CHANGE **U.S. DEPARTMENT OF TRANSPORTATION** FEDERAL AVIATION ADMINISTRATION

8260.42B CHG 1

National Policy

Effective Date: 11/20/2012

SUBJ: United States Standard for Helicopter Area Navigation (RNAV)

1. Purpose. This change incorporates new Helicopter Departure and Localizer Precision with Vertical (HLPV) criteria. Order 8260.42B contains criteria for the formulation, review, approval, and publication of area navigation (RNAV) helicopter instrument procedures based on Global Positioning System (GPS) and Wide Area Augmentation System (WAAS) navigation.

2. Audience. The primary audience for this Order is the Air Traffic Organization (ATO), Mission Support Services (MSS), Aeronautical Navigation Products Office (AeroNav Products), who has the responsibility to develop instrument flight procedures. The secondary audience includes the ATO MSS Aeronautical Information Management (AIM) Office (AJV-2), ATO Service Areas' Operational Support Group, Flight Procedures Team (OSG-FPT), Air Traffic's Technical Operations Aviation System Standards Office (AJW-3); Flight Standards headquarters, and regional office Divisions/Branches.

3. Where You Can Find This Change. You can find this order on the Directives Management System (DMS) Website: http://www.faa.gov/regulations_policies/orders_notices.

4. Explanation of Changes. Significant areas of new direction, guidance, policy, and criteria as follows:

Note: General. All references to FAA Orders 8260.52, United States Standard for Required Navigation Performance (RNP) Approach Procedures with Special Aircraft and Aircrew Authorization Required (SAAAR), and 8260.54A, The United States Standard for Area Navigation, are now found in FAA Order 8260.58, United States Standard for Performance Based Navigation (PBN) Instrument Procedure Design.

a. Table of Contents. Updated Table of Contents to coincide with the pages changed.

b. Chapter 1. Added further explanation regarding "automation" to include the use of the calculators embedded in this order and the geodetic calculator available on the AFS-420 web site, or CompSys 21 geodetic calculator available on the AeroNav Products web site, or Instrument Approach Procedure Automation/Instrument Procedures Development System (IAPA/IPDS), or other AFS-420 approved geodetic calculator.

c. Chapter 2.

(1) Paragraph 2. Added use of "rounding."

(2) Paragraph 2b. Updated Mathematics Convention to include feet per nautical mile (fpnm).

d. Chapter 6. Added Helicopter Departure criteria. This chapter describes RNAV departure criteria describing a visual departure from a non-instrument flight rules (IFR) departure location to an Initial Departure Fix to join with the IFR portion of the departure. This includes both public and special departure criteria.

e. Chapter 8. Added Helicopter Localizer Precision with Vertical (HLPV) criteria. This chapter describes the development of the HLPV Approach to a Point in Space and the initial missed approach segment.

f. Appendix C. Added new definitions to support new criteria in chapters 6 and 8.

John M. Allen
Director, Flight Standards Service

PAGE CONTROL CHART

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Chapter 1. General Information

1. Purpose of This Order. This order contains criteria for the formulation, review, approval, and publication of area navigation (RNAV) helicopter instrument procedures based on Global Positioning System (GPS) and Wide Area Augmentation System (WAAS) navigation.

2. Audience. This order is distributed in Washington headquarters to the branch level offices of Airport Safety, Standards and Communications, and Navigation and Surveillance Systems; Air Traffic Organization (Safety, En Route and Oceanic Services, Terminal Services, System Operations Services, and Technical Operations Services); Flight Standards Services; National Flight Procedures Office and the Regulatory Standards Division (at the Mike Monroney Aeronautical Center); branch level in the regional Flight Standards and Airports Divisions; special mailing list ZVS-827, and Special Military and Public Addressees.

3. Where Can I Find This Order? This information is also available on the FAA's Web site at http://www.faa.gov/regulations_policies/orders_notices

4. What This Order Cancels. Order 8260.42A, Helicopter Global Positioning System (GPS) Nonprecision Approach Criteria.

5. Explanation of Policy Changes. This document has been completely revised for harmonization with FAA Order 8260.54, The United States Standard for Area Navigation (RNAV), incorporation of criteria policy documents, and to meet FAA Order 1320.1, FAA Directives Management, formatting requirements. These criteria were written for automated implementation through the use of the calculators embedded in the document, AFS-420 geodetic calculator, Compsys 21 geodetic calculator, Instrument Approach Procedure Automation/ Instrument Procedures Development System (IAPA/IPDS), or other AFS-400 approved geodetic calculation products. Formulas are presented in Math notation and standard text to facilitate programming efforts. Calculation examples were eliminated. Instead, an Adobe Acrobat version of the criteria document is available where each formula performs the calculation as an imbedded calculator.

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Chapter 2. General Criteria

Section 1. Basic Criteria Information

2-1. General. These criteria assume use of Global Positioning System (GPS) or Wide Area Augmentation System (WAAS) receivers approved for approach operations, in accordance with Advisory Circular (AC) 20-138, Airworthiness Approval of Global Navigation Satellite System (GNSS) Equipment; Technical Standard Order (TSO) C-129 Class A (1) systems; and AC 20-130, Airworthiness Approval of Navigation or Flight Management Systems Integrating Multiple Navigation Sensors, for GPS as part of a multi-sensor system meeting TSO-C129 Class C (1) System or pertinent military guidance. Advisory Circular (AC) 20-138C, Airworthiness Approval of Positioning and Navigation Systems, and Technical Standard Order (TSO) C196A, Airborne Supplemental Navigation Sensors for Global Positioning System Equipment using Aircraft-Based Augmentation, contain updated Airworthiness guidance. WAAS navigation equipment must be approved in accordance with the requirements specified in TSO-C145, Airborne Navigation Sensors Using the Global Positioning System (GPS) Augmented by the Wide Area Augmentation System (WAAS), or TSO-C146, Stand-Alone Airborne Navigation Equipment Using the Global Positioning System (GPS) Augmented by the Wide Area Augmentation System (WAAS).

Unless otherwise specified, Order 8260.3, United States Standard for Terminal Instrument Procedures (TERPS), applies. For public use procedures, the heliport must meet the guidance contained in AC 150/5390-2, Heliport Design. Obstacle clearance area dimensions are based on 90 knots indicated airspeed (KIAS) maximum in the initial and intermediate segments and 70 KIAS maximum in the final and missed approach segments until passing the missed approach holding fix. USA/USAF/USN/USCG only: procedures are designed for 90 KIAS in the final and missed approach segments.

The following FAA orders apply:

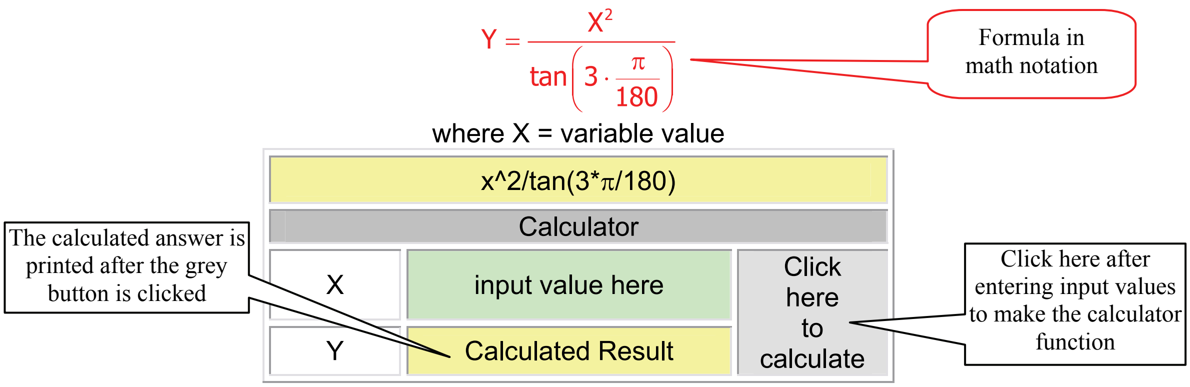
- 7130.3, Holding Pattern Criteria.
- 8260.3, United States Standard for Terminal Instrument Procedures (TERPS).
- 8260.19, Flight Procedures and Airspace.

Apply chapter 2, section 3 of Order 7130.3, Holding Pattern Criteria. Use pattern 4 for all helicopter holding (including climb-in-hold) up to and including 10,000 ft. Chart 4 nautical mile (NM) leg lengths.

The feeder, initial, intermediate, final, and missed approach criteria described in this order supersede the other publications listed above. See Order 8260.3, Volume 1, chapter 3 to determine visibility minima.

Formulas are numbered by chapter and depicted in standard mathematical notation and in standard text to aid in computer programming. Each formula contains a java script functional calculator.

Formula X-X. Formula Title



2-2. Data Resolution. Perform calculations using an accuracy of at least 15 significant digits; i.e., floating point numbers must be stored using at least 64 bits. Unless otherwise noted, do not round intermediate results. Round only the final result of calculations for documentation purposes. Required accuracy tolerance is 1 centimeter for distance and 0.002 arc-second for angles. The following list specifies the minimum accuracy standard for documenting data expressed numerically. This standard applies to the documentation of final results only; e.g., a calculated adjusted glidepath angle of 3.04178 degrees is documented as 3.05 degrees. The standard does not apply to the use of variable values during calculation. Use the most accurate data available for variable values.

a. Documentation Accuracy:

(1) WGS-84 latitudes and longitudes to the nearest one hundredth (0.01) arc second; [nearest five ten thousandth (0.0005) arc second for Final Approach Segment (FAS) data block entries];

(2) Flight Path Alignment Point (FPAP) mean sea level (MSL) elevation to the nearest foot;

(3) FPAP height above ellipsoid (HAE) to the nearest tenth (0.1) meter;

(4) Glidepath angle to the next higher one hundredth (0.01) degree;

(5) Courses to the nearest one hundredth (0.01) degree;

(6) Course width at threshold to the nearest quarter (0.25) meter; and

(7) Distances to the nearest hundredth (0.01) unit [except for "length of offset" entry in FAS data block which is to the nearest 8 meter value].

b. Mathematics Convention. Formulas in this document as depicted are written for radian calculation.

Note: The value for 1 NM was previously defined as 6,076.11548 ft. For the purposes of RNAV criteria, 1 NM is defined as the result of the following calculation:

$$fpnm = \frac{1852}{0.3048}$$

(1) Conversions:

- Degree measure to radian measure:
  $radians = degrees \cdot \frac{\pi}{180}$

- Radian measure to degree measure:
  $degrees = radians \cdot \frac{180}{\pi}$

- Feet to meters:
  $meters = feet \cdot 0.3048$

- Meters to feet:
  $feet = \frac{meters}{0.3048}$

- Feet to Nautical Miles (NM):
  $NM = feet \cdot \frac{0.3048}{1852}$

- NM to feet:
  $feet = NM \cdot \frac{1852}{0.3048}$

- NM to meters:
  $meters = NM \cdot 1852$

- Meters to NM:
  $NM = \frac{meters}{1852}$

- Temperature Celsius to Fahrenheit:
  $T_{Fahrenheit} = 1.8 \cdot T_{Celcius} + 32$

- Temperature Fahrenheit to Celsius:
  $T_{Celcius} = \frac{T_{Fahrenheit} - 32}{1.8}$

(2) Definition of Mathematical Functions and Constants:

a+b indicates addition

a-b indicates subtraction

$a \times b$ or ab or a*b or a·b indicates multiplication

$\frac{a}{b}$ or $^{a}\!/_{b}$ or a÷b indicates division

(a-b) indicates the result of the process within the parenthesis

$|a-b|$ indicates absolute value

≈ indicates approximate equality

$\sqrt{a}$ or $a^{0.5}$ or a^0.5 indicates the square root of quantity "a"

a^2 or a^2 indicates $a \times a$

In(a) or log(a) indicates the natural logarithm of "a"

tan(a) indicates the tangent of "a" degrees

$\tan^{-1}(a)$ or atan(a) indicates the arc tangent of "a"

sin(a) indicates the sine of "a" degrees

$\sin^{-1}(a)$ or asin(a) indicates the arc sine of "a"

cos(a) indicates the cosine of "a" degrees

$\cos^{-1}(a)$ or acos(a) indicates the arc cosine of "a"

e The constant e is the base of the natural logarithm and is sometimes known as Napier's constant, although its symbol (e) honors Euler. With the possible exception of π, e is the most important constant in mathematics since it appears in myriad mathematical contexts involving limits and derivatives. Its value is approximately 2.718281828459045235360287471352662497757...

r The TERPS constant for the mean radius of the earth for spherical calculations in feet. r = 20890537

(3) Operation Precedence (Order of Operations):

First: Grouping Symbols: parentheses, brackets, braces, fraction bars, etc.
Second: Functions: Tangent, sine, cosine, arcsine, and other defined functions
Third: Exponentiations: Powers and roots
Fourth: Multiplication and Division: Products and quotients
Fifth: Addition and subtraction: Sums and differences
e.g.,

$5 - 3 \times 2 = -1$ because multiplication takes precedence over subtraction

$(5 - 3) \times 2 = 4$ because parentheses take precedence over multiplication

$\frac{6^2}{3} = 12$ because exponentiation takes precedence over division

$\sqrt{9+16} = 5$ because the square root sign is a grouping symbol

$\sqrt{9} + \sqrt{16} = 7$ because roots take precedence over addition

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Chapter 6. Helicopter Instrument Departure Design Criteria

6-1. General. See chapter 2, paragraph 1, section 1.

6-2. Terms. These terms/variables are common to all formulas:

β is magnitude of heading change in degrees
θ is glidepath angle in degrees
alt is altitude AMSL
ATT is along-track tolerance
DA is decision altitude specified AMSL
$\mathbf{d_{FauxOrigin}}$ is the distance from RDP to the phantom LTP for OEA construction
FTE means "Flight Technical Error"
HAS is the height in feet above the surface beneath (within 5,200 radius of) RDP
LTP means "landing threshold point"
MSL in this document is synonymous with AMSL
$\mathbf{OBS_{elev}}$ is the obstacle AMSL elevation
$\mathbf{OBS_x}$ is the along-track distance from reference datum point
$\mathbf{PFAF_{alt}}$ is the minimum AMSL altitude at the PFAF
RDP means "reference datum point"

$$\text{Functions and Constants} \left\{ \begin{array}{l} \cdot\mathbf{deg} = \times\dfrac{\pi}{180} \\ \mathbf{fpnm} = \dfrac{1852}{0.3048} \\ \mathbf{max(a,b)} = \text{maximum value of a and b} \\ \mathbf{round(a,b)} = \text{rounds a to b decimal places} \\ \mathbf{ceiling(a)} = \text{rounds a to next integer toward positive infinity} \end{array} \right\}$$

6-3. Obstacle Departure Procedures. Reserved.

6-4. PinS Departures.

a. Background operational information for procedure designers. The PinS Departure Procedures (DPs) described in this criteria allow a pilot to depart a heliport and visually navigate and avoid obstacles to the Initial Departure Fix (IDF) where IFR obstruction clearance begins. The IDF is a FB WP. IFR helicopter departure procedures will consist of a defined route in graphic form, published/charted as a standard instrument departure (SID) and comply with design and documentation guidelines as specified in this chapter and FAA Order 8260.46 chapter 2, appendices A, C, D, and E.

b. General Procedure Design. Establish the IDF at a distance from 1.5 NM to 5.0 NM from HRP for Public DPs, and 0.55 NM to 2.0 NM for Special DPs. PCG and obstruction clearance must be provided from the earliest ATT at the IDF to the latest ATT at the last DP WP

(DP termination fix) where the DP joins the en route structure and an altitude that permits en route flight.

(1) Public DP Construction. Optimum leg length is 3.0 NM. If the magnitude (β) of the first turn is ≤ 70 degrees, the minimum leg length allowed is 3.0 NM. If β of the first turn is > 70 degrees the minimum leg length is 3.5 NM. Maximum turn magnitude is 90 degrees and leg length is 10.0 NM.

(2) Special DP Construction. The **optimum** leg length for Special helicopter DP construction is 3.0 NM. If β of the first turn angle is ≤ 30 degrees, the minimum leg length is 2.0 NM, if β of the first turn angles are > 30 degrees the minimum leg length increases to 3.0 NM. Maximum value for β is 90 degrees and maximum leg length is 10.0 NM.

(3) After the first turn fix, and expanding to full width, apply standard RNAV initial segment OEA construction for Category "A" aircraft. Minimum leg length is the greater of the current RNAV minimum leg length criteria or as construction requires after the first turn fix.

(4) Use Formula 6-1 to determine turn radius (R) and DTA appropriate for β. For a Public DP, use a design climb airspeed of 80 KIAS and a 13-degree bank angle until the climb trajectory reaches the target departure altitude. After the target departure altitude is reached, design for 140 KIAS and 15-degree bank angle. For a Special DP, use the best rate of climb airspeed (V_y), the cruising airspeed (V_c), and the design bank angle for V_y and V_c applicable to the specific design helicopter.

(5) If lower or higher airspeeds are required because of design helicopter performance or equipment operating limitations, publish a speed restriction.

Formula 6-1. Turn Radius/DTA

$$(1)\quad input\ V_{KIAS},\ bank_{angle},\ turn_{alt},\ \beta,\ HRP_{elev}$$

$$(2)\quad \mathbf{case}(turn_{alt} - HRP_{elev} > 2000):\ V_{KTW} = round(0.00198 \cdot turn_{alt} + 47, 0)$$

$$\mathbf{case}(turn_{alt} - HRP_{elev} \le 2000):\ V_{KTW} = 30$$

$$(3)\quad V_{KTAS} = \mathbf{round}\left[\frac{V_{KIAS} \cdot 171233 \cdot \sqrt{303 - 0.00198 \times turn_{alt}}}{(288 - 0.00198 \cdot turn_{alt})^{2.628}}, 0\right]$$

$$(4)\quad R = \mathbf{round}\left[\frac{(V_{KTAS} + V_{KTW})^2}{\tan(bank_{angle}{}^{\circ}) \cdot 68625.4}, 2\right]$$

$$(5)\quad DTA_{NM} = \mathbf{round}\left[R \cdot \tan\left(\frac{\beta^{\circ}}{2}\right), 2\right]$$

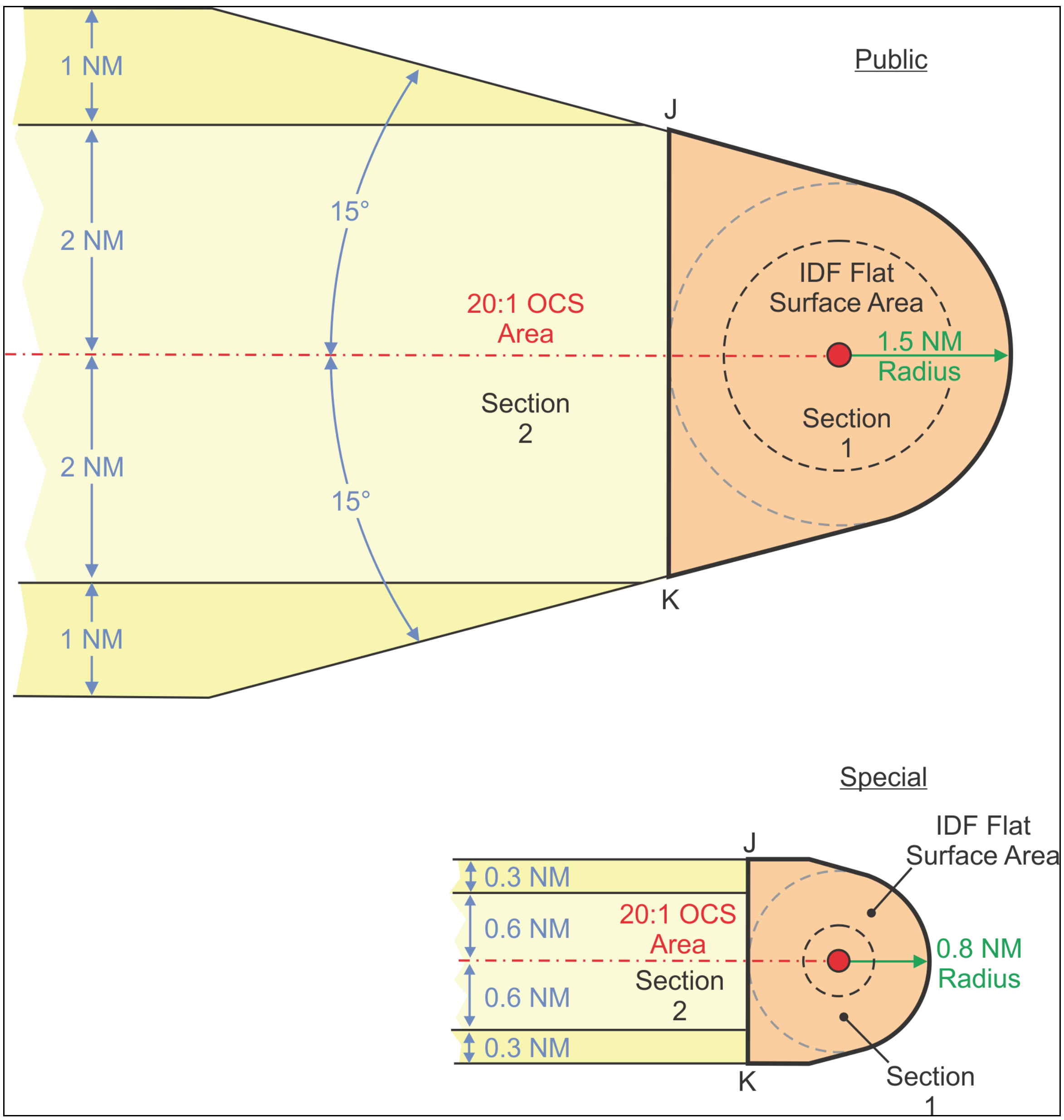
if ($turn_{alt}$-HRP_{elev}>2000) then 0.00198*$turn_{alt}$+47
else 30
round((V_{KIAS}*171233*(303-0.00198*$turn_{alt}$)^0.5)/(288-0.00198*$turn_{alt}$)^2.628,0)
round((V_{KTAS}+V_{KTW})^2/(tan($bank_{angle}$*π/180)*68625.4),2)
round(R*tan(β/2*π/180),2)

Calculator

V_{KIAS}		Click Here to calculate
$bank_{angle}$		
$turn_{alt}$		
β		
HRP_{elev}		
V_{KTW}		
R		
DTA		

6-5. Obstacle Evaluation Area. The OEA consists of Section 1 (the IDF flat surface area), and Section 2 (the 20:1 sloping OCS), as shown in Figure 6-1. The <u>JK</u> line (end of section 1/ beginning of section 2) is a line perpendicular to the initial departure course that is a specified distance from the IDF: 1.5 NM (1 NM ATT + 0.5 NM FTE) for public DPs and 0.8 NM (0.3 NM ATT + 0.5 NM FTE) for Specials the construction radius around the IDF is 1 NM ATT + 0.5 NM FTE = 1.5 NM for a Public DP and 0.3 NM + 0.5 NM FTE = 0.8 NM for a Special DP. A 15-degree splay defines the Section 1 and Section 2 outer boundaries as shown in Figure 6-1 below. The OEA entry is centered on the IDF and the route is constructed as a series of TF legs to the DP termination fix.

Figure 6-1. Section 1 Flat Surface, Section 2 OCS Areas



6-6. General Public PinS Departure Construction. For Public DP construction, OEA configuration is dependent on the course change angle at the first turn fix, and the length of the first segment. Some examples are illustrated in Figure 6-2 thru Figure 6-4. Instructions on how to define these cases (creating the specific OEAs and turn boundaries) are located in steps below:

Figure 6-2. Public OEA Area Plan View (90-Degree Turn)

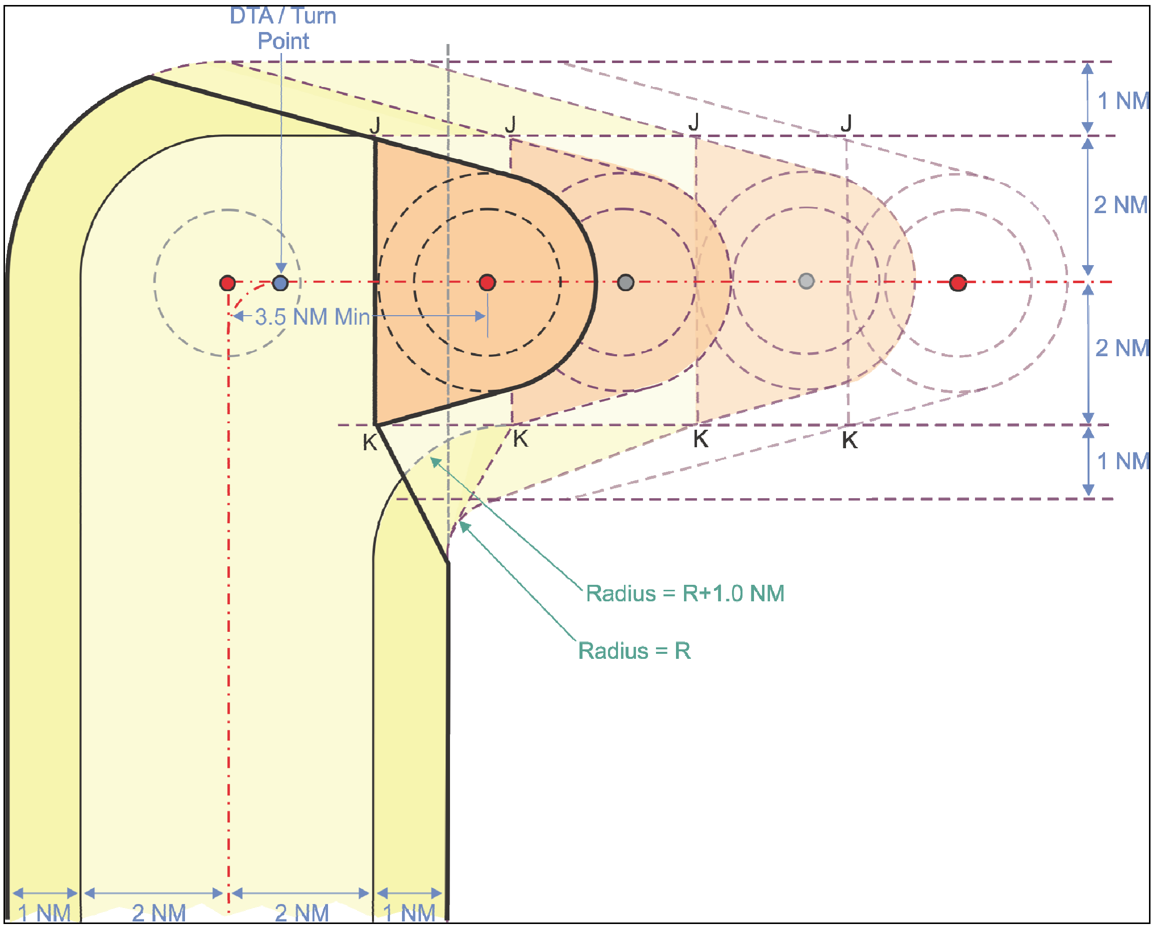


Figure 6-3. Public OEA Area Plan View (15- and 30-Degree Turns)

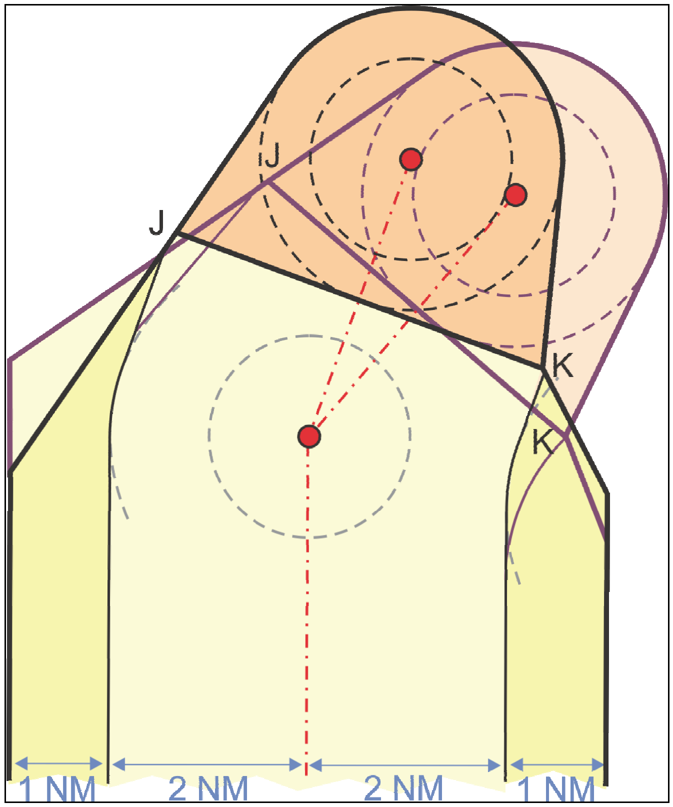
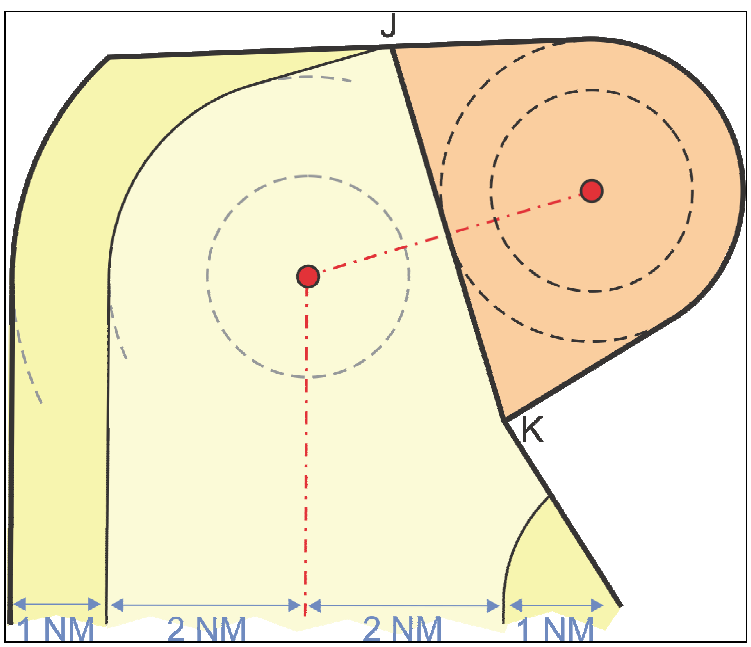


Figure 6-4. Public OEA Area Plan View (70-Degree Turn)



Step 1: Position the IDF as a FB fix. Use a fix-to-fix distance that is in accordance with chapter 2, paragraph 2b(1).

Step 2: Construct the IDF Circle as an arc with a 1.5 NM radius centered at the IDF fix.

Step 3: Construct the Designed Turning Flight Path.

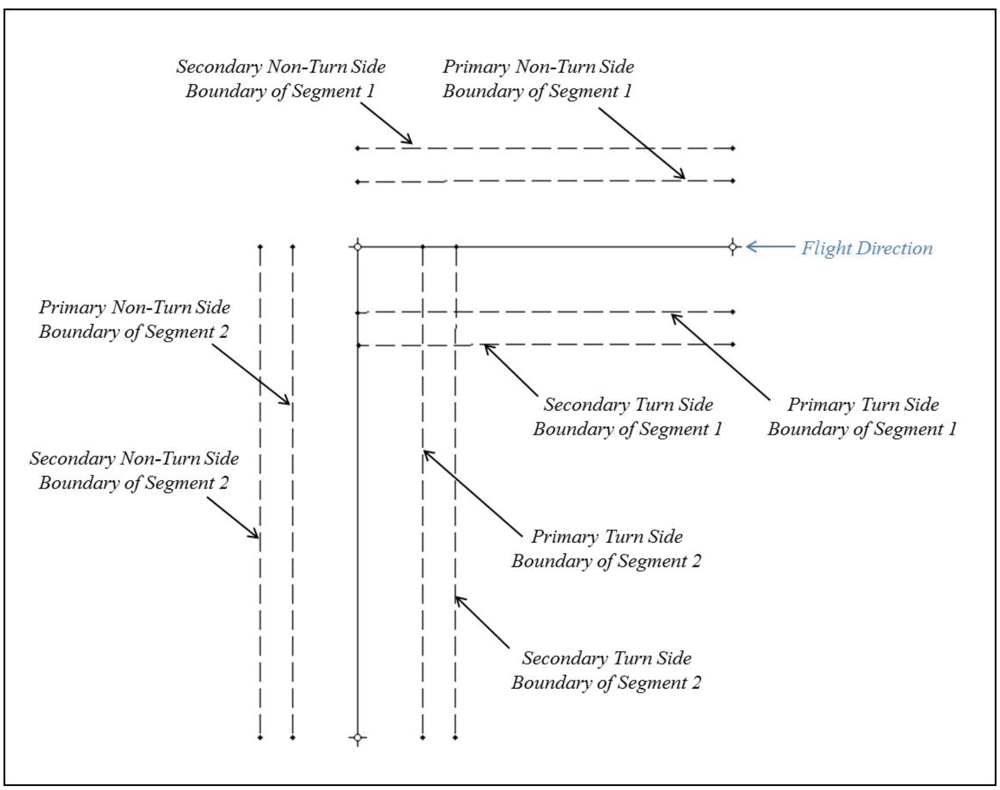
Step 3a: Determine the turn radius (R) utilizing Formula 6-1.

Step 3b: Construct an arc of radius R that lays tangent to Segments 1 and 2.

Step 4: Construct Segment 1 Boundaries. Construct Boundaries of half-widths 1-2-2-1 in reference to Segment 1. They will hereby be referred to as the Secondary Turn Side Boundary of Segment 1, the Primary Turn Side Boundary of Segment 1, the Primary Non-Turn Side Boundary of Segment 1, and the Secondary Non-Turn Side Boundary of Segment 1. These boundaries are depicted in Figure 6-5.

Step 5: Construct Segment 2 Boundaries. Construct Boundaries of half-widths 1-2-2-1 in reference to Segment 2. They will hereby be referred to as the Secondary Turn Side Boundary of Segment 2, the Primary Turn Side Boundary of Segment 2, the Primary Non-Turn Side Boundary of Segment 2, and the Secondary Non-Turn Side Boundary of Segment 2. These boundaries are depicted in Figure 6-5.

Figure 6-5. Construction of the Segment 1 and Segment 2 Boundaries



Step 6: Construct the Turn Side Splay Line (see Figure 6-6).

Step 6a: Locate the Splay End Reference Point a distance of 1.5/tan(15°) NM from the IDF along the Segment 1 Course Line.

Step 6b: Locate the Turn Side Splay Line End Point as the Splay End Reference Point projected onto the Secondary Turn Side Boundary of Segment 1.

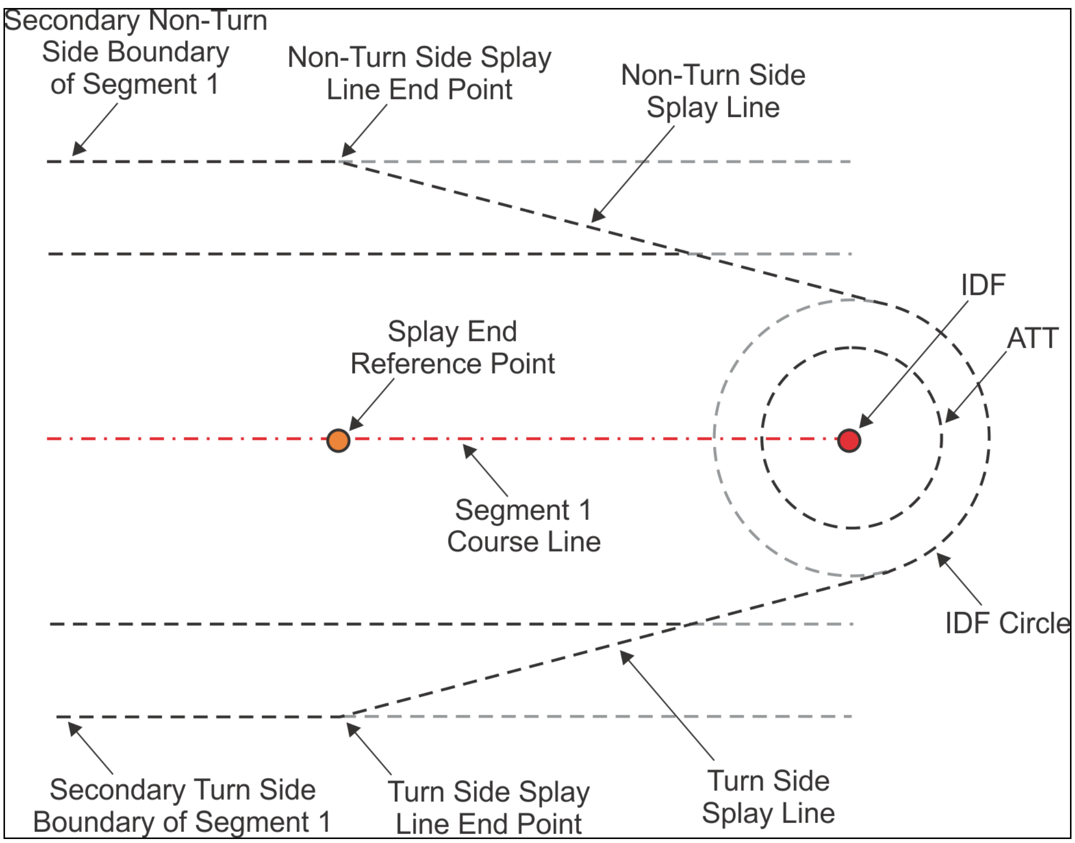
Step 6c: Construct the Turn Side Splay Line as a line that is tangent to the IDF Circle passing through the Turn Side Splay Line End Point.

Step 7: Construct the Non-Turn Side Splay Line (see Figure 6-6).

Step 7a: Locate the Non-Turn Side Splay Line End Point as the Splay End Reference Point projected onto the Secondary Non-Turn Side Boundary of Segment 1.

Step 7b: Construct the Non-Turn Side Splay Line as a line that is tangent to the IDF Circle passing through the Non-Turn Side Splay Line End Point.

Figure 6-6. Construction of the Splay Lines



Step 8: Construct the IDF Flat Surface Area (see Figure 6-7).

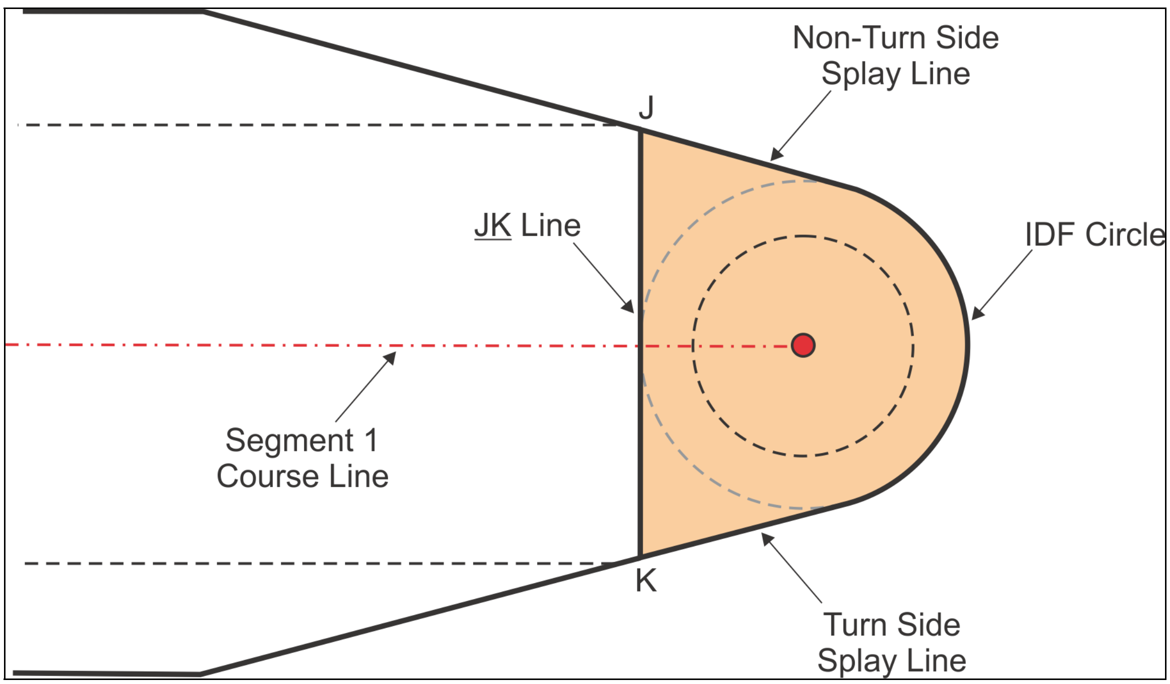
Step 8a: Construct the JK line as a line that lays tangent to the IDF Circle at a point intersecting the Segment 1 Course Line.

Step 8b: Truncate the JK line where it intersects the Turn Side Splay Line and the Non-Turn Side Splay Line.

Step 8c: The IDF Flat Surface Area is the area bounded by the IDF Circle, the Turn Side and Non-Turn Side Splay Lines, and the JK line.

Step 8d: The Turn Side end of the JK line will hereby be referred to as Point J and the Non-Turn Side end of the JK line will hereby be referred to as Point K.

Figure 6-7. Construction of the IDF Flat Surface Area

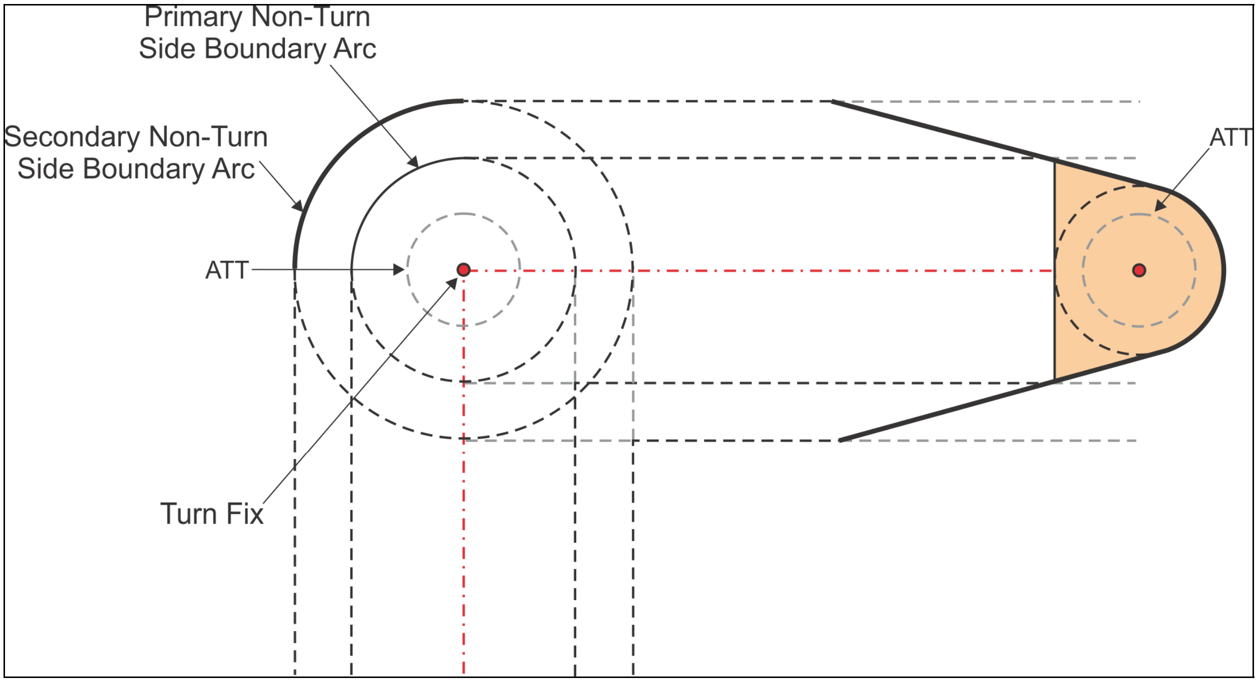


Step 9: Construct Non-Turn Side Boundary Arcs (see Figure 6-8).

Step 9a: Construct the Primary Non-Turn Side Boundary Arc centered on the turn fix with a radius equal to the Segment 1 primary half-width.

Step 9b: Construct the Secondary Non-Turn Side Boundary Arc centered on the turn fix with a radius equal to the Segment 1 primary half-width plus the segment secondary width.

Figure 6-8. Construction of the Non-Turn Side Boundary Arcs

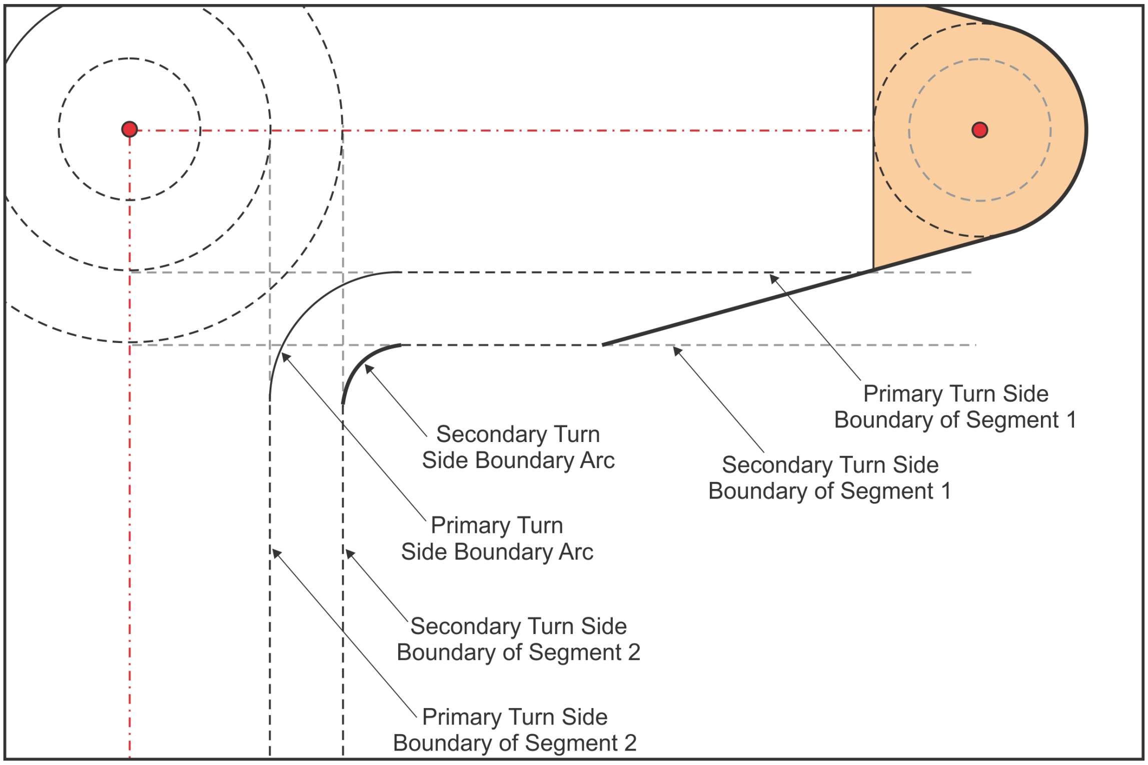


Step 10: Construct Turn Side Boundary Arcs (see Figure 6-9).

Step 10a: Construct the Primary Turn Side Boundary Arc tangent to the Primary Turn Side Boundaries of Segments 1 and 2 with a radius equal to R + 1 NM.

Step 10b: Construct the Secondary Turn Side Boundary Arc tangent to the Secondary Turn Side Boundaries of Segments 1 and 2 with a radius equal to R.

Figure 6-9. Construction of the Turn Side Boundary Arcs



Step 11: Define and Construct the Non-Turn Side Boundary.

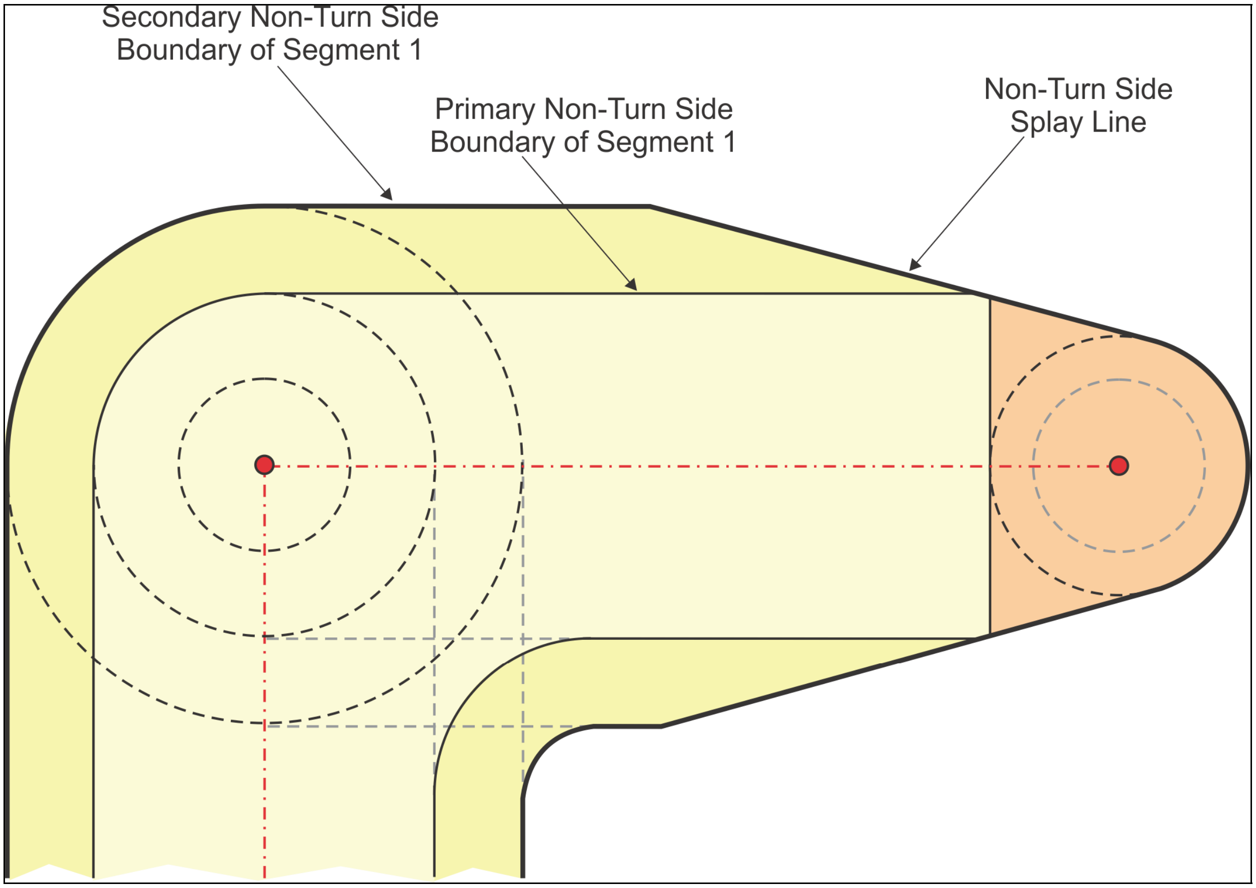
Step 11a: Depending on the course change at the second waypoint and the length of Segment 1, the Non-Turn Side Splay Line will either intersect the Secondary Non-Turn Side Boundary of Segment 1, the Secondary Non-Turn Side Boundary Arc, or the Secondary Non-Turn Side Boundary of Segment 2.

Step 11b: If the Non-Turn Side Splay Line intersects the Secondary Non-Turn Side Boundary of Segment 1 (see Figure 6-10), then:

Step 11b (1): Truncate the Secondary Non-Turn Side Boundary of Segment 1 at the intersection, and,

Step 11b (2): Truncate the Primary Non-Turn Side Boundary of Segment 1 where it intersects the Non-Turn Side Splay Line.

Figure 6-10. Construction of the Non-Turn Side Boundary, Case 1



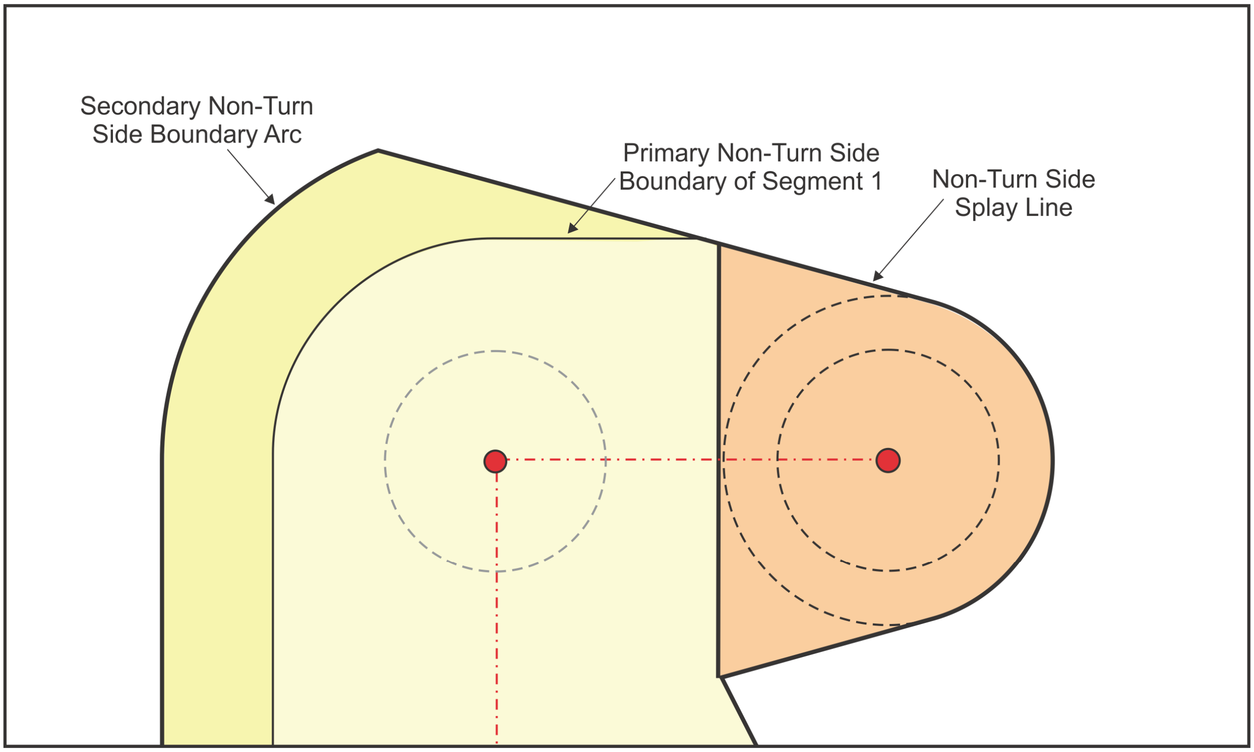
Step 11c: If the Non-Turn Side Splay Line intersects the Secondary Non-Turn Side Boundary Arc (see Figure 6-2) then,

Step 11c (1): Remove the Secondary Non-Turn Side Boundary of Segment 1,

Step 11c (2): Truncate the Secondary Non-Turn Side Boundary Arc at the intersection and,

Step 11c (3): Truncate the Primary Non-Turn Side Boundary of Segment 1 where it intersects the Non-Turn Side Splay Line.

Figure 6-11. Construction of the Non-Turn Side Boundary, Case 2



Step 11d: If the Non-Turn Side Splay Line intersects the Secondary Non-Turn Side Boundary of Segment 2 (see Figure 6-12) then,

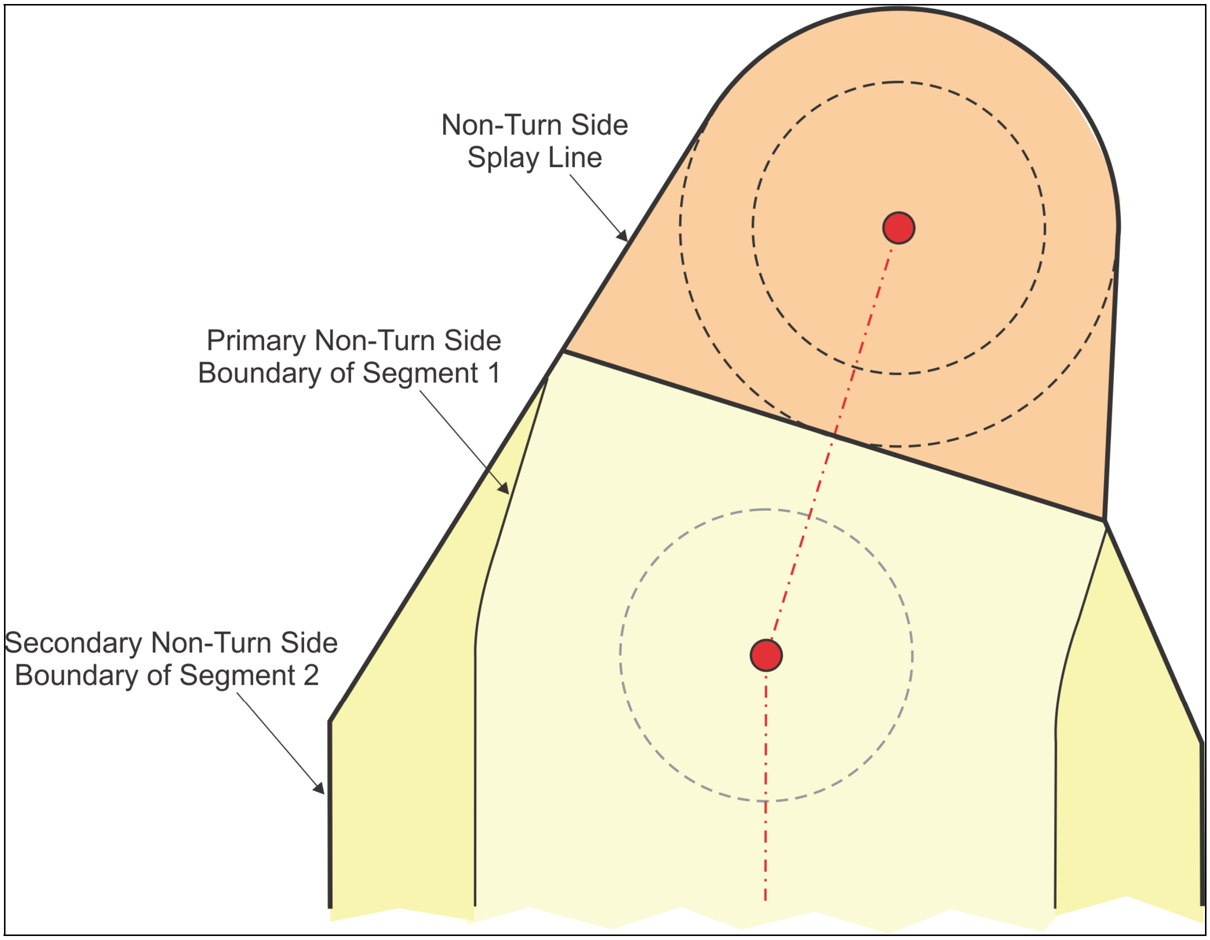
Step 11d (1): Remove the Secondary Non-Turn Side Boundary of Segment 1,

Step 11d (2): Remove the Secondary Non-Turn Side Boundary Arc,

Step 11d (3): Truncate the Secondary Non-Turn Side Boundary of Segment 2 at the intersection and,

Step 11d (4): Truncate the Primary Non-Turn Side Boundary of Segment 1 where it intersects the Non-Turn Side Splay Line.

Figure 6-12. Construction of the Non-Turn Side Boundary, Case 3



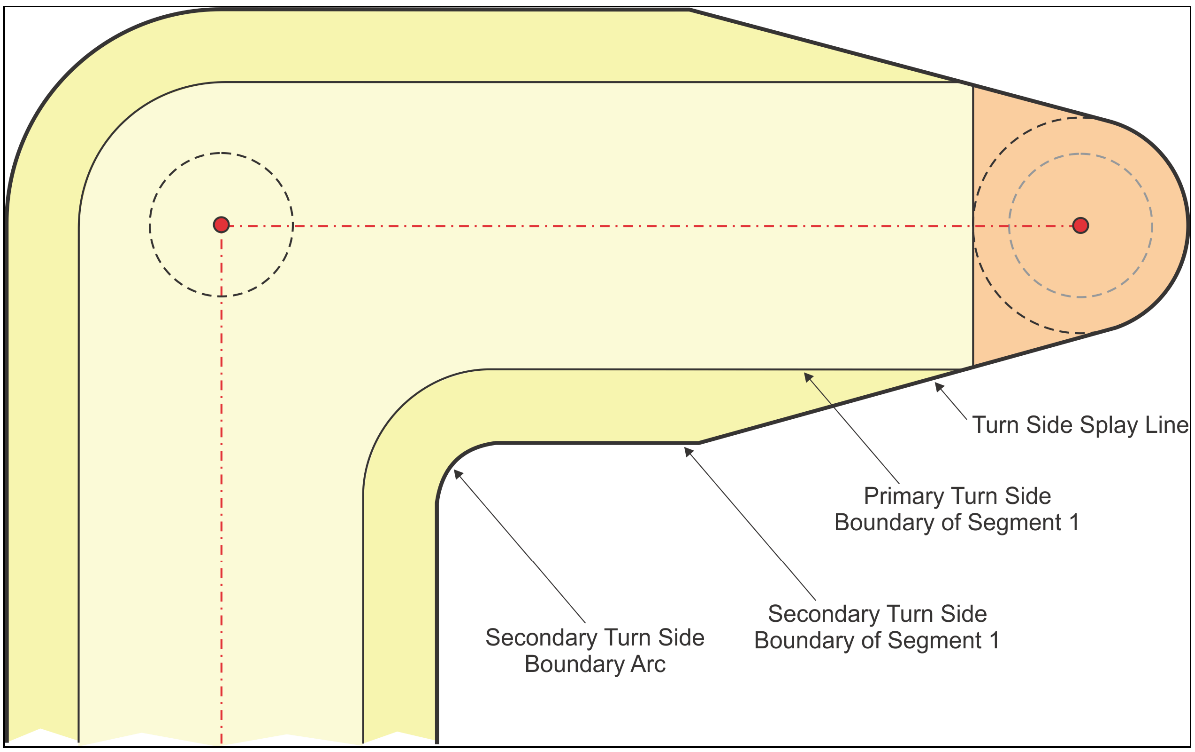
Step 12: Define and Construct the Turn Side Boundary.

Step 12a: If the Turn Side Splay Line intersects the Secondary Turn Side Boundary of Segment 1 before the start of the Secondary Turn Side Boundary Arc (see Figure 6-13) then,

Step 12a (1): Truncate the Primary Turn Side Boundary of Segment 1 at its intersection with the Turn Side Splay Line and,

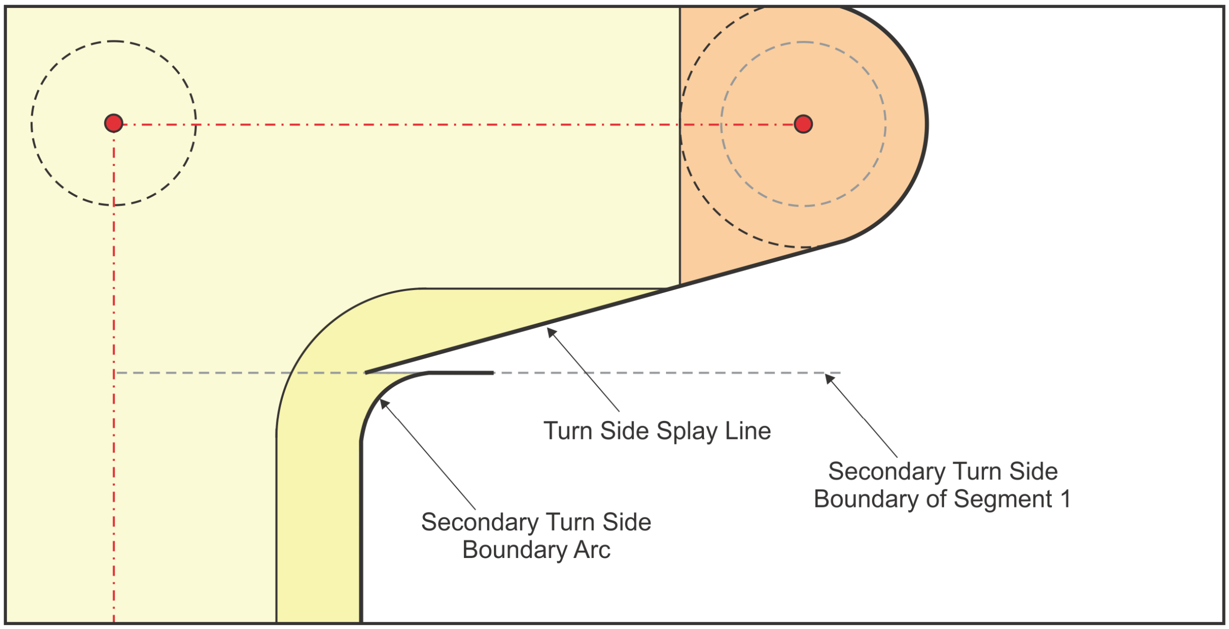
Step 12a (2): Truncate the Secondary Turn Side Boundary of Segment 1 at its intersection with the Turn Side Splay Line.

Figure 6-13. Construction of the Turn Side Boundary, Case 1



Step 12b: If the Turn Side Splay Line intersects the Secondary Turn Side Boundary of Segment 1 after the start of the Secondary Turn Side Boundary Arc (see Figure 6-14) then,

Figure 6-14. Construction of the Turn Side Boundary, Case 2 Determination



Step 12b (1): Construct the Turn Side Boundary Line as a line that lays tangent to the Secondary Turn Side Boundary Arc and passes through Point K.

Step 12b (1)(a): If the configuration of the procedure is such that this step cannot be performed, forego this step and proceed to Step 12c.

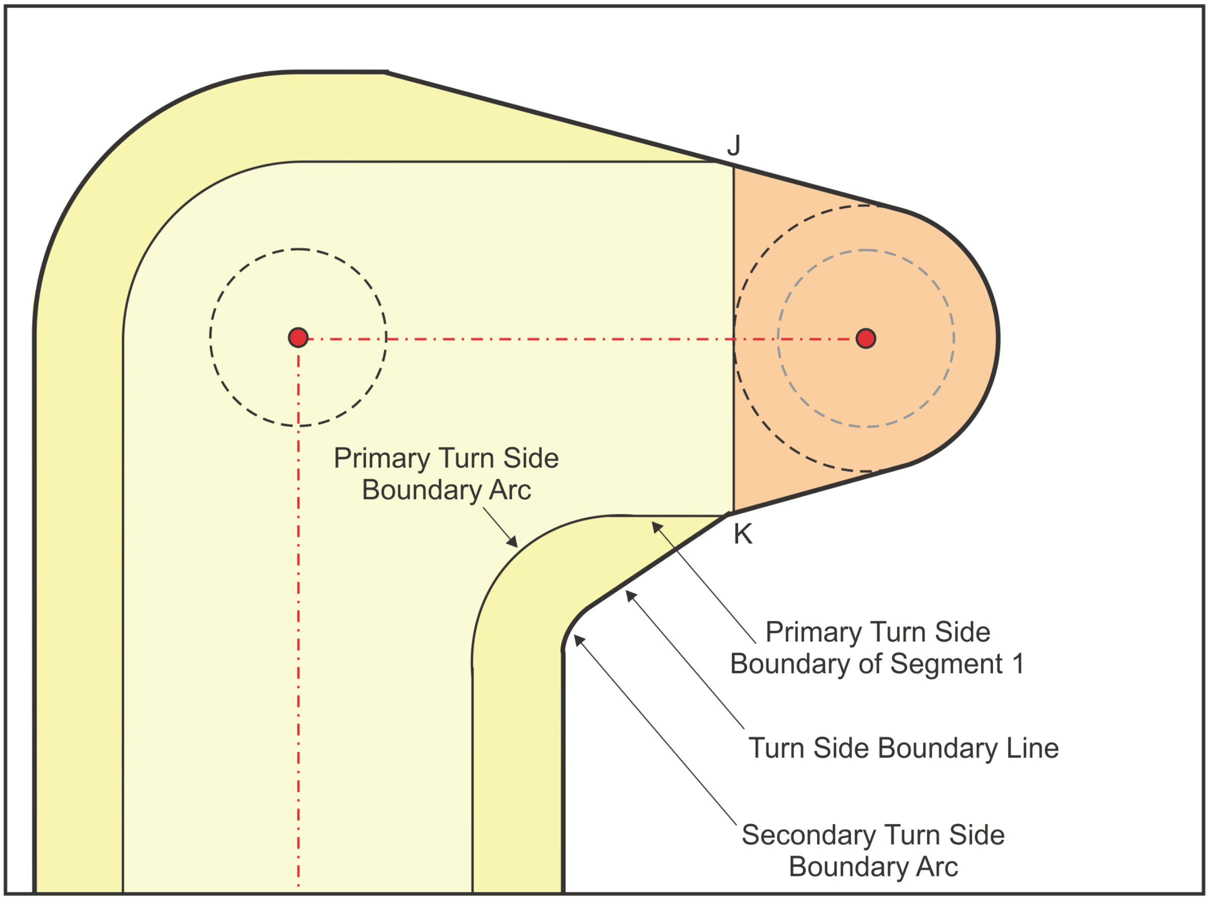
Step 12b (2): If the Turn Side Boundary Line intersects the Primary Turn Side Boundary of Segment 1 (see Figure 6-15) then,

Step 12b (2)(a): Truncate the Primary Turn Side Boundary of Segment 1 at its intersection with the Turn Side Boundary Line,

Step 12b (2)(b): Remove the Secondary Turn Side Boundary of Segment 1, and

Step 12b (2)(c): Truncate the Secondary Turn Side Boundary Arc at its point of tangency with the Turn Side Boundary Line.

Figure 6-15. Construction of the Turn Side Boundary, Case 2a



Step 12b (3): If the Turn Side Boundary Line intersects the Primary Turn Side Boundary Arc (see Figure 6-16) then,

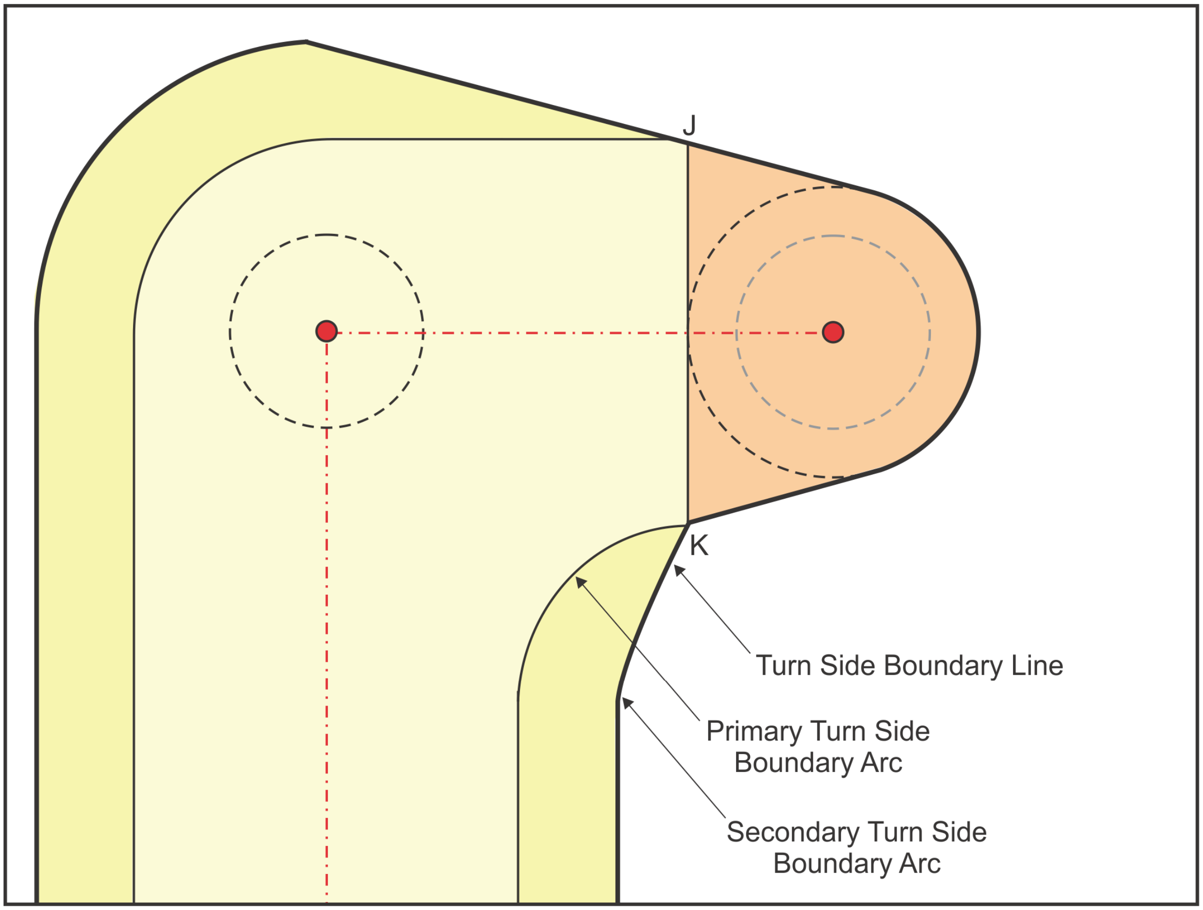
Step 12b (3)(a): Truncate the Primary Turn Side Boundary Arc at its intersection with the Turn Side Boundary Line,

Step 12b (3)(b): Truncate the Secondary Turn Side Boundary Arc at its point of tangency with the Turn Side Boundary Line,

Step 12b (3)(c): Remove the Primary Turn Side Boundary of Segment 1, and

Step 12b (3)(d): Remove the Secondary Turn Side Boundary of Segment 1.

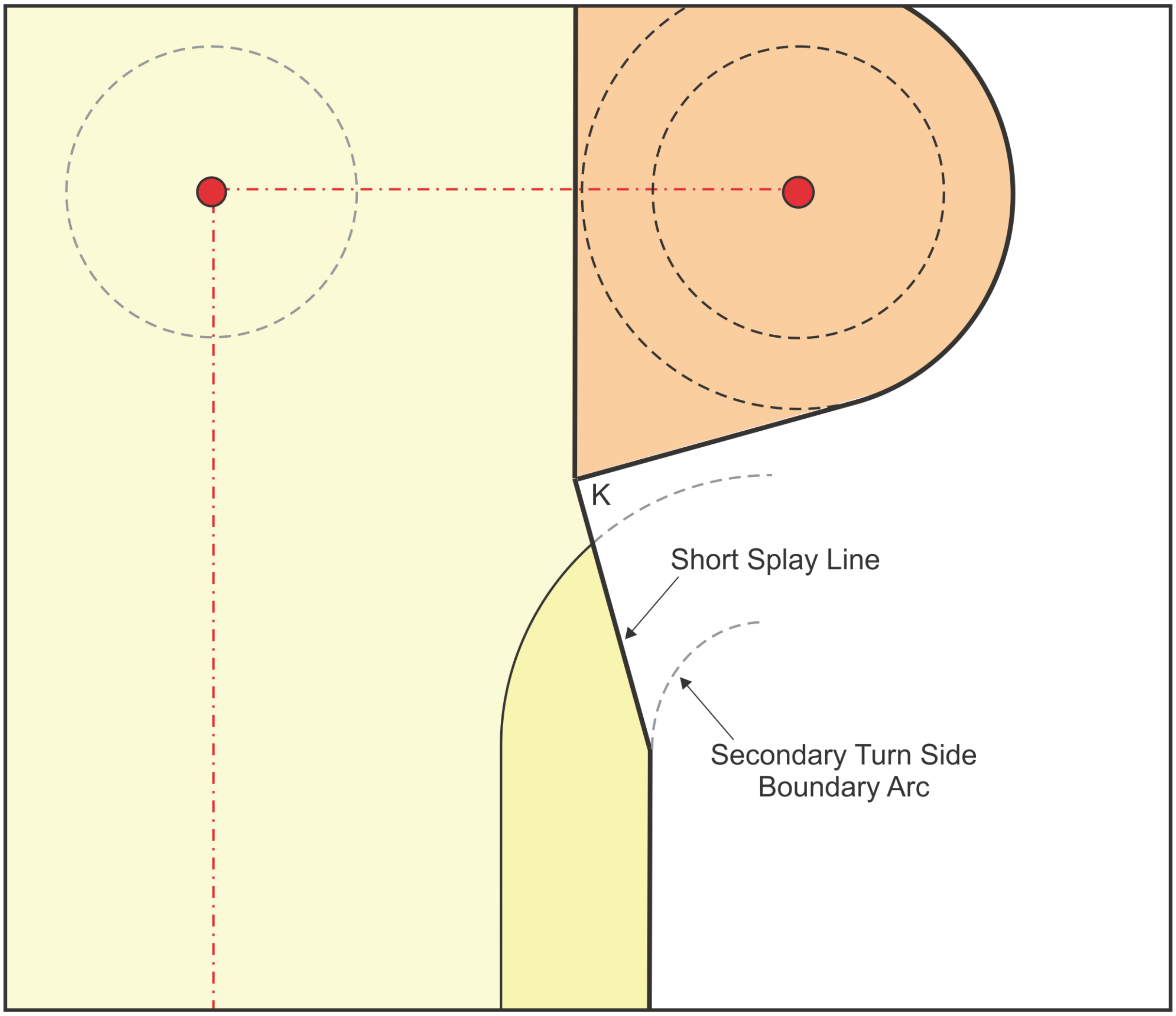
Figure 6-16. Construction of the Turn Side Boundary, Case 2b



Step 12c: If full width cannot be achieved in the initial segment [as described in Step 12a], and a tangent line cannot be drawn between Point K and the Secondary Turn Side Boundary Arc [as described in Step 12b(1)(a)],

Step 12c (1): Construct the Short Splay Line as a line that starts at Point K and ends at the end of the Secondary Turn Side Boundary Arc (see Figure 6-9).

Figure 6-17. Construction of the Turn Side Boundary, Case 3 Determination



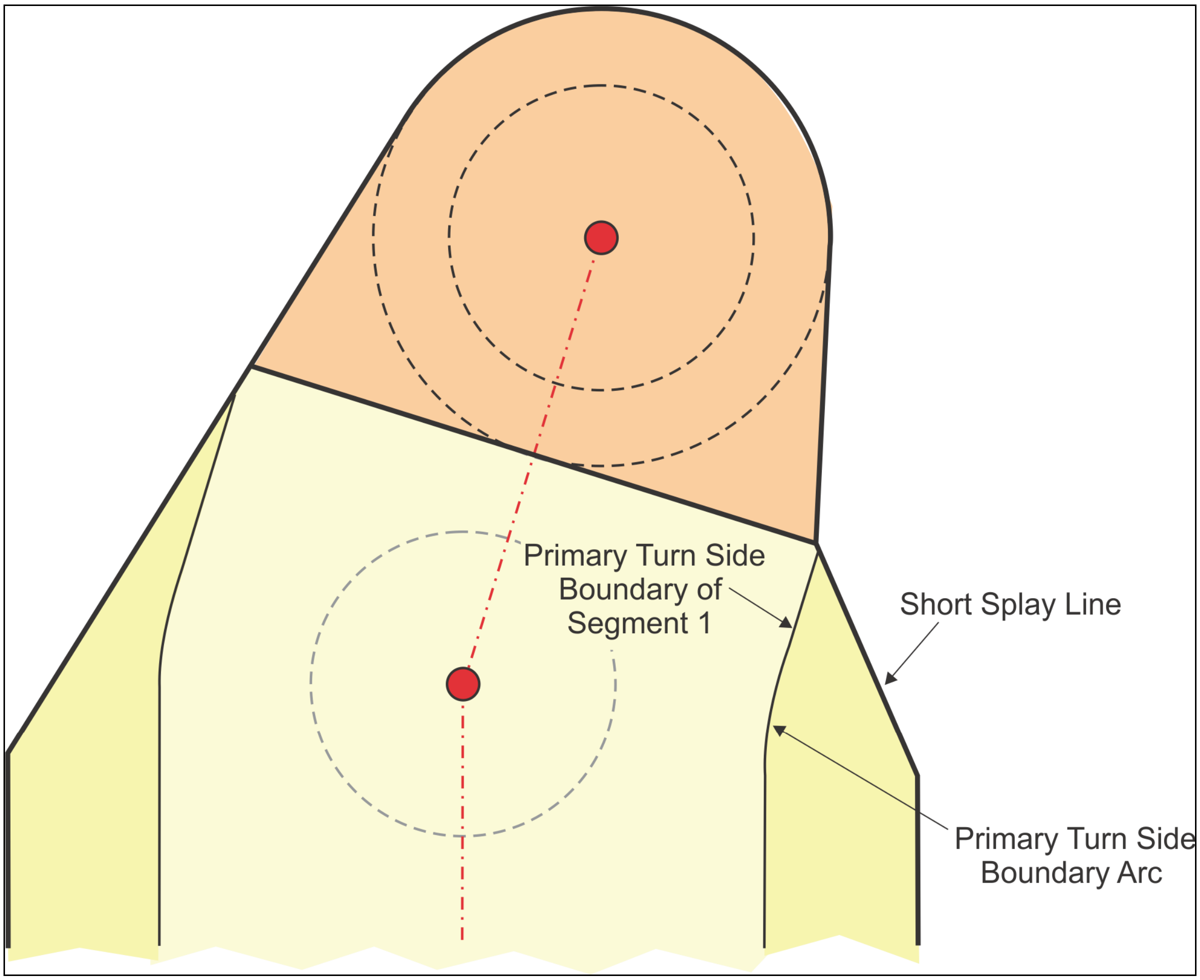
Step 12c (2): If the Short Splay Line intersects the Primary Turn Side Boundary of Segment 1 (see Figure 6-18) then,

Step 12c (2)(a): Remove the Secondary Turn Side Boundary of Segment 1,

Step 12c (2)(b): Remove the Secondary Turn Side Boundary Arc, and

Step 12c (2)(c): Truncate the Primary Turn Side Boundary of Segment 1 at its intersection with the Short Splay Line.

Figure 6-18. Construction of the Turn Side Boundary, Case 3a



Step 12c (3): If the Short Splay Line intersects the Primary Turn Side Boundary Arc (see Figure 6-19) then,

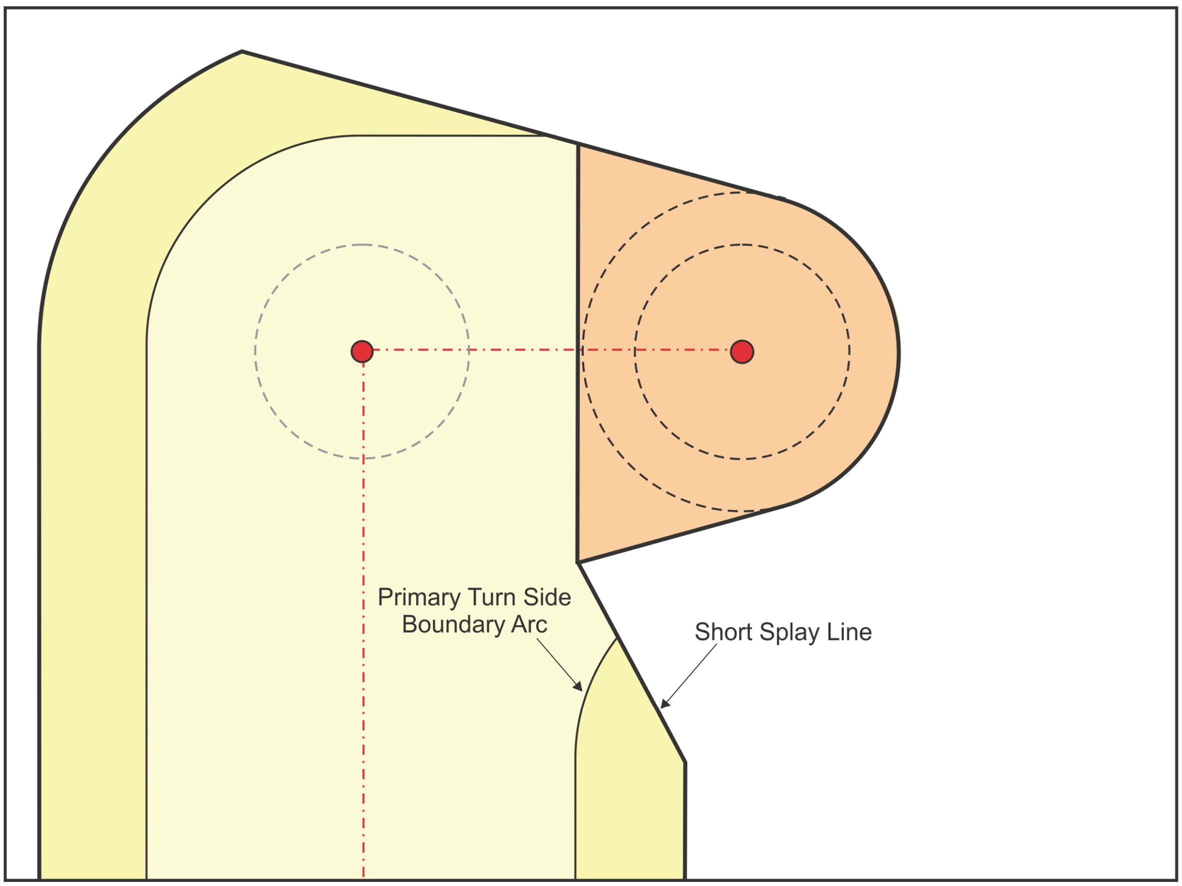
Step 12c (3)(a): Remove the Primary Turn Side Boundary of Segment 1,

Step 12c (3)(b): Remove the Secondary Turn Side Boundary of Segment 1,

Step 12c (3)(c): Remove the Secondary Turn Side Boundary Arc, and

Step 12c (3)(d): Truncate the Primary Turn Side Boundary Arc at its point of intersection with the Short Splay Line.

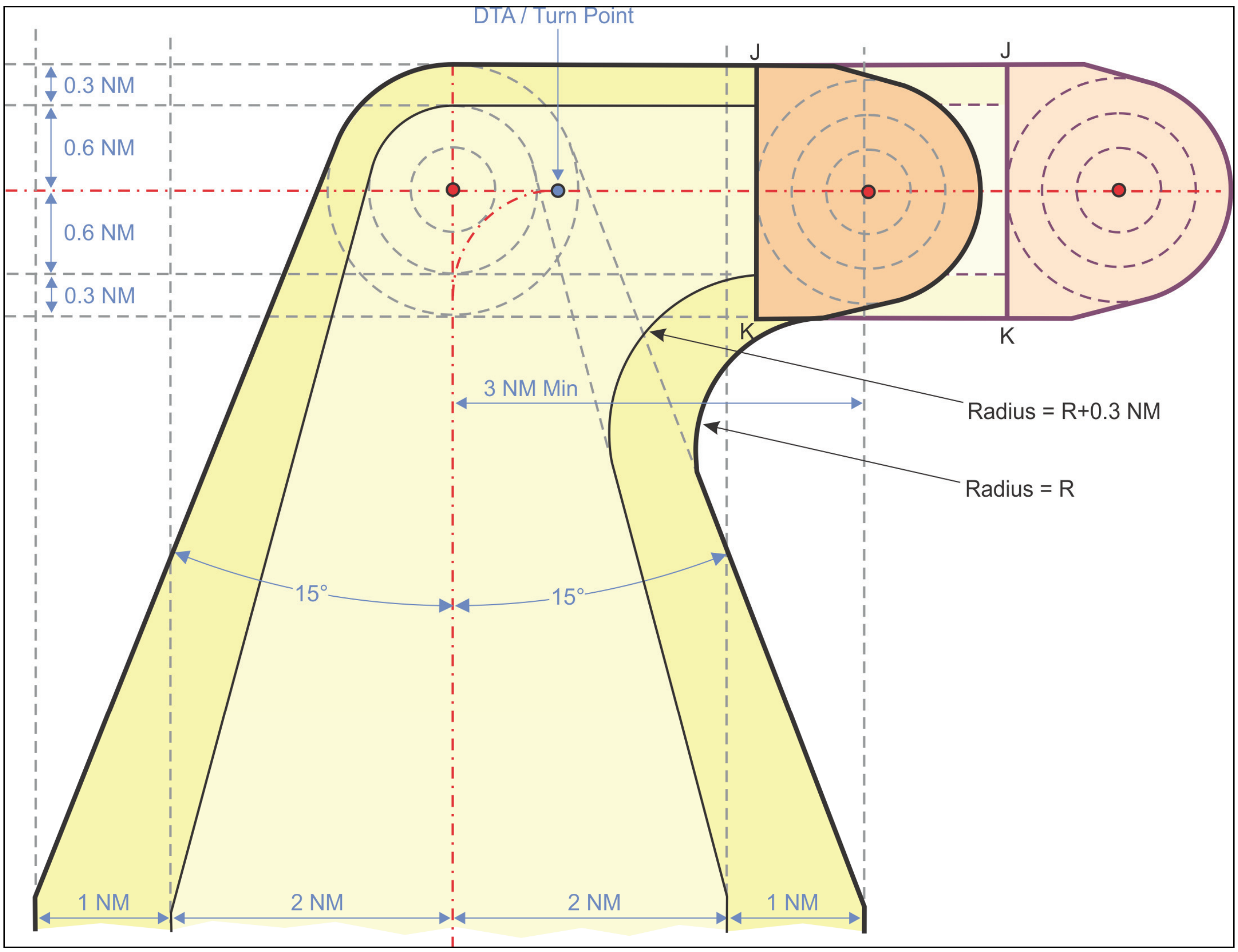
Figure 6-19. Construction of the Turn Side Boundary, Case 3b



6-7. Special PinS Departure Construction. When necessary to avoid obstacles, a Special DP may be constructed where the initial departure leg (only) is designed with an ATT value of 0.3 NM (RNP/RNAV 0.3).

For this construction, multiple OEA configurations can occur that are greatly affected by the course change angle and the length of the first departure segment. Some examples of these different scenarios are illustrated in Figure 6-20. Instructions on how to define these cases and create the resulting OEAs are located in this paragraph.

Figure 6-20. Special OEA Area Plan View (90 Degree Turn)



Step 1: Position the IDF as an FB fix. Use a fix-to-fix distance that is in accordance with chapter 2, paragraph 2b.

Step 2: Construct the IDF Circle as an arc with a 0.8 NM radius centered at the IDF fix.

Step 3: Construct the Designed Turning Flight Path.

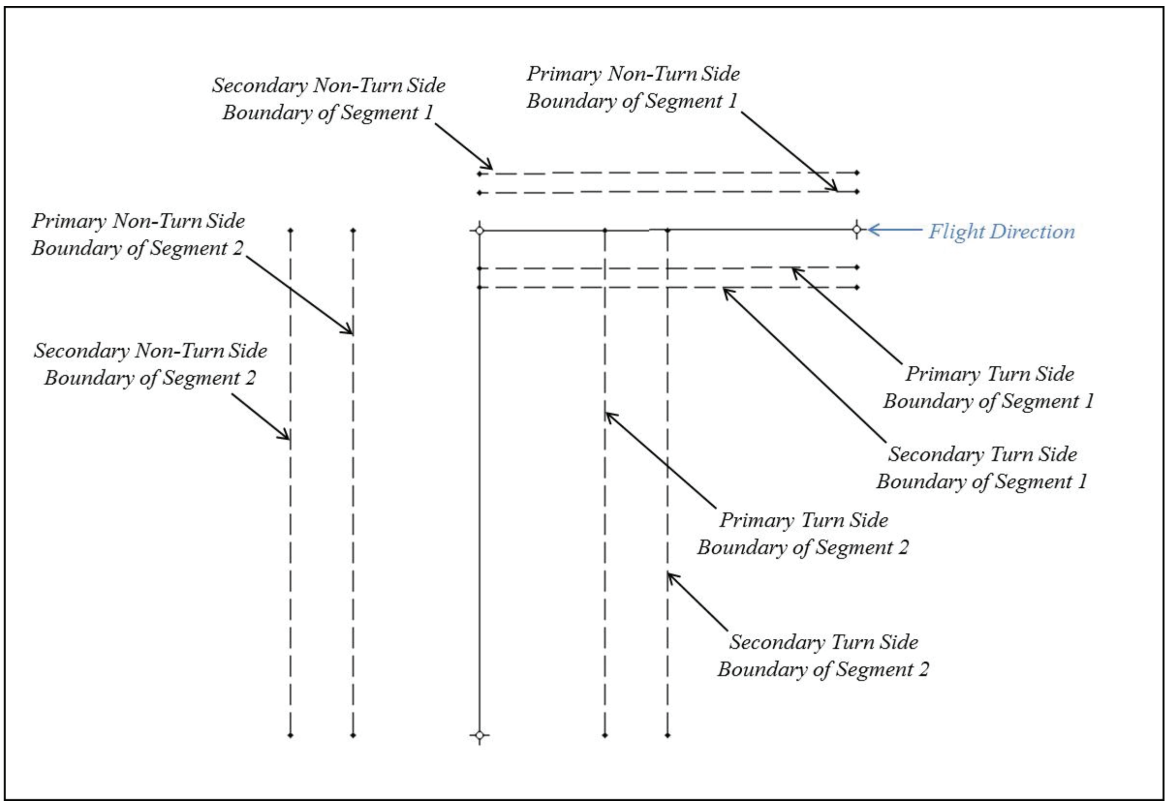
Step 3a: Determine the turn radius (R) utilizing Formula 6-1.

Step 3b: Construct an arc of radius R starting at the early turn point that lays tangent to Segments 1 and 2.

Step 4: Construct Segment 1 Boundaries. Construct Boundaries of half-widths 0.3-0.6-0.6-0.3 in reference to Segment 1. They will hereby be referred to as the Secondary Turn Side Boundary of Segment 1, the Primary Turn Side Boundary of Segment 1, the Primary Non-Turn Side Boundary of Segment 1, and the Secondary Non-Turn Side Boundary of Segment 1. These boundaries are depicted in Figure 6-21.

Step 5: Construct Segment 2 Boundaries. Construct Boundaries of half-widths 1-2-2-1 in reference to Segment 2. They will hereby be referred to as the Secondary Turn Side Boundary of Segment 2, the Primary Turn Side Boundary of Segment 2, the Primary Non-Turn Side Boundary of Segment 2, and the Secondary Non-Turn Side Boundary of Segment 2. These boundaries are depicted in Figure 6-21.

Figure 6-21. Construction of the Segment 1 and Segment 2 Boundaries



Step 6: Construct the Segment 1 Turn Side Splay Line (see Figure 6-22).

Step 6a: Locate the Segment 1 Splay End Reference Point a distance of 0.1/tan(15°) NM from the IDF along the Segment 1 Course Line.

Step 6b: Locate the Segment 1 Turn Side Splay Line End Point as the Segment 1 Splay End Reference Point projected onto the Secondary Turn Side Boundary of Segment 1.

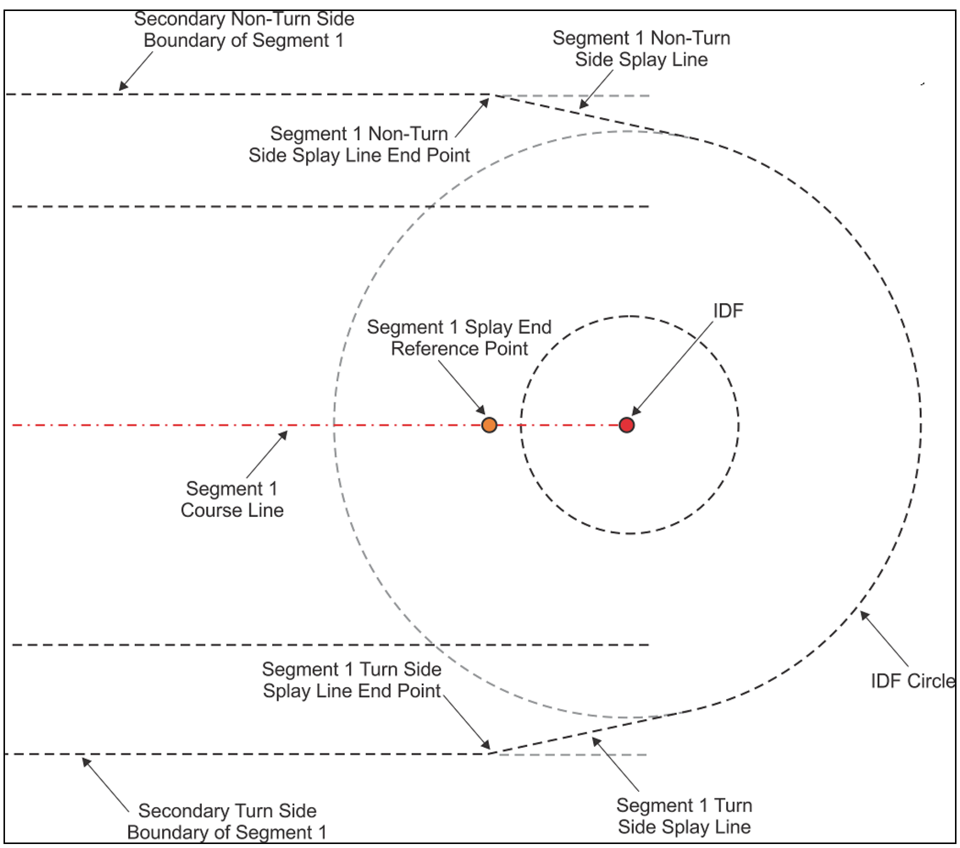
Step 6c: Construct the Segment 1 Turn Side Splay Line as a line that is tangent to the IDF Circle passing through the Segment 1 Turn Side Splay Line End Point.

Step 7: Construct the Segment 1 Non-Turn Side Splay Line (see Figure 6-22).

Step 7a: Locate the Segment 1 Non-Turn Side Splay Line End Point as the Segment 1 Splay End Reference Point projected onto the Secondary Non-Turn Side Boundary of Segment 1.

Step 7b: Construct the Segment 1 Non-Turn Side Splay Line as a line that is tangent to the IDF Circle passing through the Segment 1 Non-Turn Side Splay Line End Point.

Figure 6-22. Construction of the Splay Lines



Step 8: Construct the IDF Flat Surface Area (see Figure 6-23).

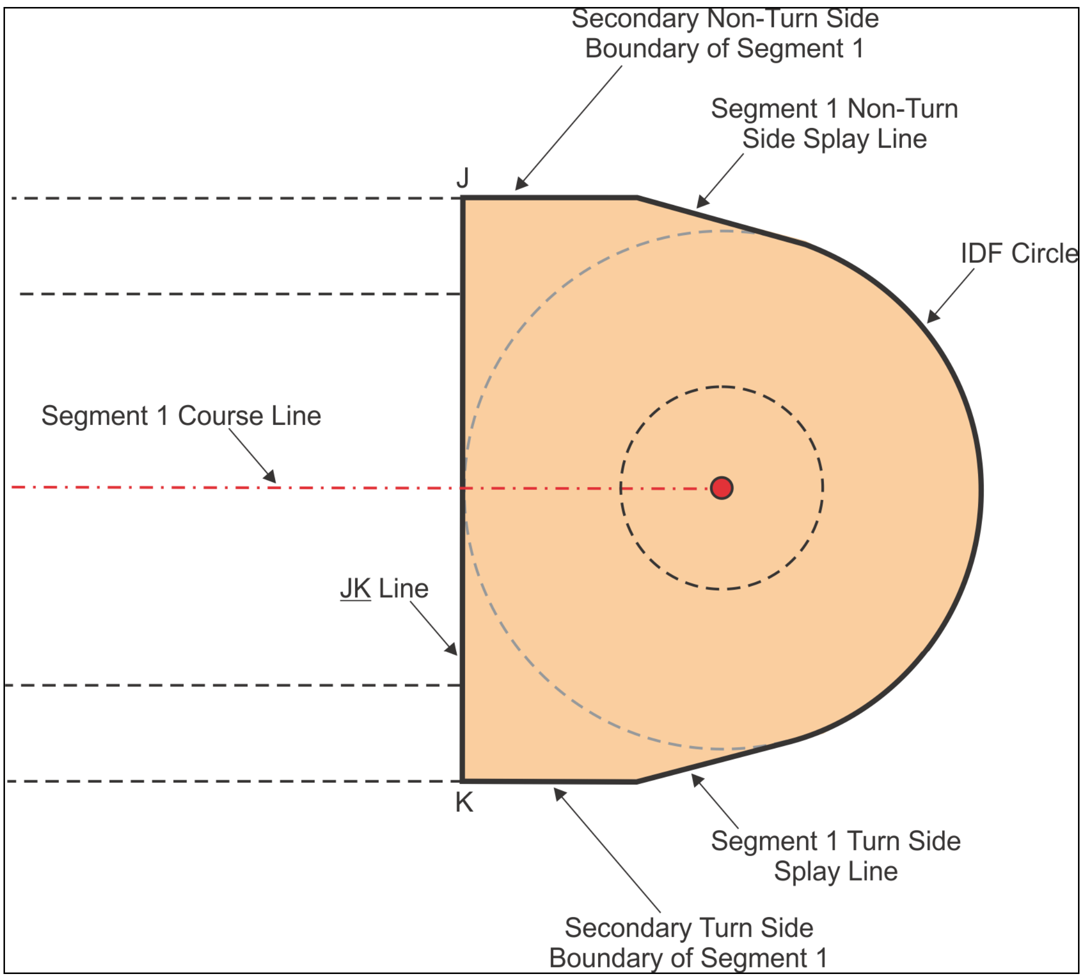
Step 8a: Construct the JK line as a line that lays tangent to the IDF Circle at a point intersecting the Segment 1 Course Line.

Step 8b: Truncate the JK line where it intersects the Secondary Non-Turn Side Boundary of Segment 1 and the Secondary Turn Side Boundary of Segment 1.

Step 8c: The IDF Flat Surface Area is the area bounded by the IDF Circle, the Segment 1 Turn Side and Non-Turn Side Splay Lines, the Secondary Turn Side and Non-Turn Side Boundaries of Segment 1, and the JK line.

Step 8d: The Turn Side end of the JK line will hereby be referred to as Point K and the Non-Turn Side end of the JK line will hereby be referred to as Point J.

Figure 6-23. Construction of the IDF Flat Surface Area

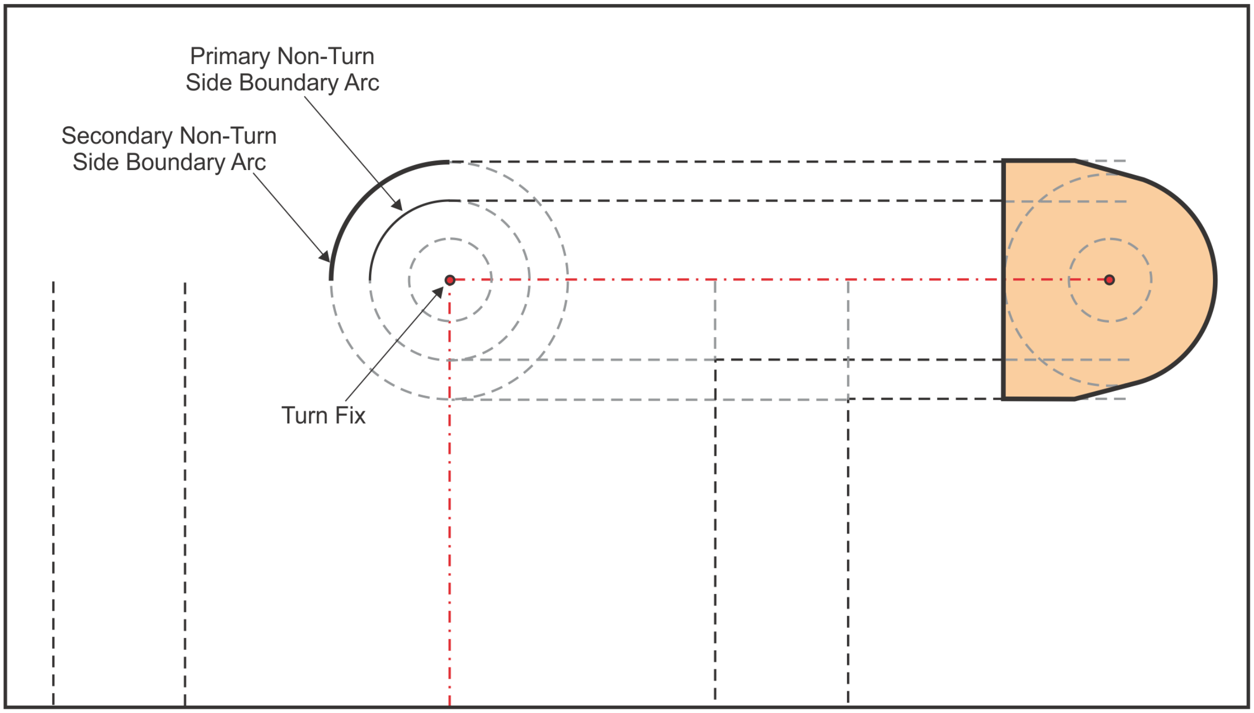


Step 9: Construct Non-Turn Side Boundary Arcs (see Figure 6-24).

Step 9a: Construct the Primary Non-Turn Side Boundary Arc centered on the turn fix with a radius equal to the Segment 1 primary half-width.

Step 9b: Construct the Secondary Non-Turn Side Boundary Arc centered on the turn fix with a radius equal to the Segment 1 primary half-width plus the segment secondary width.

Figure 6-24, Construction of the Non-Turn Side Boundary Arcs



Step 10: Construct Segment 2 Splay Lines.

Step 10a: Construct Segment 2 Secondary Non-Turn Side Splay Line (see Figure 6-25).

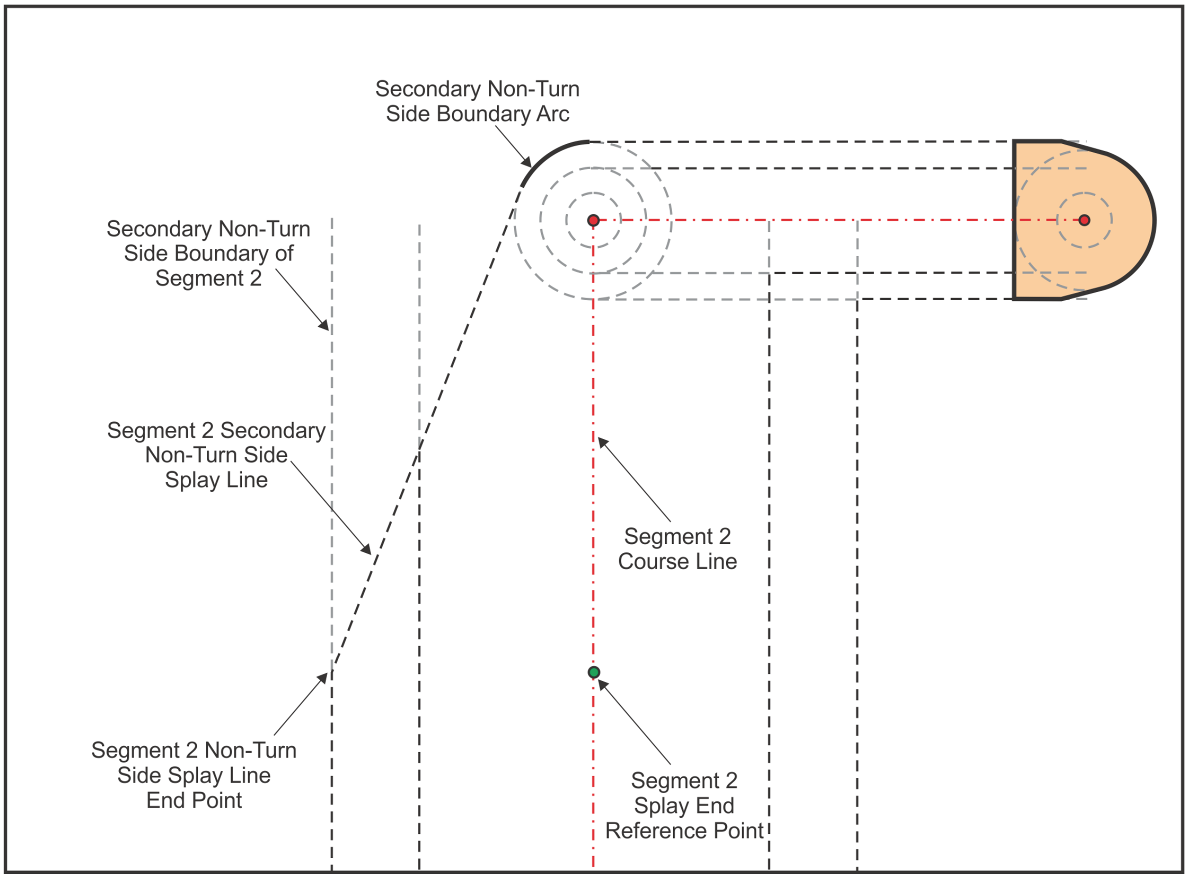
Step 10a (1): Locate the Segment 2 Splay End Reference Point a distance of 2.1/tan(15°) NM from the turn fix along the Segment 2 Course Line.

Step 10a (2): Locate the Segment 2 Non-Turn Side Splay Line End Point as the Segment 2 Splay End Reference Point projected onto the Secondary Non-Turn Side Boundary of Segment 2.

Step 10a (3): Construct the Segment 2 Secondary Non-Turn Side Splay Line as a line that is tangent to the Secondary Non-Turn Side Boundary Arc passing through the Segment 2 Non-Turn Side Splay Line End Point.

Step 10a (4): If Segment 2 is not long enough to allow for a full expansion with a 15-degree splay, utilize a splay angle ≥ 15 degrees as necessary to reach full expansion at the termination of Segment 2.

Figure 6-25. Construction of the Segment 2 Secondary Non-Turn Side Splay Line



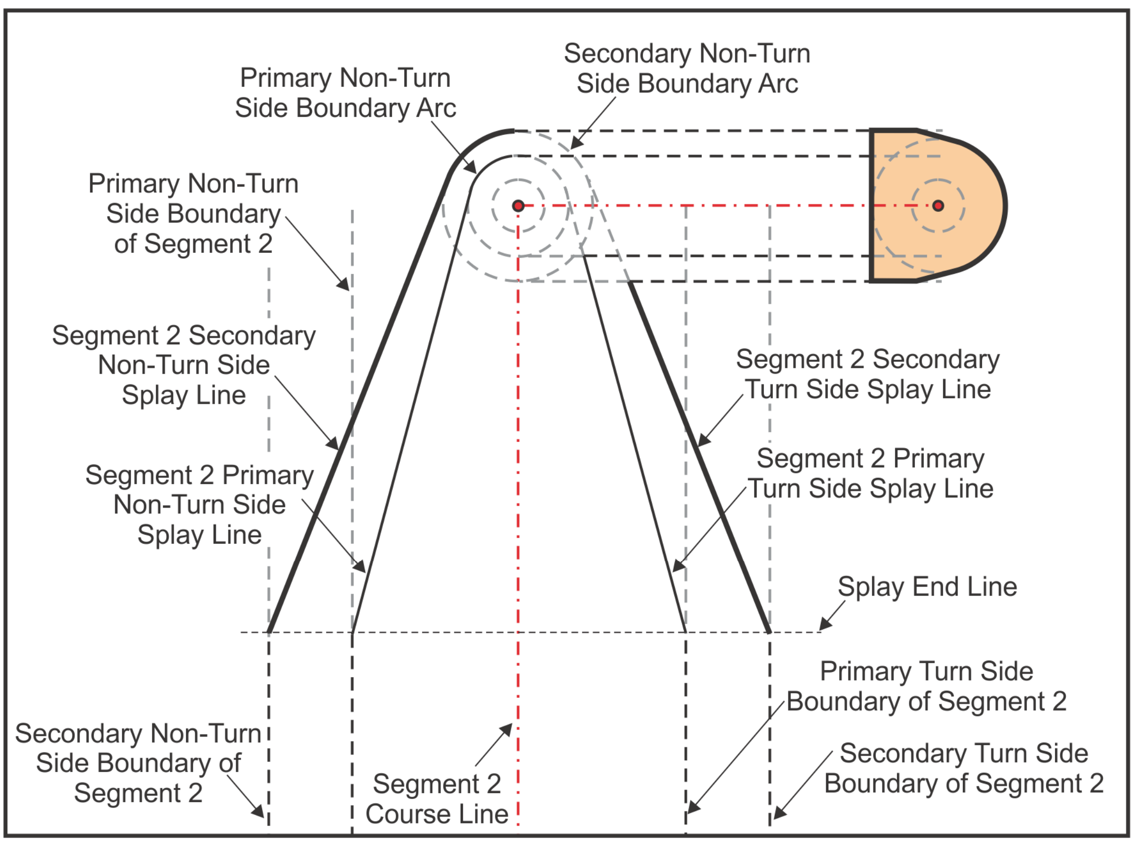
Step 10b: Construct the Splay End Line as an infinite line that is perpendicular to the Segment 2 Course Line and intersects at the end point of the Segment 2 Secondary Non-Turn Side Splay Line. The Splay End Line will be used to determine the end points of the remaining Segment 2 splay lines (see Figure 6-26).

Step 10c: Construct the Segment 2 Primary Non-Turn Side Splay Line as a line tangent to the Primary Non-Turn Side Boundary Arc and runs through the intersection of the Splay End Line and the Primary Non-Turn Side Boundary of Segment 2 (see Figure 6-26).

Step 10d: Construct the Segment 2 Primary Turn Side Splay Line as a line tangent to the Primary Non-Turn Side Boundary Arc and runs through the intersection of the Splay End Line and the Primary Turn Side Boundary of Segment 2 (see Figure 6-26).

Step 10e: Construct the Segment 2 Secondary Turn Side Splay Line as a line tangent to the Secondary Non-Turn Side Boundary Arc and runs through the intersection of the Splay End Line and the Secondary Turn Side Boundary of Segment 2 (see Figure 6-26).

Figure 6-26. Construction of the Segment 2 Splay Lines



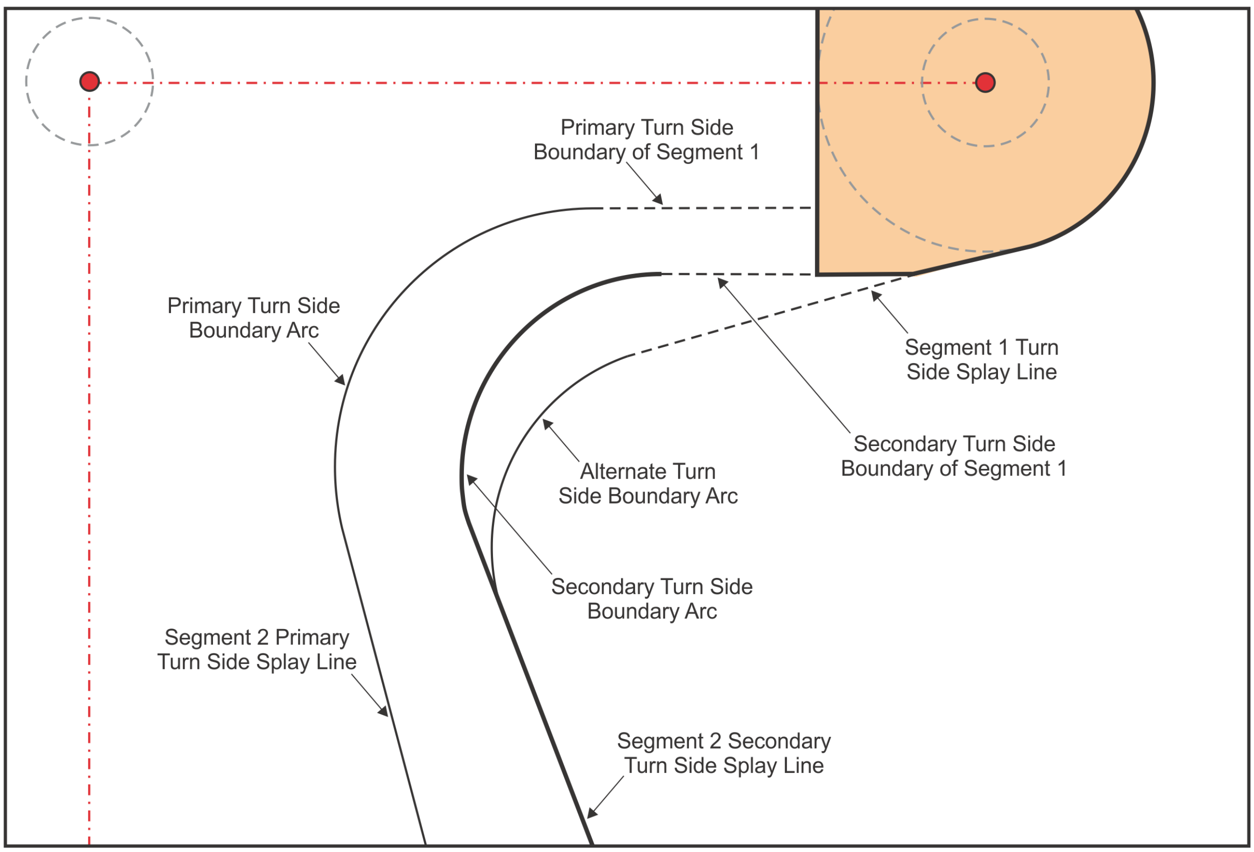
Step 11: Construct Turn Side Boundary Arcs (see Figure 6-27).

Step 11a: Construct the Primary Turn Side Boundary Arc as an arc that is tangent to both the Segment 2 Primary Turn Side Splay Line and the Primary Turn Side Boundary of Segment 1 with a radius equal to R + 0.3 NM.

Step 11b: Construct the Secondary Turn Side Boundary Arc an arc that is tangent to both the Segment 2 Secondary Turn Side Splay Line and the Secondary Turn Side Boundary of Segment 1 with a radius equal to R.

Step 11c: Construct the Alternate Turn Side Boundary Arc as an arc that is tangent to both the Segment 2 Secondary Turn Side Splay Line and the Segment 1 Turn Side Splay Line with a radius equal to R.

Figure 6-27. Construction of the Turn Side Boundary Arcs

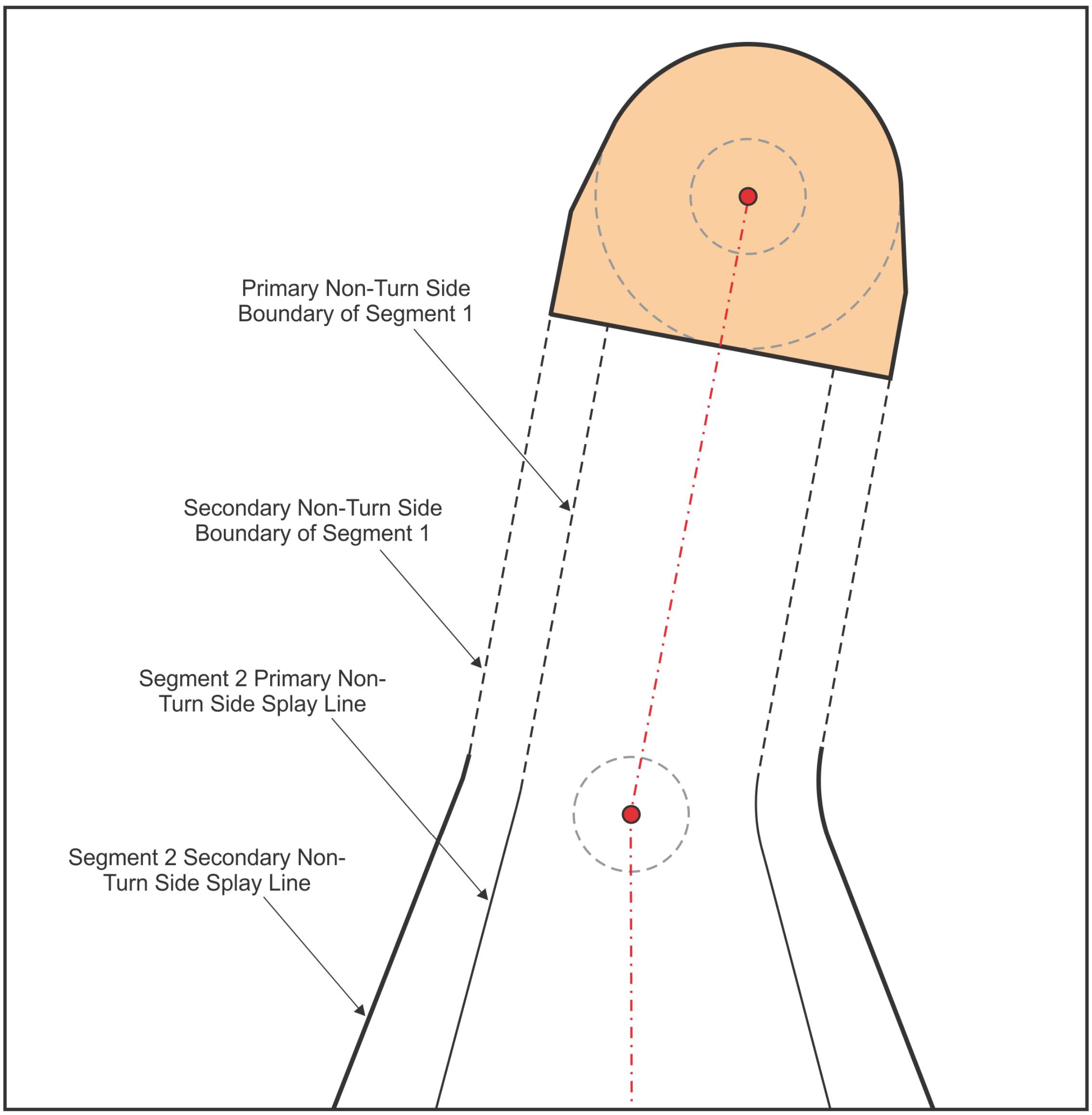


Step 12: Define and Construct the Secondary Non-Turn Side Boundary.

Step 12a: If the Secondary Non-Turn Side Boundary of Segment 1 intersects the Segment 2 Secondary Non-Turn Side Splay Line, as depicted in Figure 6-28, then remove the Secondary Non-Turn Side Boundary Arc and truncate the Secondary Non-Turn Side Boundary of Segment 1 and the Segment 2 Secondary Non-Turn Side Splay Line at their intersection.

Step 12b: Otherwise, truncate the Secondary Non-Turn Side Boundary of Segment 1 and the Segment 2 Secondary Non-Turn Side Splay Line at their point of tangency with the Secondary Non-Turn Side Boundary Arc (see Figure 6-29).

Figure 6-28. Construction of the Non-Turn Side Boundary, Case 1

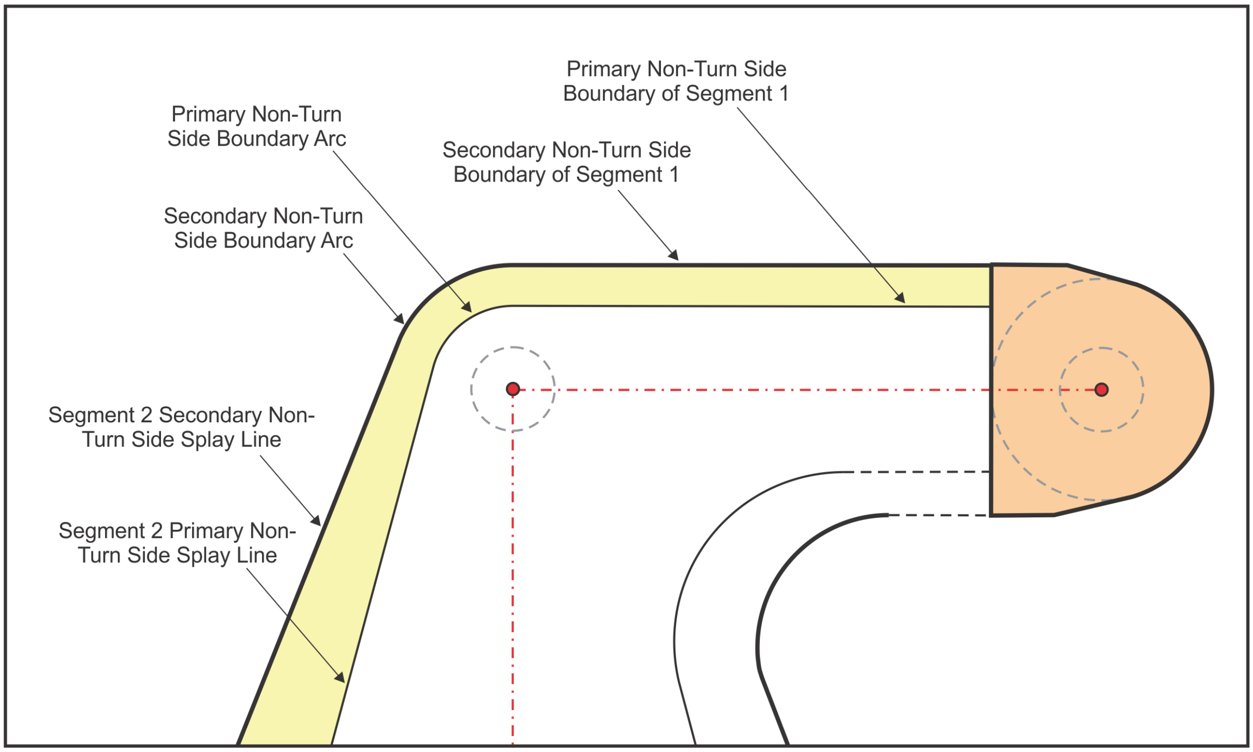


Step 13: Define and Construct the Primary Non-Turn Side Boundary.

Step 13a: If the Primary Non-Turn Side Boundary of Segment 1 intersects the Segment 2 Primary Non-Turn Side Splay Line, as depicted in Figure 6-28, then remove the Primary Non-Turn Side Boundary Arc and truncate the Primary Non-Turn Side Boundary of Segment 1 and the Segment 2 Primary Non-Turn Side Splay Line at their intersection.

Step 13b: Otherwise, truncate the Primary Non-Turn Side Boundary of Segment 1 and the Segment 2 Primary Non-Turn Side Splay Line at their point of tangency with the Primary Non-Turn Side Boundary Arc (see Figure 6-29).

Figure 6-29. Construction of the Non-Turn Side Boundary, Case 2



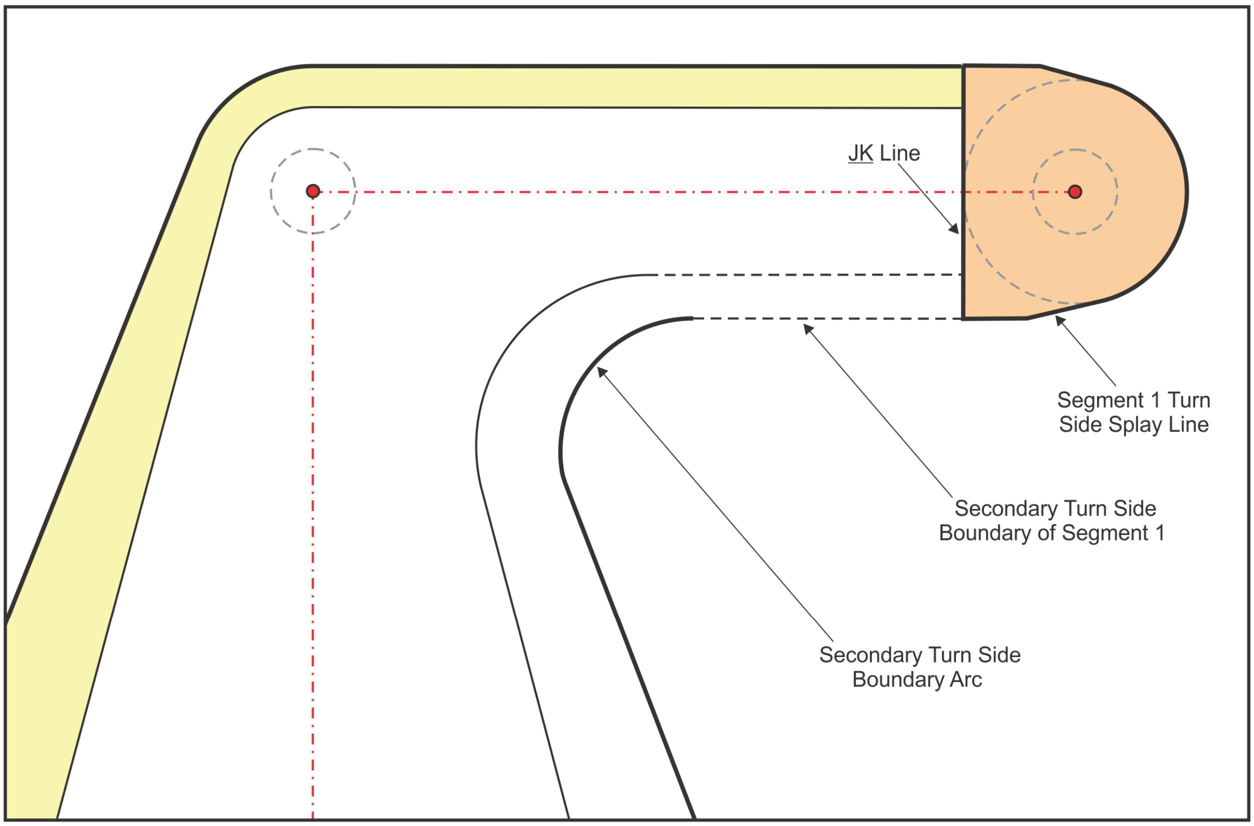
Step 14: Define and Construct the Secondary Turn Side Boundary

Step 14a: If the intersection of the Secondary Turn Side Boundary of Segment 1 and the Segment 1 Turn Side Splay Line occurs before the start of the Secondary Turn Side Boundary Arc (see Figure 6-30) then,

Step 14a (1): Remove the Alternate Turn Side Boundary Arc, and

Step 14a (2): Truncate the Secondary Turn Side Boundary of Segment 1 where it intersects the JK line.

Figure 6-30. Construction of the Secondary Turn Side Boundary, Case 1



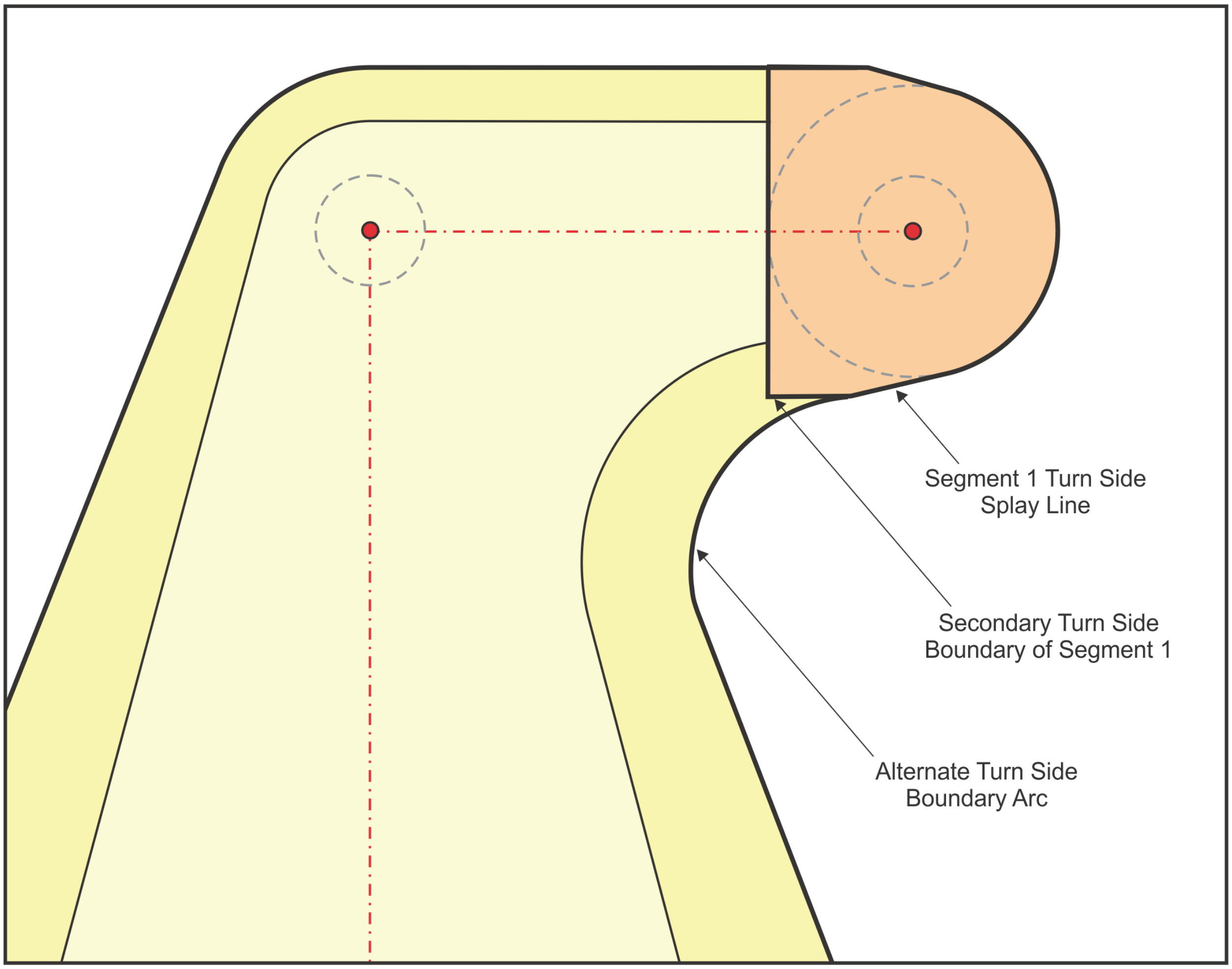
Step 14b: If the intersection of the Secondary Turn Side Boundary of Segment 1 and the Segment 1 Turn Side Splay Line occurs after the start of the Secondary Turn Side Boundary Arc (see Figure 6-31) then,

Step 14b (1): Remove the Secondary Turn Side Boundary Arc,

Step 14b (2): Remove the Secondary Turn Side Boundary of Segment 1, and

Step 14b (3): Extend the Segment 1 Turn Side Splay Line to the Alternate Turn Side Boundary Arc.

Figure 6-31. Construction of the Secondary Turn Side Boundary, Case 2

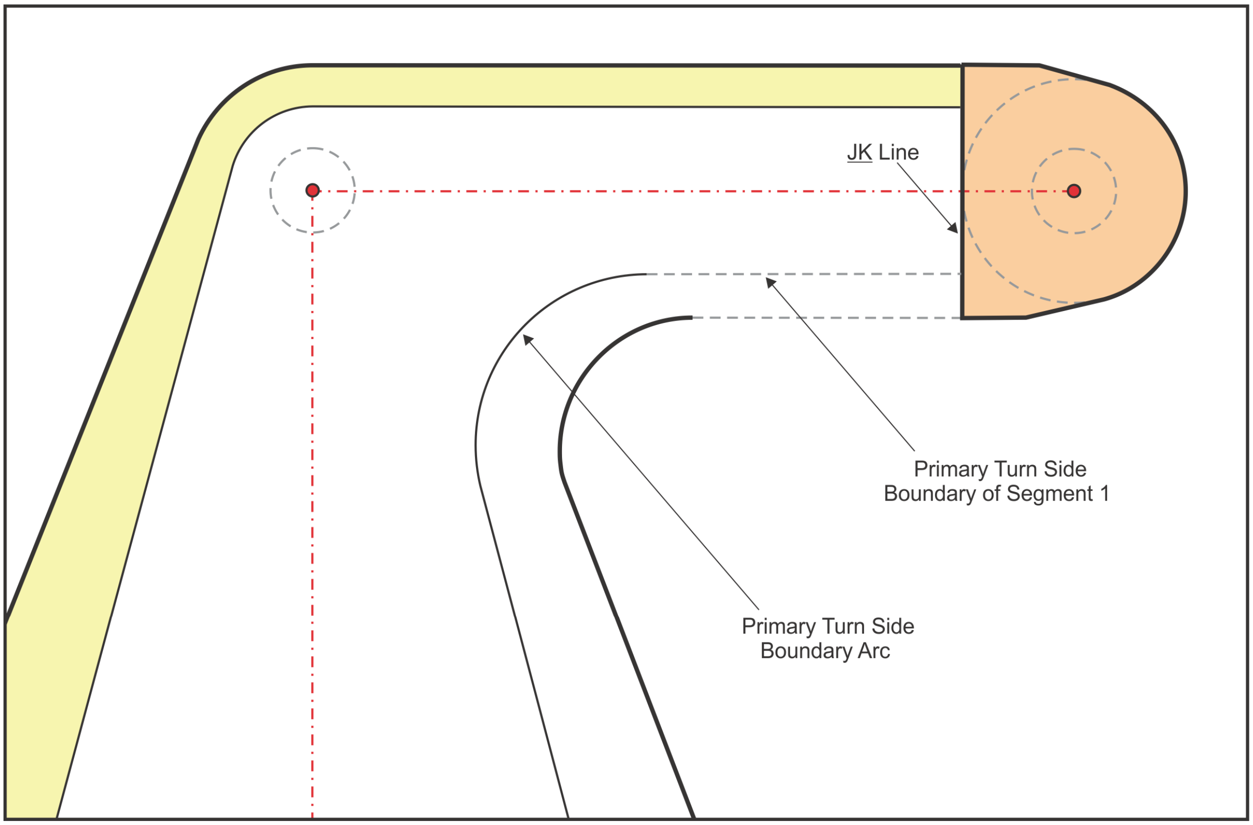


Step 15: Define and Construct the Primary Turn Side Boundary

Step 15a: If the JK line intersects the Primary Turn Side Boundary of Segment 1 (see Figure 6-32) then,

Step 15a (1): Truncate the Primary Turn Side Boundary of Segment 1 where it intersects the JK line.

Figure 6-32. Construction of the Primary Turn Side Boundary, Case 1

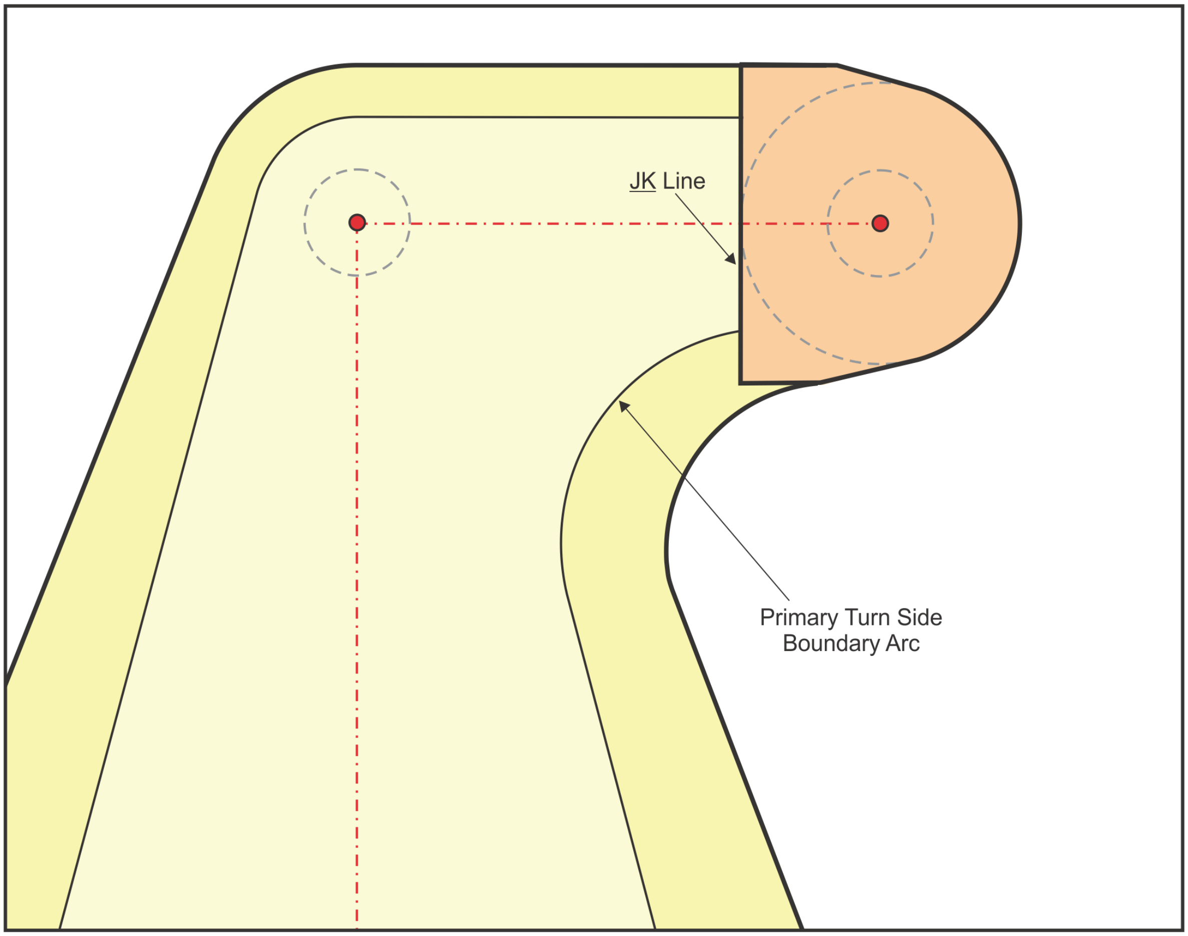


Step 15b: If the JK line intersects the Primary Turn Side Boundary Arc (see Figure 6-33) then,

Step 15b (1): Remove the Primary Turn Side Boundary of Segment 1, and

Step 15b (2): Truncate the Primary Turn Side Boundary Arc where it intersects the JK line.

Figure 6-33. Construction of the Primary Turn Side Boundary, Case 2



6-8. Obstacle Evaluation (OE). Starting at the JK line, apply a 20:1 OCS in the primary OEA, and a 6:1 OCS in the secondary OEA rising perpendicular from the edge of the primary area. Where an obstacle penetrates the primary OCS, or the *secondary OCS throughout the DP, calculate a minimum CG to clear the penetration(s) for all departure segments (legs) or raise the IDF crossing altitude. The highest required CG of all the departure legs is maintained until penetration(s) are cleared, and then the CG may be relaxed. See Figure 6-34 for a Climb Area Profile View and Figure 6-35/Figure 6-36 for a Climb Area Plan View. See paragraph 6-8 for assessing ROC, minimum altitude and CG.

* The elevation of obstacles in the secondary is reduced.

Figure 6-34. Climb Area Profile View

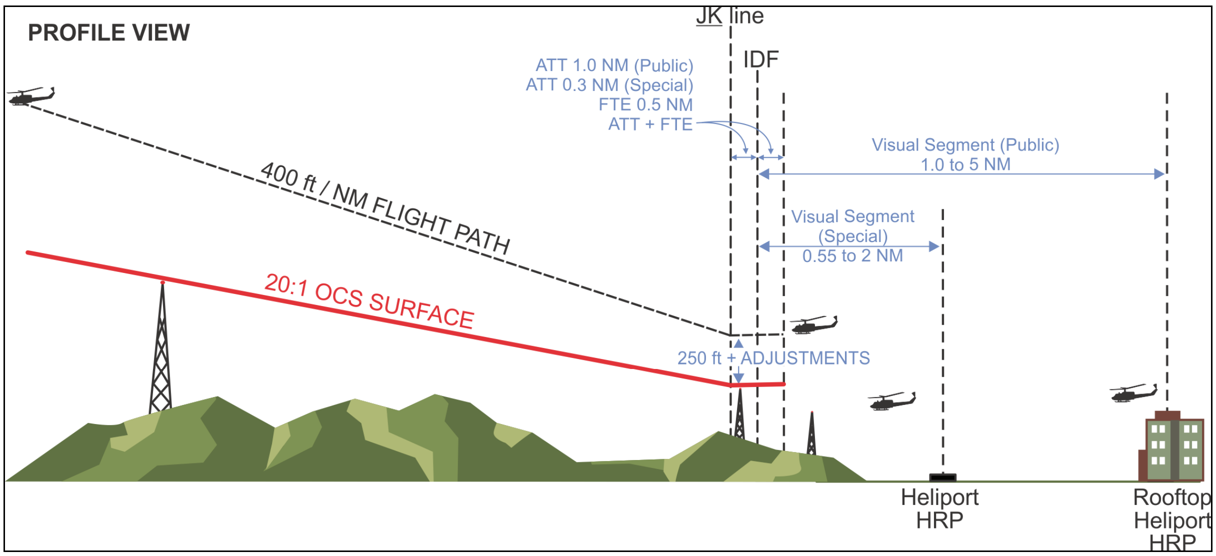


Figure 6-35. Departure Climb Area Plan View (Public)

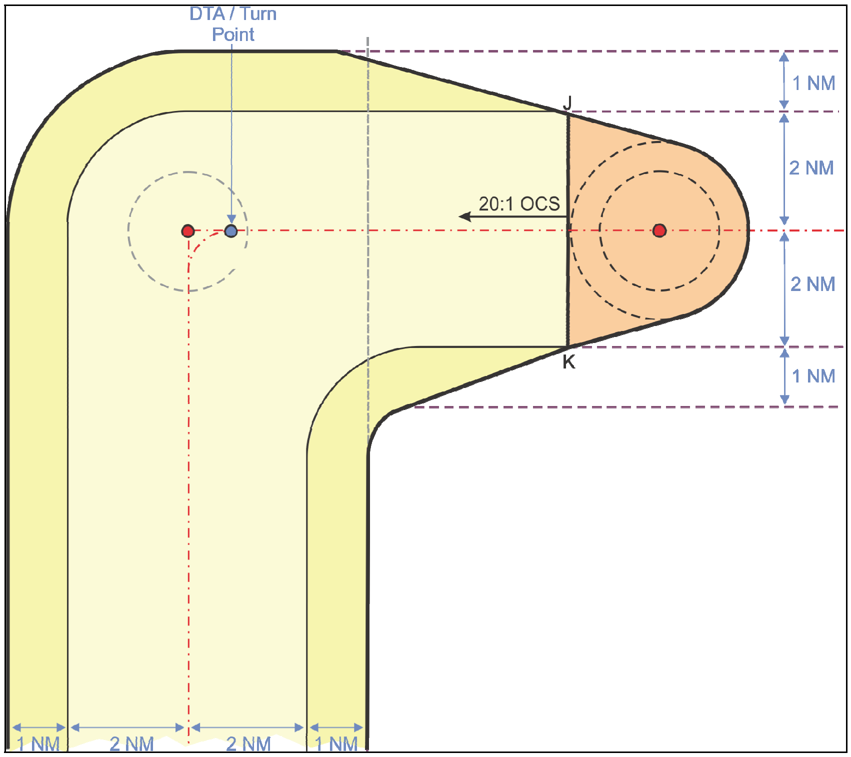
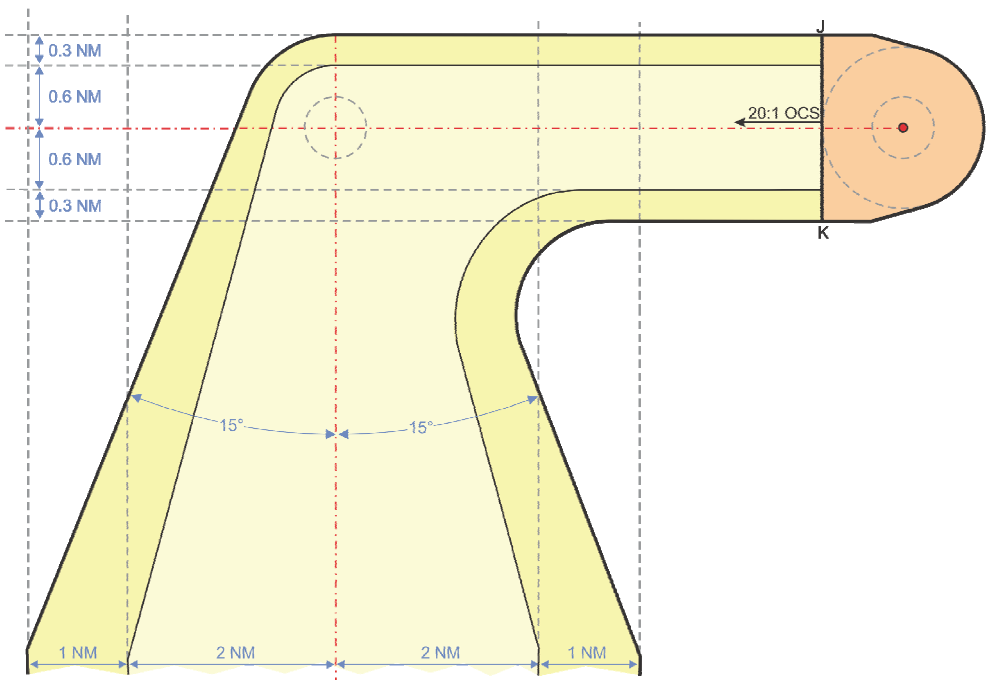


Figure 6-36. Departure Climb Area Plan View (Special)



6-9. Required Obstacle Clearance (ROC).

a. Section 1 Obstacle Clearance.

(1) The PinS DP minimum ROC at the IDF is 250 ft, plus any adjustments for RASS (when altimeter source greater than 5 NM from the IDF), precipitous terrain, and obstacle accuracy code.

Note 1: Precipitous terrain apply Section 1 only.

Note 2: IDF altitude must not be lower than the heliport elevation.

(2) ROC is applied within the IDF flat surface area (Section 1), and then rounded to the next higher 100-ft increment. For example, 500 ft remains 500 ft and 501 ft becomes 600 ft. The rounded altitude is the IDF crossing altitude.

(3) Accuracy Code. Obstacle accuracy code is 2C (50 ft horizontal/20 ft vertical) in the IDF flat surface area.

b. Section 2 Obstacle Clearance.

(1) Sloping OCS. ROC increases at 96 ft/NM for all climb gradients.

(2) Primary OEA. Apply a 20:1 OCS originating at the JK line in the direction of departure. The OCS origin elevation is equal to the IDF crossing altitude subtracting ROC and any adjustments.

(3) Secondary OEA. Apply a 6:1 OCS from the edge of the primary OEA. The OCS origin elevation is equal to the height of the primary OEA boundary directly abeam the obstacle and perpendicular to the segment track. For obstacles located within a turn OEA (see Figure 6-37).

(4) Obstacle evaluation. If the OCS is clear, then the standard CG (400 ft/NM) applies. If the OCS is not clear, then take the following actions:

(a) Publish a CG to clear the penetration(s). CGs in excess of 600 ft/NM requires Flight Standards approval.

(b) Alternatively, raise the IDF altitude to clear the penetration(s) to accommodate helicopters that cannot meet the non-standard climb gradient.

Note: This option will increase the ceiling value at the IDF.

(c) Lastly, design another DP over a different route to achieve a lower CG.

(5) Level Surface. The departure OCS continues to increase until reaching 1,000 ft of ROC for non-mountainous regions (2,000 ft for mountainous regions) to the highest obstacle

located within the primary OEA (or secondary equivalent), and round the result to the next higher 100-ft increment. For example, 5,700 ft remains 5,700 ft and 5,701 ft becomes 5,800 ft.

(6) Accuracy Code. The obstacle accuracy code for the 20:1 OCS area is 4D (250 ft horizontal/50 ft vertical).

(7) Calculate the ROC over an obstacle, the altitude at which the ROC is achieved, and the resulting required CG using Formula 6-2.

Formula 6-2. ROC/Min Alt/CG

(1) $\text{input } d,\ d_{secondary},\ OBS_{elev},\ adj,\ aircraft_{SOC}$

(2) $ROC_{OBS} = (250+adj)+\frac{96\cdot d}{fpnm}$

(3) $OBS_{elev} = \text{if}\left[\left(OBS_{elev} - aircraft_{SOC} - \frac{d_{secondary}}{6}\right) \le 0, 0, OBS_{elev} - \frac{d_{secondary}}{6}\right]$

(4) $alt_{min} = OBS_{elev} + ROC_{OBS}$

(5) $CG_{minimum} = \text{ceiling}\left[\frac{r}{d}\cdot\ln\left(\frac{r+alt_{min}}{r+aircraft_{SOC}}\right)\cdot fpnm\right]$

(6) $CG_{required} = \max[400,\ CG_{minimum}]$

(250+adj)+96*d/fpnm
if OBS in secondary, OBS_{elev}= OBS_{elev}- $d_{secondary}$/6
OBS_{elev}+ROC_{OBS}
ceiling(r/d*ln((r+alt_{min})/(r+$aircraft_{SOC}$))*fpnm)
max(400,$CG_{minimum}$)

Calculator		
d		Click here to calculate
$d_{secondary}$		
OBS_{elev}		
adj		
$aircraft_{SOC}$		
ROC_{OBS}		
alt_{min}		
$CG_{minimum}$		
$CG_{required}$		

6-10. Obstacle Distance Measurement. Obstacle distance (d) is measured using the shortest distance from each primary area obstacle to the JK line as illustrated in Figure 6-37 and Figure 6-38. Secondary area obstacles that occur during turn expansions have an obstacle distance that begins at the JK line and ends at the point on the edge of the primary boundary closest to the obstacle. Secondary area obstacles that do not occur during turn expansion have an obstacle distance that begins at the JK line and ends at the point of intersection of a line perpendicular to the flight path passing through the obstacle and boundary of the primary area. Secondary area obstacle evaluations are further reduced based on their distances to the primary edge boundary as shown in Formula 6-2. Detailed steps for obstacle distance measurements and calculations are found below:

a. Obstacle in the Primary evaluation. Determine obstacle evaluation distance (d), as the shortest distance within the primary area from the obstacle to the JK line.

b. Obstacle in the Secondary evaluation.

(1) Determine the intersecting element of a line drawn from the obstacle to the closest point on the flight path.

(a) If the intersecting element is an arc, determine the Obstacle Primary Point as the closest point on the primary boundary to the obstacle.

(b) If the intersecting element is not an arc, determine the Obstacle Primary Point as the point of intersection between a line drawn from the obstacle perpendicular to the flight path and the Primary Boundary.

(2) Determine obstacle evaluation distance (d), as the shortest distance within the primary area to from the Obstacle Primary Point to the JK line.

(3) Determine distance into the secondary ($d_{secondary}$) as the distance from the obstacle to the Obstacle Primary Point.

Figure 6-37. Measuring Obstacle Distance (Public)

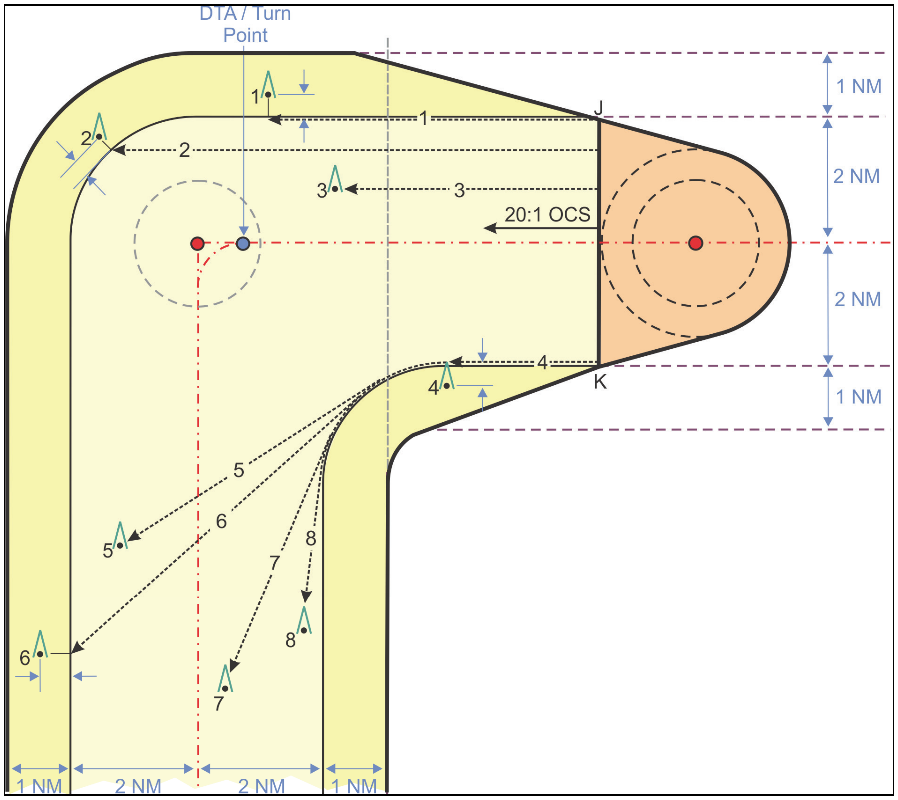
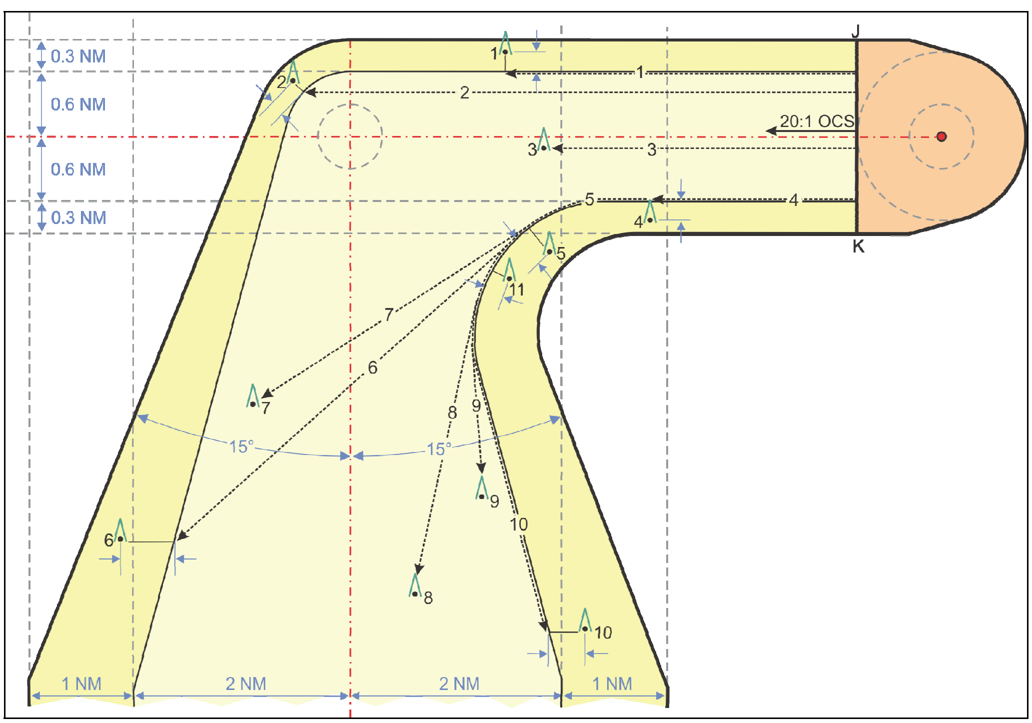


Figure 6-38. Measuring Obstacle Distance (Special)



6-11. Visual Segment (Specials only). To ensure a safe IFR operation from a heliport, it is essential to establish the acceptability of the landing site, to design a safe, flyable departure procedure, and to provide a flight inspection evaluation consistent with the type of operation. This paragraph provides the construction guidance for the visual segment of this type of procedure.

a. Procedure design. The special procedure provides a measure of obstruction protection/ identification along the visual track from a specific VFR heliport to the IDF.

Note: In most cases the DP will be developed to utilize the waypoints of a corresponding Approach Procedure, resulting in the IDF being in the same location as the MAP.

(1) Alignment. The visual segment connects the helipoint to the IDF. The optimum visual segment is aligned with the FAC. The course change at the IDF must not exceed 30 degrees.

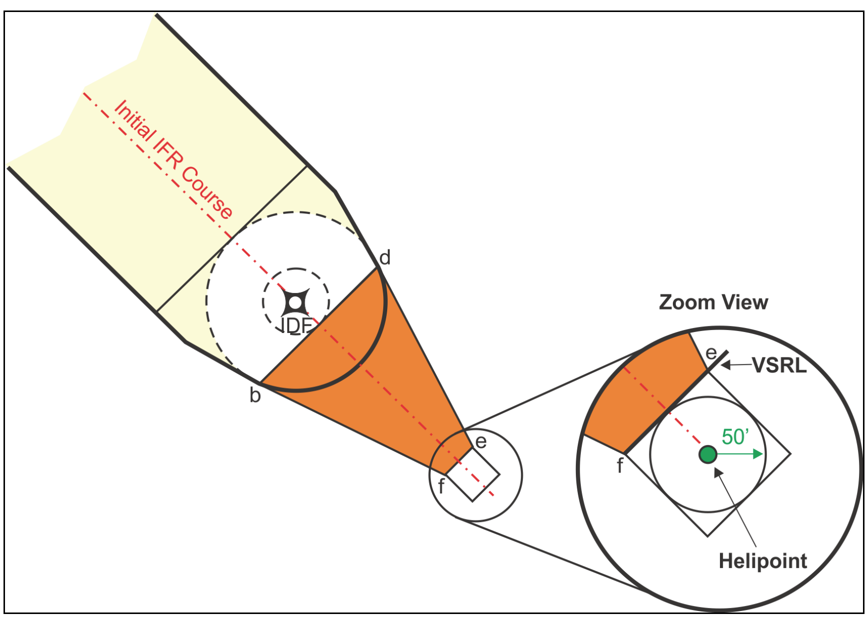
(2) Area.

(a) Length. The visual segment OEA begins at the VSRL and ends at the IDF. The visual segment OEA maximum length is 2 NM, measured from the helipoint to the IDF plotted position. The optimum helipoint to the ATD/IDF fix distance is 0.65 NM.

(b) Width. The visual segment splay begins at the VSRL. It splays from the VSRL endpoints to 0.6 NM either side of the IDF, perpendicular to the Initial IFR course.

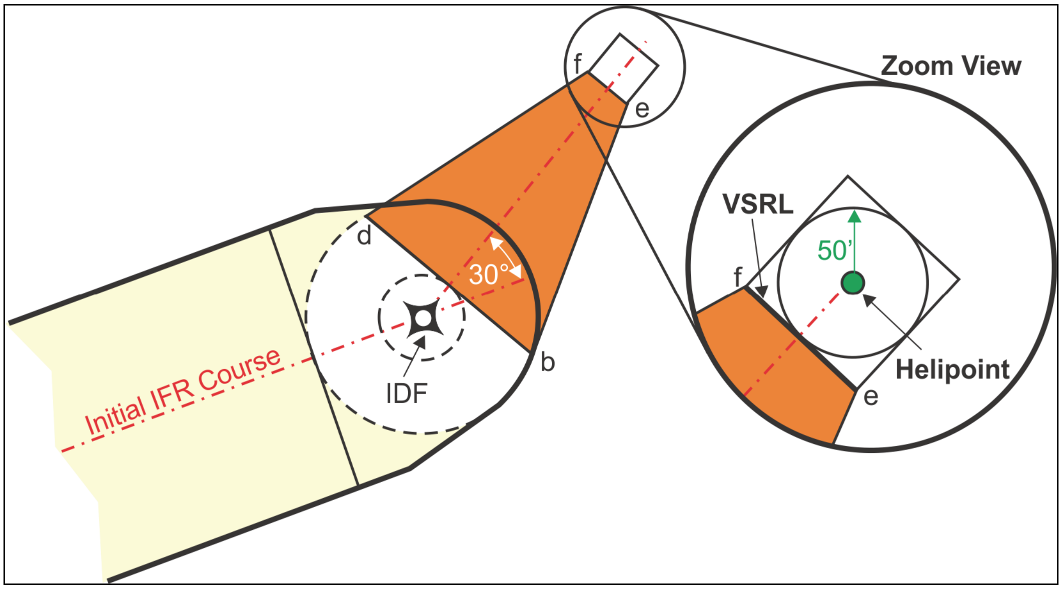
1. Straight Course Construction. Connect the VSRL outer edges (EF) to points B and D - 0.6 NM either side of the IDF, perpendicular to the Initial IFR course (see Figure 6-39).

Figure 6-39. Straight Visual Segment OEA



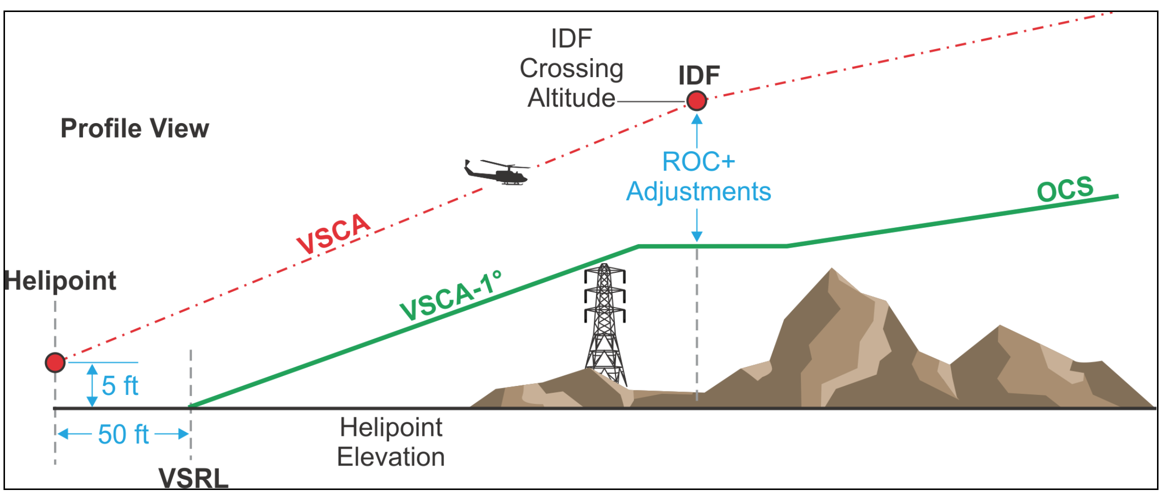
2. Turn at the IDF Construction. Connect the VSRL outer edges (EF) to points B and D - 0.6 NM either side of the IDF, perpendicular to the Initial IFR course (see Figure 6-40).

Figure 6-40. Visual Segment with Turn at IDF OEA



(c) Visual Segment Climb Angle (VSCA). The VSCA is a developer-specified angle extending from a point 5 to 20 ft directly above the helipoint to the IDF altitude (see Figure 6-41).

Figure 6-41. VSCA and OIS



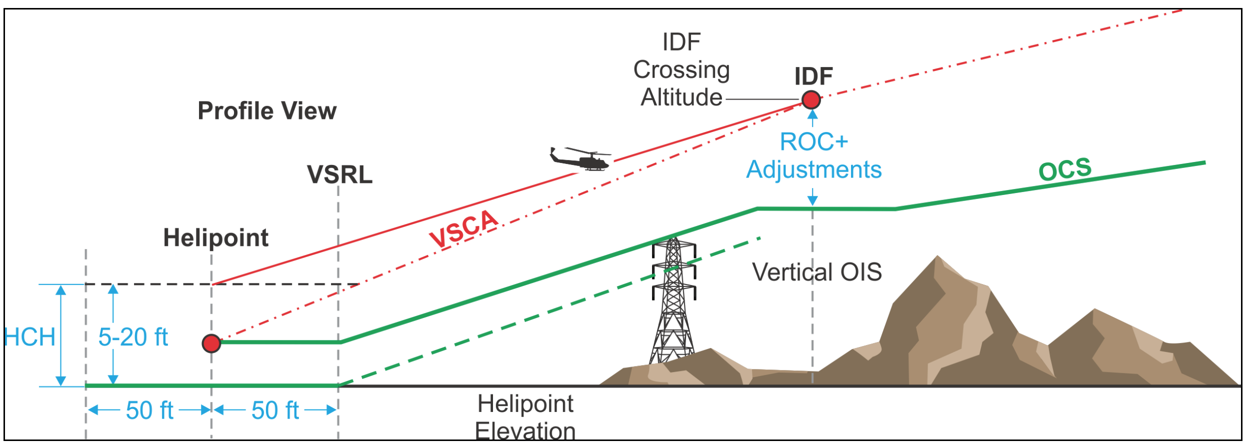
(d) Visual Segment OIS. The OIS begins at the VSRL and extends upward toward the IDF at an angle of (VSCA – 1 degree). The OIS rises to the point it reaches an altitude equal to the IDF altitude minus the ROC and adjustments, after which it becomes a level surface to the end of the IDF area. Measure obstacles using the shortest distance to the VSRL. Obstacles should not penetrate the OIS; if they penetrate in the initial evaluation; take one of the following actions, listed in preferential order (see Figure 6-42):

1. Remove or adjust obstacle location and/or height to eliminate the penetration, or

2. Raise the VSCA (Maximum 8.13°) to achieve an OIS angle that clears the obstacle, (verify that the helicopter meets this new climb performance), or

3. Raise the HCH to ≤ 20 ft. Consult with the operator to determine ability of the helicopter fleet to hover at the adjusted HCH. When this procedure is applied, raise the OIS origin above the helipoint elevation by the amount that the HCH is increased (see Figure 6-42).

Figure 6-42. VSCA and OIS Evaluation



b. Charting requirements.

(1) Publish the VSCA and climb gradient to the IDF.

(2) Chart the obstructions required by the application of the attached criteria.

(3) If the procedure is determined to be unusable at night, or night operations are not requested, annotate the procedure: "Procedure NA at night."

6-12. Weather Minimums. Calculate ceiling and visibility weather minimums required for documenting the RNAV PinS DP on FAA Form 8260-15.

a. The minimum ceiling will correspond with the IFR MSL altitude required at the IDF rounded up to the next higher 100-ft increment, or the highest HRP elevation rounded up to the next higher 100-ft increment, whichever is higher. For example, 500 ft remains 500 ft and 501 ft becomes 600 ft.

b. The visibility for a DP without a visual segment is in accordance with standard VFR minima. See FAA Form 8260-15 examples in FAA Order 8260.46, appendix F.

c. The visibility for a Special DP with a visual segment is the greater of ¾ SM or the distance between the HRP and the IDF. Conduct an obstacle evaluation of the visual segment area, ensure that a satisfactory day/night flight validation is accomplished, and obtain Flight Standards approval of the Special DP.

Chapter 8. HLPV PinS Final Approach Segment (FAS) Evaluation

8-1. General. Helicopter specific LPV PinS criteria are based on chapter 2 OEA concepts; however, the LPV and LNAV procedure follows the same ground track and fixes and the along-track location of DA and the LNAV MAP are the same. For procedures annotated "Proceed VFR," DA must be at least 250 ft above the terrain/surface and obstacles within a radius of 5,280 ft of the latest ATT point of the LNAV/LPV MAP/DA (see Figure 8-1 and Figure 8-2). For procedures annotated "Proceed Visually" DA must be at least 250 ft HAL.

Figure 8-1. Pins LPV Reference Datum Point (RDP)

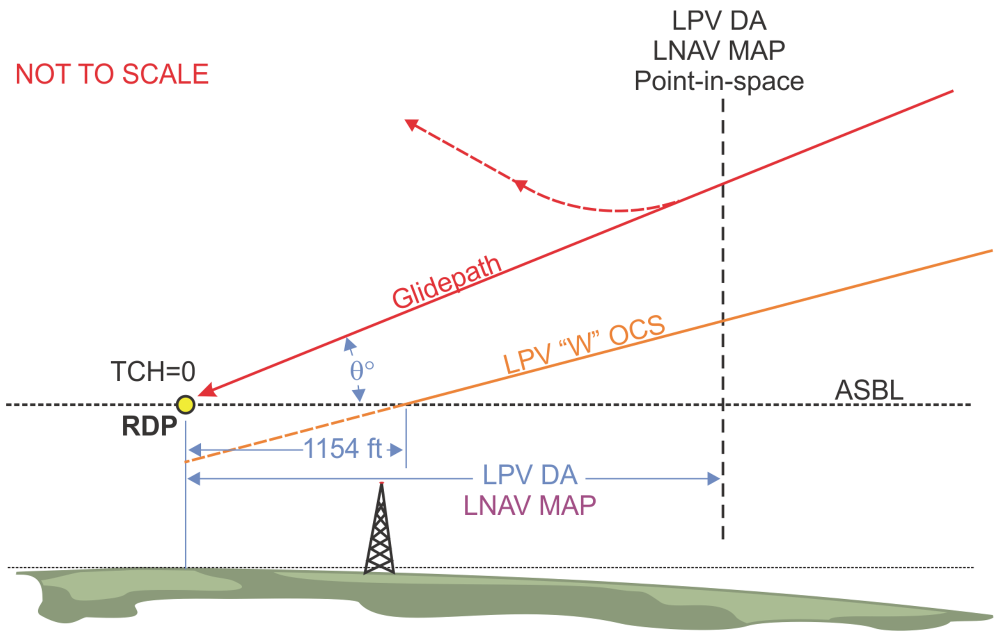
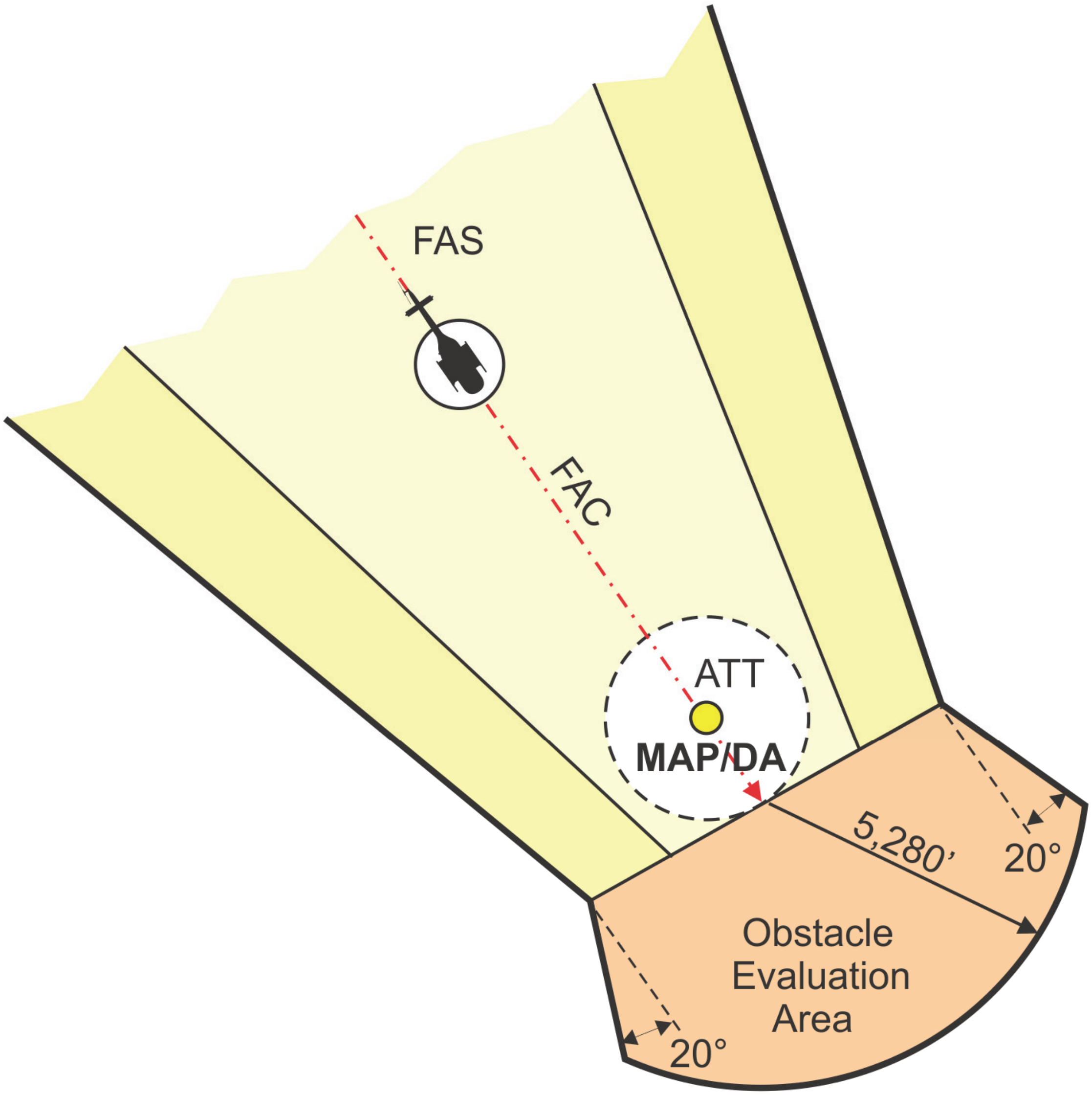


Figure 8-2. PinS VFR Area



8-2. Final Segment Obstruction Evaluation Area (OEA). The HLPV PinS final segment begins at the distance 1,154 ft from the RDP and extends to GPIP. The OEA protection extends the along-track segment dimension by the ATT value (40 m, 131.234 ft) at each end (see Figure 8-3 and Figure 8-4).

Figure 8-3. PinS OEA Plan View

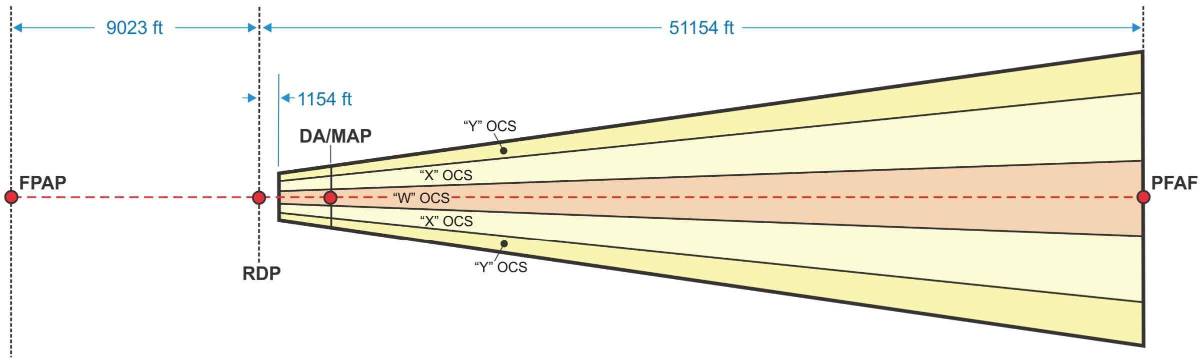
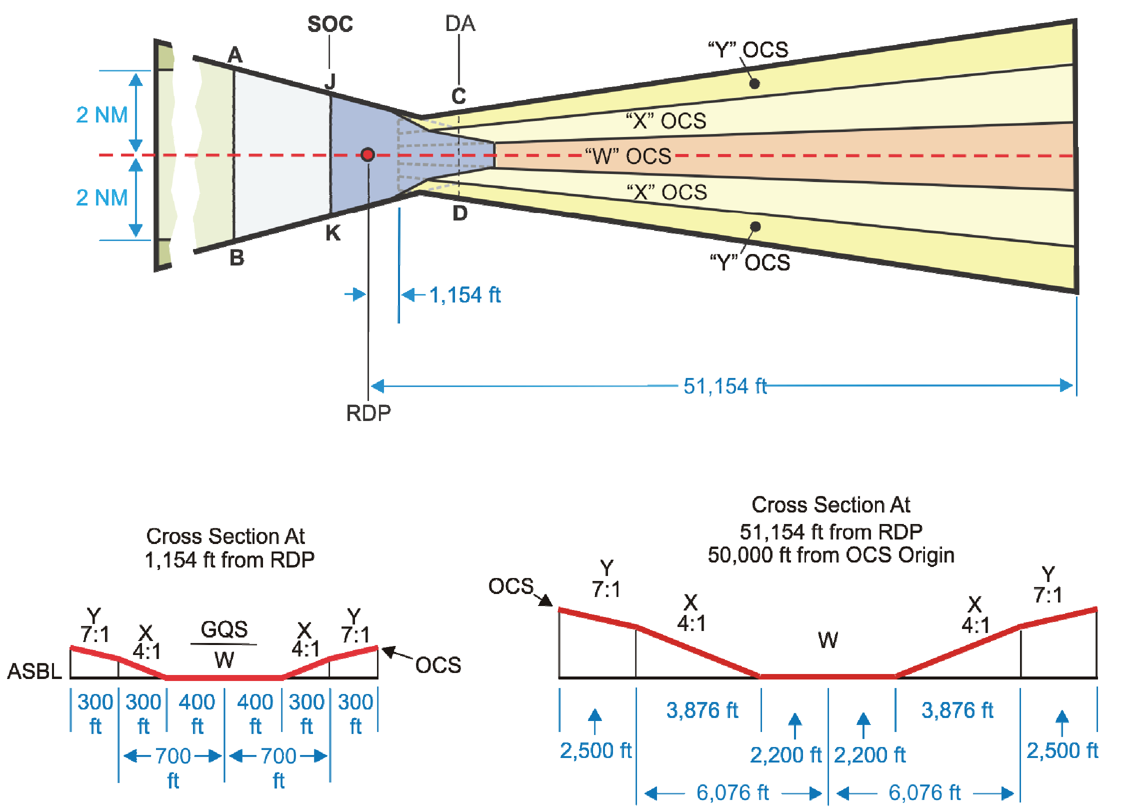


Figure 8-4. GPIP

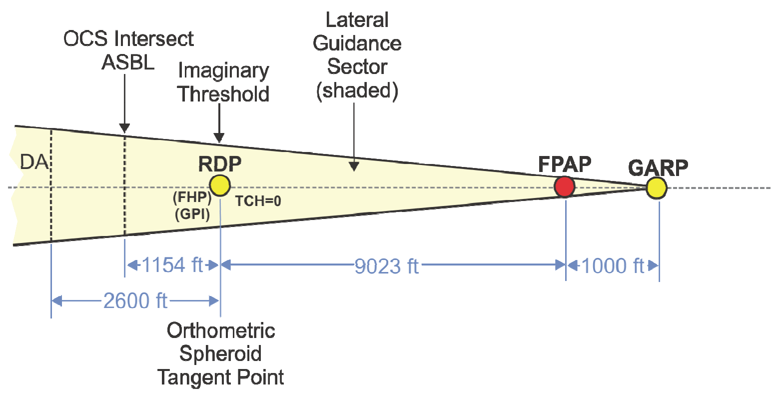


a. Calculate the distance from RDP to PFAF using Formula 2-15 (coincident with LNAV PFAF). Minimum length is 3 NM and maximum 10 NM. When using Formula 2-15 replace HCH with 0, and HRP_{elev} with RDP_{elev}.

b. Locate the FPAP 9,023 ft from RDP on a continuation of the final approach course (FAC), see Figure 8-5. The following are values entered into the procedure FAS data block (see paragraph 8-11).

Distance RDP to FPAP = 9,023 ft
Distance FPAP to GARP = 304.8 m (1,000 ft)
Course Width at RDP = 106.75 m (350 ft)

Figure 8-5. FPAP



c. OEA Alignment. The FAC is nominally aligned with landing site approach track extended (± 0.03°). Where a unique operational requirement indicates a need to offset the track from DA/MAP to the landing site from the track of the FAC, the offset must not exceed 30 degrees measured at DA.

d. OCS Slope. In this document, OCS slope is expressed as run over rise; e.g., 22.667:1. Determine the OCS slope (OCS_{slope}) associated with a specific θ° using Formula 8-1.

Formula 8-1. OCS Slope

$$(1)\ \text{input } \theta°$$

$$(2)\ OCS_{slope} = \mathbf{round}\left[\frac{102}{\theta°}, 3\right]$$

round(102/θ°,3)		
Calculator		
θ°		Click Here to Calculate
OCS_{slope}		

e. OCS Origin and Elevation. For obstacle evaluation, the OCS originates 1,154 ft from (prior to) the RDP at the same elevation. Along-track distance measurements in the final segment OEA are from RDP.

8-3. W OCS. All final segment OCS (W, X, and Y surfaces) obstacles are evaluated relative to the height of the W surface based on their along-track distance (OBS_X) from RDP, perpendicular distance (OBS_Y) from the FAC centerline, and MSL elevation (OBS_{elev}) adjusted for earth curvature and X/Y surface rise if appropriate. This adjusted elevation is termed obstacle effective elevation (O_{EE}) and is covered in paragraph 8-3b.

a. Half-Width. (Perpendicular distance from FAC centerline to surface boundary.) The perpendicular distance ($W_{boundary}$) from FAC centerline to the boundary is 400 ft at the point 1,154 ft from RDP and expands uniformly to 2,200 ft at a point 51,154 ft from RDP then remains constant. Calculate $W_{boundary}$ for any distance from RDP using Formula 8-2.

Formula 8-2. W OCS Half-Width

(1) input OBS_X

(2) $W_{boundary} = 0.036 \cdot (OBS_X - 954) + 392.8$

Where OBS_X = any along-track distance from RDP $\leq$ 51,154 ft

0.036*(OBS_X-954)+392.8		
Calculator		
OBS_X		Click Here to Calculate
$W_{boundary}$		

b. Height. Calculate the MSL height (ft) of the W OCS (W_{elev}) at any distance from RDP using Formula 8-3.

Formula 8-3. W OCS MSL Elevation

(1) input DA, $\theta°$, OBS_X

(2) $$W_{elev} = \frac{(r + DA) \cdot \cos\left(\operatorname{atan}\left(\frac{\theta}{102}\right)\right)}{\cos\left(\frac{OBS_X - 1154}{r} + \operatorname{atan}\left(\frac{\theta}{102}\right)\right)} - r$$

(r+DA)*cos(atan(θ°/102))/cos((OBS$_X$-1154)/r+atan(θ°/102))-r		
Calculator		
DA		Click Here to Calculate
θ°		
OBS$_X$		
W$_{elev}$		

The glide path is a straight line in space extending from RDP. The OCS is; therefore, a flat plane (does not follow earth curvature) to protect the straight-line glide path. The elevation of the OCS at any point is the elevation of the OCS at the FAC centerline abeam it. Since the earth's surface curves away from these surfaces as distance from RDP increases, the MSL elevation (OBS_{elev}) of an obstacle is reduced to account for earth curvature. This reduced value is termed the obstacle effective elevation (O_{EE}). Calculate O_{EE} using Formula 8-4 with adjustment "Q" for "X" or "Y" surface rise (0 if in W Surface).

Formula 8-4. Calculation of O_{EE}

$$(1)\ input\ OBS_{elev},\ DA,\ OBS_Y,\ Q$$

$$(2)\ O_{EE} = OBS_{elev} - \left((r + DA) \cdot \left(\frac{1}{\cos\left(\frac{OBS_Y}{r}\right)} - 1 \right) + Q \right)$$

OBS$_{elev}$-((r+DA)*(1/cos(OBS$_Y$/r)-1)+Q)		
Calculator		
OBS_{elev}		Click Here to Calculate
DA		
OBS_Y		
Q		
O_{EE}		

c. W OCS Evaluation. Compare the obstacle O_{EE} to W_{elev} at the obstacle location. Lowest minimums are achieved when the W surface is clear. To eliminate or avoid a penetration, take one or more of the following actions listed in the order of preference.

(1) Remove or adjust the obstruction location and/or height.

(2) Raise the GPA (see paragraph 8-7) up to a maximum GPA of 9 degrees.

(3) Adjust DA (for existing obstacles only) see paragraph 8-6.

(4) Raise RDP elevation

(5) Adjust Final Approach Course.

8-4. X OCS.

a. Width. Calculate the perpendicular distance ($X_{boundary}$) from the FAC centerline to the X surface boundary using Formula 8-5.

Formula 8-5. Perpendicular Distance to "X" Boundary

$$(1)\ input\ OBS_X$$

$$(2)\ X_{boundary} = 0.10752 \cdot (OBS_X - 954) + 678.496$$

0.10752*(OBS$_X$-954)+678.496		
Calculator		
OBS_X		Click Here to Calculate
$X_{boundary}$		

b. X Surface Obstacle Elevation Adjustment (Q). The X OCS begins at the height of the W surface and rises at a slope of 4:1 in a direction perpendicular to the FAC. The MSL elevation of an obstacle in the X surface is adjusted (reduced) by the amount of surface rise. Use Formula 8-6 to determine the obstacle height adjustment (Q) for use in Formula 8-4. Evaluate the obstacle under paragraphs 8-3b and 8-3c.

Formula 8-6. X OCS Obstacle Height Adjustment

$$(1)\ input\ OBS_Y, W_{boundary}$$

$$(2)\ Q = \frac{OBS_Y - W_{boundary}}{4}$$

(OBS$_y$-W$_{boundary}$)/4		
Calculator		
OBS_y		Click Here to Calculate
$W_{boundary}$		
Q		

8-5. Y OCS.

a. Width. Calculate the perpendicular distance ($Y_{boundary}$) from the FAC centerline to the Y surface boundary using Formula 8-7.

Formula 8-7. Perpendicular Distance to "Y" Boundary

$$(1)\quad input\ \ OBS_X$$

$$(2)\quad Y_{boundary} = 0.15152 \cdot (OBS_X - 954) + 969.696$$

0.15152*(OBS$_X$-954)+969.696		
Calculator		
OBS_X		Click Here to Calculate
$Y_{boundary}$		

b. Y Surface Obstacle Elevation Adjustment (Q). The Y OCS begins at the height of the X surface and rises at a slope of 7:1 in a direction perpendicular to the FAC. The MSL elevation of an obstacle in the Y surface is adjusted (reduced) by the amount of X and Y surface rise. Use Formula 8-8 to determine the obstacle height adjustment (Q) for use in Formula 8-4. Evaluate the obstacle under paragraphs 8-3b and 8-3c.

Formula 8-8. Y OCS Obstacle Height Adjustment

$$(1)\quad input\ \ X_{boundary},\ W_{boundary},\ OBS_Y$$

$$(2)\quad Q = \frac{X_{boundary} - W_{boundary}}{4} + \frac{OBS_Y - X_{boundary}}{7}$$

($X_{boundary}$-$W_{boundary}$)/4+(OBS_y-$X_{boundary}$)/7		
Calculator		
$X_{boundary}$		Click Here to Calculate
$W_{boundary}$		
OBS_Y		
Q		

8-6. HAS and DA. Where the OCS is clear, the minimum HAS is the greater of 250 ft.

a. DA Calculation (Clear OCS). The minimum DA value is 250 ft above the highest obstruction (terrain+obstacle or vegetation) rounded to the next higher 1-ft increment.

b. DA Adjustment to mitigate OCS Penetration. Calculate the adjusted DA for an obstacle penetration of the OCS using Formula 8-9.

Formula 8-9. Adjusted DA

$$(1)\quad input\ \ \theta°,\ DA,\ O_{EE}$$

$$(2)\quad D_{adjusted} = r \cdot \left(\frac{\pi}{2} - \mathbf{atan}\left(\frac{\theta°}{102}\right) - \mathbf{asin}\left(\frac{\mathbf{cos}\left(\mathbf{atan}\left(\frac{\theta°}{102}\right)\right) \cdot \left(r + DA - 954 - \frac{\theta° \cdot 954}{102}\right)}{r + O_{EE}}\right)\right)$$

$$(3)\quad DA_{adjusted} = \mathbf{ceiling}\left[\frac{(r + DA - 954) \cdot \mathbf{cos}\left(\theta° \cdot \frac{\pi}{180}\right)}{\mathbf{cos}\left(\frac{D_{adjusted}}{r} + \theta° \cdot \frac{\pi}{180}\right)} - r\right]$$

r*(π/2-atan(θ°/102)-asin(cos(atan(θ°/102))*(r+DA-954-θ°*954/102)/(r+O_{EE}))) ceiling((r+DA-954)*cos(θ°*π/180)/cos($D_{adjusted}$/r+θ°*π/180)-r)		
Calculator		
$\theta°$		Click Here to Calculate
DA		
O_{EE}		
$D_{adjusted}$		
$DA_{adjusted}$		

8-7. Revising Glide Path Angle ($\theta°_{adjusted}$) for OCS Penetrations. Raising the θ° may eliminate OCS penetrations. To determine $\theta°_{adjusted}$, use Formula 8-10.

Formula 8-10. Glide Path Angle Adjustment

(1) input OBS_X, OBS_{elev}, RDP_{elev}

(2) $$s = (r + RDP_{elev})^2 + (r + OBS_{elev})^2 - 2 \cdot (r + RDP_{elev}) \cdot (r + OBS_{elev}) \cdot \cos\left(\frac{OBS_X - 1154}{r}\right)$$

(3) $$b = \operatorname{acos}\left(\frac{(r + RDP_{elev})^2 + s - (r + OBS_{elev})^2}{2 \cdot (r + RDP_{elev}) \cdot \sqrt{s}}\right) - \frac{\pi}{2}$$

(4) $$OCS_{adjusted\_slope} = \operatorname{round}\left(\frac{1}{\tan(b)}, 2\right)$$

(5) $$\theta_{adjusted} = \operatorname{round}\left(\frac{102}{OCS_{adjusted\_slope}}, 2\right)$$

(r+RDP$_{elev}$)^2+(r+OBS$_{elev}$)^2-2*(r+RDP$_{elev}$)*(r+OBS$_{elev}$)*cos((OBS$_X$-1154)/r) acos(((r+RDP$_{elev}$)^2+s-(r+OBS$_{elev}$)^2)/(2*(r+RDP$_{elev}$)*sqrt(s)))-π/2 OCS$_{adjusted_slope}$=round(1/tan(b),2) θ$_{adjusted}$=round(102/OCS$_{adjusted_slope}$,2)		
Calculator		
OBS_X		Click Here to Calculate
OBS_{elev}		
RDP_{elev}		
$OCS_{adjusted\_slope}$		
$\theta°_{adjusted}$		

The descent rate of the adjusted glidepath angle should not exceed 800 ft/min. Descent rate is heavily dependent on airspeed. Determine the airspeed that yields 800 ft/min ($V_{KIAS\_800ft\_min}$) for the adjusted glidepath angle using Formula 8-11. If $V_{KIAS\_800ft\_min}$ is less than the normal approach speed, publish a final approach airspeed restriction of $V_{KIAS\_800ft\_min}$. The minimum adjusted glidepath angle should not be less than three degrees. If operationally required, with AFS approval, the maximum descent rate can be increased to 1,000 ft/min.

Formula 8-11. Descent Rate Indicated Airspeed

(1) input $\theta°_{adjusted}$, DA

(2) $$V_{KIAS\_800*ft/min} = \textbf{round}\left[\left(\frac{800*}{101.26859 \cdot \sin\left(\theta°_{adjusted} \cdot \frac{\pi}{180}\right)} - 10\right) \cdot \frac{(288 - 0.00198 \cdot DA)^{2.628}}{171233 \cdot \sqrt{303 - 0.00198 \cdot DA}}, 0\right]$$

*1000 when the airspeed limit is required for 1000 ft/min

round[(800/(101.26859*sin(θ°adjusted*π/180))-10)*((288-0.00198*DA)^2.628)/(171233*sqrt(303-0.00198*DA)),0]		
Calculator		
$\theta°_{adjusted}$		Click Here to Calculate
DA		
$V_{KIAS\_800ft/min}$		
$V_{KIAS\_1000ft/min}$ (with AFS approval)		

8-8. Adjusting TCH to Reduce/Eliminate OCS Penetrations. NA for PinS LPV procedures.

8-9. Missed Approach Section 1 (Height Loss and Initial Climb). Section 1 begins at DA (CD line) and ends at the AB line. It accommodates height loss and establishment of missed approach climb gradient. Obstacle protection is based on an assumed minimum climb gradient of 400 ft/NM (≈15.19:1 slope). Section 1 is centered on a continuation of the FAC and is subdivided into sections 1a and 1b (see Figures 8-6 and 8-7).

Figure 8-6. Section 1 3D Perspective

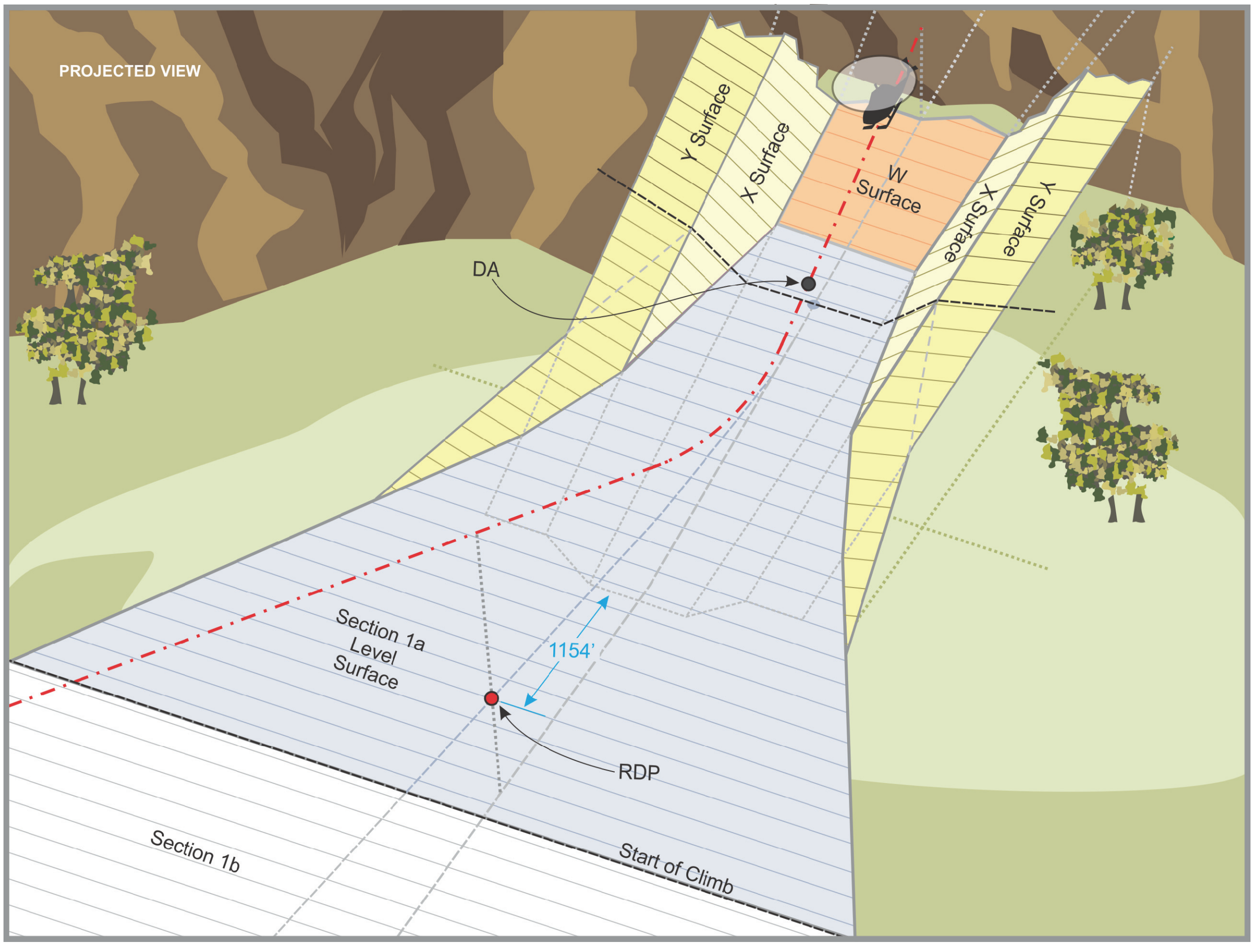
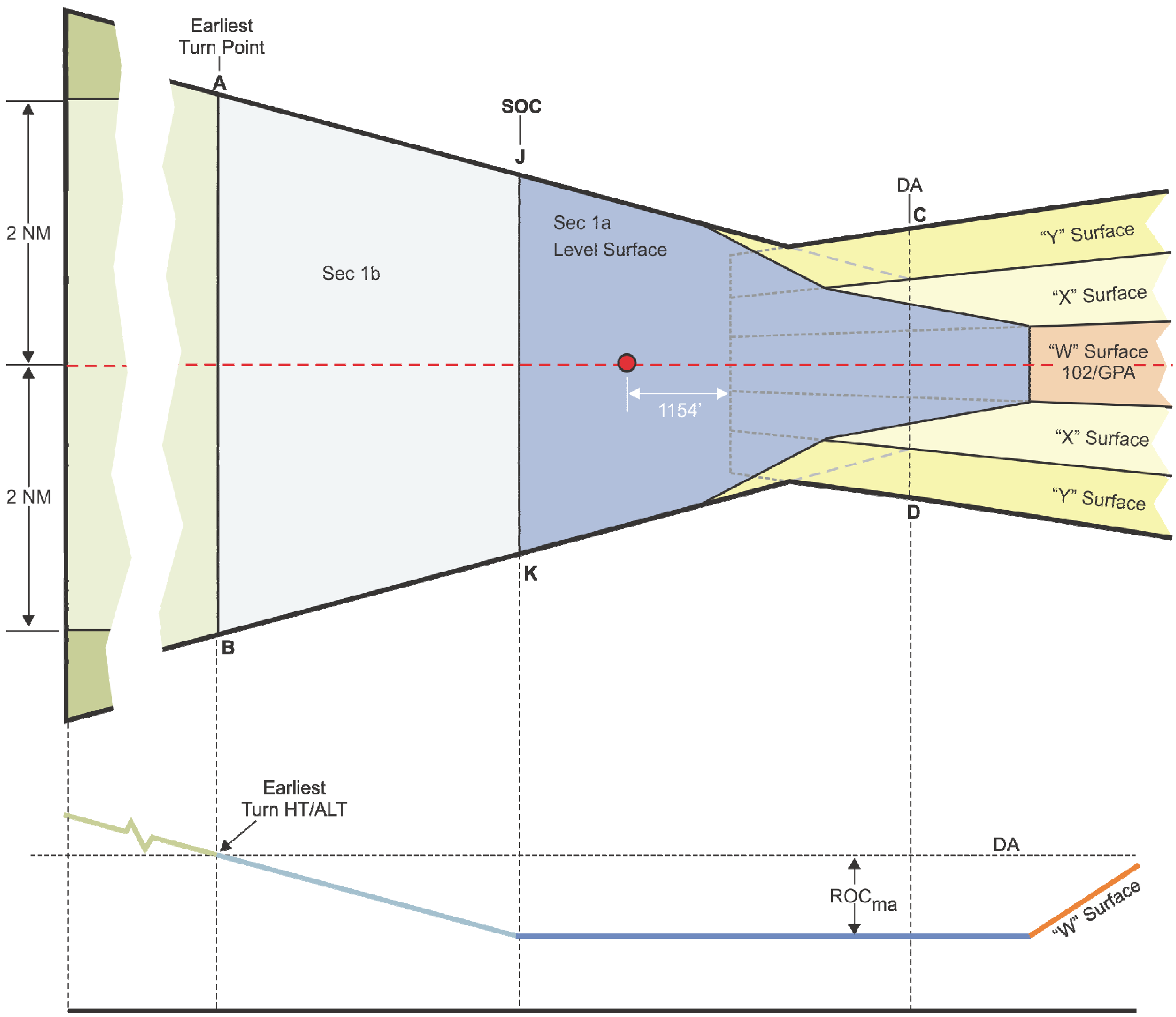


Figure 8-7. Section 1 (a/b) 2D Perspective



a. Missed Approach Section 1. Section 1 begins at DA (CD line) and ends at the JK line which is the Start-Of-Climb (SOC) point. It accommodates reconfiguration, inherent height loss, and establishing required missed approach climb gradient (CG_{MA}) of 400 ft/NM (20:1 slope), unless higher climb gradients and the appropriate slope adjustments are authorized. Section 1 is subdivided into sections 1a and 1b, and is centered on a continuation of the FAC. These surfaces must not be penetrated. Section 1a, is protected by a level surface that provides required ROC (ROC_{sec_1a}) based on glide path angle and airspeed. ROC is 115 ft for glide path angles up to 3.2 degrees. Apply ROC adjustments for glide path angles exceeding 3.2 degrees, for RDP elevations greater than 3,000 ft., and for final indicated airspeed. Calculate section 1a ROC (ROC_{sec_1a}) and the level surface MSL elevation (sec_1a_{elev}) using Formula 8-12.

Formula 8-12. MA Beginning ROC

(1) input DA, RDP_{elev}, $\theta°$, V_{KIAS}

(2) **if** $(\theta° > 3.2°)$ **then**

$$\theta°_{adjustment} = 0.05 \cdot 25 \cdot \frac{\theta° - 3.2}{0.1}$$

else

$$\theta°_{adjustment} = 0$$

end if

(3) **if** $(RDP_{elev} > 3000)$ **then**

$$Elev_{adjustment} = 0.02 \cdot 25 \cdot \frac{RDP_{elev}}{1000}$$

else

$$Elev_{adjustment} = 0$$

end if

(4) $ROC_{sec\_1a} = 115 + \theta°_{adjustment} + Elev_{adjustment} - 25 \cdot \frac{90 - V_{KIAS}}{90}$

(5) $Level\_sfc_{elev} = DA - ROC_{sec\_1a}$

0.05*25*(θ° -3.2)/0.1 0.02*25*RDP_{elev}/1000 115+$\theta°_{adjustment}$+$Elev_{adjustment}$-25*(90-V_{KIAS})/90 DA- ROC_{sec_1a}		
Calculator		
DA		Click Here to Calculate
RDP_{elev}		
θ°		
V_{KIAS}		
ROC_{sec_1a}		
$Level\_sfc_{elev}$		

(1) Section 1a. Section 1a length varies with altitude, airspeed, and glide path angle. The 1a surface splays at 15 degrees relative the FAC extension, from X boundary at its beginning (CD line) until reaching the JK line. Calculate X width at section 1a start point using the final segment X width. Calculate section 1a length ($Length_{sec1a}$) using Formula 8-13.

Formula 8-13. Section 1a Length

(1) input $\theta°$, V_{KTAS}

(2) $anpe = 1.225 \cdot \frac{40}{0.3048}$

(3) $wpr = 60 \cdot \tan\left(\theta \cdot \frac{\pi}{180}\right)$

(4) $fte = \frac{75}{\tan\left(\theta \cdot \frac{\pi}{180}\right)}$

(5) $d1 = 10 \cdot \frac{(V_{KTAS} + 10) \cdot fpnm}{3600}$

(6) $Length_{sec1a} = \textbf{round}\left[d1 + \frac{4}{3} \cdot \sqrt{anpe^2 + wpr^2 + fte^2}, 0\right]$

1.225*40/0.3048 60*tan(θ°*π/180) 75/tan(θ°*π/180) 10*(V_{KTAS}+10)*fpnm/3600 round(d1+(4/3)*(anpe^2+wpr^2+fte^2)^0.5,0)		
Calculator		
$\theta°$		Click Here to Calculate
V_{KTAS}		
$Length_{sec1a}$		

(a) Calculate the 1a surface half-width (½$width_{sec1a}$) at any along-track distance (d_{1a}) from DA assuming a beginning half-width of the final segment "X" surface at DA (½X_{sfc_DA}) using Formula 8-14.

Formula 8-14. Section 1a Width

(1) input d_{1a}, DA, RDP_{elev}, θ°

(2) $$\tfrac{1}{2}width_{sec1a} = d_{1a} \cdot \tan\left(15 \cdot \frac{\pi}{180}\right) + 0.036 \cdot \left(\frac{DA - RDP_{elev}}{\tan\left(\theta° \cdot \frac{\pi}{180}\right)} - 954\right) + 398.2$$

d1a*tan(15*π/180)+0.036*((DA-RDPelev)/tan(θ°*π/180)-954)+398.2		
Calculator		
d_{1a}		Click Here to Calculate
DA		
RDP_{elev}		
θ°		
½$width_{sec1a}$		

(b) Obstacles within the lateral boundaries of the flat surface that underlie the X or Y surfaces may be evaluated against the higher of: (1) the W surface abeam the obstacle, or (2) the flat surface elevation. Conduct the evaluation using the "Obstacle Effective Elevation" (O_{EE}).

(2) Section 1b. Section 1b provides initial climb protection from SOC at the specified CG_{MA} until minimum turn height/altitude (alt_{turn}) is attained. Its lateral boundaries continue the section 1a splay until alt_{turn} is reached or until reaching full width, whichever occurs first. Calculate section 1b length using Formula 8-15.

Formula 8-15. Section 1b Length

$$(1) \quad input \quad alt_{turn},\ Level\_sfc_{elev},\ CG_{MA}$$

$$(2) \quad Length_{sec1b} = \frac{r \cdot fpnm \cdot \ln\left[\frac{r + alt_{turn}}{r + Level\_sfc_{elev}}\right]}{CG_{MA}}$$

r*fpnm*ln((r+alt_{turn})/(r+$Level\_sfc_{elev}$))/CG_{MA}		
Calculator		
alt_{turn}		Click Here to Calculate
$Level\_sfc_{elev}$		
CG_{MA}		
$Length_{sec1b}$		

(a) Calculate the width of the section 1b surface (½$width_{sec1b}$) at any distance d_{sec1a_end} from the end of section 1a using Formula 8-16.

Formula 8-16. Section 1b Width

$$(1) \quad input \ d_{sec1a\_end},\ \tfrac{1}{2}width_{sec1a}$$

$$(2) \quad \tfrac{1}{2}width_{sec1b} = d_{sec1a\_end} \cdot \tan\left(15 \cdot \frac{\pi}{180}\right) + \tfrac{1}{2}width_{sec1a}$$

d_{sec1a_end}*tan(15*π/180)+1/2$width_{sec1a}$		
Calculator		
d_{sec1a_end}		Click Here to Calculate
½$width_{sec1a}$		
½$width_{sec1b}$		

(b) The surface rises at a rate related to the assigned CG_{MA} from sec_1a$_{elev}$. Determine the 1b MA surface elevation (OCS_1b$_{OBS_x}$) at any section 1b obstacle distance (d), and the elevation of the OCS at section 1b end (OCS_1b$_{end_elev}$) using Formula 8-17.

Formula 8-17. MA Slope and Section 1b Elevation

$$(1)\ \text{input } CG_{MA},\ d_{sec1b\_end},\ Level\_sfc_{elev},\ OBS_x$$

$$(2)\ MA_{slope} = \frac{fpnm}{CG_{MA} - 96}$$

$$(3)\ OCS\_1b_{end\_elev} = \frac{d_{sec1b\_end}}{MA_{slope}} + Level\_sfc_{elev}$$

$$(4)\ OCS\_1b_{OBS\_x} = \frac{OBS_x}{MA_{slope}}$$

fpnm/(CG_{MA}-96) $d_{sec1b\ end}/MA_{slope}$+$Level\_sfc_{elev}$ OBS_x/MA_{slope}		
Calculator		
CG_{MA}		Click Here to Calculate
d_{sec1b_end}		
$Level\_sfc_{elev}$		
OBS_x		
MA_{slope}		
$OCS\_1b_{end\_elev}$		
$OCS\_1b_{OBS\_X}$		

b. Section 2. See chapter 5.

8-10. Surface Height Evaluation.

a. Section 1a. Obstacles that penetrate these surfaces are mitigated during the final segment OCS evaluation. However, missed approach segment penetrations are not allowed and must be mitigated by:

(1) Removing or reducing obstruction height.

(2) Adjusting RDP elevation.

(3) Adjusting the FAC.

(4) Adjusting DA (for existing obstacles).

(5) A combination of the above mitigations.

b. Section 1b/Section 2 Surface Penetration. The CG_{MA} may be increased, (if operationally feasible) in addition to the options listed in paragraph 8-11a. Climb gradients above 600 ft/NM require Flight Standards approval.

Note: See formula 5-3 to determine CG_{MA} increase method.

c. End of Section 1 Values. Calculate the assumed aircraft MSL altitude at the end of section 1b ($acft_{1b\_alt}$), the OCS MSL elevation at the end of section 1b (OCS_{1b_elev}), and the ROC at section 1b end (ROC_{end_1b}) using Formula 8-18.

Formula 8-18. Section 1b End Values

$$(1)\quad input\ DA,\ OCS\_1a_{elev},\ Length_{sec1b},\ CG_{MA}$$

$$(2)\quad MA_{slope} = \frac{fpnm}{CG_{MA} - 96}$$

$$(3)\quad acft_{1b\_alt} = DA + \left(CG_{MA} \cdot \frac{Length_{sec1b}}{fpnm} \right)$$

$$(4)\quad OCS_{1b\_elev} = OCS\_1a_{elev} + \frac{Length_{sec1b}}{MA_{slope}}$$

$$(5)\quad ROC_{end\_1b} = acft_{1b\_alt} - OCS_{1b\_elev}$$

fpnm/(CG_{MA}-96) DA+(CG_{MA}*$Length_{sec1b}$/fpnm) OCS_1a_{elev}+ $Length_{sec1b}$/MA_{slope} $acft_{1b\_alt}$-OCS_{1b_elev}		
Calculator		
DA		Click Here to Calculate
OCS_1a_{elev}		
$Length_{sec1b}$		
CG_{MA}		
$acft_{1b\_alt}$		
OCS_{1b_elev}		
ROC_{end_1b}		

8-11. Final Approach Segment (FAS) Data Requirements. Values are as indicated unless otherwise specified.

a. Operation type: 0

b. Service Provider Identifier: 0

c. Airport Identifier: Use the heliport identifier. If the heliport does not have an identifier one must be obtained. For procedures serving multiple heliports, the identifier for the primary heliport should be used.

d. Runway Number: Final approach track rounded to nearest 10 degrees and enter as a two digit number.

e. Runway Letter: Leave blank.

f. Approach Performance Designator: 0

g. Route Indicator: Leave blank.

h. Reference Path Data Selector (RPDS): 0

i. Reference Path Identifier: [W] [Final approach track rounded to nearest 10 degrees (2 digits)] ["A" first procedure, "B" second procedure, etc.] EXAMPLE: W23A.

j. LTP/RDP Latitude: WGS-84 Latitude of RDP entered to five ten-thousandths of an arc second. The last digit must be rounded down to either a 0 or 5. EXAMPLE: 225436.2128N (*11 characters*) is entered for 22°54'36.2125"N.

k. LTP/RDP Longitude: WGS-84 Longitude of RDP entered to five ten-thousandths of an arc second. The last digit must be rounded to either a 0 or 5. EXAMPLE: 1093247.8783E (12 characters) is entered for 109°32'47.8780"E.

l. LTP/RDP height above ellipsoid (HAE): HAE value for RDP. The value is entered in meters using 5 characters. The first character is a + or – and the resolution value is in tenths of a meter. EXAMPLE: +00356 (+35.6 m), -00022 (-2.2 m).

m. Flight Path Alignment Point (FPAP) Latitude: WGS-84 Latitude of FPAP using the same requirements as paragraph 8-11j.

n. Flight Path Alignment Point (FPAP) Longitude: WGS-84 Longitude of FPAP using the same requirements as paragraph 8-11k.

o. TCH: 0000.0

p. TCH Units Selector: F (feet) or M (Meters)

q. Glidepath Angle: Specify in degrees, resolution of hundredths of a degree using 4 characters. EXAMPLE: 04.50

r. Course Width at Threshold: 106.75

s. ΔOffset: 0

t. Horizontal Alert Limit (HAL): 40

u. Vertical Alert Limit (VAL): 50

v. Final Approach Segment CRC Remainder: 32 bit cyclic redundancy check (CRC) appended to the end of each FAS Data Block in order to ensure approach data integrity. The CRC word is calculated on the entire data block.

Appendix C. Administrative Information

1. Distribution. This order is distributed in Washington headquarters to the branch level in the Offices of Airport Safety and Standards and Communications, Navigation, and Surveillance Systems; Air Traffic Organization (Safety, En Route and Oceanic Services, Terminal Services, System Operations Services, and Technical Operations Services), and Flight Standards Services; to the National Flight Procedures Office and the Regulatory Standards Division at the Mike Monroney Aeronautical Center; to branch level in the regional Flight Standards and Airports Divisions; special mailing list ZVS-827, and to Special Military and Public Addressees.

2. Background. The analysis of Global Positioning System/Wide Area Augmentation System (GPS/WAAS) navigation flight test data provides the basis for these criteria. A significant difference exists between approach procedures to runways and approach procedures to heliports. Approaches to runways terminate in relatively obstacle-free environments. Approaches to heliports commonly terminate in areas of dense population and large buildings. Speed limitations incorporated in these criteria provide the smallest obstacle clearance areas, the shortest segment lengths, and the lowest ceiling and visibility minimums. The graphic illustrations in this order are not to scale. The guidance published in this directive supersedes previous guidance concerning helicopters published in Terminal Instrument Procedures (TERPS) Instruction Letters (TILs) and other correspondence.

3. Definitions.

a. Approach Procedure Types using RNAV (GPS).

(1) IFR to an IFR Heliport (Public and Special). An IFR approach to a heliport that meets Advisory Circular (AC) 150/5390-2, Heliport Design, standards for an IFR heliport.

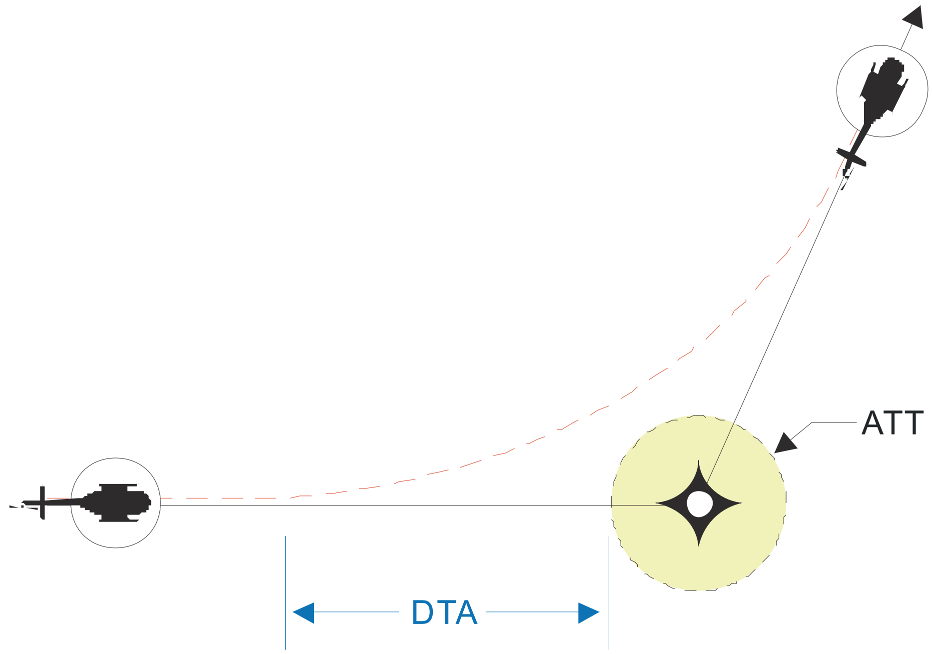
(2) IVH (Proceed Visually) (Special). An IFR approach to a VFR heliport that meets AC 150/5390-2 standards. This procedure requires flight standards approval. The phrase “Proceed Visually” is charted on the procedure for the visual segment from the MAP to the heliport. IVR applies IVH criteria to an approach to a VFR runway.

(3) Point-in-Space (PinS) Approach (Proceed VFR) (Public and Special). An IFR PinS approach to one or more VFR heliports. The phrase “Proceed VFR” is charted on the procedure for the VFR segment following the MAP.

(4) IFR to a Runway (Public and Special). An IFR helicopter approach procedure to a runway.

b. Distance of Turn Anticipation (DTA). DTA represents the maximum distance prior to a fly-by-fix that a helicopter is expected to start a turn to intercept the course of the next segment. The along-track tolerance (ATT) value, associated with a fix, is added to the DTA value when DTA is applied (see figure C-1 and formula 2-6).

Figure C-1. Distance of Turn Anticipation (DTA)



DTA = Radius x tan (degrees of turn ÷ 2)

c. Fly-By Fix.  A fly-by fix is a waypoint where a turn is initiated prior to reaching it.

d. Fly-Over Waypoint (WP).  A fly-over WP is a waypoint over which an aircraft is expected to fly before one turn is initiated.

e. Final Approach and Takeoff Area (FATO). A defined area over which the final phase of the approach to a hover, or a landing, is completed and from which the takeoff is initiated. The guidance for a FATO is published in AC 150/5390-2.

f. Fictitious Helipoint (FHP). The FHP is located 2,600 ft beyond the MAP and 9,023 ft in front of the flight path alignment point (FPAP). It is used to establish the approach course width for the WAAS.

g. Flight Path Alignment Point (FPAP). The FPAP is a 3-dimensional (3D) point defined by World Geodetic System of 1984/North American Datum of 1983 (WGS-84/NAD-83) latitude, longitude, mean sea level (MSL) elevation, and WGS-84 Geoid height. The FPAP is used in conjunction with the FHP and the geometric center of the WGS-84 ellipsoid to define the final approach azimuth [localizer performance with vertical guidance (LPV) glidepath's vertical plane, where used) associated with a localizer performance (LP) or LPV final course.

h. Flight Technical Error (FTE). FTE is the measure of the pilot or autopilot's ability to control an aircraft so that its indicated position matches the desired position.

i. Global Navigation Satellite System (GNSS) Azimuth Reference Point (GARP). A calculated point 1,000 ft beyond the FPAP lying on an extension of a geodesic line from the landing threshold point/fictitious threshold point (LTP/FTP) through the FPAP. This point is used by the airborne system as the origin of the lateral guidance sector. It may be considered as the origin of an imaginary localizer antenna.

j. Geoid Height (GH). The GH is the height of the Geoid relative to the WGS-84 ellipsoid. It is a positive value when the Geoid is above the WGS-84 ellipsoid and negative when it is below. The value is used to convert a mean sea level (MSL) elevation to an ellipsoidal or geodetic height - the height above ellipsoid (HAE).

Note: The Geoid is an imaginary surface within or around the earth that is everywhere normal to the direction of gravity and coincides with MSL in the oceans. It is the reference surface for MSL heights.

k. Heliport Approach Lighting System (HALS). The HALS is a distinctive approach lighting configuration designed to prevent it from being mistaken for an airport runway approach lighting system. HALS consists of ten bars of lights at 100-ft increments and has a length of 1,000 ft (305 m). HALS provides a visibility credit of 1/4 statute mile (SM) for nonprecision approaches.

l. Height Above Landing Area Elevation (HAL). The HAL is the height of the minimum descent altitude (MDA) above helipoint elevation.

m. Height Above Surface (HAS). HAS is the height of the MDA above the highest terrain/surface within a 5,200-ft radius of the MAP in the PinS procedure.

n. Helipoint Crossing Height (HCH). The HCH is the height of the vertical guidance path above the heliport elevation at the helipoint.

o. Helipoint. The helipoint is the aiming point for the visual segment and is normally centered in the touchdown and lift-off area (TLOF). The TLOF is normally centered in the FATO.

p. Heliport. An area of land, water, or structure used or intended to be used for helicopter landings and takeoffs and includes associated buildings and facilities. IFR and VFR heliports are described in AC 150/5390-2.

q. Heliport Elevation (HE). For heliports without a precision approach, the heliport elevation is the highest point of the FATO expressed as the distance above mean sea level (MSL).

r. Heliport Reference Point (HRP). The geographic position of the helipoint, measured at the center of the FATO or the central point of multiple FATOs, expressed as (WGS-84/NAD-83) latitude and longitude to the nearest hundredth of a second. The HRP elevation is equal to the heliport elevation.

s. Initial Departure Fix (IDF). The first fix on a PinS departure procedure where application of IFR obstruction protection and air traffic separation standards are provided.

t. IFR Heliports. Facility specifications for IFR Heliports are described in chapters 6 or 7 as appropriate of Advisory Circular 150/5390-2, Heliport Design. Chapter 6 of AC 150/5390-2 relates to paragraph 5.3 of this order for nonprecision IFR approach procedures to IFR heliports.

u. Landing and Takeoff Site. The area of intended landing and takeoff. It can be a heliport, helistop, vertiport, or other point of landing designated for a PinS approach.

v. Landing Threshold Point. The LTP is a 3D point at the intersection of the runway centerline and the runway threshold (RWT). WGS-84/NAD-83 latitude, longitude, MSL elevation, and geoid height define it. It is used in conjunction with the FPAP and the geometric center of the WGS-84 ellipsoid to define the vertical plane of an RNAV final approach course.

w. Proceed Visually. This phrase requires the pilot to acquire and maintain visual contact with the FATO or elements associated with the FATO such as heliport lighting, precision approach path indicator (PAPI), etc. at or prior to the MAP. Obstacle and terrain avoidance from the MAP to the FATO is the responsibility of the pilot. A missed approach procedure is not provided between the MAP and the landing FATO.

x. Proceed VFR. For PinS procedures, this phrase requires the pilot to proceed from the MAP to the selected landing area on the approach chart with no less than the visibility and ceiling required on the approach chart. For flights that do not terminate at the selected landing area on the approach chart, the pilot is required to proceed from the MAP under the applicable VFR for ceiling and visibility required by the applicable Title 14 Code of Federal Regulations (14 CFR) but no less than the visibility required on the approach chart, operations specifications (OpsSpec), or letter of agreement (LOA). The pilot is responsible for obstacle and terrain avoidance from the MAP to the landing site. A missed approach procedure is not provided between the MAP and the landing site. The landing site is not required to be in sight from the MAP.

y. Reference Datum Point (RDP). The RDP is a 3D point defined by the LTP or FTP latitude/longitude position, MSL elevation, and a threshold crossing height (TCH) value. The RDP is in the vertical plane associated with the final approach course and is used to relate the glidepath angle of the final approach track to the landing runway.

z. Touchdown and Lift-Off Area (TLOF). A TLOF is a load bearing, generally paved area, normally centered in the FATO, on which the helicopter lands or takes off (see AC 150/5390-2).

aa. United States Air Force (USAF).

bb. United States Army (USA).

cc. United States Coast Guard (USCG).

dd. United States Navy (USN).

ee. VFR Heliports. Standards and recommendations for VFR and IFR heliports are described in chapters 2 through 5 and chapter 8 of AC 150/5390-2. Paragraph 5.4 of this order relates to VFR heliports.

ff. Minimum instrument meteorological condition airspeed (V_{mini}). V_{mini} means instrument flight minimum speed, utilized in complying with minimum limit speed requirements for instrument flight. This is the certified minimum airspeed that a specific helicopter is approved to enter instrument meteorological flight conditions.

gg. Visual Segment Descent Angle (VSDA). The angle of descent in the visual segment.

hh. Visual Segment Descent Point (VSDP). The descent point within the visual segment of a helicopter instrument approach to an IFR heliport or runway.

ii. Visual Segment Reference Line (VSRL). A line perpendicular to the final course at a distance of 75 ft (22.9 m) from the helipoint for public use heliports and 50 ft (15.27 m) from the helipoint for heliports with special instrument procedures. It extends 75 ft (22.9 m) on each side of the final course centerline for public use heliports and 50 ft (15.27 m) on each side of the final course centerline for heliports with special instrument procedures. For IFR procedures the line is 75 ft (22.9 m) from the helipoint and it extends 75 ft (22.9 m) on each side of the final approach course.

jj. Wide Area Augmentation System (WAAS) Localizer Performance (LP). The LP approach applies lateral-only WAAS guidance (and reduced OEA) within the FAS to a PinS.

4. Data Resolution. See chapter 2, paragraph 2.

5. Related Publications. All directives in this order refer to the latest editions:

a. Advisory Circular 150/5390-2, Heliport Design.

b. Order 7130.3, Holding Pattern Criteria.

c. Order 8260.3, United States Standard for Terminal Instrument Procedure (TERPS).

d. Order 8260.19, Flight Procedures and Airspace.

e. Order 8260.40, Flight Management System Instrument Procedures Development.

f. Order 8260.45, Terminal Arrival Area (TAA) Design Criteria.

g. Order 8260.54, United States Standards for Area Navigation (RNAV).

6. Information Update. For your convenience, FAA Form 1320-19, Directive Feedback Information, is included at the end of this order to note any deficiencies found, clarifications needed, or suggested improvements regarding the contents of this order. When forwarding your comments to the originating office for consideration, please use the “Other Comments” block to provide a complete explanation of why the suggested change is necessary.

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