

Appendix A

ACHD Fastest Path Procedure

Appendix A ACHD Fastest Path Procedure

Fastest Path Definition

The fastest path is the path of least travel time made by a passenger vehicle traversing through the roundabout in the absence of other traffic and ignoring all lane markings. A true fastest path is comprised of a series of consecutive spiral curves that are tangent to each other. The speeds of the fastest path are limited by the smallest radius of each spiral, superelevation, and a vehicle's ability to accelerate.

Procedure Objectives

All measured fastest paths and their corresponding speeds are estimates based on engineering practices and judgment. The purpose of the ACHD Fastest Path Procedure is to remove as much guesswork and variability from fastest path measurements as possible and to achieve the following goals:

- Be objective;
- Be repeatable;
- Be consistent with the most current edition of the FHWA Roundabout Guide recommendations; and
- Reflect anticipated driver behavior and vehicle performance.

Procedure Applicability

The ACHD Fastest Path Procedure should be used to estimate the fastest paths of typical roundabouts with one and two entry lanes with either flat or tight exit geometry. In rare cases (e.g., a dog bone shaped roundabout) the Procedure is not anticipated to be applicable and an experienced roundabout designer hand sketch should be used. The ACHD Fastest Path Procedure is performed with a Computer Aided Drafting (CAD) software but should be supplemented with an experienced designer's hand sketch or other tested procedure to confirm the results and identify potential enhancements to the procedure.

*The resulting path from the ACHD Fastest Path Procedure is not intended to trace or resemble the actual fastest path because it is replacing spirals with arcs and tangents. Rather, the results are intended to provide arc radii that match the actual fastest path spiral radii at their tightest points.

Procedure Steps

First, determine whether the subject approach has one or two entry lanes and whether the corresponding exit has flat or tight exit geometry (Procedure A – Exit Type Test). Second, follow the applicable procedure (Procedure #1, #2, or #3) and measure the fastest path radii and/or acceleration distances for the subject approach. Next, determine the roadway's superelevation for each measurement (typically $e = +0.02$ for right-turns and $e = -0.02$ for left-turns at roundabouts). Last, calculate an estimated 85th-percentile speed for each movement with the applicable equations (see below).

Speed Based on Defining Radius

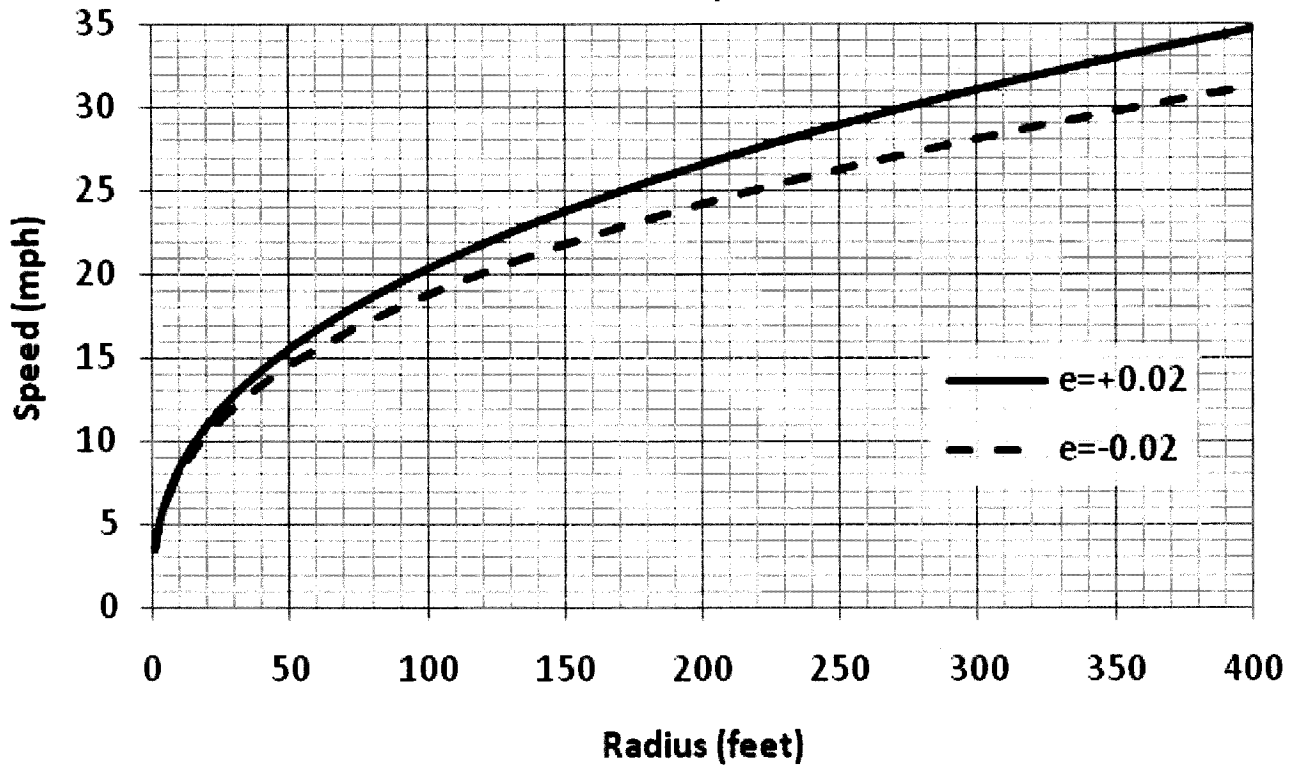
Below are fitted equations that are used to estimate vehicle speed (V , mph) based on its path radius (R , feet) and superelevation (e). These equations should be used to estimate most or all of the fastest path speeds in a roundabout. Figure A1 plots the speed versus radius equations for supplementary reference.

$$V = 3.4415 \times R^{0.2961}, \text{ for } e = +0.02$$

$$V = 3.4614 \times R^{0.2673}, \text{ for } e = -0.02$$

Appendix A
 ACHD Fastest Path Procedure

**Figure A1
 Speed-Radius
 Relationship**



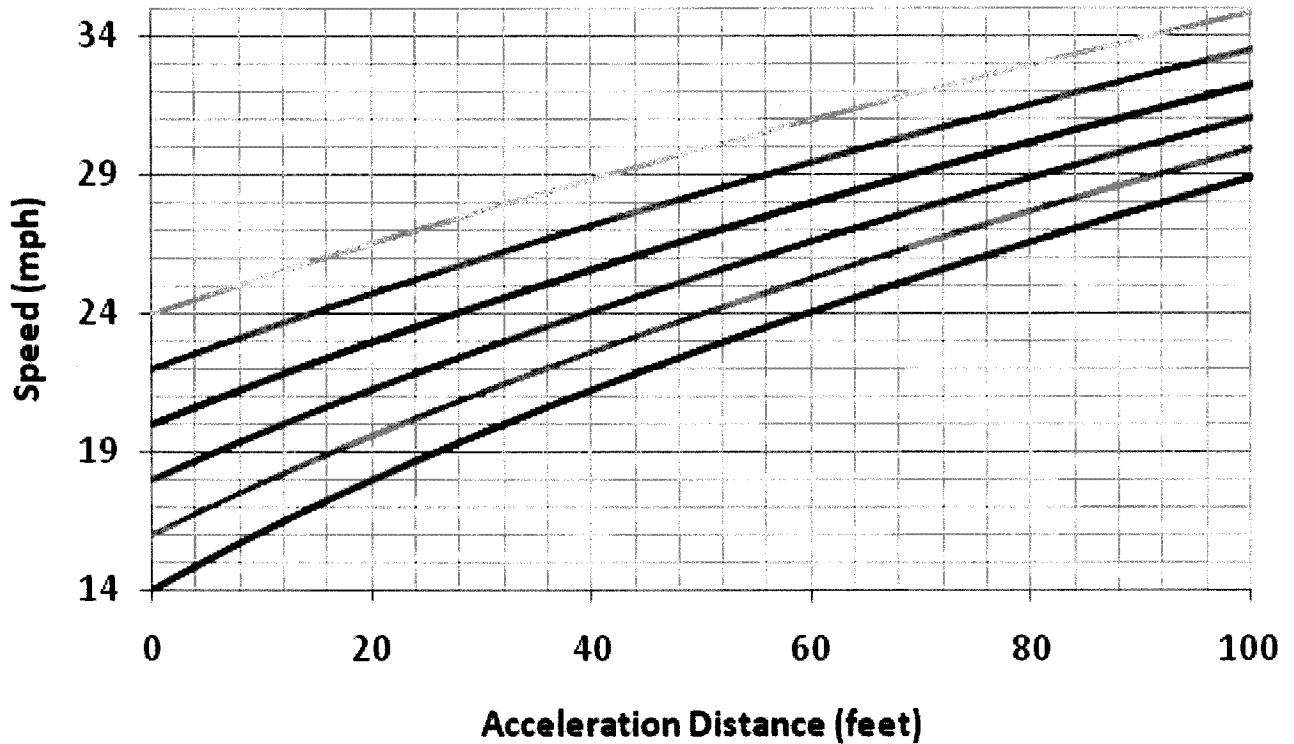
Speed Based on Acceleration Distance

The equation below is used to estimate vehicle speed (V_3 , mph) based on the previous movement's speed (V_2 , mph) and the distance (D , feet) between the midpoint of the V_2 path and the point of interest along the V_3 path. This equation is typically used to estimate the speed of exiting through movement vehicles in roundabouts with flat exits. Figure A2 plots the speed versus acceleration distance equation for supplementary reference.

$$V_3 = \frac{1}{1.47} \sqrt{(1.47 \times V_2)^2 + 13.8 \times D}$$

Appendix A
ACHD Fastest Path Procedure

Figure A2
Speed-Acceleration Distance Relationship



Questions or Comments

Please contact Andrew Cibor in ACHD's traffic department at (208) 387-6140 with any questions or comments concerning the ACHD Fastest Path Procedure.

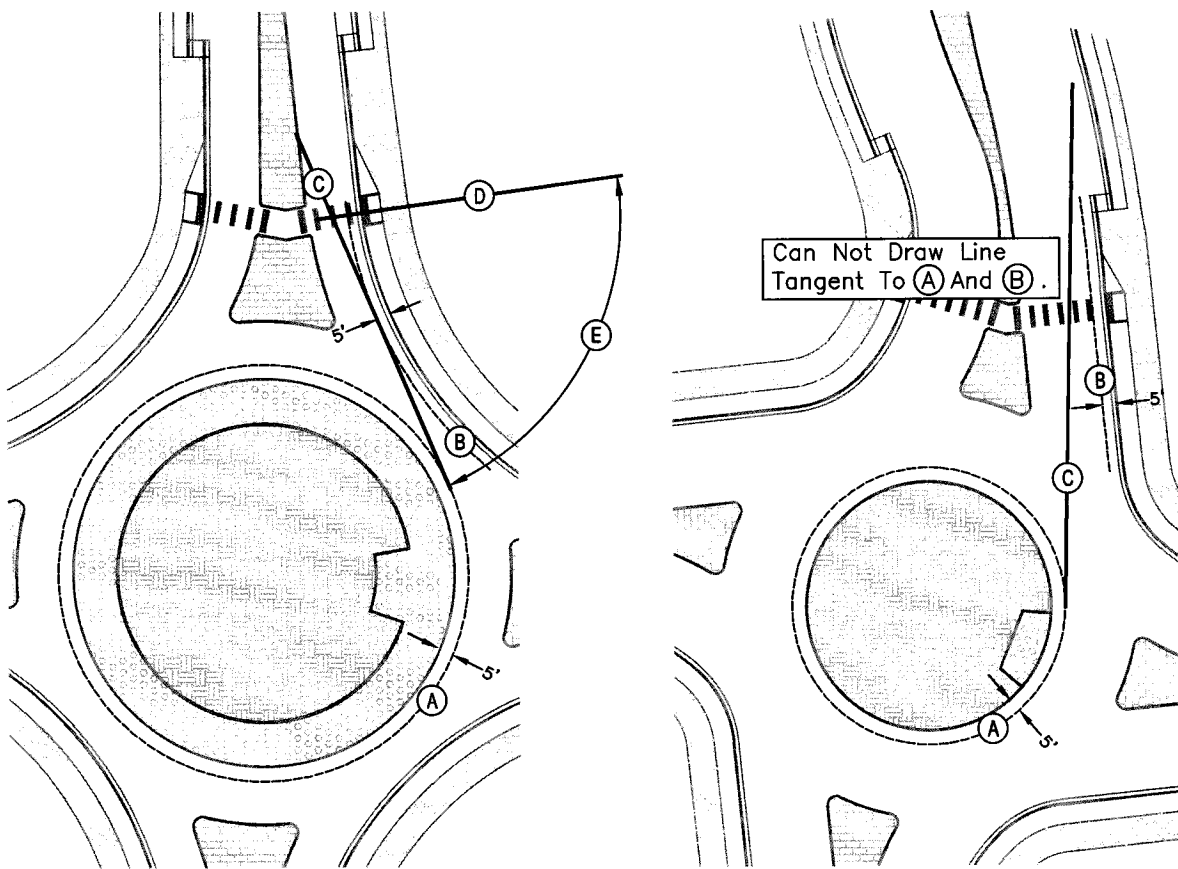
Attachments

- Procedure A - Exit Type Test (Page A4)
- Procedure #1 - Single Entry Lane with Flat Exit (Pages A5 to A12)
- Procedure #2 - Two Entry Lanes with Flat Exit (Pages A13 to A20)
- Procedure #3 - Tight Exit (Pages A21 to A27)

ACHD FASTEST PATH PROCEDURE

Procedure A – Exit Type Test

Revised: November 30, 2010



Exit Type Test

Steps A to E

- Step (A) – Offset The Center Island Curb (Outside Of Truck Apron If Present) By 5–Feet Toward The Outside.
- Step (B) – Offset The Outside Exit Curb By 5–Feet Toward The Inside.
- Step (C) – Draw A Line Tangent To Center Island Offset And Outside Exit Offset. If This Lines Does Not Exist, Skip Steps (D) and (E).
- Step (D) – Draw A Line Perpendicular To Outside Exit Curb Approximately 30 Feet Beyond Circulatory Roadway (Center Of Crosswalk).
- Step (E) – Measure Angle Between Tangent Line Drawn In Step (C) And Perpendicular Line Drawn In Step (D).

Fastest Path Procedure Selection

If Step (C) Tangent Line Does Not Exist Or If The Angle Measured In Step (E) Is Greater Than 90 Degrees Proceed With One Of The Following Procedures:

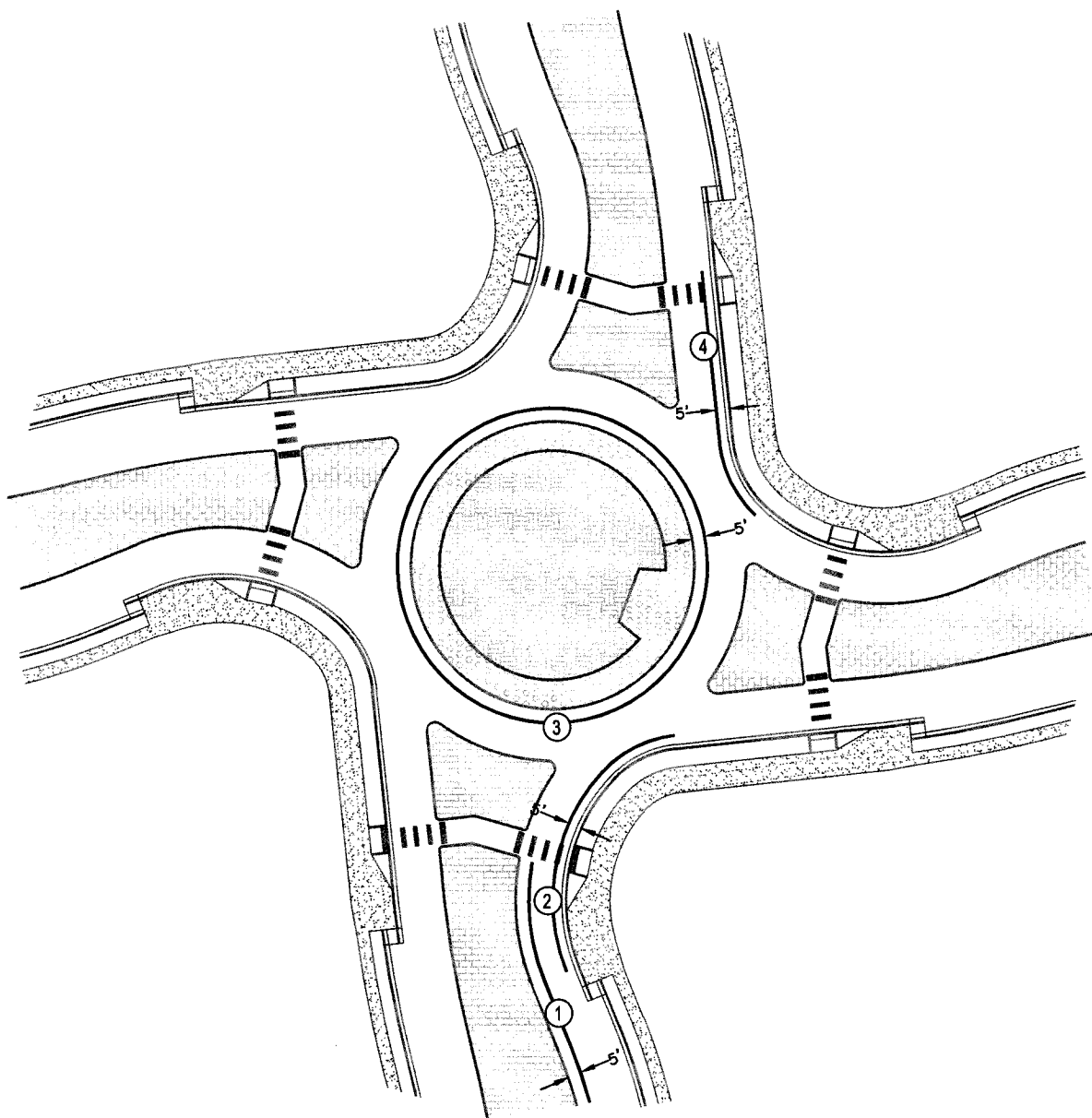
- Procedure #1 (Pages A5 To A12) – Single Entry Lane With Flat Exit If There Is Only One Entry Lane; or
- Procedure #2 (Pages A13 To A20) – Two Entry Lanes With Flat Exit If There Are Two Entry Lanes.

If The Angle Measured In Step (E) Is Less Than 90 Degrees Proceed With The Following Procedure:

- Procedure #3 (Pages A21 to A27) – Tight Exit.

ACHD FASTEST PATH PROCEDURE

Procedure #1 – Single Entry Lane With Flat Exit
Revised: November 30, 2010



Fastest Path Layout

Offset Construction Points

Steps 1 to 4

- Step ① – Offset The Inside Approach Curb By 5–Feet Toward The Outside.
- Step ② – Offset The Outside Entry Curb By 5–Feet Toward The Inside.
- Step ③ – Offset The Center Island Curb (Outside Of Truck Apron If Present) By 5–Feet Toward The Outside.
- Step ④ – Offset The Outside Departure Curb By 5–Feet Toward The Inside.

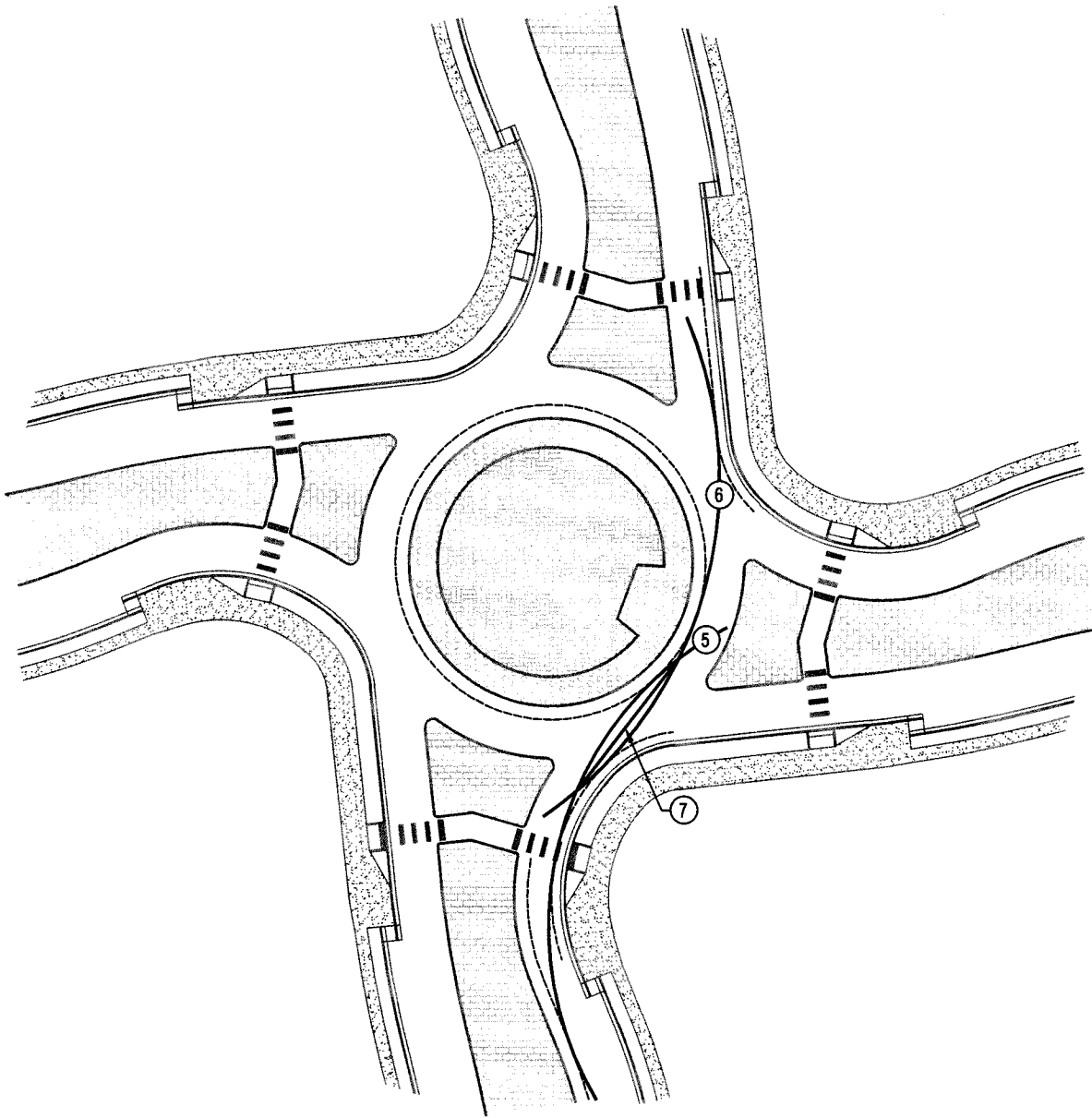
Fastest Path Values

R4 = The Radius Of The Circle Drawn In Step ③

ACHD FASTEST PATH PROCEDURE

Procedure #1 – Single Entry Lane With Flat Exit

Revised: November 30, 2010



Fastest Path Layout

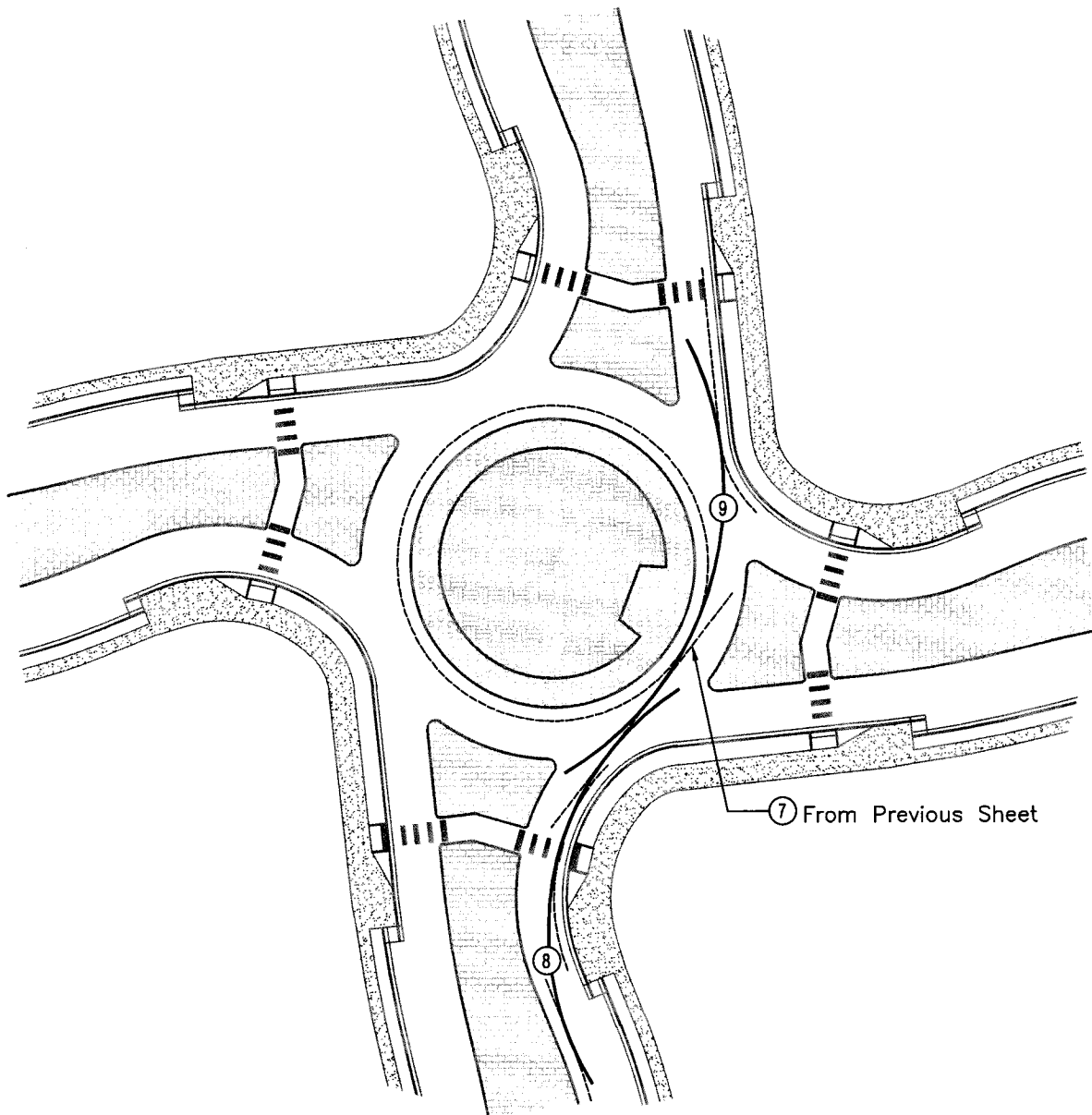
Tangent Construction Lines

Steps 5 to 7

- Step ⑤ – Draw A 3 Point Circle, Tangent To Inside Approach Offset, The Outside Entry Offset, And The Center Island Offset.
- Step ⑥ – Draw A 3 Point Circle, Tangent To Outside Entry Offset, Center Island Offset, And Outside Exit Offset.
- Step ⑦ – Draw A Straight Line Between The Two Points Where The Circles From Step ⑤ And Step ⑥ Cross Each Other.

ACHD FASTEST PATH PROCEDURE

Procedure #1 – Single Entry Lane With Flat Exit
Revised: November 30, 2010



Fastest Path Layout

Tangent Construction Circles
Steps 8 to 9

- Step ⑧ – Draw A 3 Point Circle, Tangent To Inside Approach Offset, The Outside Entry Offset, And The Straight Line Drawn In Step ⑦.
- Step ⑨ – Draw A 3 Point Circle, Tangent To The Straight Line Drawn In Step ⑦, The Center Island Offset, And The Outside Departure Offset.

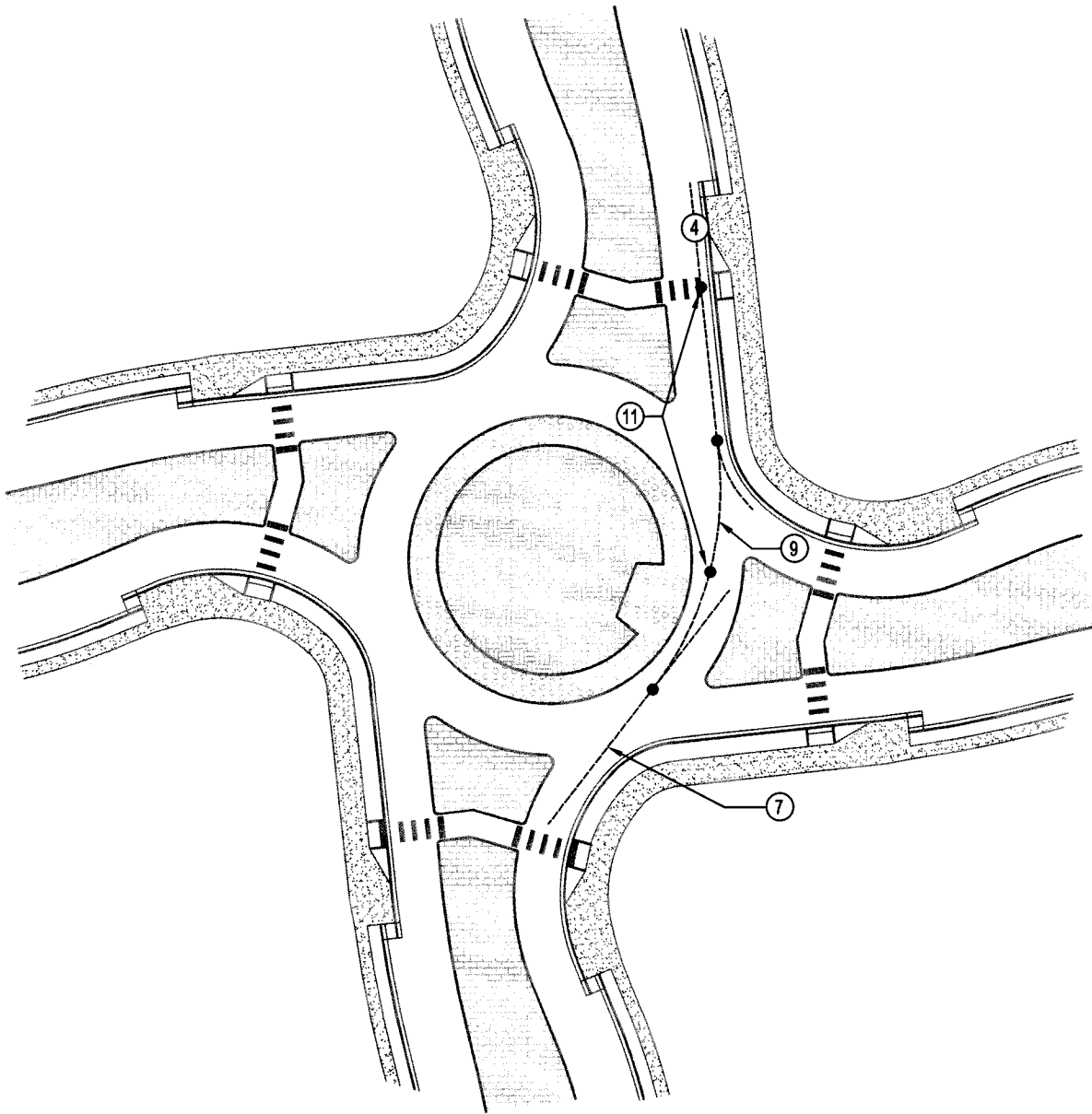
Fastest Path Values

R2 = The Radius Of The Circle Drawn In Step ⑨

ACHD FASTEST PATH PROCEDURE

Procedure #1 – Single Entry Lane With Flat Exit

Revised: November 30, 2010



Fastest Path Layout

Acceleration Distance
Steps 10 to 11

- Step ⑩ – Trim The Circle Drawn In Step ⑨ With The Line Drawn In Step ⑦ And The Outside Departure Offset Drawn In Step ④.
- Step ⑪ – Measure The Distance Traveled Along The Combination Of The Arc Created In Step ⑩ And The Tangent Outside Departure Offset From The Midpoint Of The Arc Crated In Step ⑩ To The Midpoint Of The Pedestrian Crosswalk.

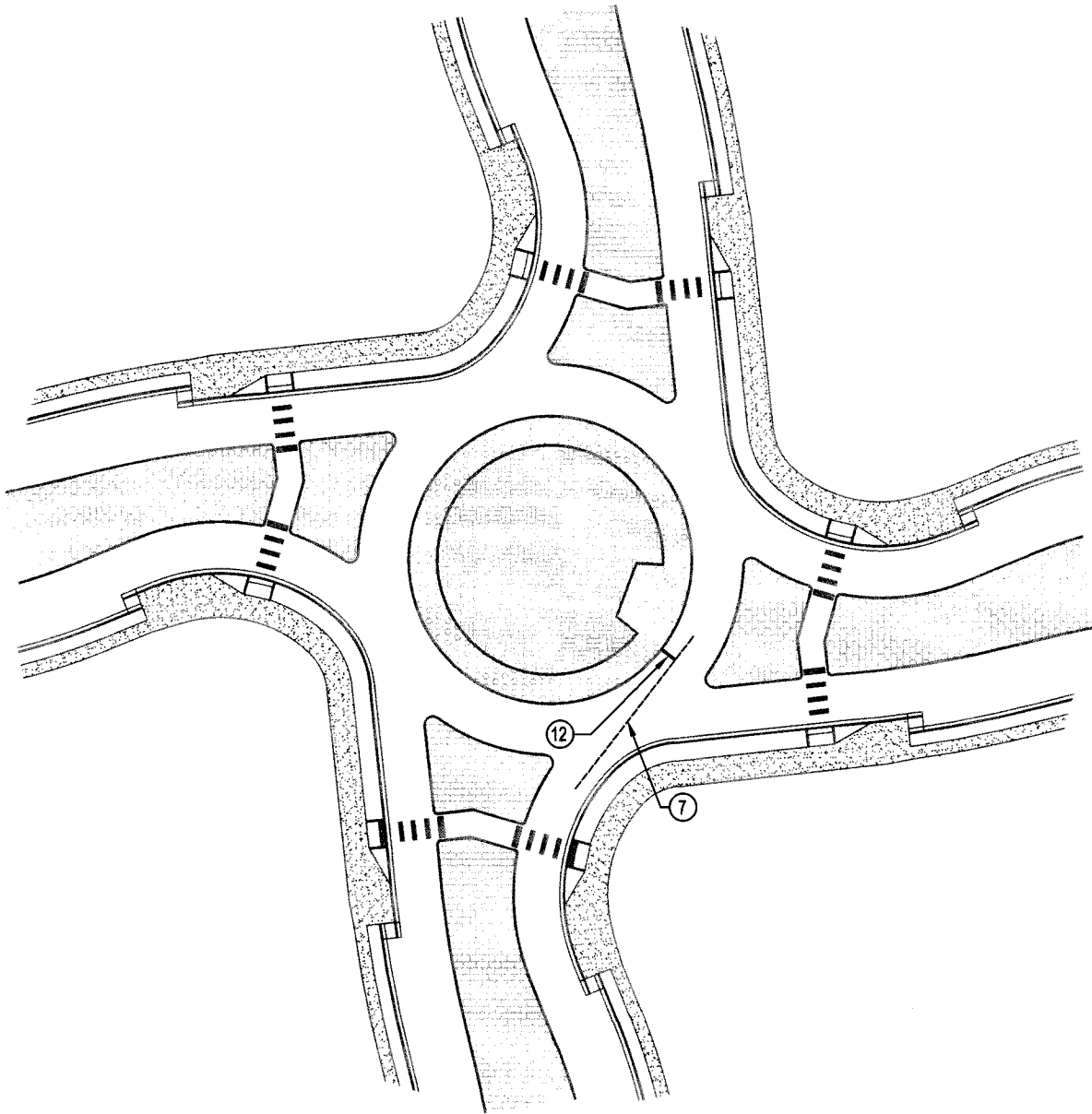
Fastest Path Values

V3 = Calculate Based On Speed Of R2 And Acceleration Over Distance Measured In Step ⑪ .

ACHD FASTEST PATH PROCEDURE

Procedure #1 – Single Entry Lane With Flat Exit

Revised: November 30, 2010



Fastest Path Layout

New Offset Measurement

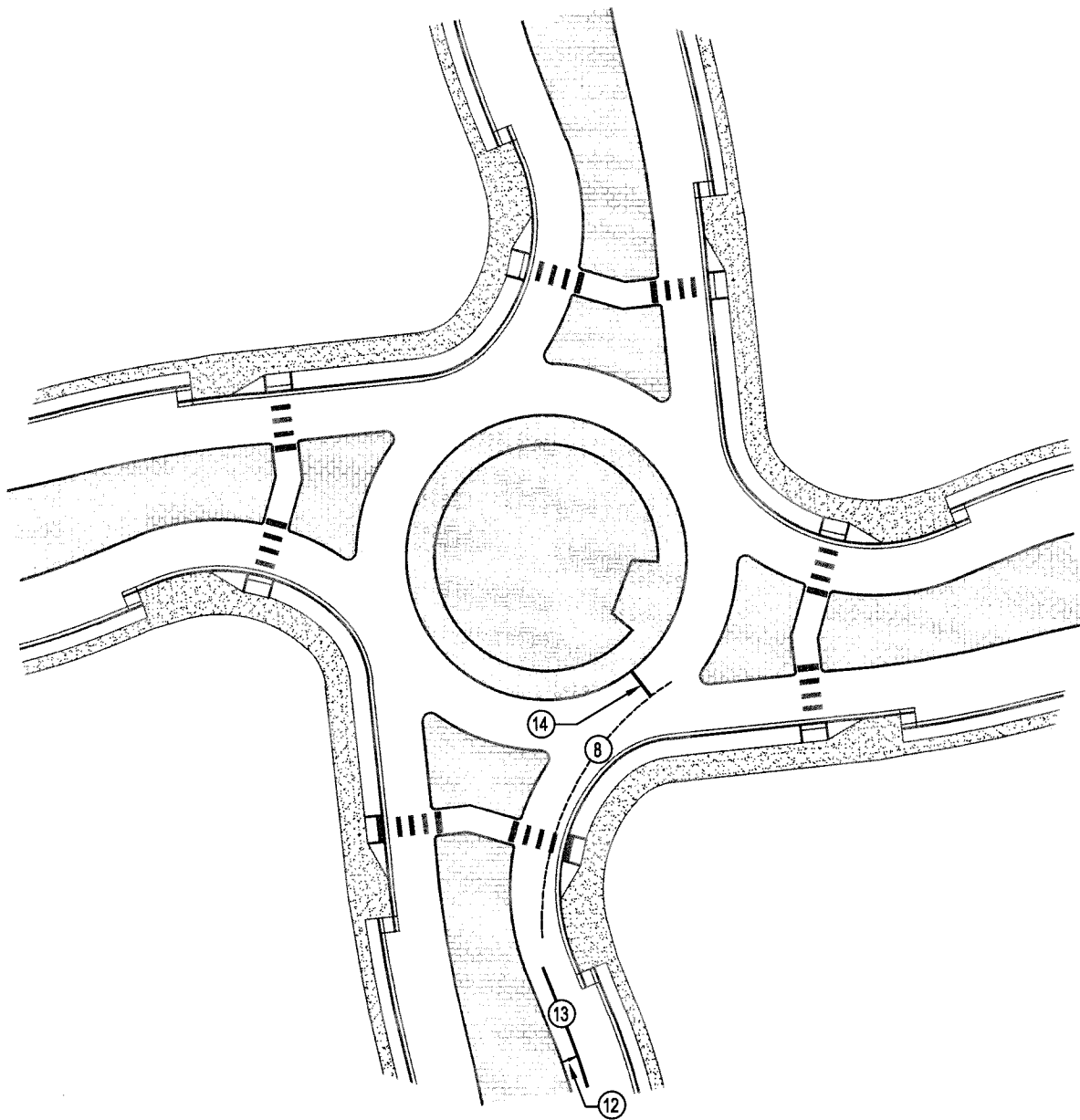
Step 12

Step ⑫ – Draw A Straight Line From The Center Of The Roundabout, Perpendicular To The Straight Line Drawn In Step ⑦, And Measure The Distance Along This Line From The Center Island Curb (Outside Of The Truck Apron Curb If Present) To Line ⑦.

ACHD FASTEST PATH PROCEDURE

Procedure #1 – Single Entry Lane With Flat Exit

Revised: November 30, 2010



Fastest Path Layout

Construction Offset Lines

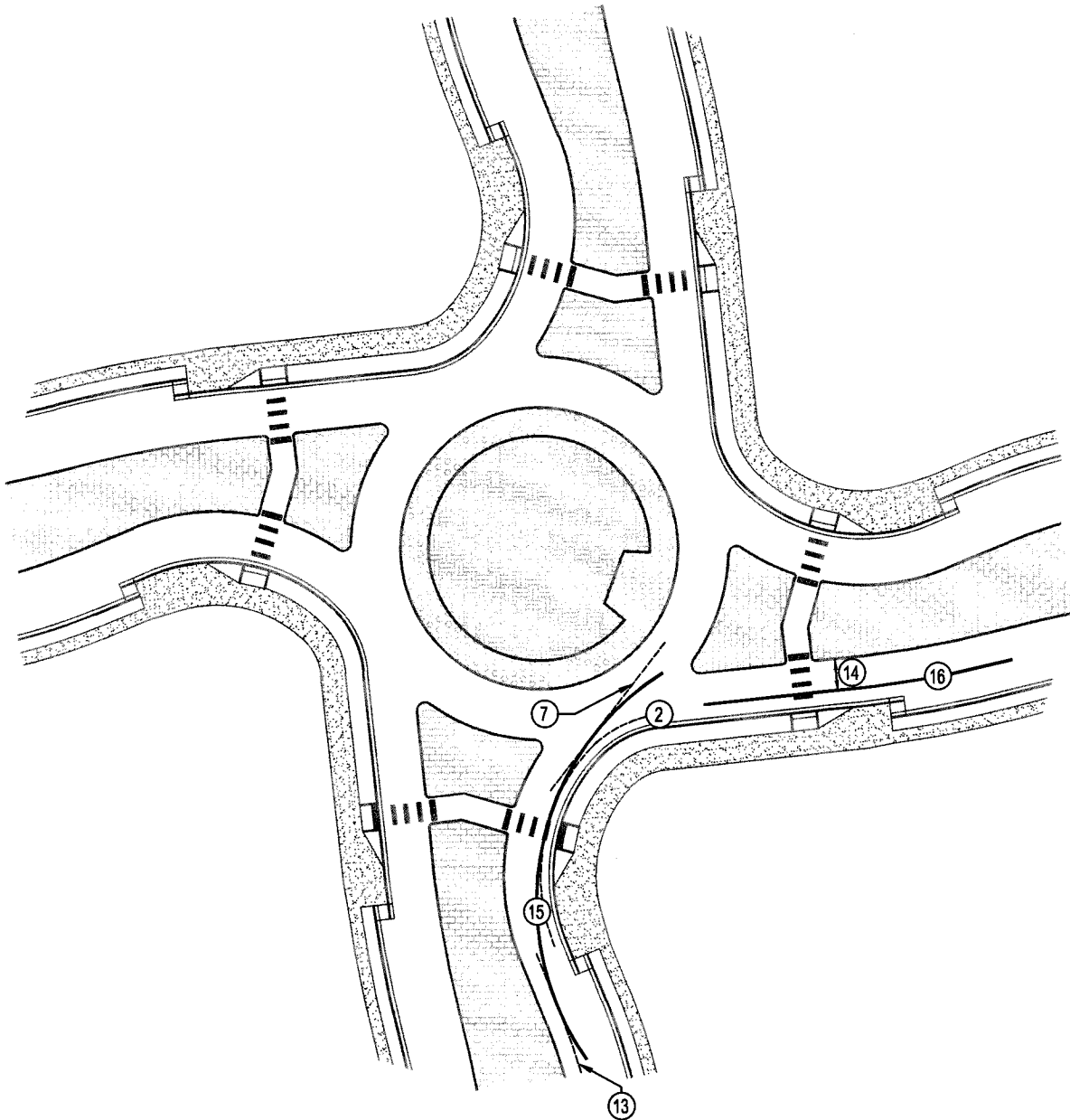
Steps 13 to 14

- Step ⑬ – Offset The Inside Approach Curb By The Distance Measured In Step ⑫ Toward The Outside.
- Step ⑭ – Draw A Straight Line From The Center Of The Roundabout, Perpendicular To The Circle Drawn In Step ⑧, And Measure The Distance Along This Line From The Center Island Curb (Outside Of The Truck Apron Curb If Present) To Circle ⑧.

ACHD FASTEST PATH PROCEDURE

Procedure #1 – Single Entry Lane With Flat Exit

Revised: November 30, 2010



Fastest Path Layout

Measurement Circle
Steps 15 to 16

- Step 15 – Draw A 3 Point Circle, Tangent To The Inside Approach Offset Drawn In Step 13 , The Outside Entry Offset Drawn In Step 2 , And The Straight Line Drawn In Step 7 .
- Step 16 – Offset The Inside Right-Turn Departure Curb By The Distance Measured in Step 14 Toward The Outside.

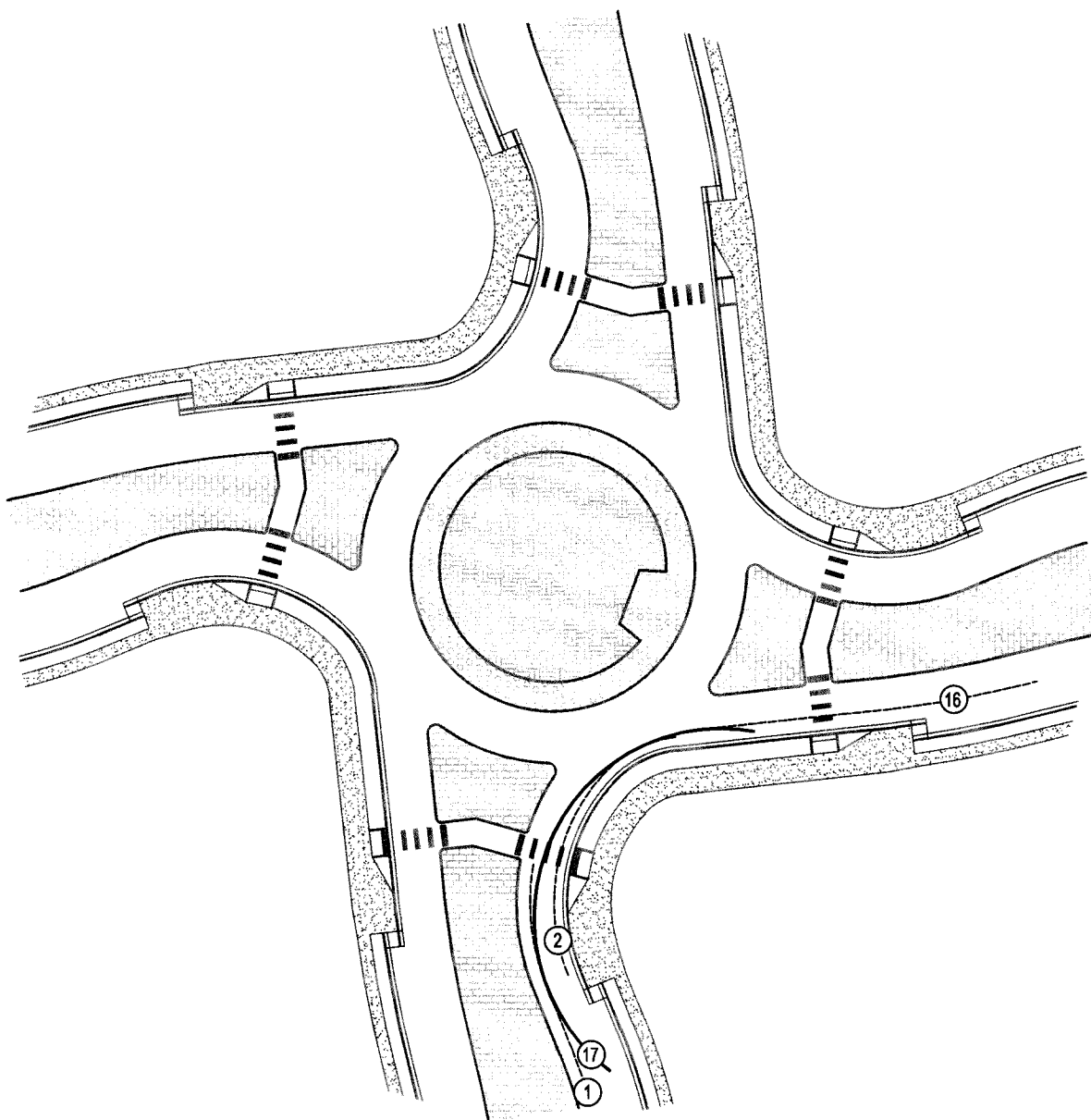
Fastest Path Values

R1 = The Radius Of The Circle Drawn In Step 15

ACHD FASTEST PATH PROCEDURE

Procedure #1 – Single Entry Lane With Flat Exit

Revised: November 30, 2010



Fastest Path Layout

Right Turn Measurement Circle

Step 17

Step ⑰ – Draw A 3 Point Circle, Tangent To The Inside Approach Offset Drawn In Step ①, The Outside Entry Offset Drawn In Step ②, And The The Inside Right-Turn Departure Curb Offset Drawn In Step ⑯.

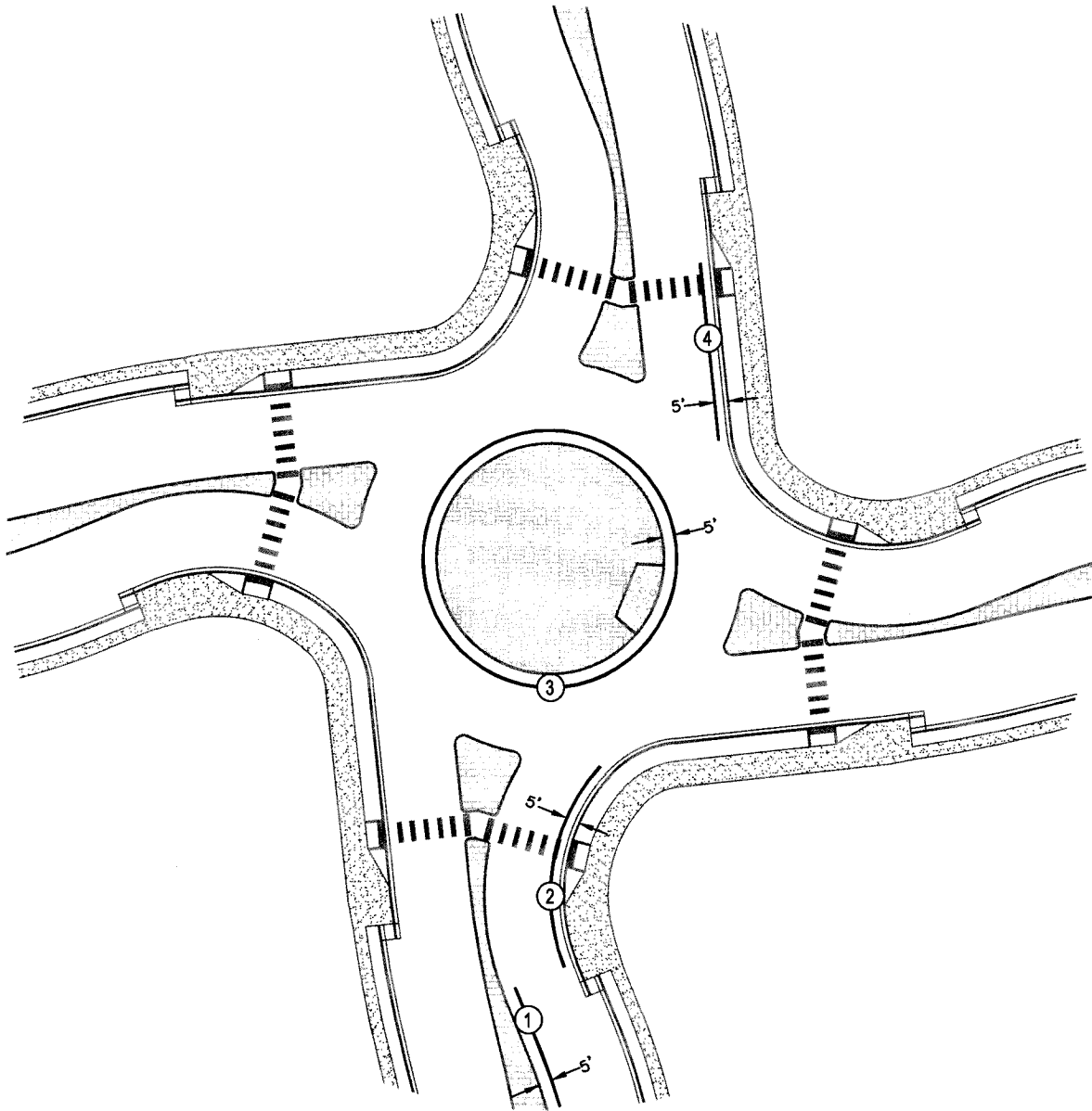
Fastest Path Values

R5 = The Radius Of The Circle Drawn In Step ⑰

ACHD FASTEST PATH PROCEDURE

Procedure #2 – Two Entry Lanes With Flat Exit

Revised: November 30, 2010



Fastest Path Layout

Offset Construction Points

Steps 1 to 4

- Step ① – Offset The Inside Approach Curb By 5–Feet Toward The Outside.
- Step ② – Offset The Outside Entry Curb By 5–Feet Toward The Inside.
- Step ③ – Offset The Center Island Curb (Outside Of Truck Apron If Present) By 5–Feet Toward The Outside.
- Step ④ – Offset The Outside Departure Curb By 5–Feet Toward The Inside.

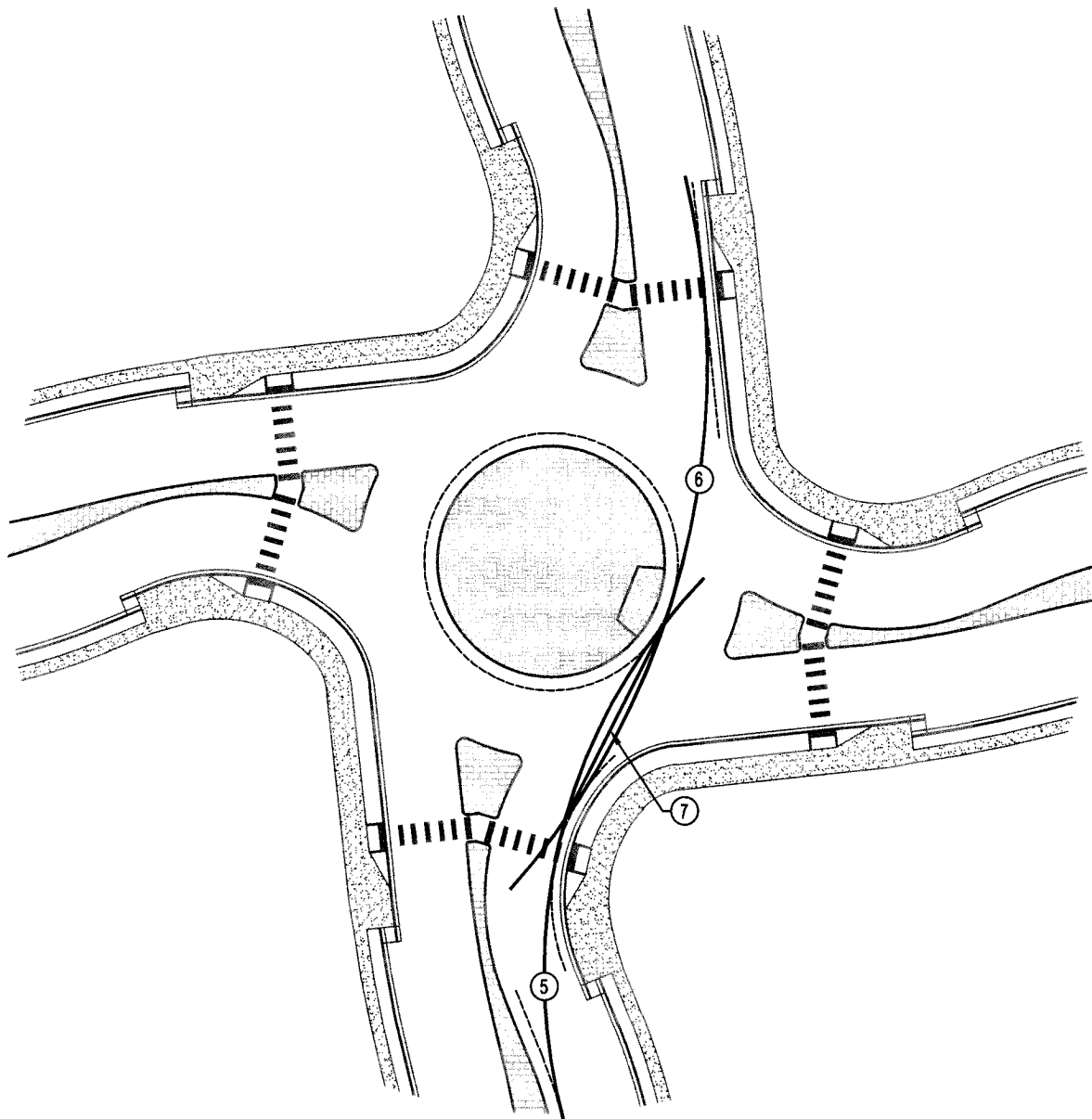
Fastest Path Values

R4 = The Radius Of The Circle Drawn In Step ③

ACHD FASTEST PATH PROCEDURE

Procedure #2 – Two Entry Lanes With Flat Exit

Revised: November 30, 2010



Fastest Path Layout

Tangent Construction Lines

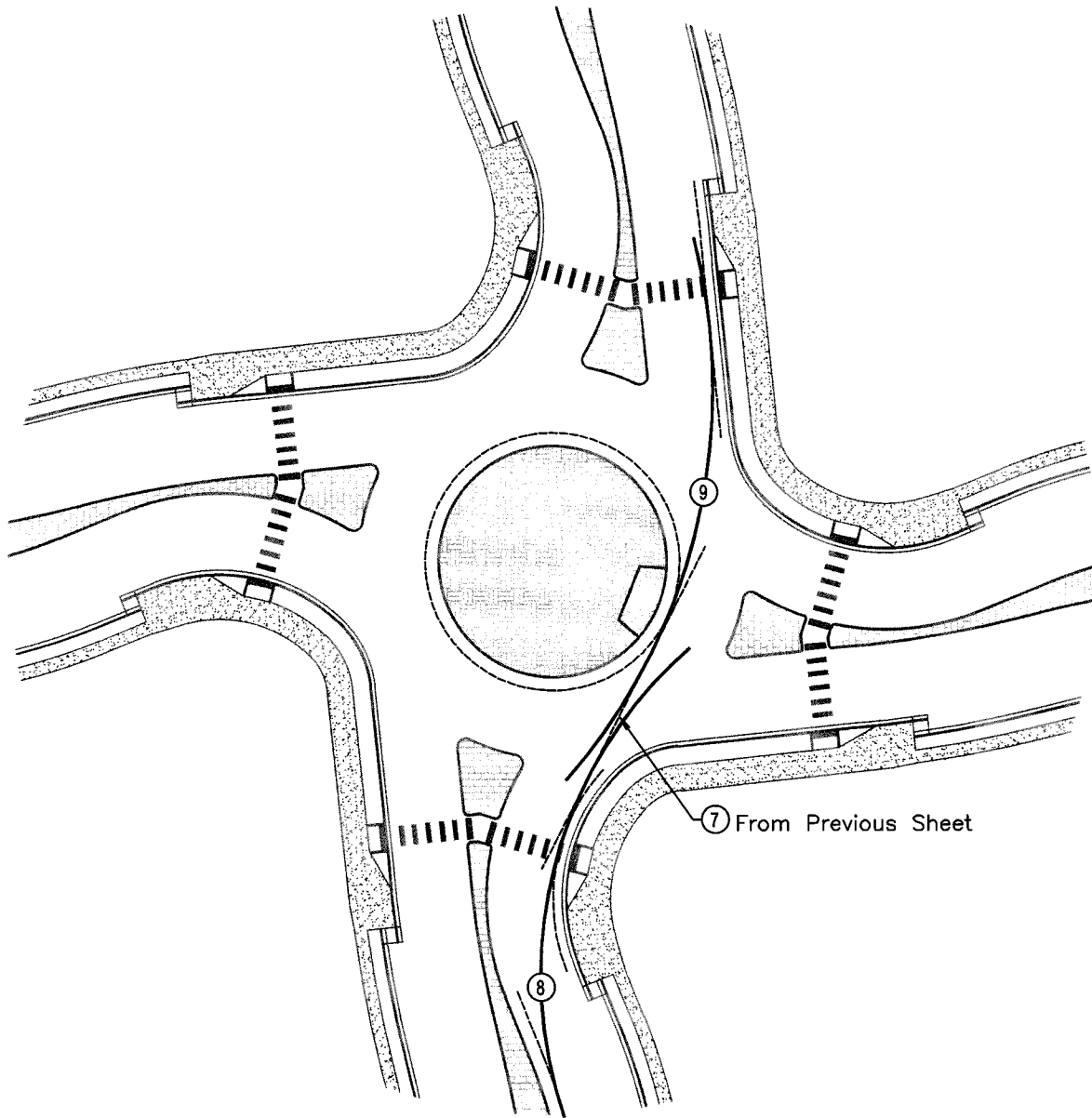
Steps 5 to 7

- Step ⑤ – Draw A 3 Point Circle, Tangent To Inside Approach Offset, The Outside Entry Offset, And The Center Island Offset.
- Step ⑥ – Draw A 3 Point Circle, Tangent To Outside Entry Offset, Center Island Offset, And Outside Exit Offset.
- Step ⑦ – Draw A Straight Line Between The Two Points Where The Circles From Step ⑤ And Step ⑥ Cross Each Other.

ACHD FASTEST PATH PROCEDURE

Procedure #2 – Two Entry Lanes With Flat Exit

Revised: November 30, 2010



Fastest Path Layout

Tangent Construction Circles

Steps 8 to 9

- Step ⑧ – Draw A 3 Point Circle, Tangent To Inside Approach Offset, The Outside Entry Offset, And The Straight Line Drawn In Step ⑦.
- Step ⑨ – Draw A 3 Point Circle, Tangent To The Straight Line Drawn In Step ⑦, The Center Island Offset, And The Outside Departure Offset.

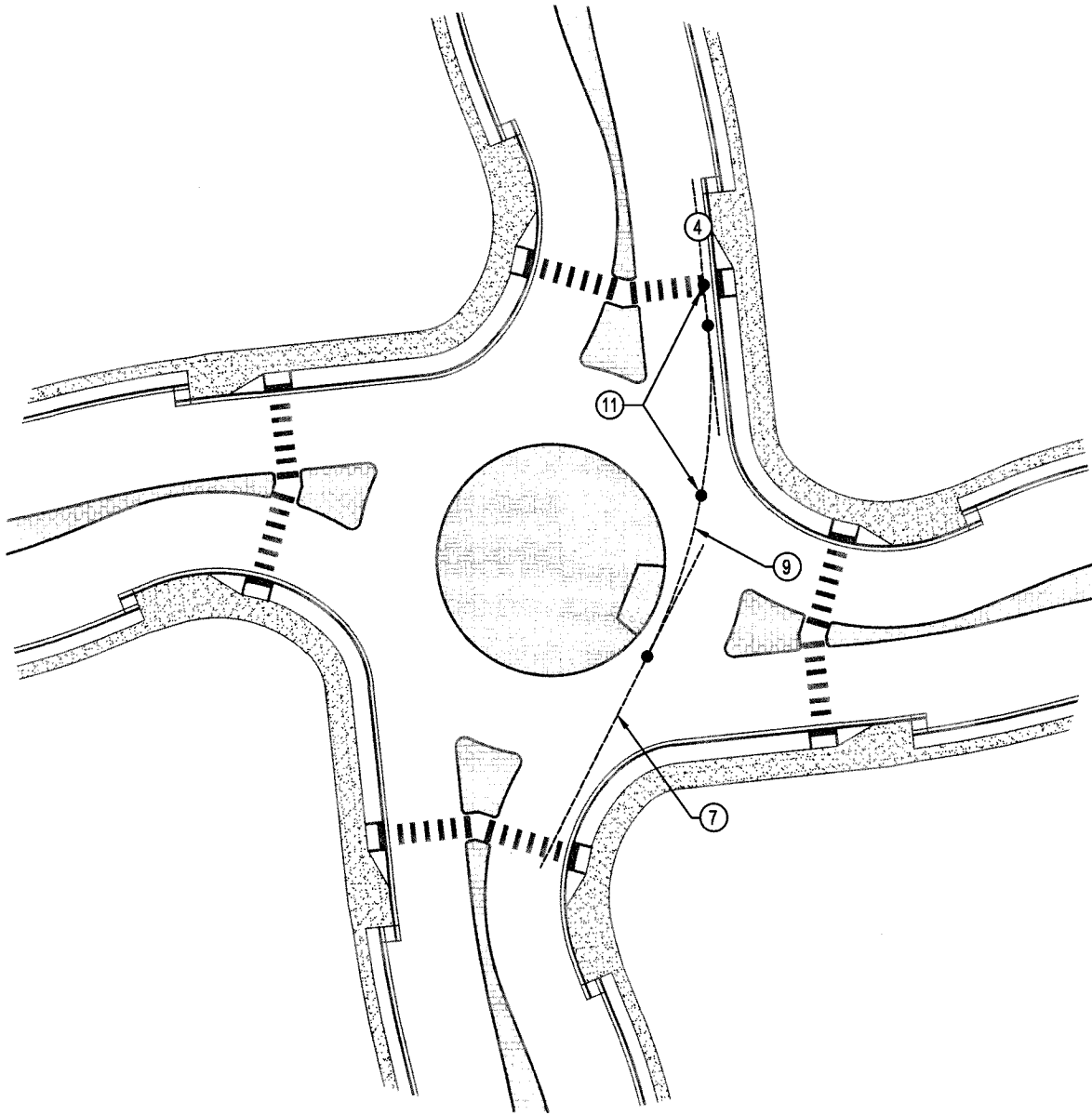
Fastest Path Values

R2 = The Radius Of The Circle Drawn In Step ⑨

ACHD FASTEST PATH PROCEDURE

Procedure #2 – Two Entry Lanes With Flat Exit

Revised: November 30, 2010



Fastest Path Layout

Acceleration Distance
Steps 10 to 11

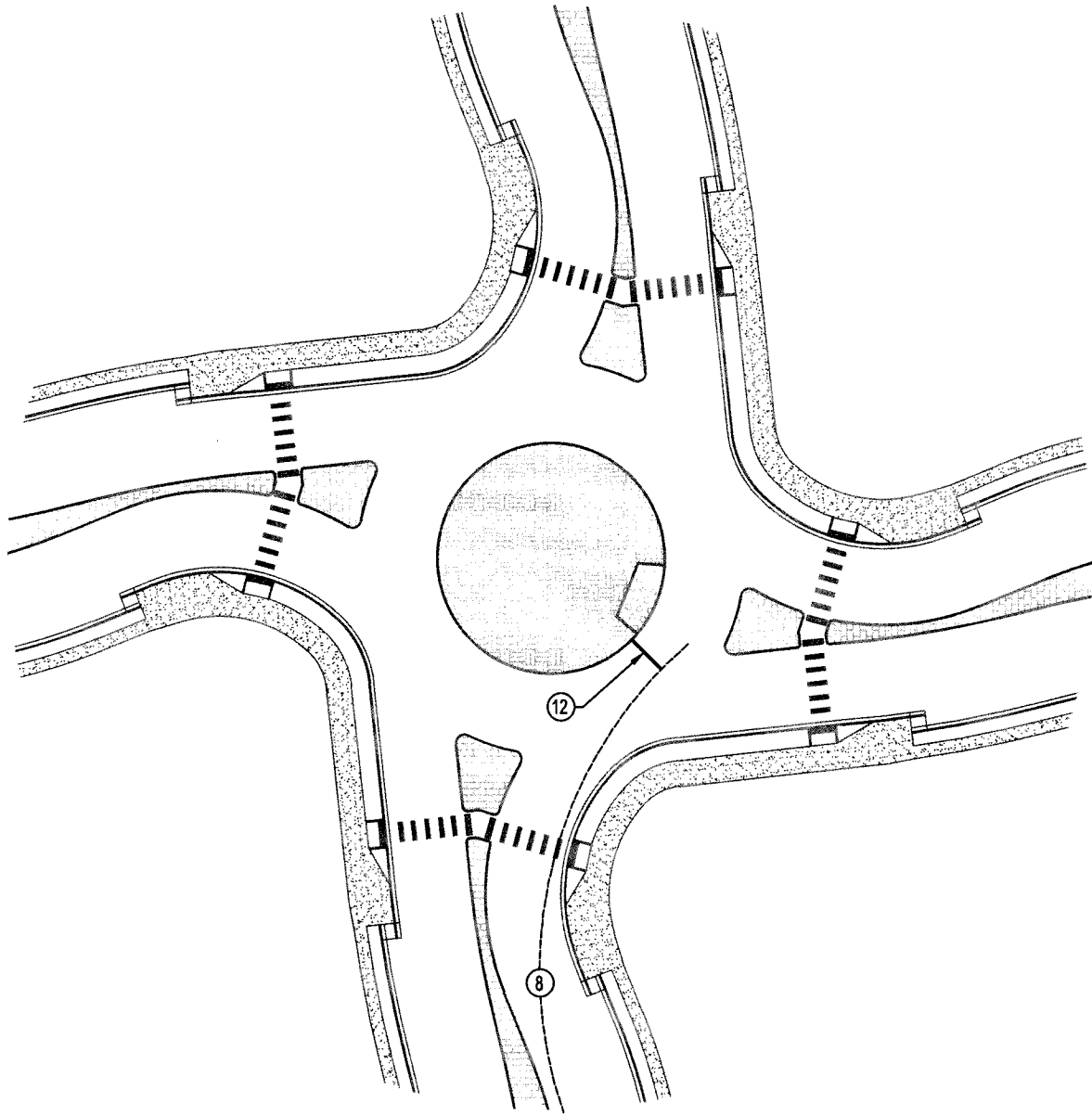
- Step ⑩ – Trim The Circle Drawn In Step ⑨ With The Line Drawn In Step ⑦ And The Outside Departure Offset Drawn In Step ④.
- Step ⑪ – Measure The Distance Traveled Along The Combination Of The Arc Created In Step ⑩ And The Tangent Outside Departure Offset From The Midpoint Of The Arc Created In Step ⑩ To The Midpoint Of The Pedestrian Crosswalk.

Fastest Path Values

V3 = Calculate Based On Speed Of R2 And Acceleration Over Distance Measured In Step ⑪ .

ACHD FASTEST PATH PROCEDURE

Procedure #2 – Two Entry Lanes With Flat Exit
Revised: November 30, 2010



Fastest Path Layout

New Offset Measurement

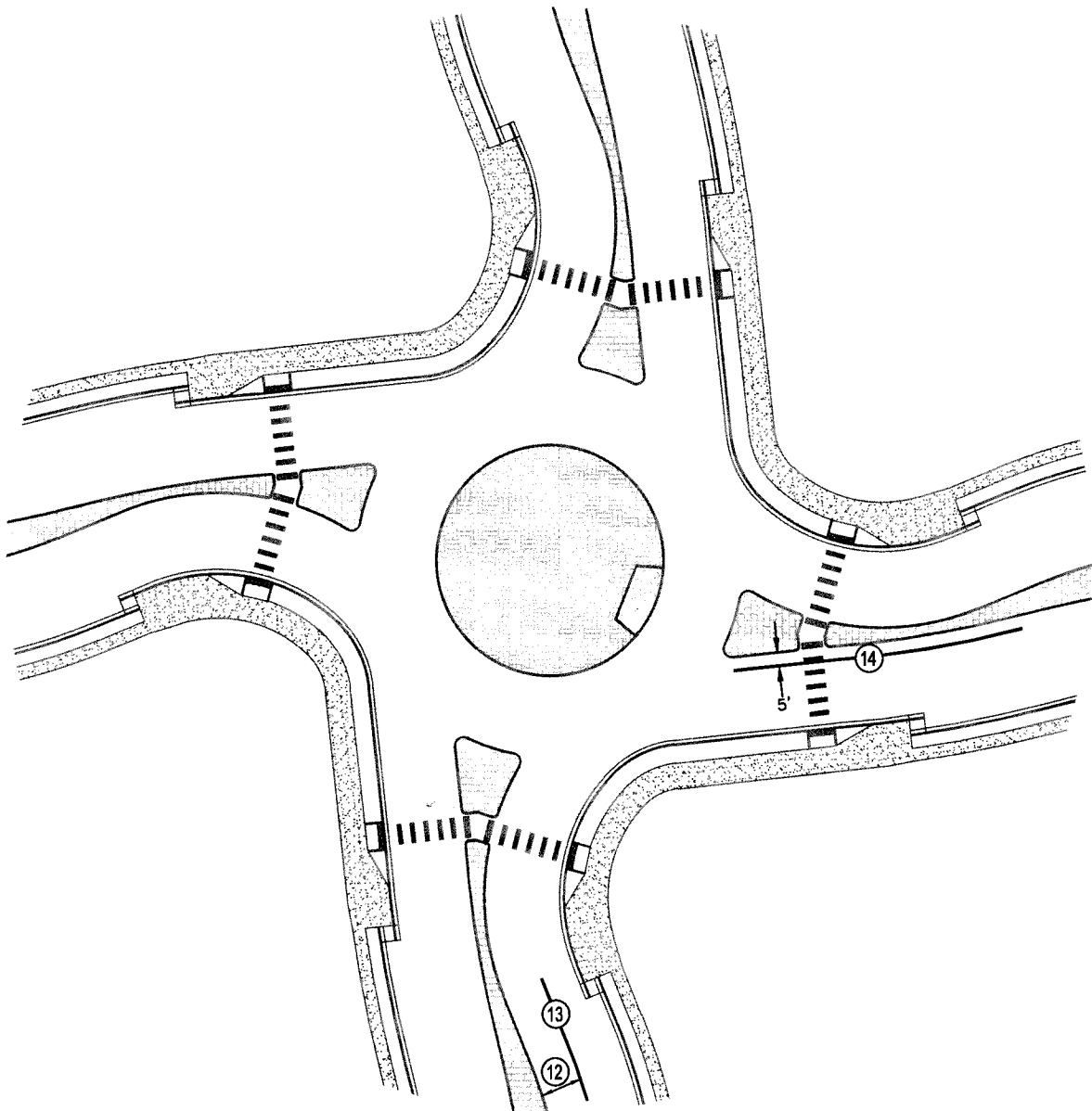
Step 12

Step ⑫ – Draw A Straight Line From The Center Of The Roundabout, Perpendicular To The Circle Drawn In Step ⑧, And Measure The Distance Along This Line From The Center Island Curb (Outside Of The Truck Apron Curb If Present) To Circle ⑧.

ACHD FASTEST PATH PROCEDURE

Procedure #2 – Two Entry Lanes With Flat Exit

Revised: November 30, 2010



Fastest Path Layout

Construction Offset Lines

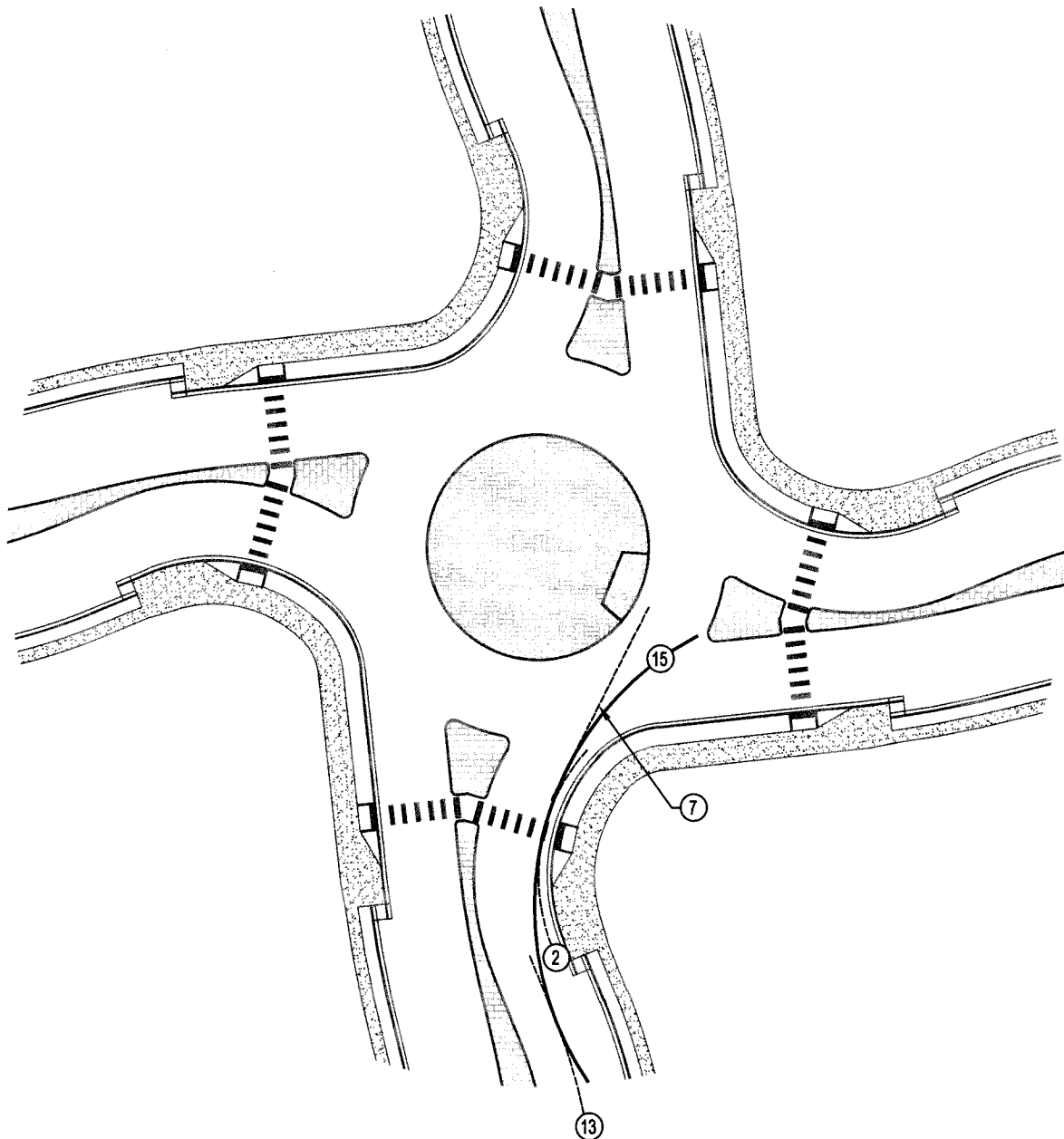
Steps 13 to 14

- Step ⑬ – Offset The Inside Approach Curb By The Distance Measured In Step ⑫ Toward The Outside.
- Step ⑭ – Offset The Inside Right-Turn Departure Curb By 5-Feet Toward The Outside.

ACHD FASTEST PATH PROCEDURE

Procedure #2 – Two Entry Lanes With Flat Exit

Revised: November 30, 2010



Fastest Path Layout

Measurement Circle

Step 15

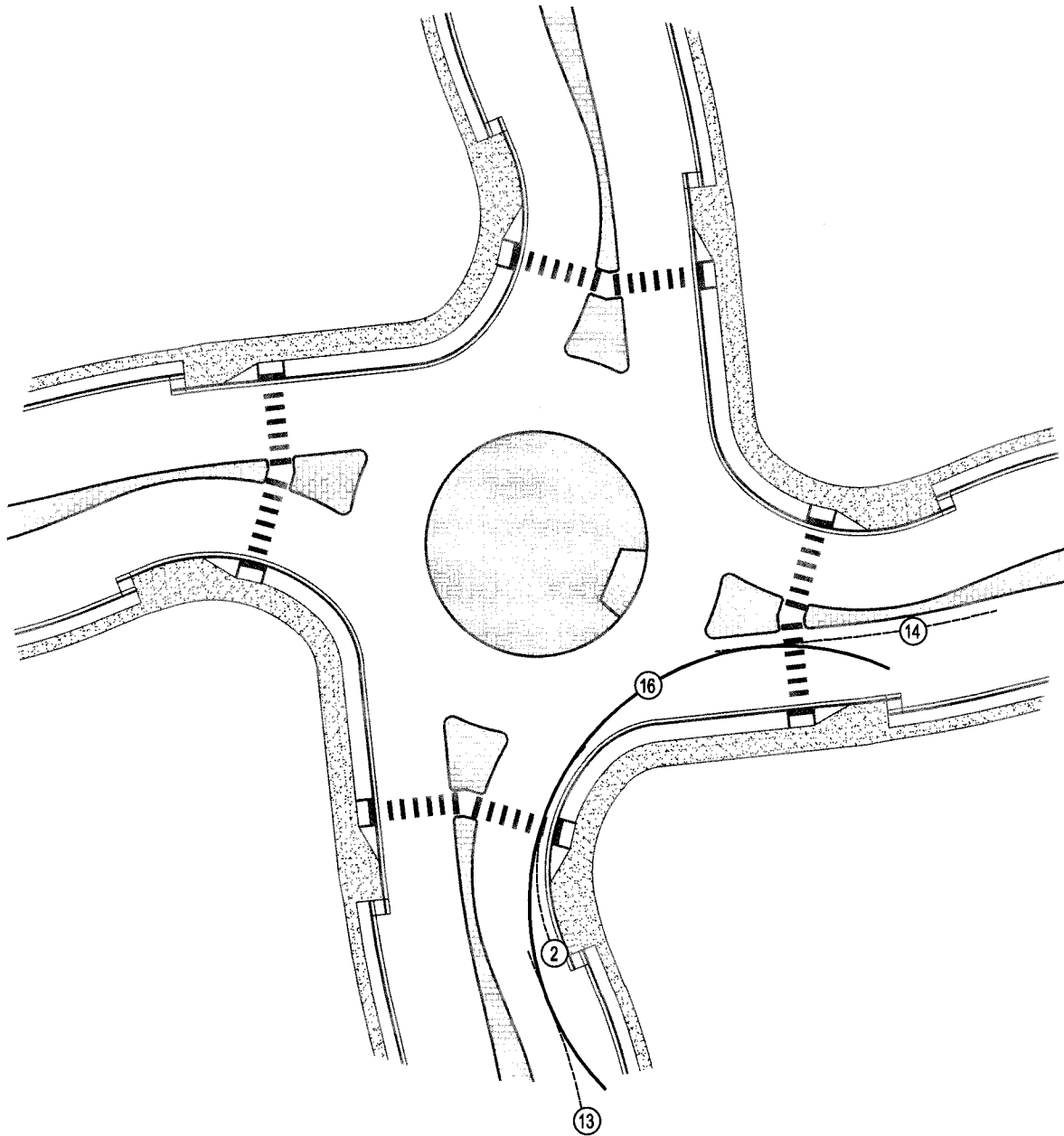
Step ⑮ – Draw A 3 Point Circle, Tangent To The Inside Approach Offset Drawn In Step ⑬, The Outside Entry Offset Drawn In Step ②, And The Straight Line Drawn In Step ⑦.

Fastest Path Values

R1 = The Radius Of The Circle Drawn In Step ⑮

ACHD FASTEST PATH PROCEDURE

Procedure #2 – Two Entry Lanes With Flat Exit
Revised: November 30, 2010



Fastest Path Layout

Right Turn Measurement Circle
Step 16

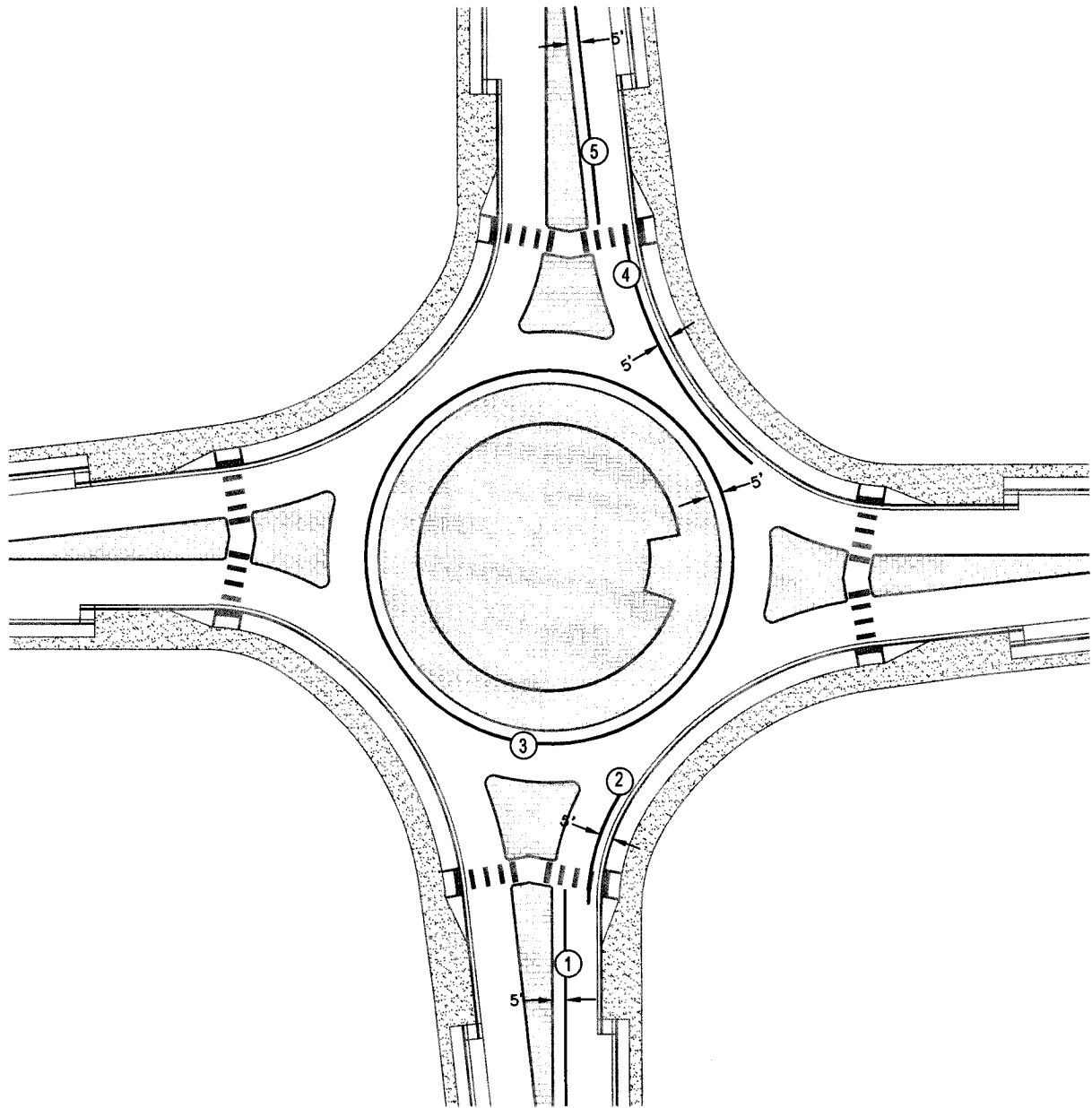
Step 16 – Draw A 3 Point Circle, Tangent To The Inside Approach Offset Drawn In Step 13 , The Outside Entry Offset Drawn In Step 2 , And The The Inside Right-Turn Departure Curb Offset Drawn In Step 14 .

Fastest Path Values

$R5$ = The Radius Of The Circle Drawn In Step 16

ACHD FASTEST PATH PROCEDURE

Procedure #3 – Tight Exit
Revised: November 30, 2010



Fastest Path Layout

Offset Construction Points
Steps 1 to 5

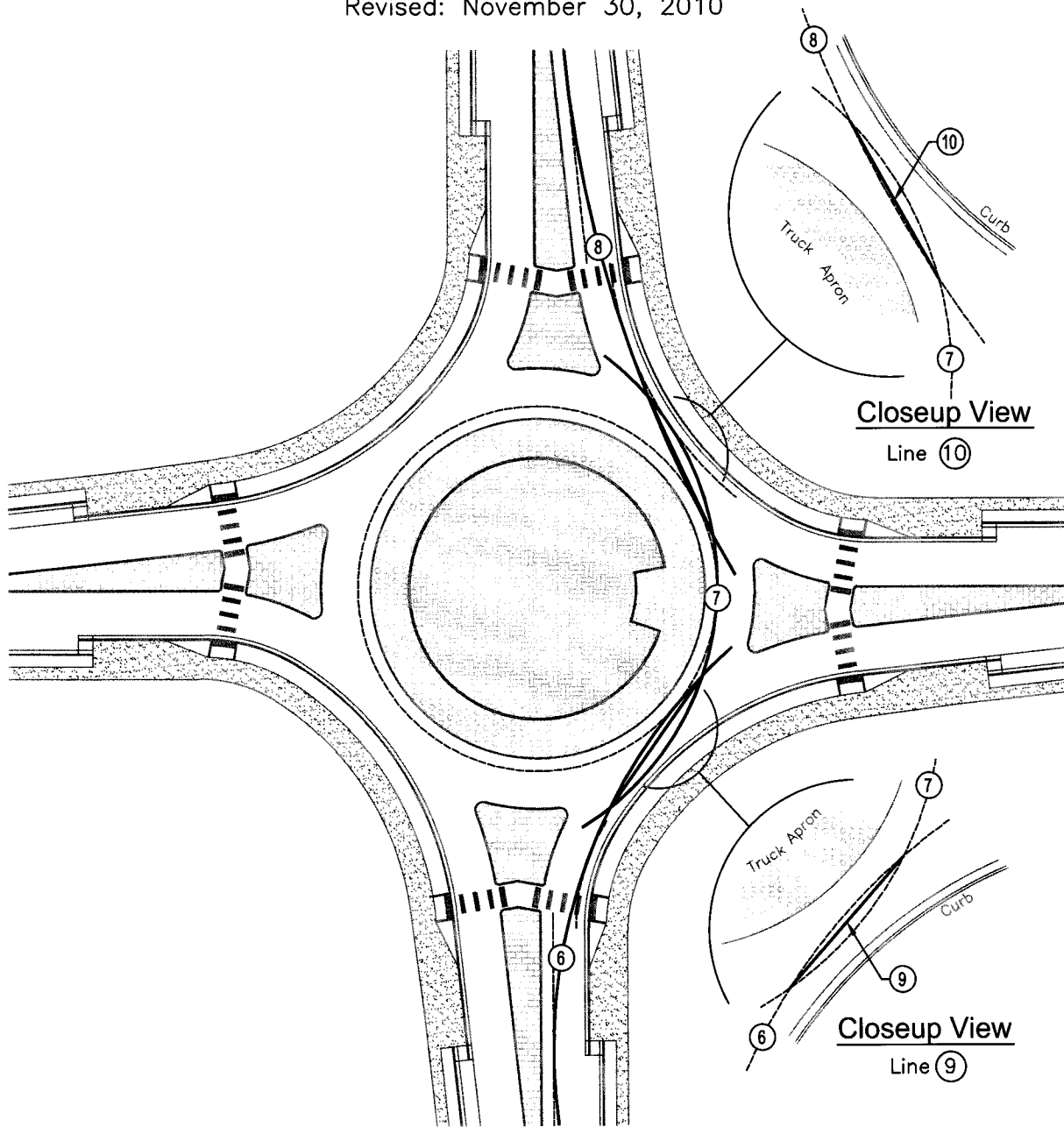
- Step ① – Offset The Inside Approach Curb By 5–Feet Toward The Outside.
- Step ② – Offset The Outside Entry Curb By 5–Feet Toward The Inside.
- Step ③ – Offset The Center Island Curb (Outside Of Truck Apron If Present) By 5–Feet Toward The Outside.
- Step ④ – Offset The Outside Exit Curb By 5–Feet Toward The Inside.
- Step ⑤ – Offset The Inside Departure Curb By 5–Feet Toward The Outside.

Fastest Path Values

R4 = The Radius Of The Circle Drawn In Step ③

ACHD FASTEST PATH PROCEDURE

Procedure #3 – Tight Exit
Revised: November 30, 2010



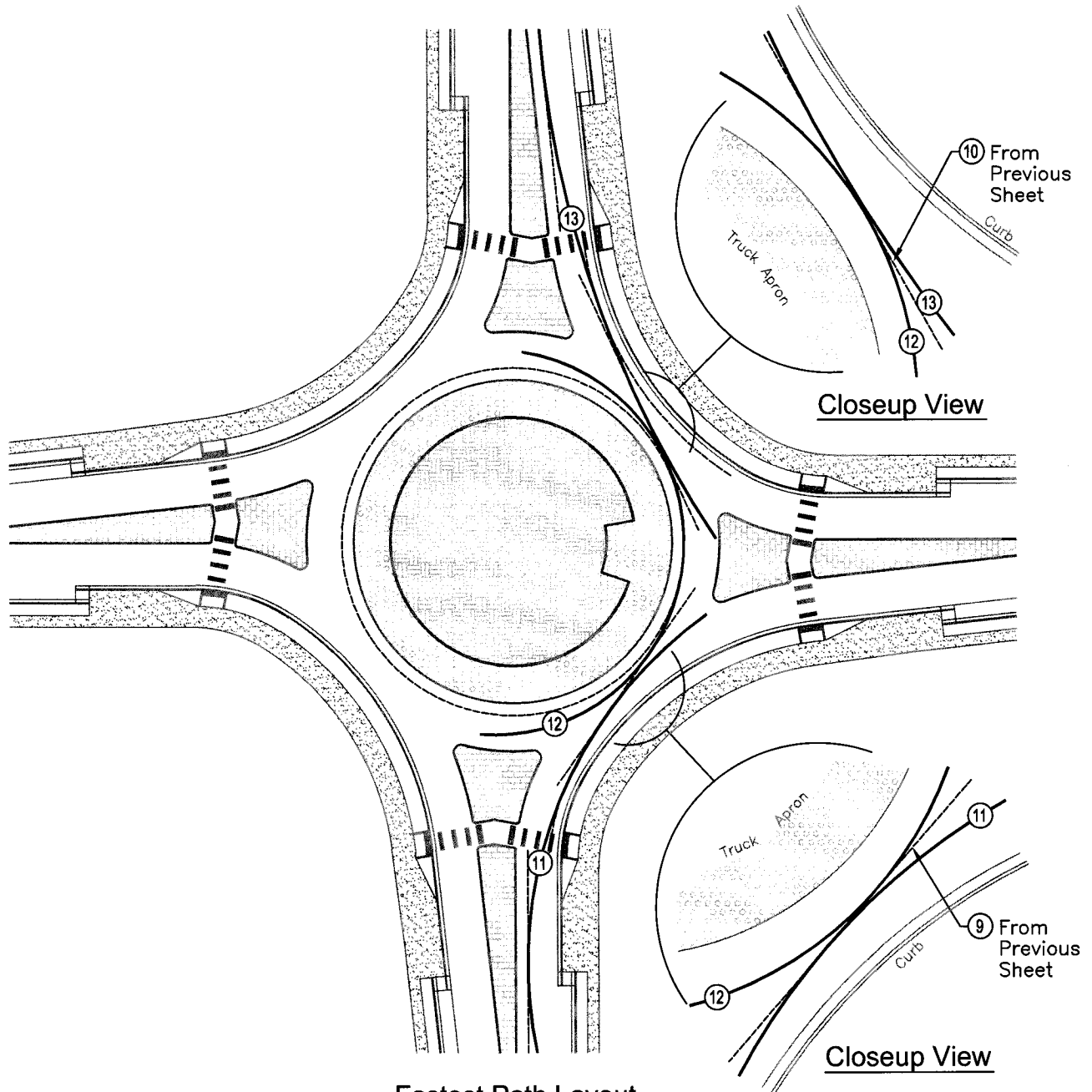
Fastest Path Layout

Tangent Construction Lines
Steps 6 to 8

- Step ⑥ – Draw A 3 Point Circle, Tangent To Inside Approach Offset, The Outside Entry Offset, And The Center Island Offset.
- Step ⑦ – Draw A 3 Point Circle, Tangent To Outside Entry Offset, Center Island Offset, And Outside Exit Offset.
- Step ⑧ – Draw A 3 Point Circle, Tangent To Center Island Offset, Outside Exit Offset, And Inside Departure Offset.
- Step ⑨ – Draw A Straight Line Between The Two Points Where Circles ⑥ And ⑦ Cross Each Other.
- Step ⑩ – Draw A Straight Line Between The Two Points Where Circles ⑦ And ⑧ Cross Each Other.

ACHD FASTEST PATH PROCEDURE

Procedure #3 – Tight Exit
Revised: November 30, 2010



Fastest Path Layout

Tangent Construction Circles
Steps 11 to 13

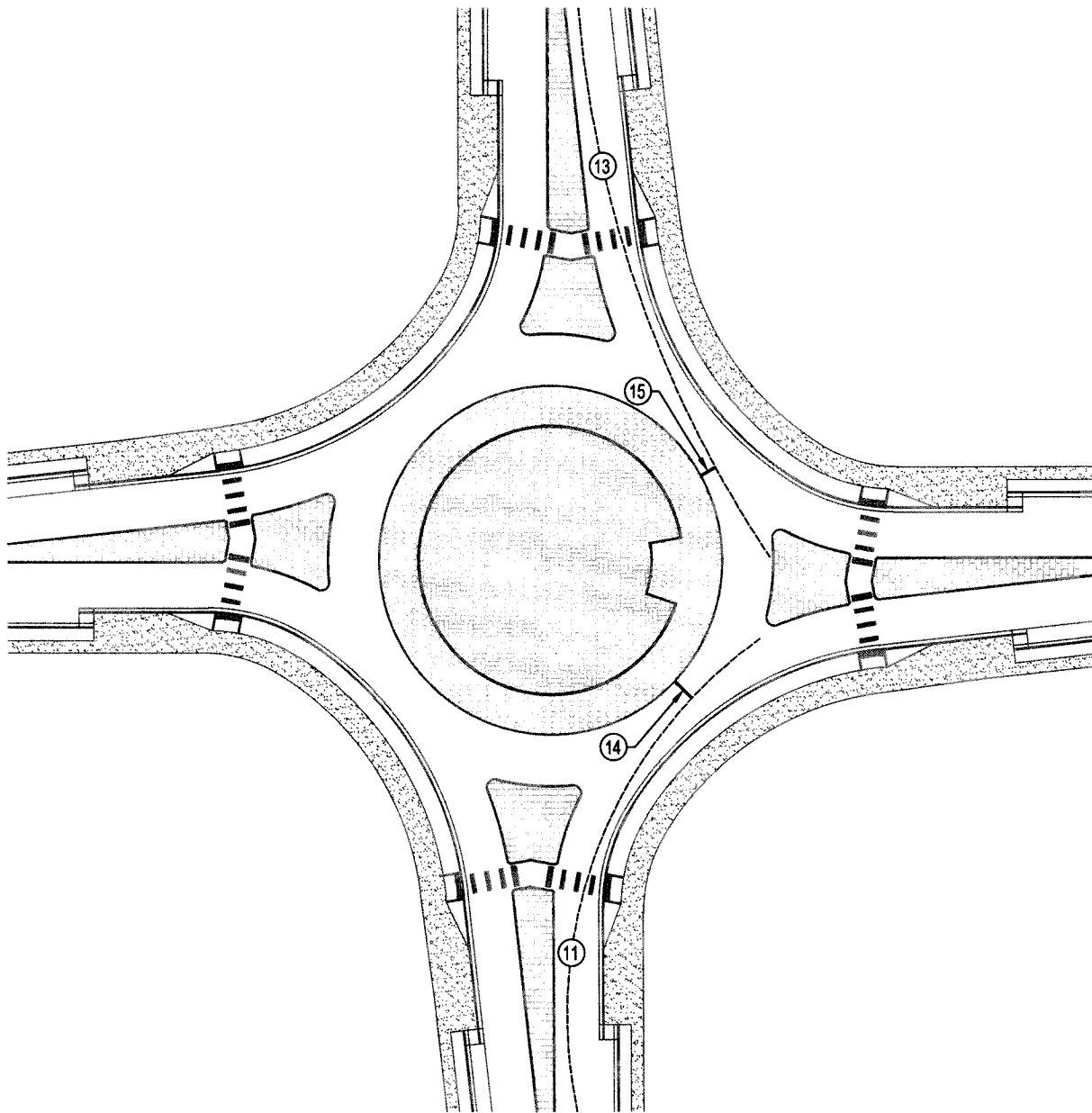
- Step ⑪ – Draw A 3 Point Circle, Tangent To Inside Approach Offset, Outside Entry Offset, And The Straight Line Drawn In Step ⑨
- Step ⑫ – Draw A 3 Point Circle, Tangent To The Straight Line Drawn In Step ⑨, The Center Island Offset, And The Straight Line Drawn In Step ⑩
- Step ⑬ – Draw A 3 Point Circle, Tangent To The Straight Line Drawn In Step ⑩, The Outside Exit Offset, And The Inside Departure Offset.

Fastest Path Values

$R2$ = The Radius Of The Circle Drawn In Step ⑫

ACHD FASTEST PATH PROCEDURE

Procedure #3 – Tight Exit
Revised: November 30, 2010



Fastest Path Layout

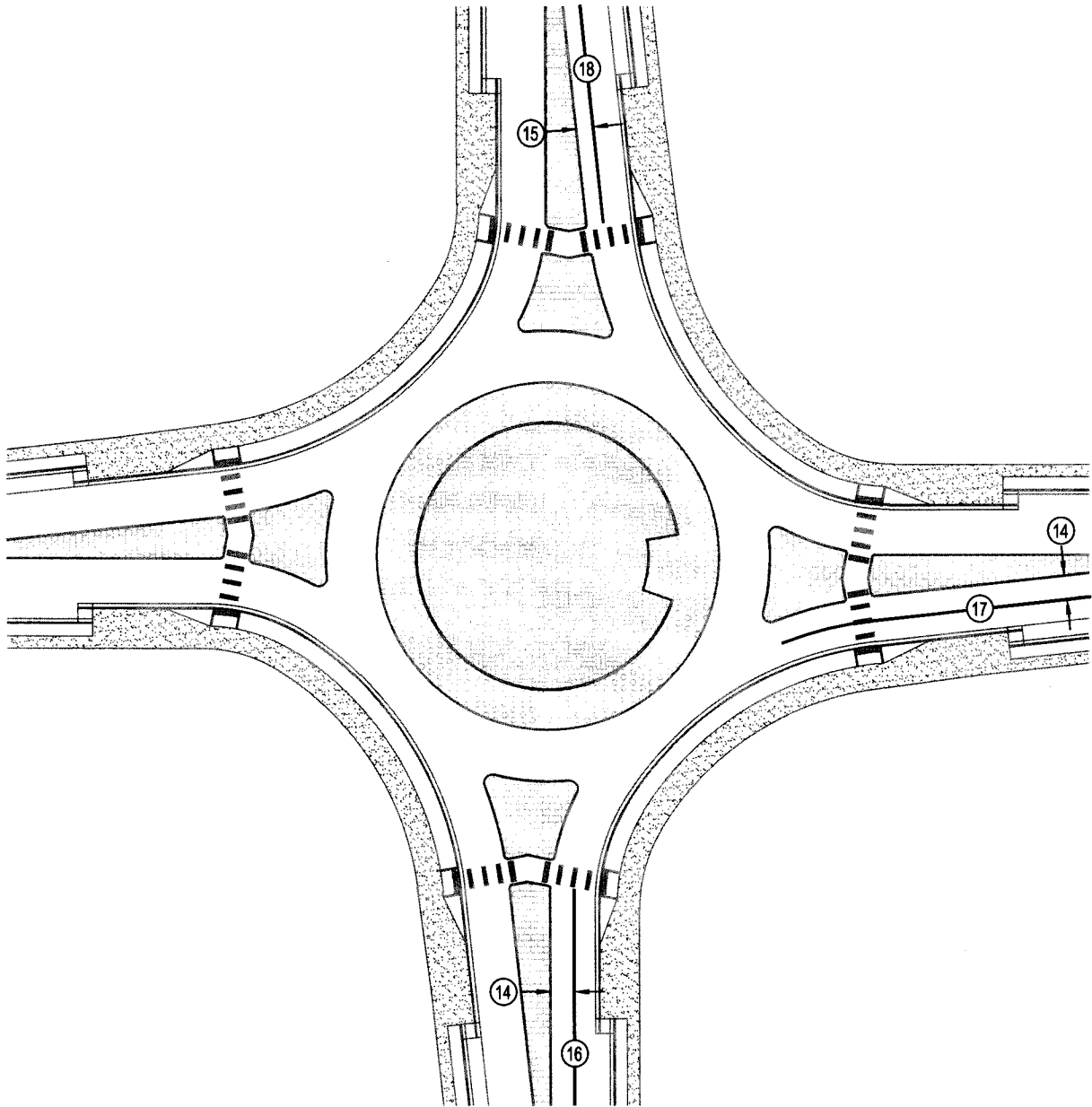
New Offset Measurements

Steps 14 to 15

- Step ⑭ – Draw A Straight Line From The Center Of The Roundabout, Perpendicular To The Circle Drawn In Step ⑪ , And Measure The Distance Along This Line From The Center Island Curb (Outside Of Truck Apron Curb If Present) To Circle ⑪ .
- Step ⑮ – Draw A Straight Line From The Center Of The Roundabout, Perpendicular To The Circle Drawn In Step ⑬ , And Measure The Distance Along This Line From The Center Island Curb (Outside Of Truck Apron Curb If Present) To Circle ⑬ .

ACHD FASTEST PATH PROCEDURE

Procedure #3 – Tight Exit
Revised: November 30, 2010



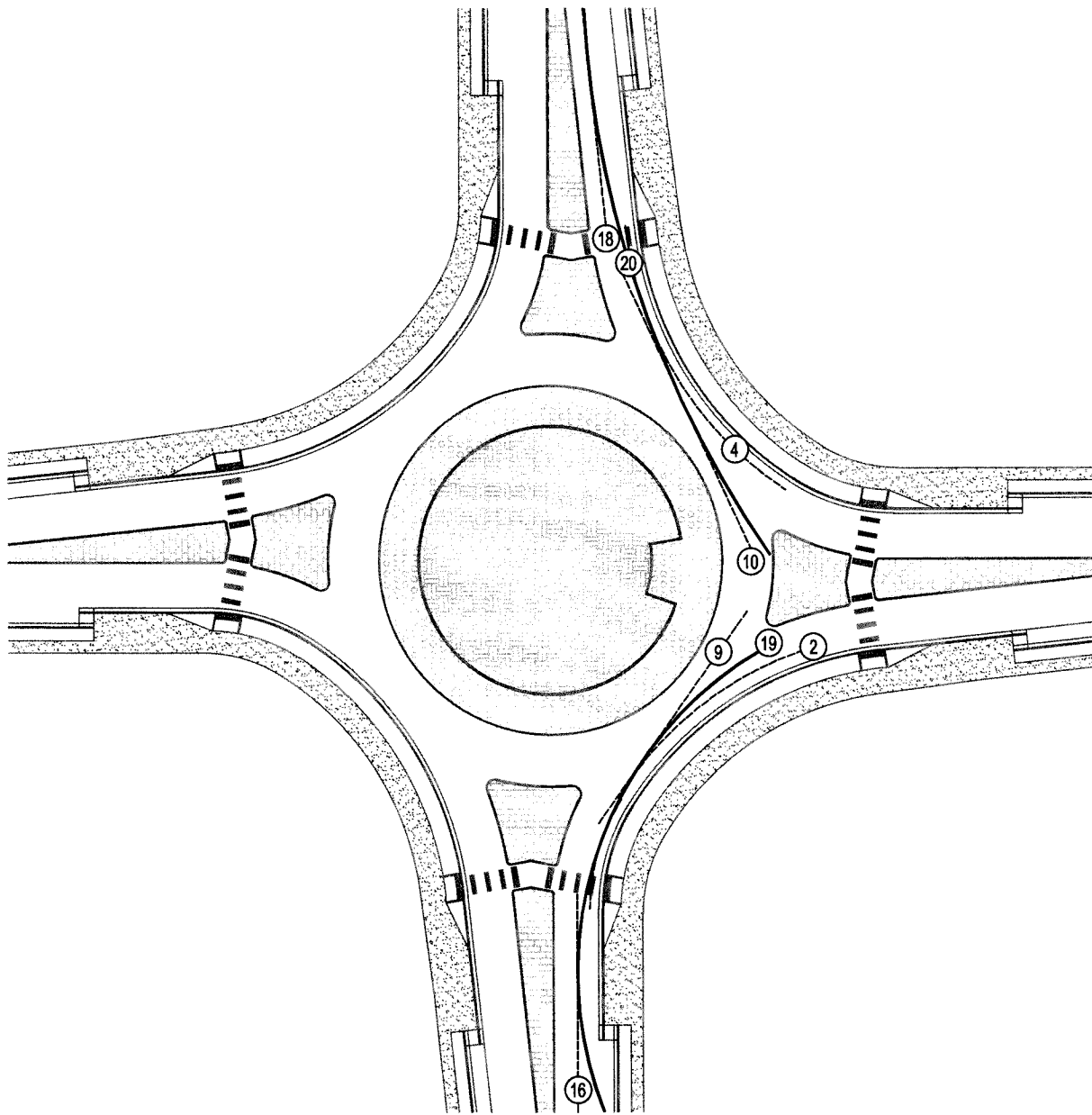
Fastest Path Layout

Construction Offset Lines
Steps 16 to 18

- Step ①⑥ – Offset The Inside Approach Curb By The Distance Measured In Step ①④ Toward The Outside.
- Step ①⑦ – Offset The Inside Right-Turn Departure Curb By The Distance Measured In Step ①④ Toward The Outside.
- Step ①⑧ – Offset The Inside Departure Curb By The Distance Measured In Step ①⑤ Toward The Outside.

ACHD FASTEST PATH PROCEDURE

Procedure #3 – Tight Exit
Revised: November 30, 2010



Fastest Path Layout

Measurement Circles
Steps 19 to 20

- Step ⑱ – Draw A 3 Point Circle, Tangent To The New Inside Approach Offset Drawn In Step ⑯, The Outside Entry Offset Drawn In Step ②, And The Straight Line Drawn In Step ⑨.
- Step ⑳ – Draw A 3 Point Circle, Tangent To The Straight Line Drawn In Step ⑩, The Outside Exit Offset Drawn In Step ④, And The New Inside Departure Offset Drawn In Step ⑱.

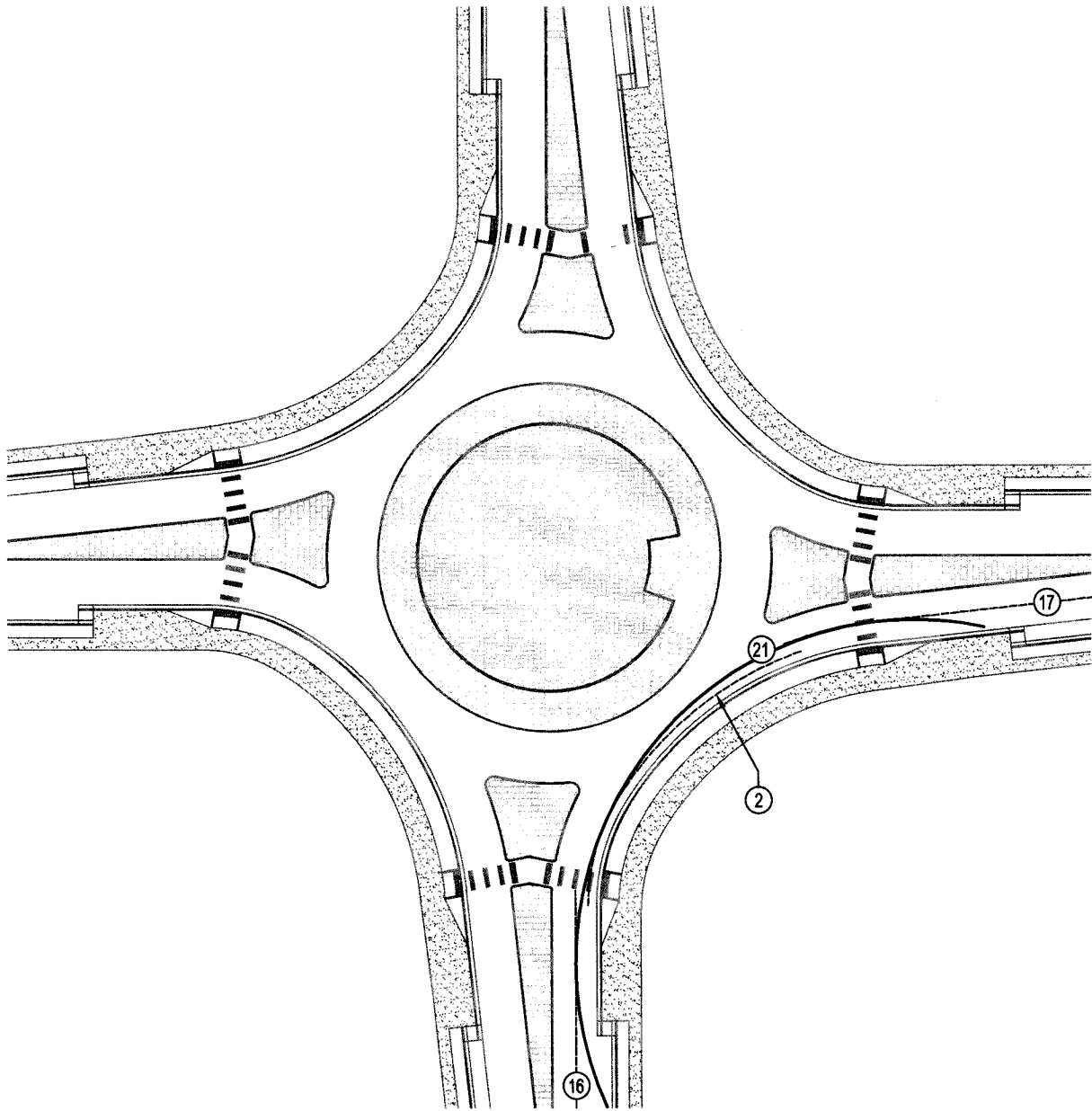
Fastest Path Values

R1 = The Radius Of The Circle Drawn In Step ⑱

R3 = The Radius Of The Circle Drawn In Step ⑳

ACHD FASTEST PATH PROCEDURE

Procedure #3 – Tight Exit
Revised: November 30, 2010



Fastest Path Layout

Measurement Circle
Step 21

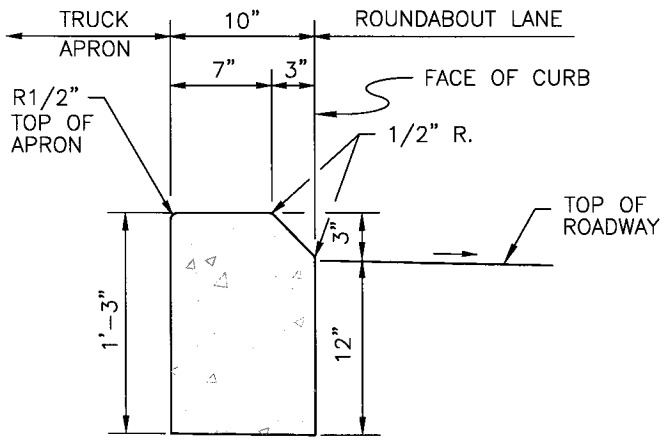
Step 21 – Draw A 3 Point Circle, Tangent To The Inside Approach Offset Drawn In Step 16 ,
The Outside Entry Offset Drawn In Step 2 , And The The Inside Right-Turn
Departure Curb Offset Drawn In Step 17 .

Fastest Path Values

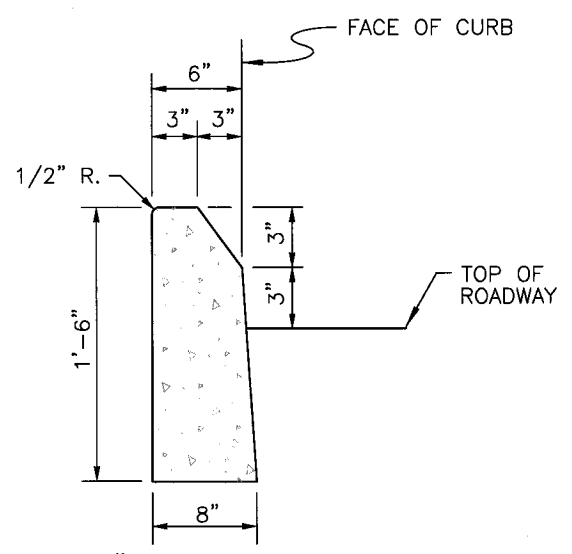
R5 = The Radius Of The Circle Drawn In Step 21

Appendix B

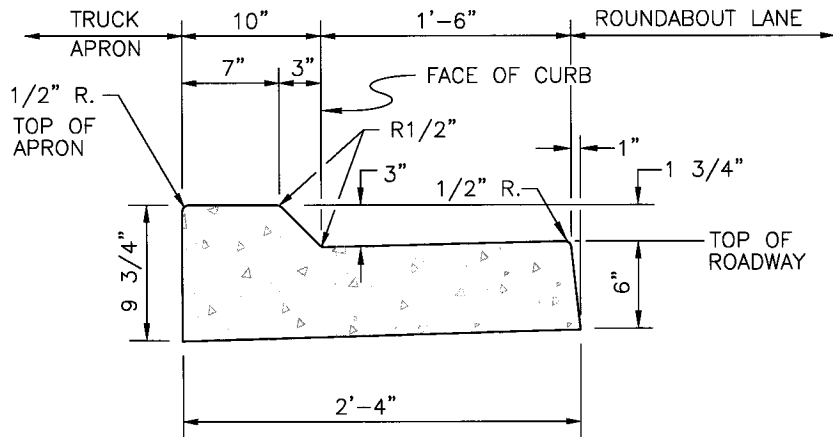
ISPWC SD-701B
(Roundabout Standard Curb Drawing)



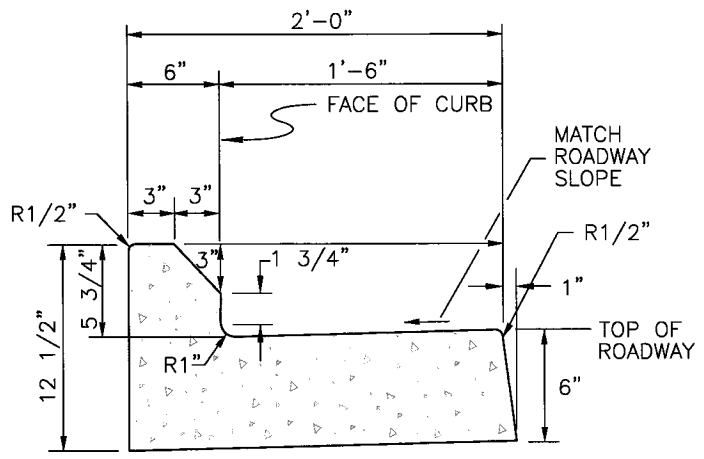
**3" MOUNTABLE TRUCK APRON CURB
(NO GUTTER)**



**6" ROUNDABOUT CURB
(NO GUTTER)**



3" MOUNTABLE TRUCK APRON CURB AND GUTTER



6" ROUNDABOUT CURB AND GUTTER

ACHD REVISION 2010

IDAHO STANDARDS
FOR PUBLIC WORKS
CONSTRUCTION

MOUNTABLE
ROUNDABOUT CURBS

STANDARD DRAWING
NO. SD-701B

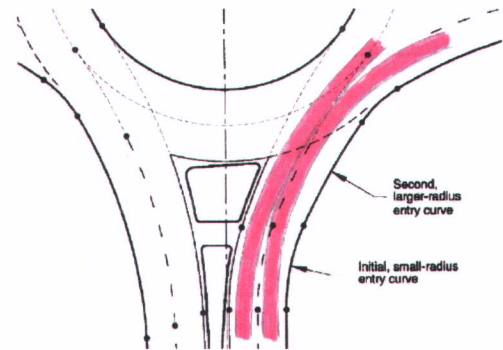
Appendix C

Design Parameter Checklist Assistant

Appendix C
Design Parameter Checklist Assistant

Natural Paths

1. Has every movement from each lane on each approach been included?
2. Do the entry paths point vehicles toward their lane in the circulating roadway, toward another lane, or toward an island?
3. If vehicles followed the lane and curb lines precisely, would they be required to make any sharp or sudden changes in direction or speed?
4. If that vehicle does not change its path sharply or its speed suddenly would it strike a curb or overlap an adjacent vehicle's path?



Fastest Paths

1. Has every movement from each approach been included?
2. Have the fastest paths been drawn by hand (or by an ACHD approved method if drawn by computer)?
3. Are they offset 5 ft from curbs (or 3 ft from stripes if no curb) at the closest point?
4. Have consecutive paths been drawn to approximate the shortest travel time? (A driver would not maximize entry speed if that would require a slower circulating speed.)
5. Have the speeds been measured at the slowest point on each of the paths and adjusted for the super-elevation at that point?
6. Have the exit speeds been calculated both ways? (The circulating speed + acceleration will control if it is slower than the speed determined by the exit radius. Acceleration is 7 ft/sec^2 for half the distance between the circulating speed location and the exit speed location)
7. Do any of the entry speeds exceed 20 mph (25 mph for multilane entries)?
8. Do any of the consecutive speeds differ by more than 6 mph (12 mph for multilane entries)?
9. Do any of the conflicting speeds differ by more than 6 mph (12 mph for multilane entries)?

Wheel & Swept Paths

1. Has every movement from every approach been included?
2. Have the appropriate design vehicles been used for each movement?
3. Is each path drawn the way a driver would actually drive it? (Long trucks will straddle both lanes on the entry, circle, and exit of multilane roundabouts; cabs will not use truck aprons.)
4. Are all paths offset at least 2 ft from adjacent paths and 1 ft from roundabout curb, except semi-truck trailers on truck aprons, at the closest point?

Grading

1. Are all lanes and truck aprons sloped toward the outside of the roundabout?
2. Are the slopes across the lanes (to the ends of the splitter islands) and truck aprons between 1.5% and 2.5%?
3. Are the slopes in the direction of travel around the circle between -4% and +4%?
4. Does the transition from the approach roadway to the circulating roadway have any sudden grade changes?

Appendix C
Design Parameter Checklist Assistant

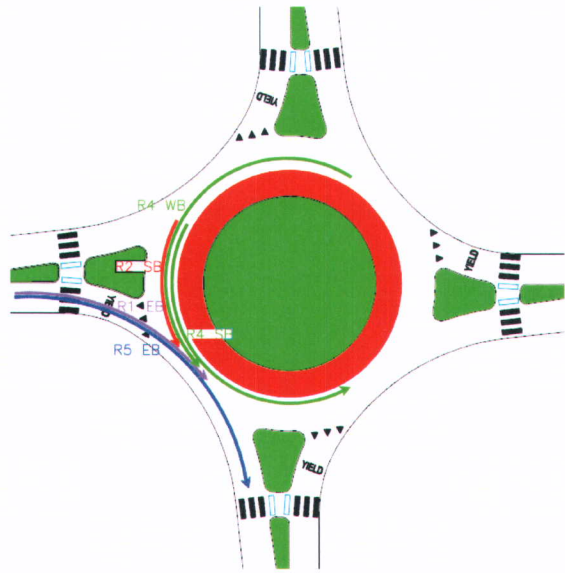
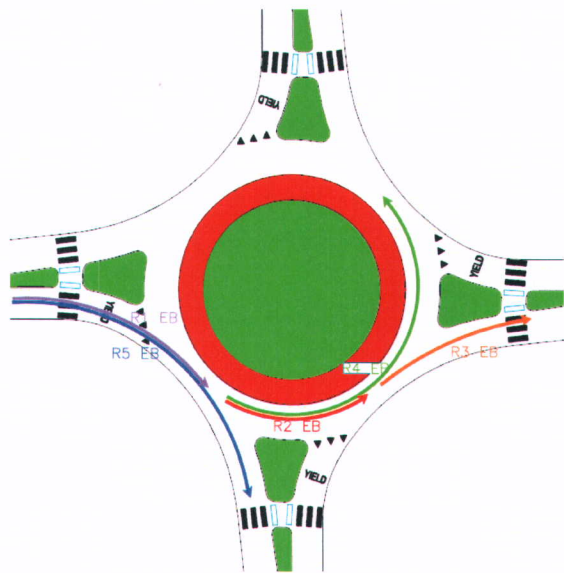
Fastest path example template for a standard 4-leg single-lane roundabout (the arrows below depict direction only, the actual fastest paths will overlap):

Eastbound Approach

R1 (Entry)	R4 (LT)	R3 _{rad} (Exit)	R3 _{min}
R5 (RT)	R2 (TH)	R3 _{acc} (Exit)	

EB Conflicting Speed Comparison

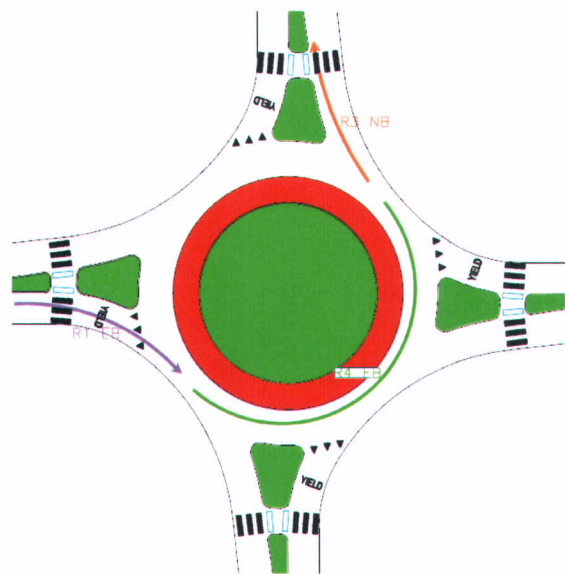
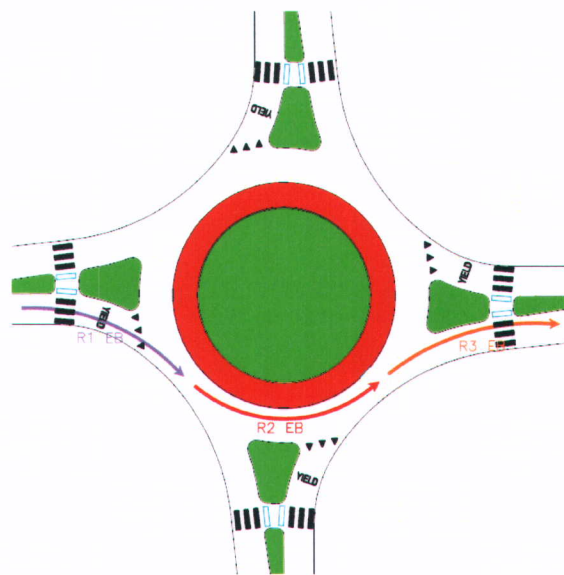
R1 (EB), R5 (EB), R2 (SB), R4 (WB), R4 (SB)



EB Consecutive Speed Comparison

R1 (EB), R2 (EB), R3 (EB)

R1 (EB), R4 (EB), R3 (NB)



Appendix C
Design Parameter Checklist Assistant

Northbound Approach

R1 (Entry)	R4 (LT)	R3 _{rad} (Exit)	R3 _{min}
R5 (RT)	R2 (TH)	R3 _{acc} (Exit)	

NB Conflicting Speed Comparison
R1 (NB), R5 (NB), R2 (EB), R4 (SB), R4 (EB)

NB Consecutive Speed Comparison
R1 (NB), R2 (NB), R3 (NB)
R1 (NB), R4 (NB), R3 (WB)

Westbound Approach

R1 (Entry)	R4 (LT)	R3 _{rad} (Exit)	R3 _{min}
R5 (RT)	R2 (TH)	R3 _{acc} (Exit)	

WB Conflicting Speed Comparison
R1 (WB), R5 (WB), R2 (NB), R4 (EB), R4 (NB)

WB Consecutive Speed Comparison
R1 (WB), R2 (WB), R3 (WB)
R1 (WB), R4 (WB), R3 (SB)

Southbound Approach

R1 (Entry)	R4 (LT)	R3 _{rad} (Exit)	R3 _{min}
R5 (RT)	R2 (TH)	R3 _{acc} (Exit)	

SB Conflicting Speed Comparison
R1 (SB), R5 (SB), R2 (WB), R4 (NB), R4 (WB)

SB Consecutive Speed Comparison
R1 (SB), R2 (SB), R3 (SB)
R1 (SB), R4 (SB), R3 (EB)



Encroachments/Obstructions

Removal & Mitigation Procedures

Encroachment/Obstruction – Defined

- Encroachments include, but are not limited to, any gate, building, private sign, mailbox, facility, structure, object, hedge, tree, shrubbery, fence, or wall that is placed on, over, beneath, or within or otherwise encroaches into any portion of any highway or any public right-of-way.
- Sight Obstructions include, but are not limited to any gate, building, private sign, mailbox, facility, structure, object, hedge, tree, shrubbery, fence, or wall that that interferes with driver vision.

Actual Notice

- Clear and concise verbal communication to a Commissioner or an employee; in person, or by telephone call/voice mail
- Clear and concise e-mail via Tellus or ACHD smart phone application, or directly to a staff member's work e-mail
- Clear and concise letter to the District, a Commissioner or an employee
- Clear and concise written public meeting comment
- Direct and documented observation by an employee

Transmit for Review

- Forward Notice to Traffic Engineering for field review

OR

- Roadside Vegetation Crew for immediate action

Determine Required Action

- Remove without Notice - Meets criteria in 40-2319(2) – obstructs and prevents use of an open highway by vehicles or is unsafe for pedestrian, bicyclist or motorist use of an open highway
 - Action by Maintenance for:
 - Vegetation
 - Trash/Debris
 - Water on Roadway

- Action by Zone Inspection (activities requiring permits – could also apply to Capital Projects and Subdivisions) for:
 - Dumpsters
 - Material Storage Containers
 - Construction Materials (e. g., gravel, lumber, steel)
 - Temporary Traffic Control Devices (improperly positioned or not in active use)
 - Emergency Action (Storm/Natural Disaster) – potentially all the above, plus:
 - Coordination with utilities
 - Coordination with city public works staff
 - On-call Maintenance Supervisors at Cloverdale or Adams (depending on location of event)
 - Require Owner to Remove Encroachment per 40-2319(1),(3) – encroachment does not constitute an effectual obstruction or unsafe condition
 - Provide 10-day notice to owner
 - If owner complies, document and close investigation
 - If owner fails to respond within 5 days of the 10-day notice period, District may remove at owner’s expense
 - If owner responds but fails to remove after 15 days
 - Refer to City/County Code Enforcement - Vegetation
 - If owner complies, document and close investigation
 - If owner refuses removal:
 - Citation by Code Enforcement
 - Referral to Legal Department for Civil Action
 - Refer to Legal Department for Civil Action
- If suitable for License Agreement
 - Provide property owner License Agreement Application (Right-of-Way)
 - If owner does not apply for and sign License Agreement
 - Provide 10-day notice to owner
 - If owner signs License Agreement
 - Document and close investigation

Temporary Mitigation

Where an encroachment exists and immediate removal of the encroachment is impractical due to the nature of the encroachment, unsafe site conditions, inclement weather or other reasons, temporary measures may be used to mitigate potential hazards to pedestrians and vehicles, including but not limited to:

- Road Closure
- Lane Closure or flagging operations
- Channelization or re-alignment of vehicle lanes and/or pedestrian facilities
- Placement of barricades or barriers or other temporary devices to mark or separate the hazardous condition from the roadway users

ACHD Encroachments/Obstructions

