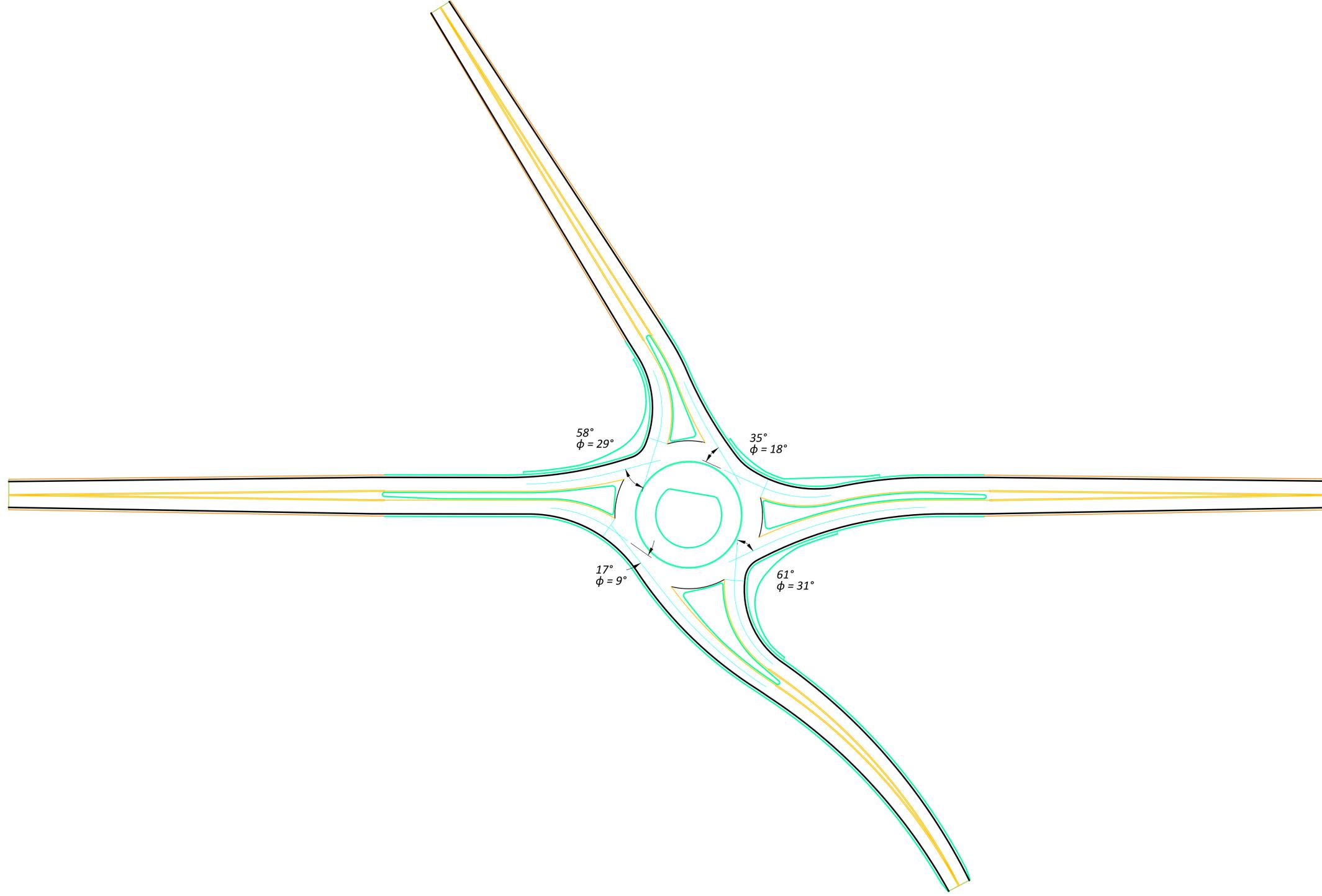
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SHEET TOTAL

P.1 19

STA-173-1.07 - ROUNDABOUT PACKET

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STA-173-1.07 (S.R. 173 & PARIS RAB)
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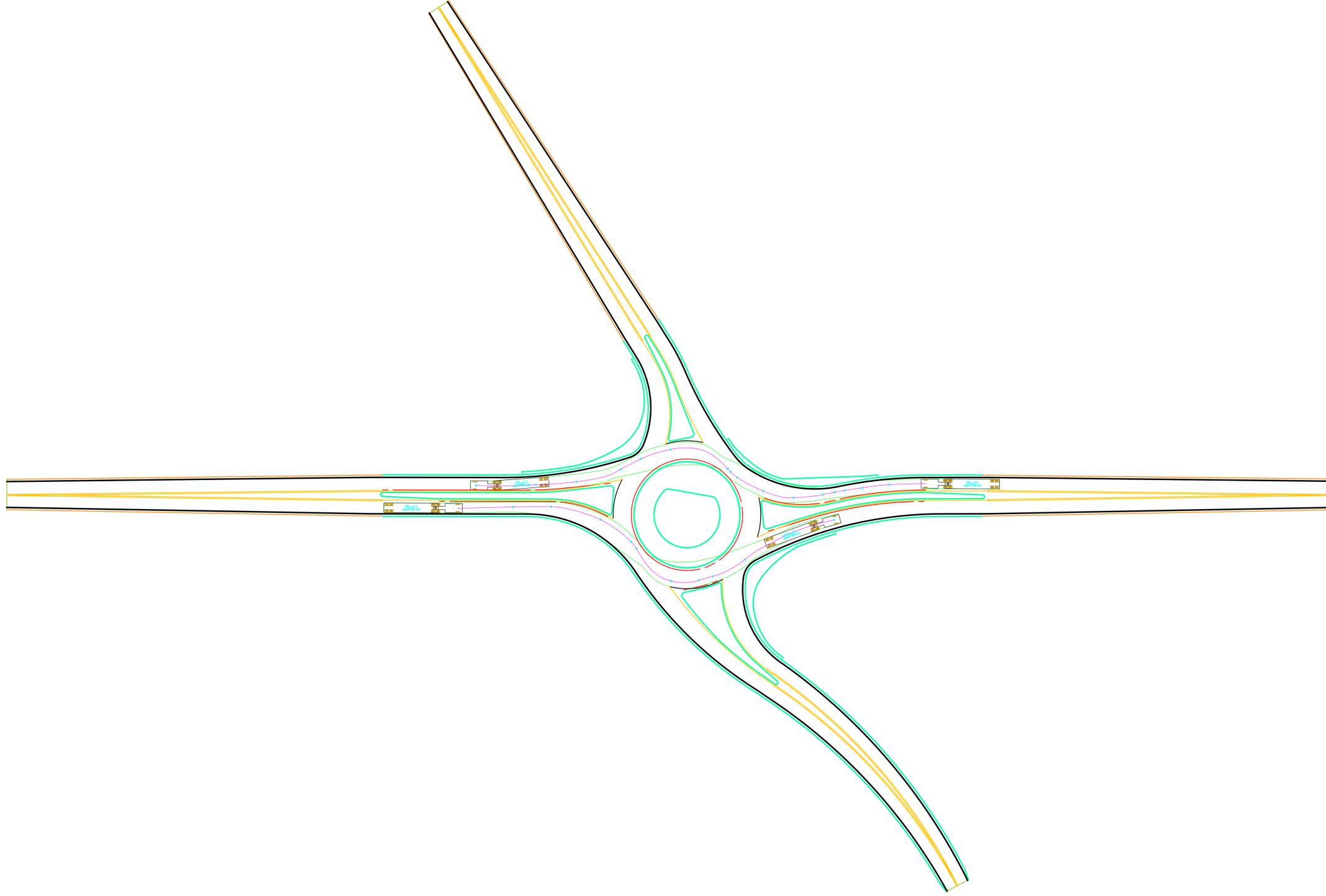
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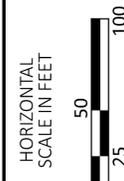
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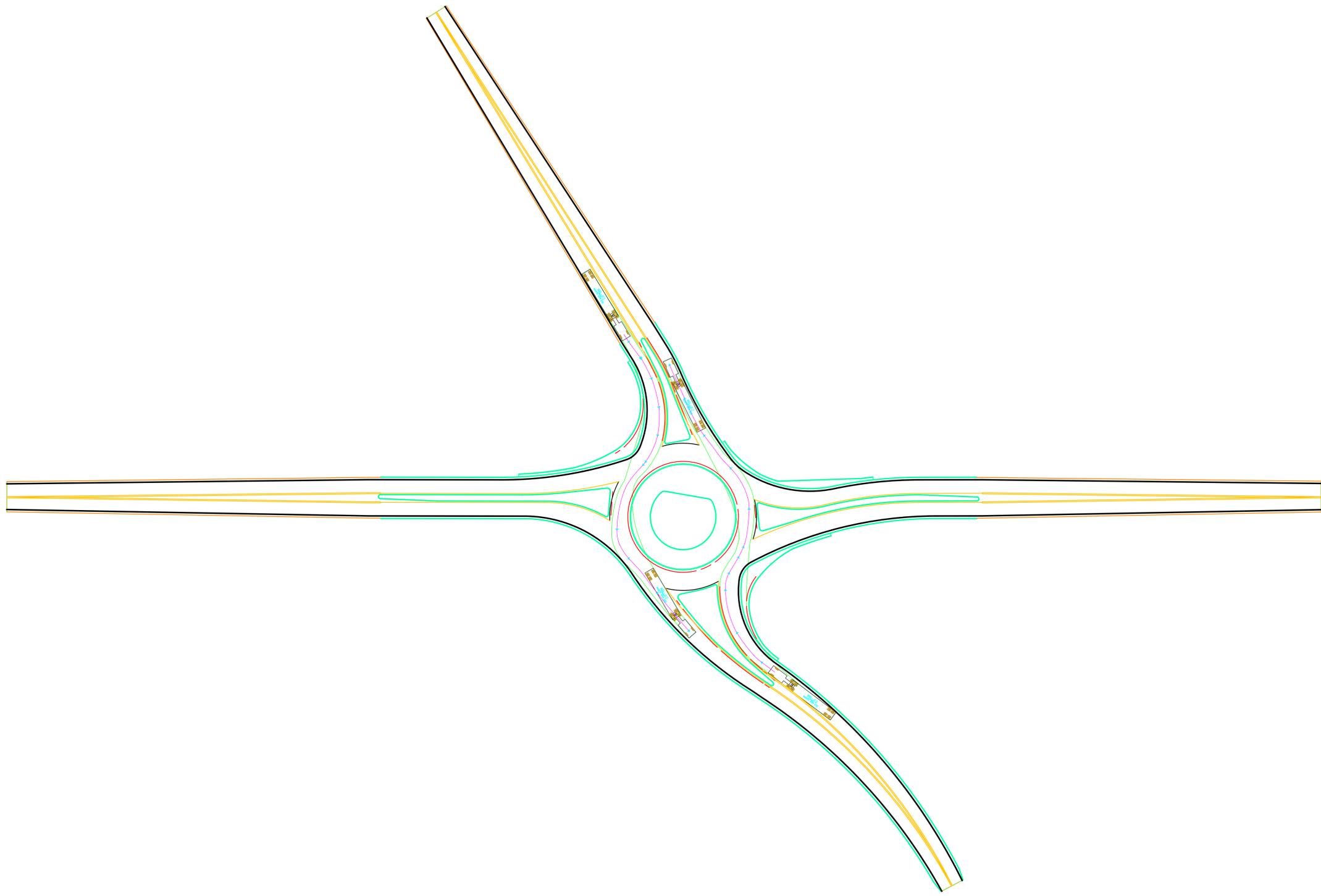
P.3 19

**STA-173-1.07 (S.R. 173 & PARIS RAB)
TURNING MOVEMENTS - EB & WB THROUGH**



STA-173-1.07 - ROUNDABOUT PACKET

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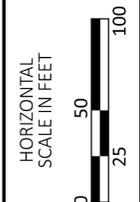
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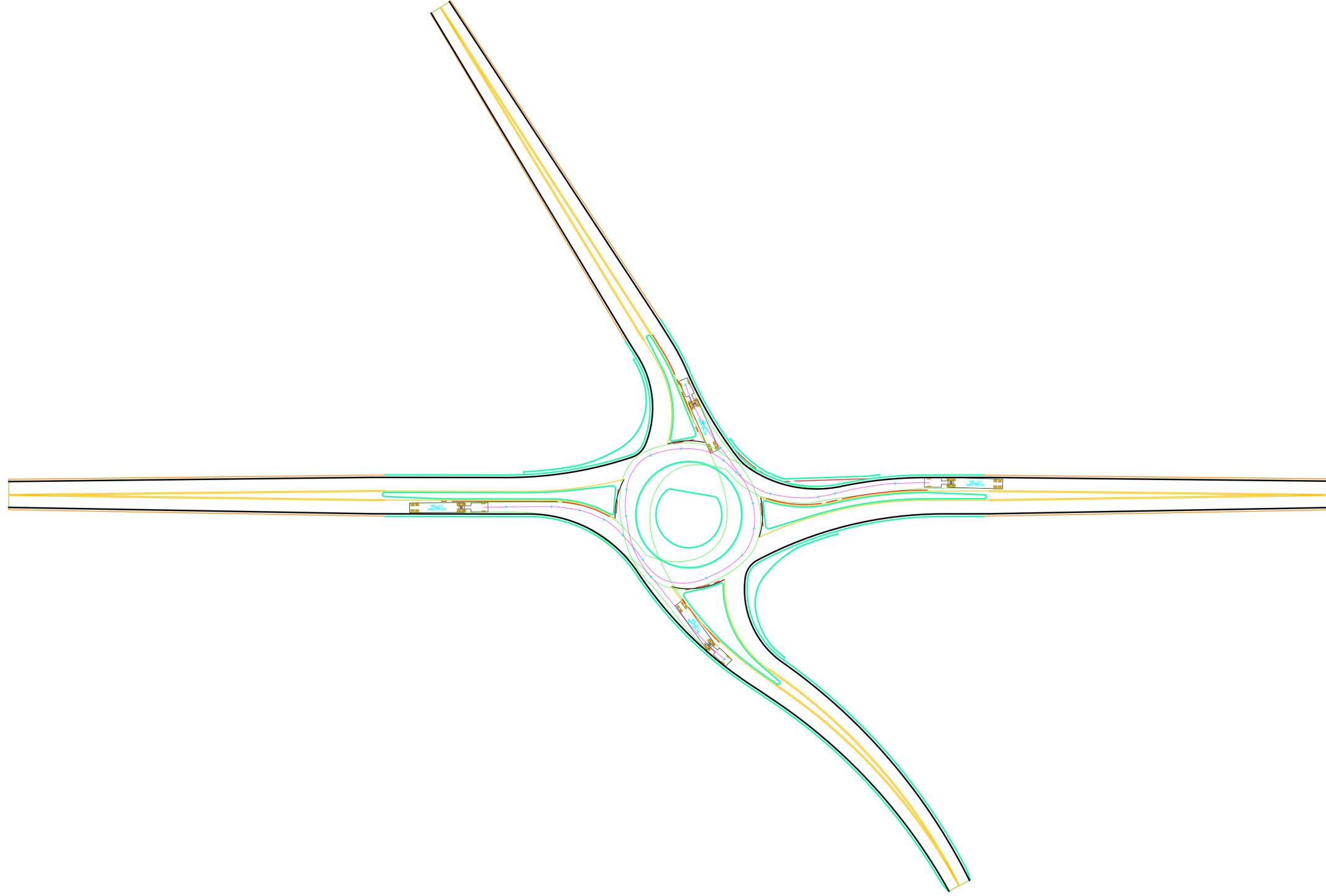
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P.4 19

STA-173-1.07 (S.R. 173 & PARIS RAB)
TURNING MOVEMENTS - NB & SB THROUGH



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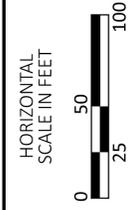
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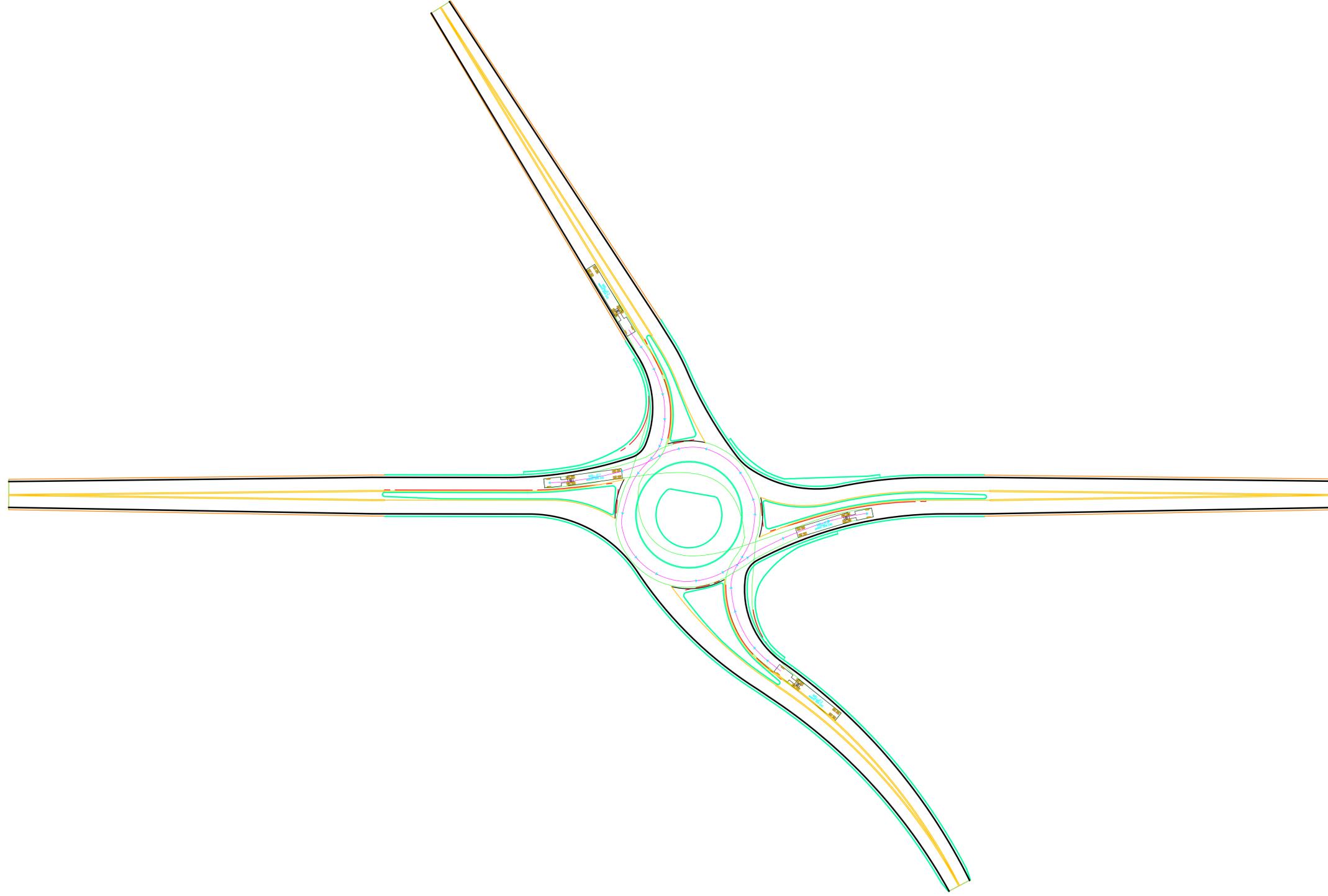
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P.5 19

STA-173-1.07 (S.R. 173 & PARIS RAB)
TURNING MOVEMENTS - EB & WB LEFTS



STA-173-1.07 - ROUNDABOUT PACKET

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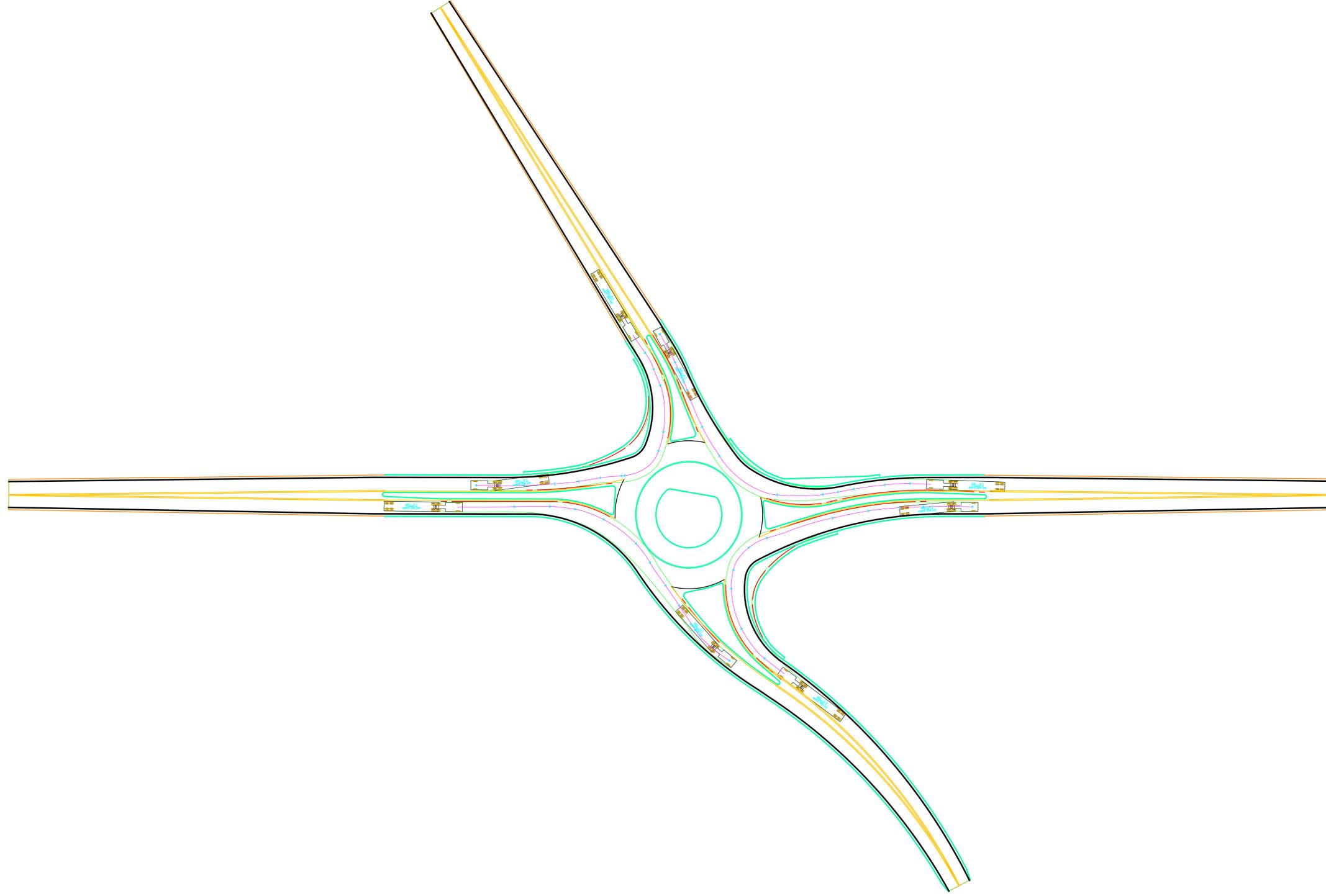
P.6 19

STA-173-1.07 (S.R. 173 & PARIS RAB)
TURNING MOVEMENTS - NB & SB LEFTS



STA-173-1.07 - ROUNDABOUT PACKET

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DESIGN AGENCY



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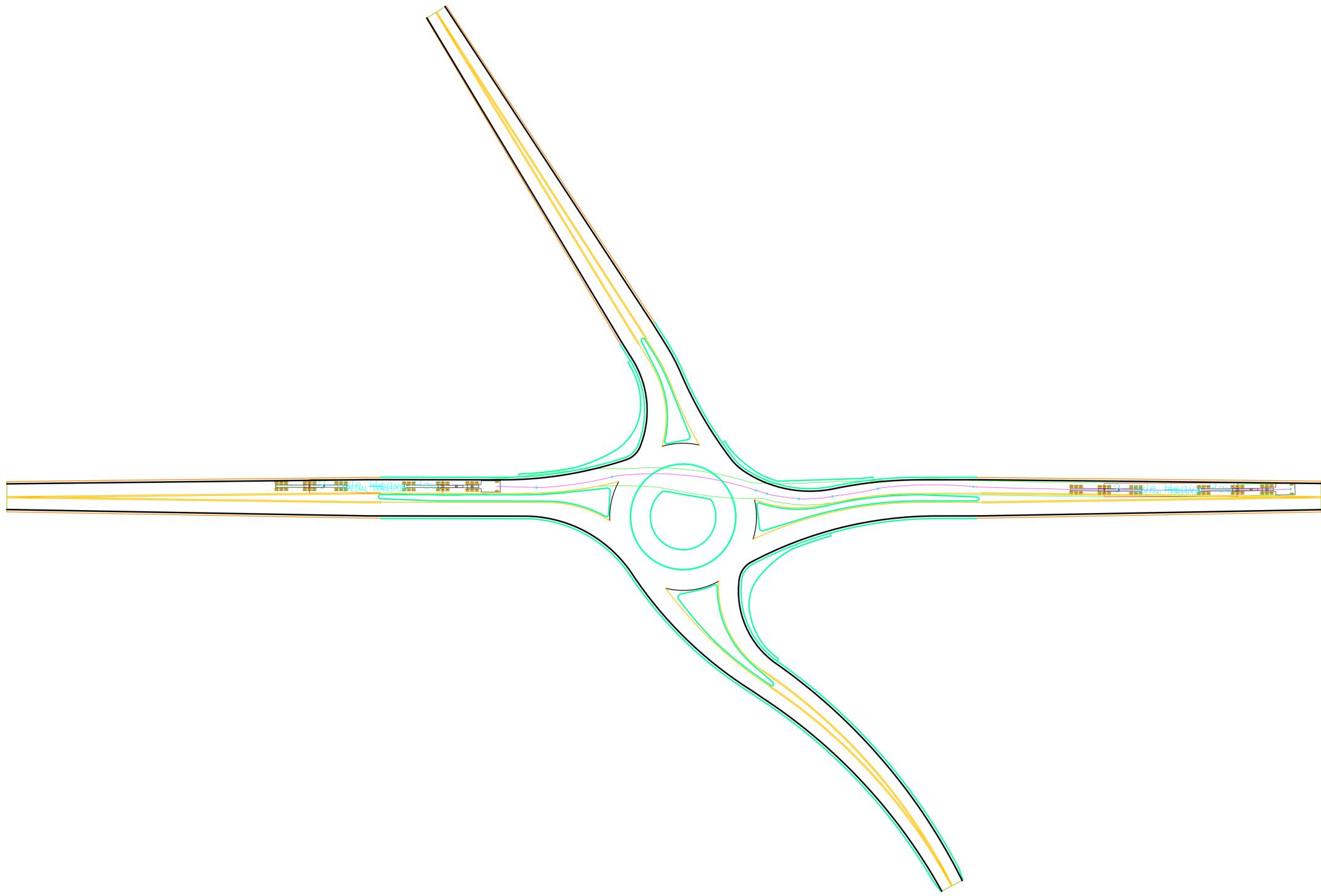
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P.7 19

STA-173-1.07 (S.R. 173 & PARIS RAB)
TURNING MOVEMENTS - RIGHTS



STA-173-1.07 - ROUNDABOUT PACKET

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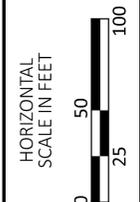
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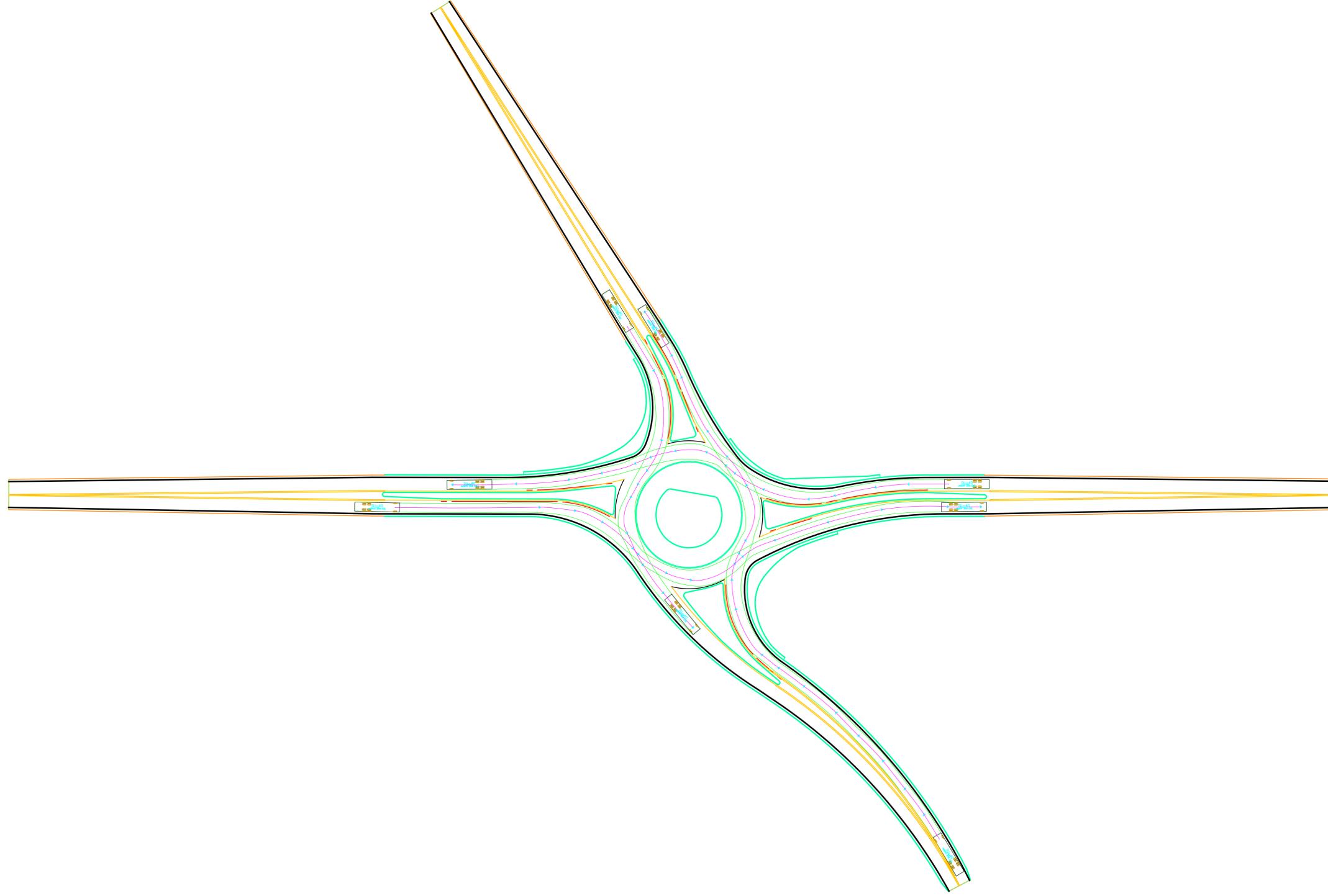
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P.8 19

STA-173-1.07 (S.R. 173 & PARIS RAB)
TURNING MOVEMENTS - OVERSIZE



STA-173-1.07 - ROUNDABOUT PACKET

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PROJECT ID
121934

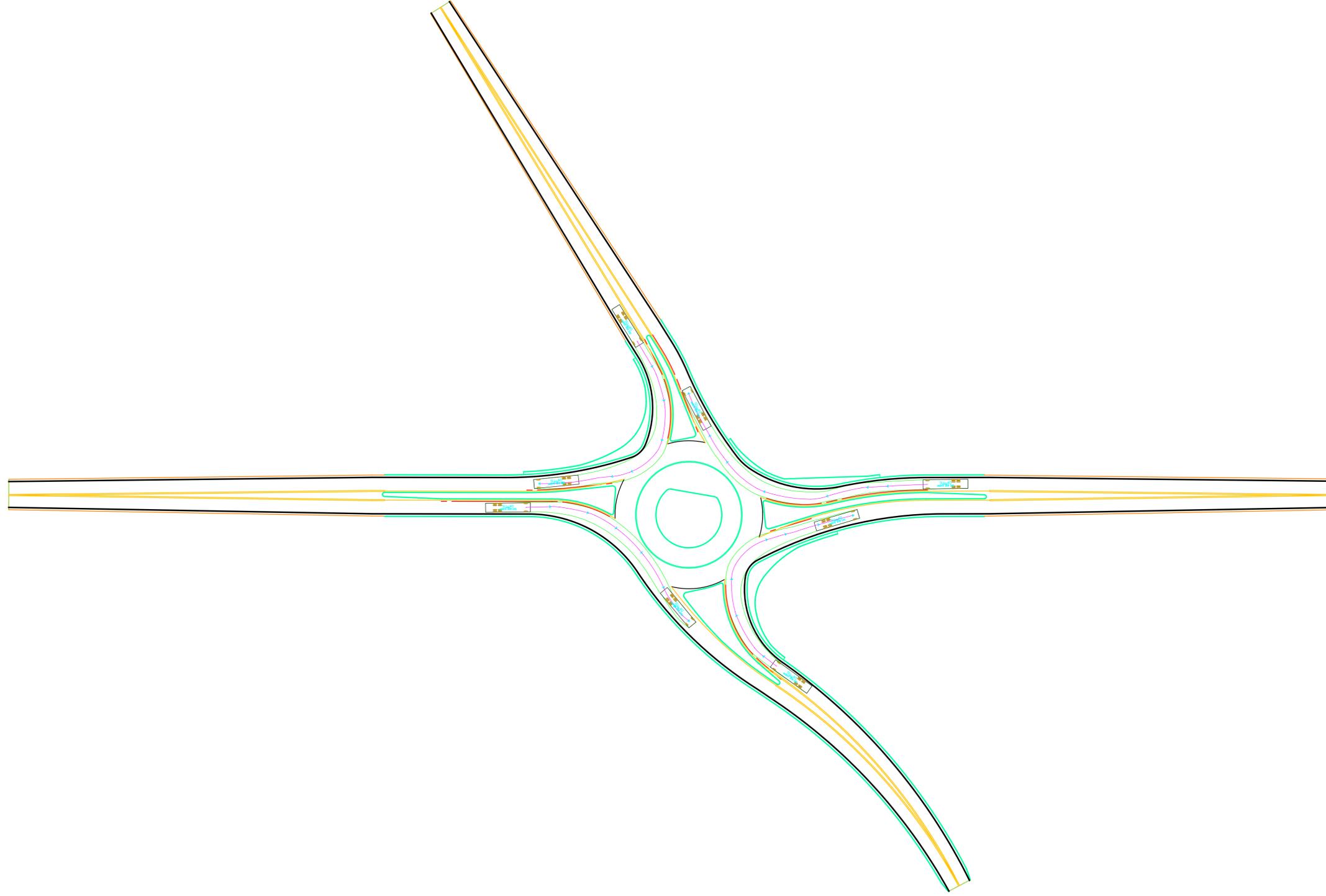
SHEET TOTAL
P.9 19

STA-173-1.07 (S.R. 173 & PARIS RAB)
TURNING MOVEMENTS - SU-40 THRU

HORIZONTAL
SCALE IN FEET
0 25 50 100

STA-173-1.07 - ROUNDABOUT PACKET

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DESIGN AGENCY



DESIGNER
MEP

REVIEWER
MSG 1/29/26

PROJECT ID
121934

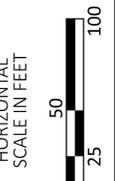
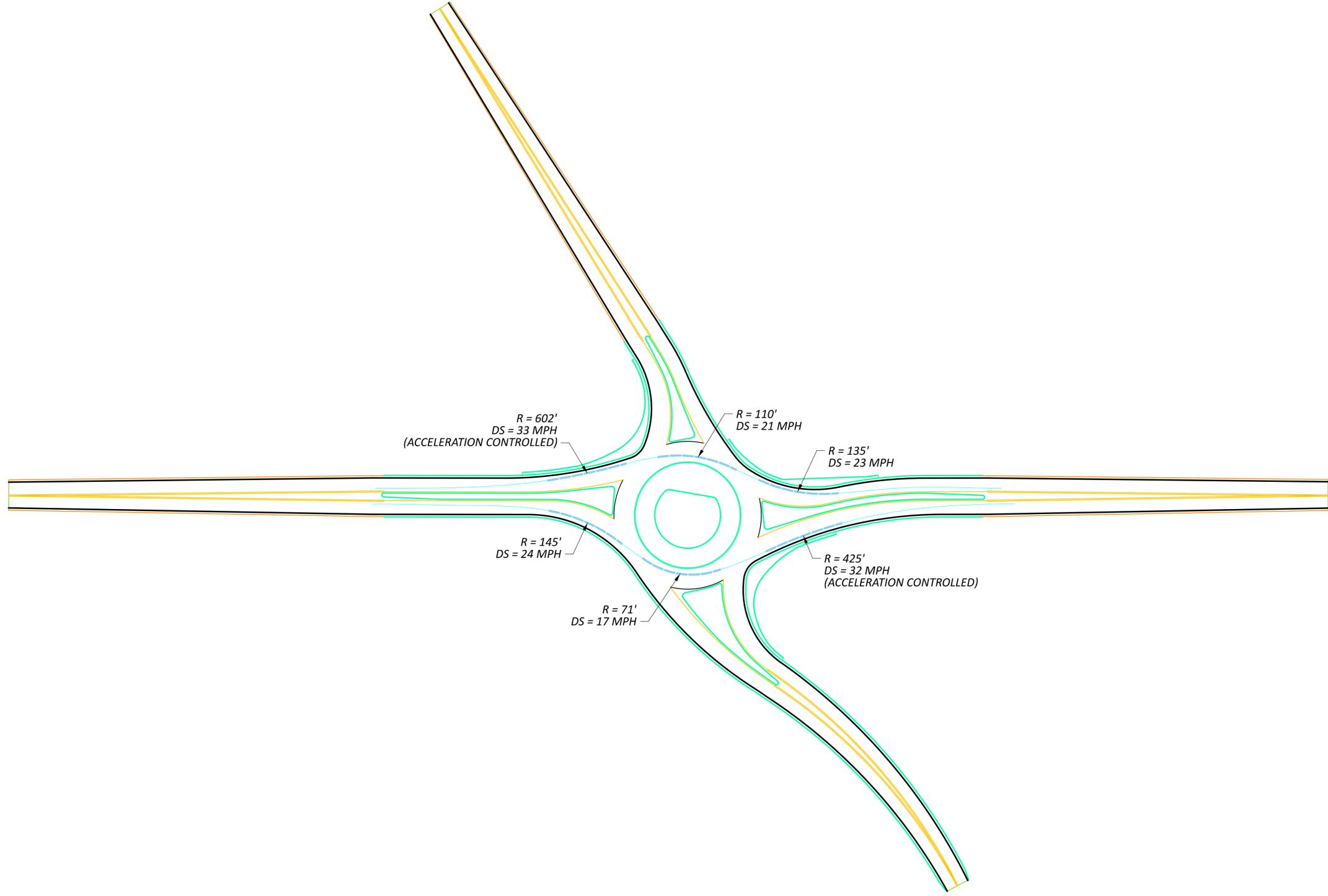
SHEET TOTAL
P.10 19

STA-173-1.07 (S.R. 173 & PARIS RAB)
TURNING MOVEMENTS - SU-40 RIGHTS



STA-173-1.07 - ROUNDABOUT PACKET

MODEL: EB-WB Thru [Sheet] PAPER SIZE: 34x22 (in.) DATE: 1/29/2026 TIME: 09:11:48 USER: mphlip1
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STA-173-1.07 (S.R. 173 & PARIS RAB)
FASTEST PATHS - EB & WB THROUGH

DESIGN AGENCY



DESIGNER
MEP

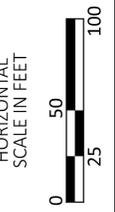
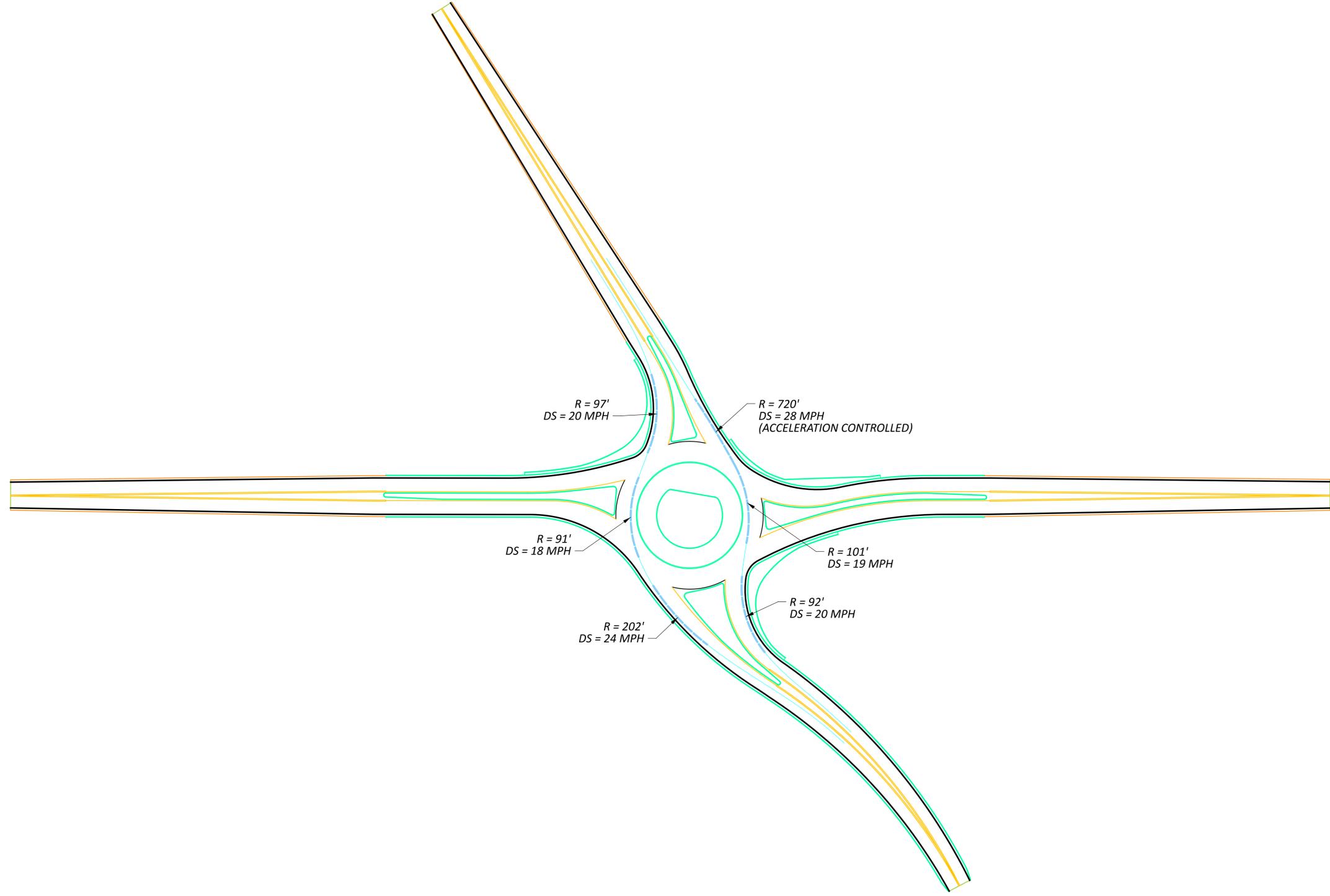
REVIEWER
MSG 1/29/26

PROJECT ID
121934

SHEET	TOTAL
P.11	19

STA-173-1.07 - ROUNDABOUT PACKET

MODEL: NB-SB Thru [Sheet] PAPER SIZE: 34x22 (in.) DATE: 1/29/2026 TIME: 09:11:55 USER: mphillip1
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**STA-173-1.07 (S.R. 173 & PARIS RAB)
 FASTEST PATHS - NB & SB THROUGH**

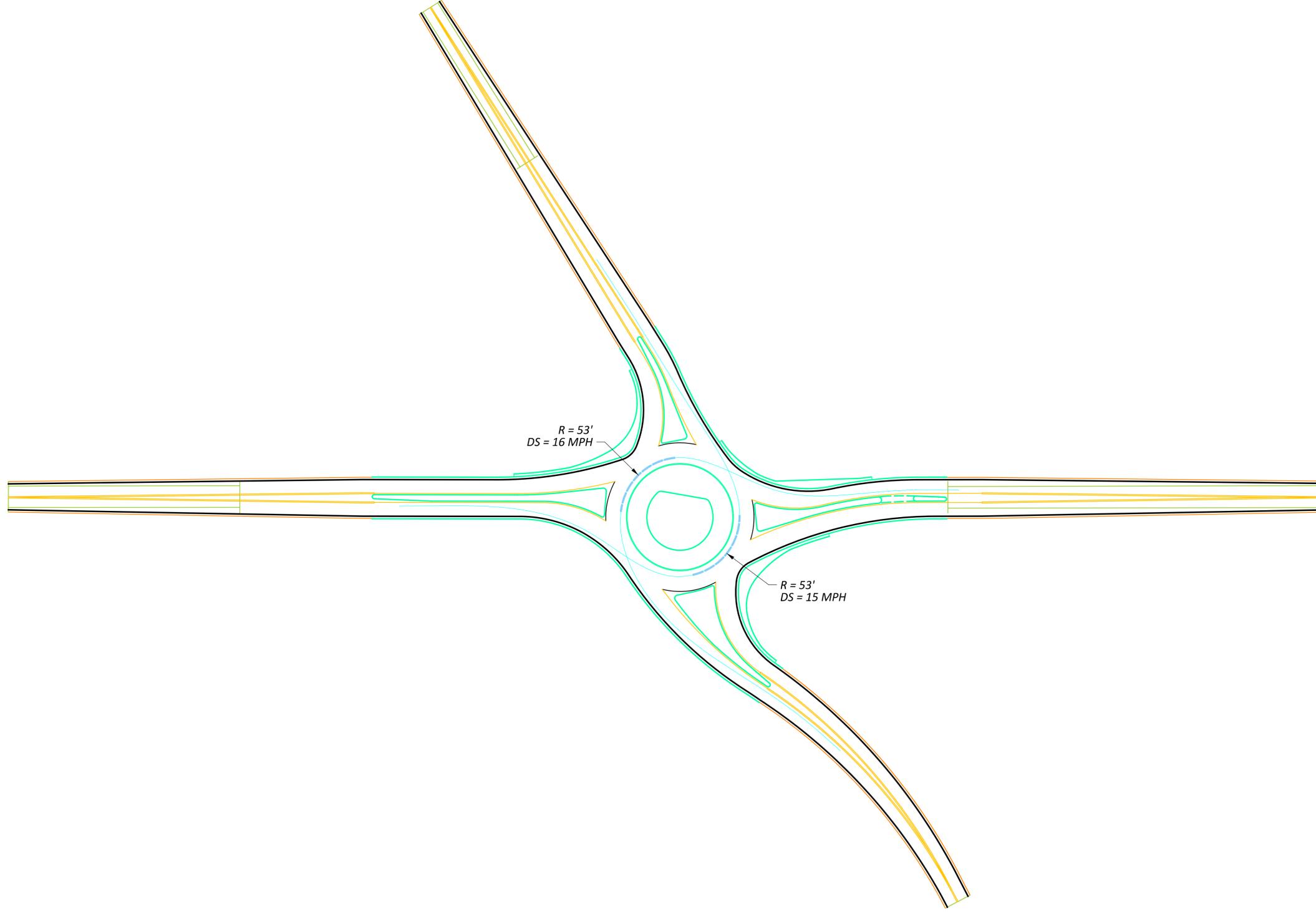
DESIGN AGENCY



DESIGNER	MEP
REVIEWER	MSG 1/29/26
PROJECT ID	121934
SHEET	TOTAL
P.12	19

STA-173-1.07 - ROUNDABOUT PACKET

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DESIGN AGENCY



DESIGNER
MEP

REVIEWER
MSG 2/26/26

PROJECT ID
121934

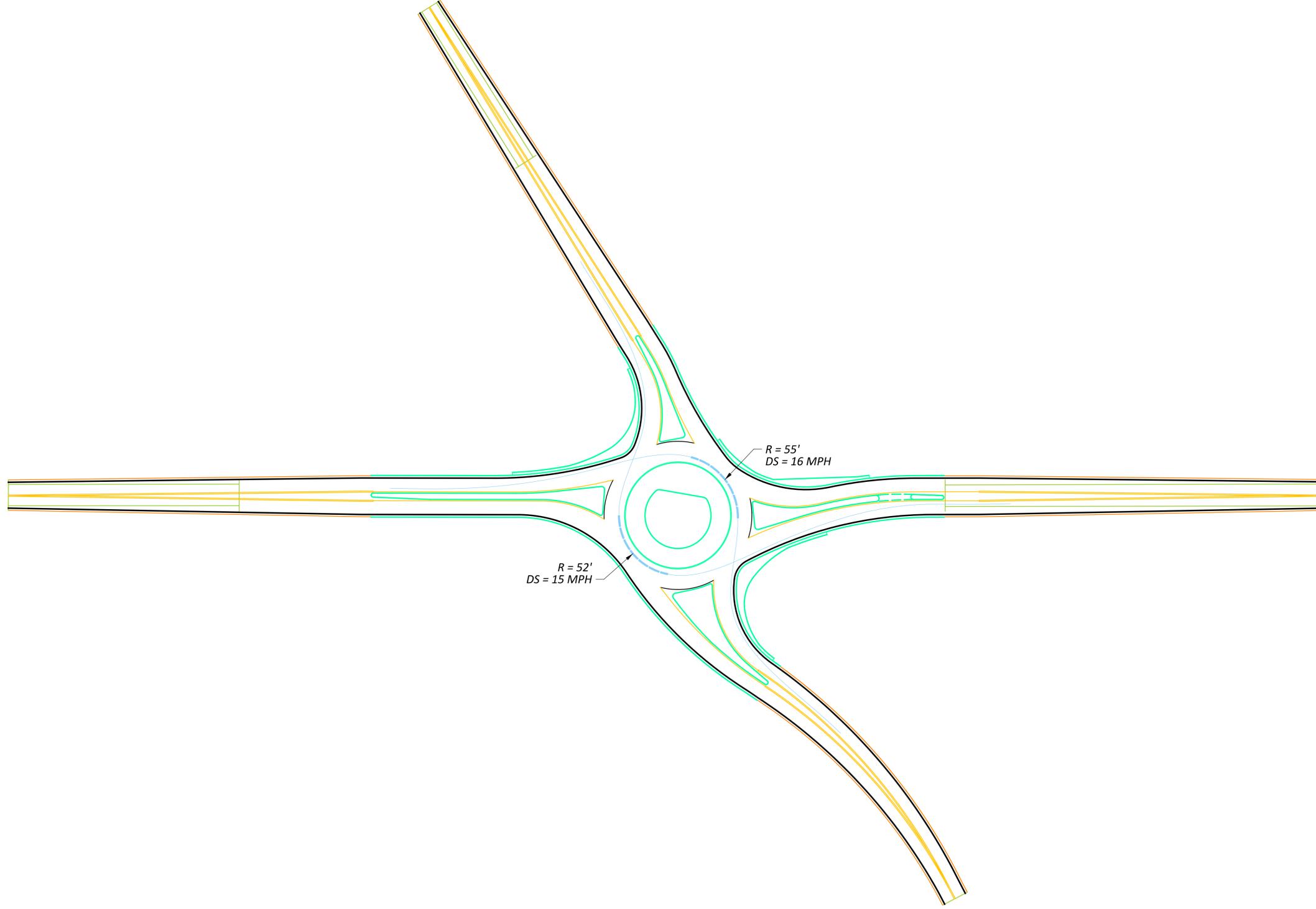
SHEET TOTAL
P.13 19

STA-173-1.07 (S.R. 173 & PARIS RAB)
FASTEST PATHS - EB & WB LEFTS

HORIZONTAL
SCALE IN FEET
0 25 50 100

STA-173-1.07 - ROUNDABOUT PACKET

MODEL: NB-SB Lefts [Sheet] PAPER SIZE: 34x22 (in.) DATE: 2/26/2026 TIME: 10:22:20 USER: mphillip1
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DESIGN AGENCY



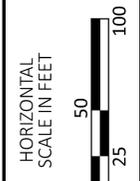
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MEP

REVIEWER
MSG 2/26/26

PROJECT ID
121934

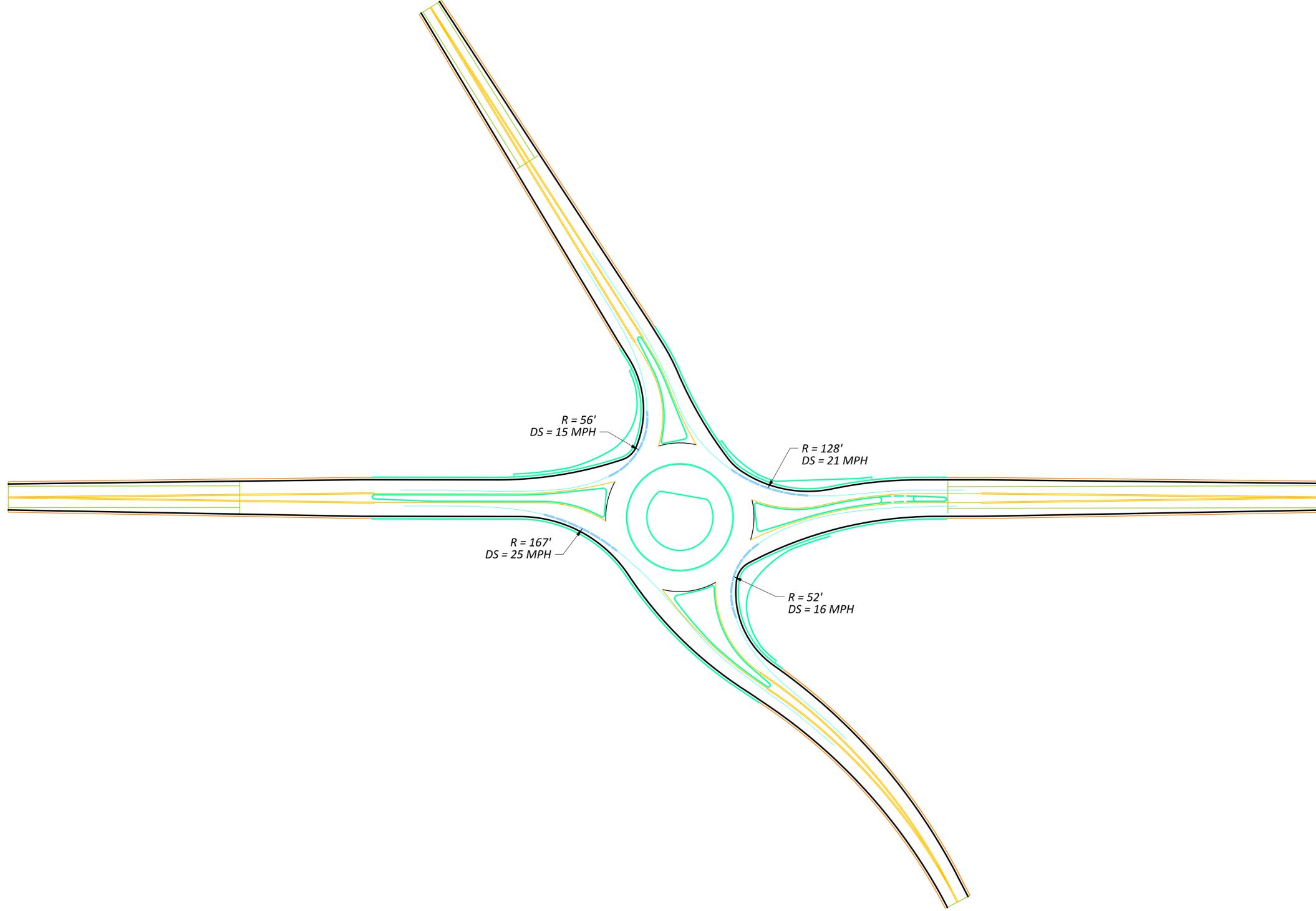
SHEET TOTAL
P.14 19

STA-173-1.07 (S.R. 173 & PARIS RAB)
FASTEST PATHS - NB & SB LEFTS



STA-173-1.07 - ROUNDABOUT PACKET

MODEL: Rights [Sheet] PAPER: 34x22 (in.) DATE: 2/26/2026 TIME: 10:22:26 USER: mphilip1
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STA-173-1.07 (S.R. 173 & PARIS RAB)
FASTEST PATHS - RIGHTS

DESIGN AGENCY



DESIGNER
MEP

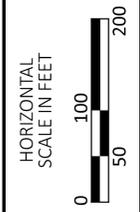
REVIEWER
MSG 2/26/26

PROJECT ID
121934

SHEET	TOTAL
P.15	19

STA-173-1.07 - ROUNDABOUT PACKET

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STA-173-1.07 (S.R. 173 & PARIS RAB)
APPROACH STOPPING SIGHT DISTANCE (SSD)

DESIGN AGENCY



DESIGNER

MEP

REVIEWER

MSG 1/29/26

PROJECT ID

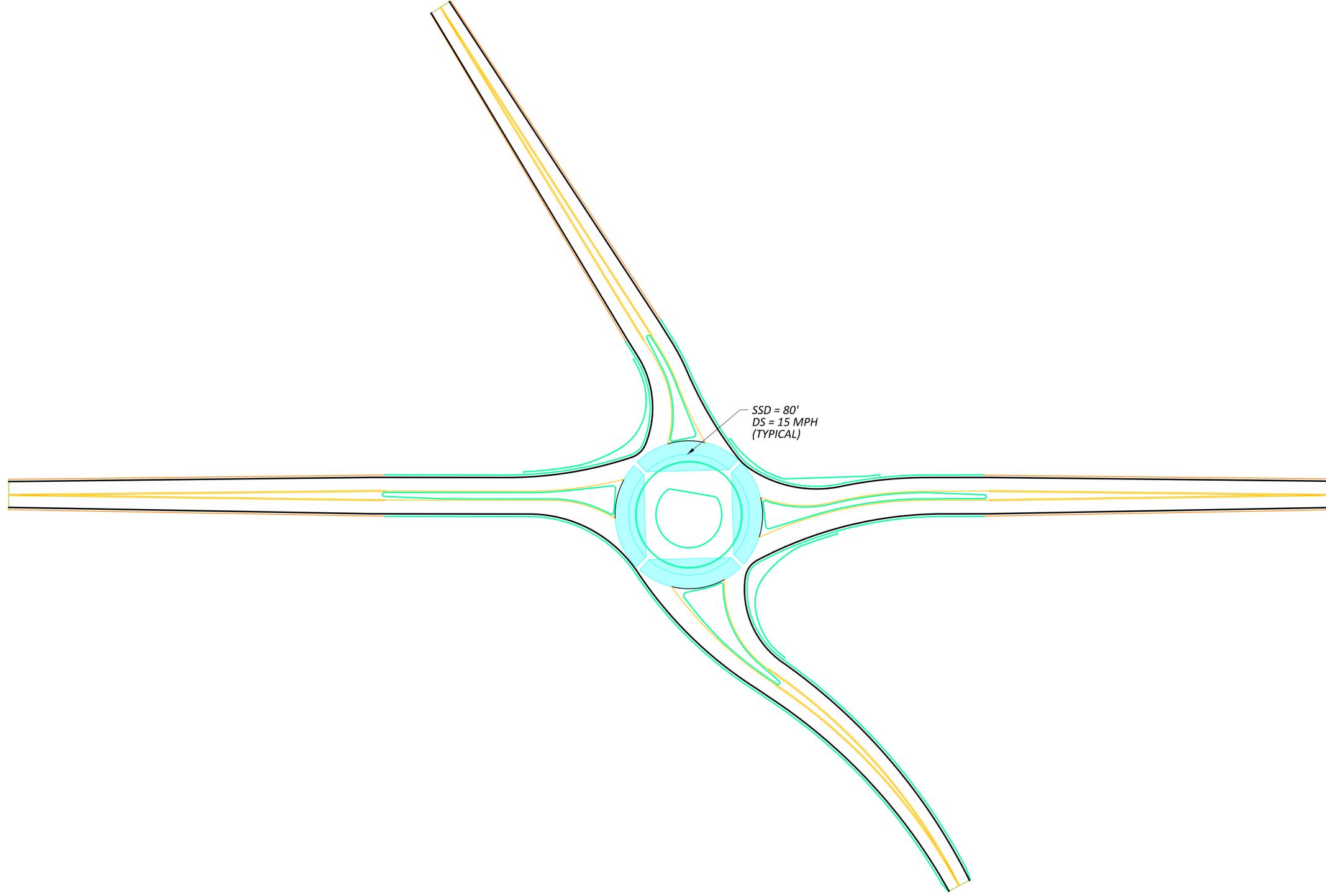
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SHEET TOTAL

P.16 19

STA-173-1.07 - ROUNDABOUT PACKET

MODEL: Circulatory SSD [Sheet] PAPER SIZE: 34x22 (in.) DATE: 1/29/2026 TIME: 09:12:28 USER: mphilip1
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DESIGN AGENCY



DESIGNER

MEP

REVIEWER

MSG 1/29/26

PROJECT ID

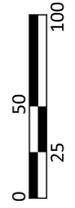
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SHEET TOTAL

P.17 19

STA-173-1.07 (S.R. 173 & PARIS RAB)
CIRCULATORY STOPPING SIGHT DISTANCE (SSD)

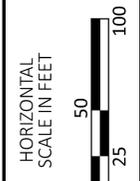
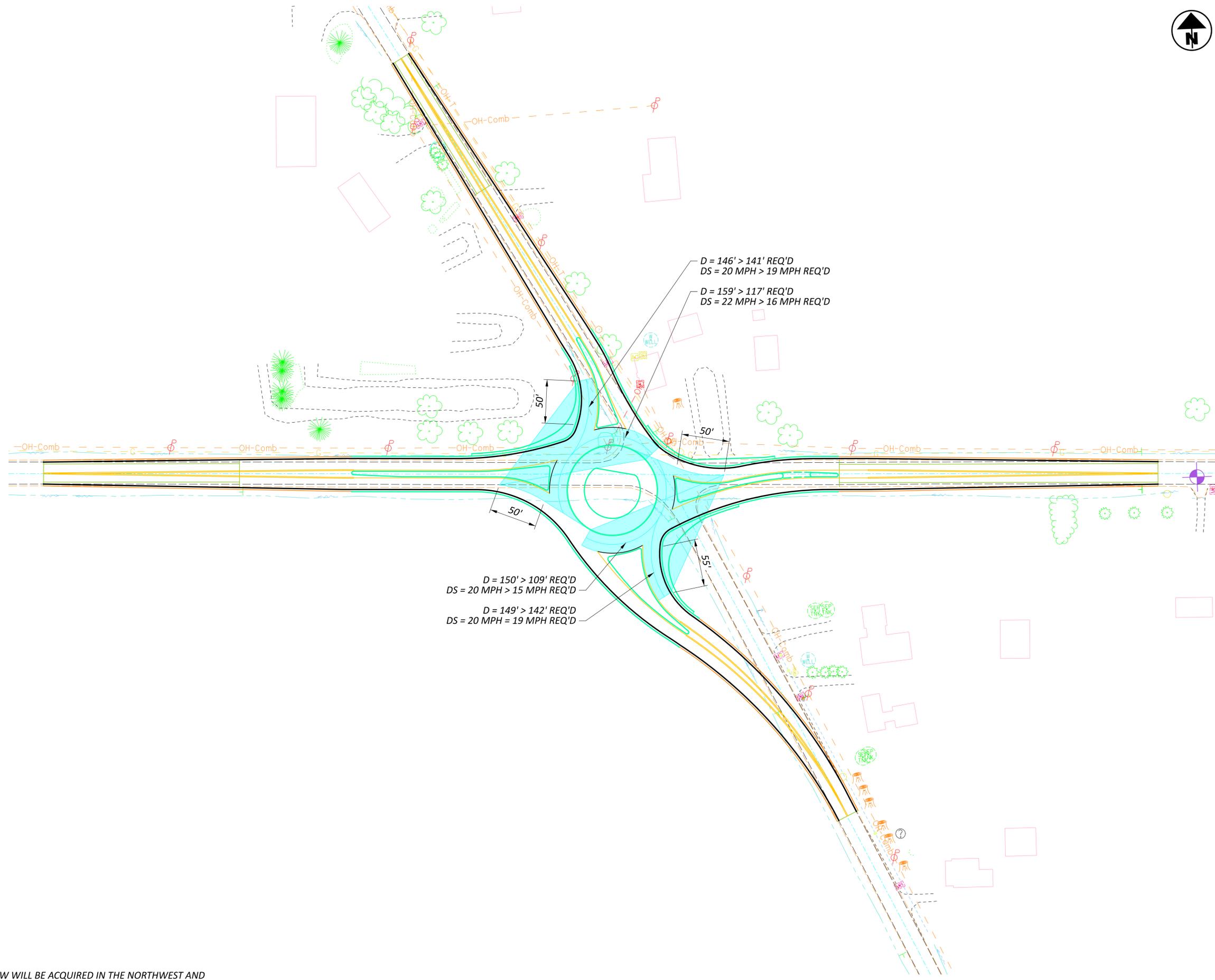
HORIZONTAL
SCALE IN FEET



STA-173-1.07 - ROUNDABOUT PACKET

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NOTE TO REVIEWER:
 IT IS ANTICIPATED THAT R/W WILL BE ACQUIRED IN THE NORTHWEST AND
 SOUTHEAST QUADRANTS TO ENSURE SIGHT DISTANCE IS MAINTAINED.



**STA-173-1.07 (S.R. 173 & PARIS RAB)
 EB & WB INTERSECTION SIGHT DISTANCE (ISD)**

DESIGN AGENCY



DESIGNER
 MEP

REVIEWER
 MSG 2/26/26

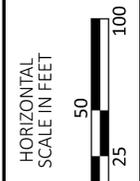
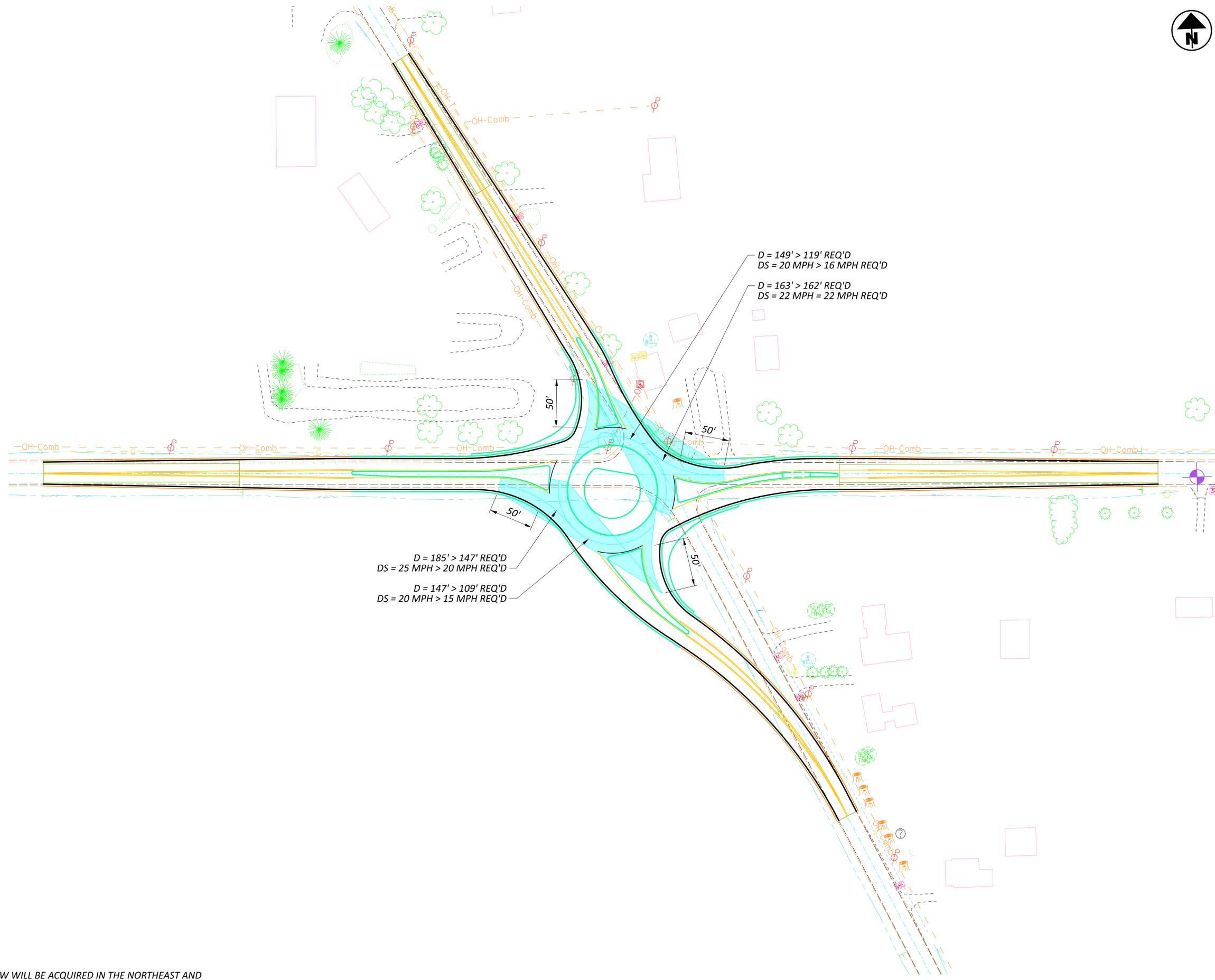
PROJECT ID
 121934

SHEET	TOTAL
P.18	19

STA-173-1.07 - ROUNDABOUT PACKET

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NOTE TO REVIEWER:
 IT IS ANTICIPATED THAT R/W WILL BE ACQUIRED IN THE NORTHEAST AND
 SOUTHWEST QUADRANTS TO ENSURE SIGHT DISTANCE IS MAINTAINED.



**STA-173-1.07 (S.R. 173 & PARIS RAB)
 NB & SB INTERSECTION SIGHT DISTANCE (ISD)**

DESIGN AGENCY



DESIGNER
MEP

REVIEWER
MSG 2/26/26

PROJECT ID
121934

SHEET	TOTAL
P.19	19