



INTERNATIONAL CIVIL AVIATION ORGANIZATION

A United Nations Specialized Agency

PBN Airspace Design Workshop

Good Design Practices

**Asia and Pacific Regional Sub-Office
Beijing, China**

APAC RSO BEIJING



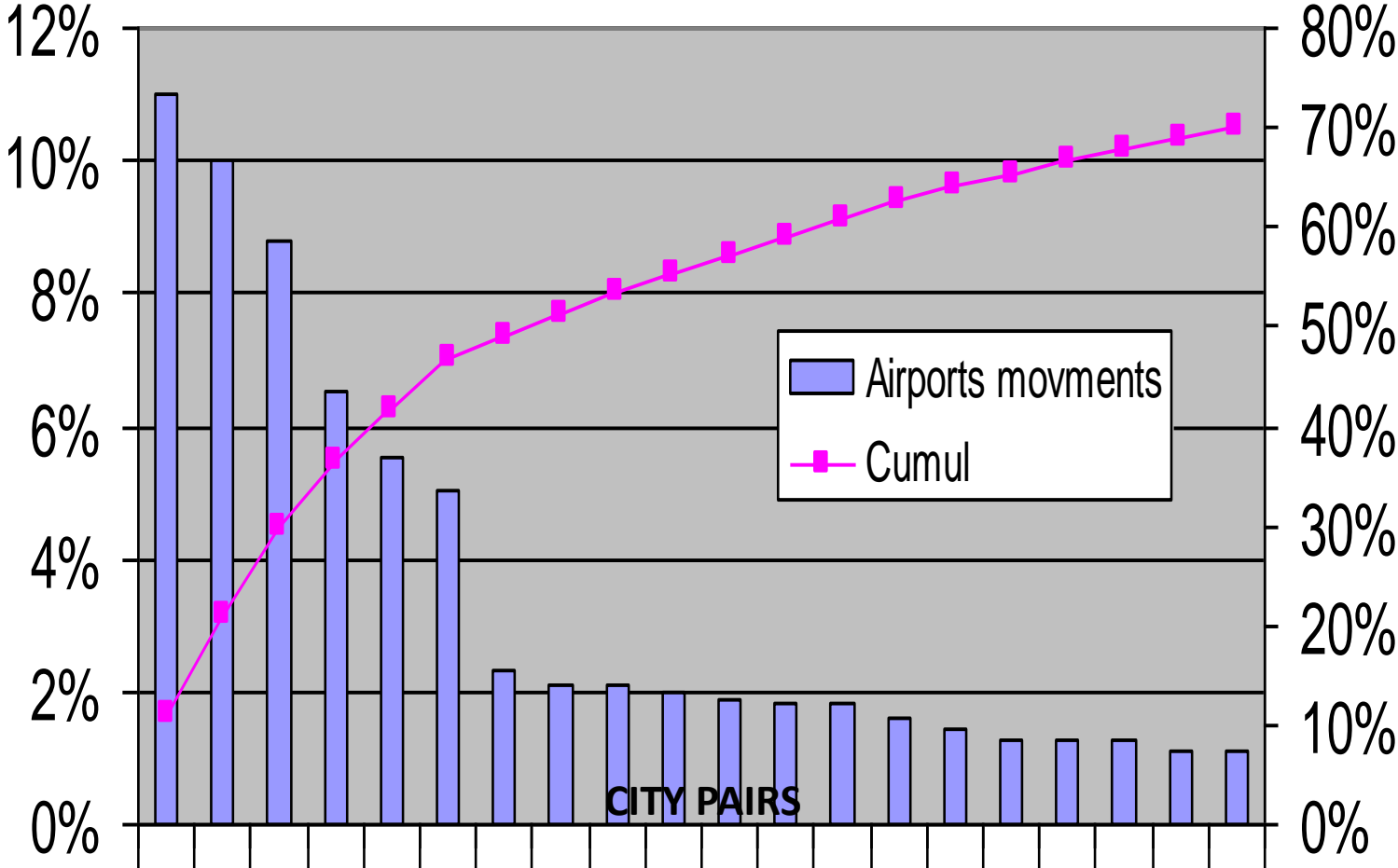
Presentation Outline

- **Traffic Distribution**
- **Traffic Capability**
- **Implementation Objectives**
- **Design Overview and Considerations**
- **Good Design Practices**
- **Summary**

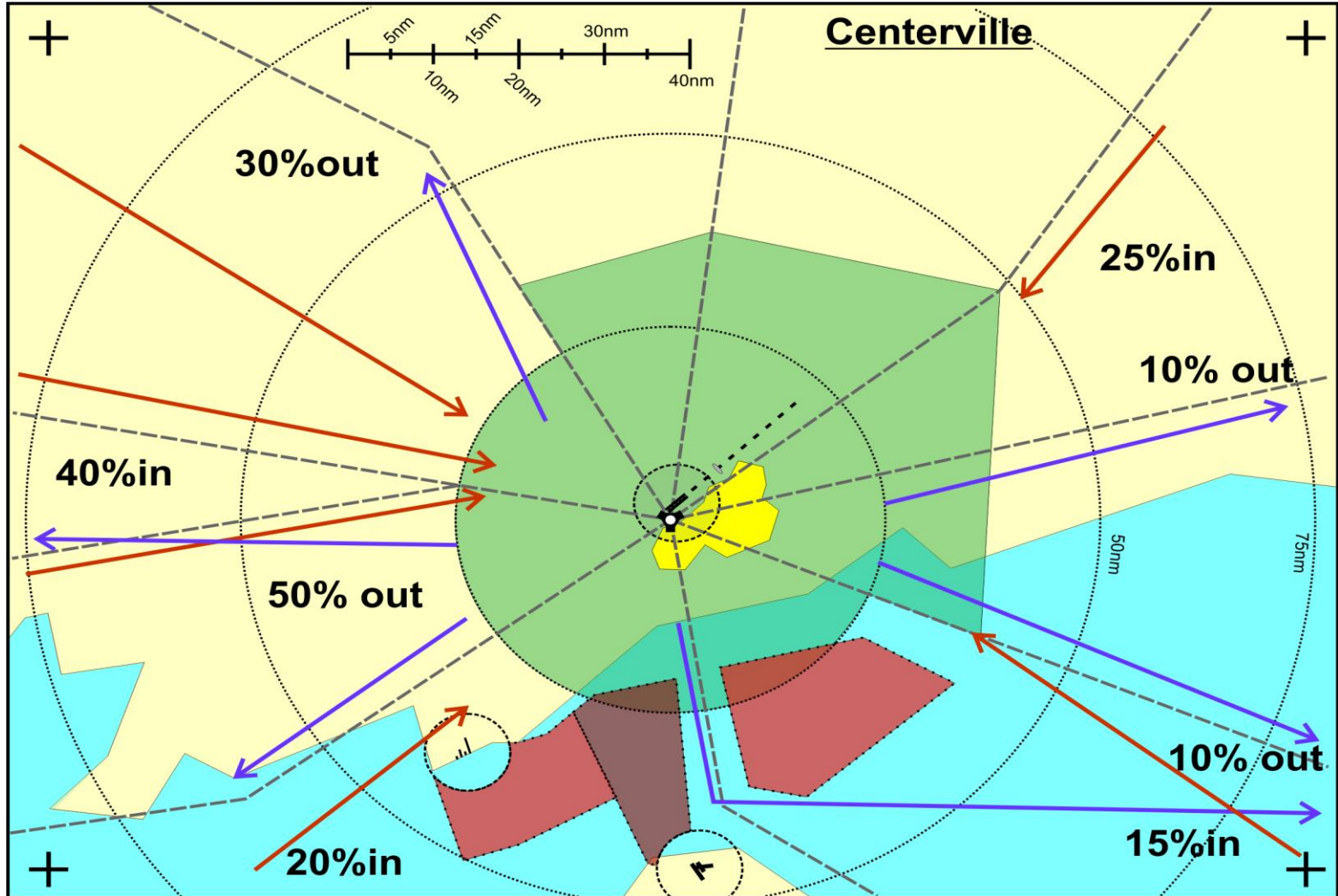
Analysis – Sample Traffic Distribution



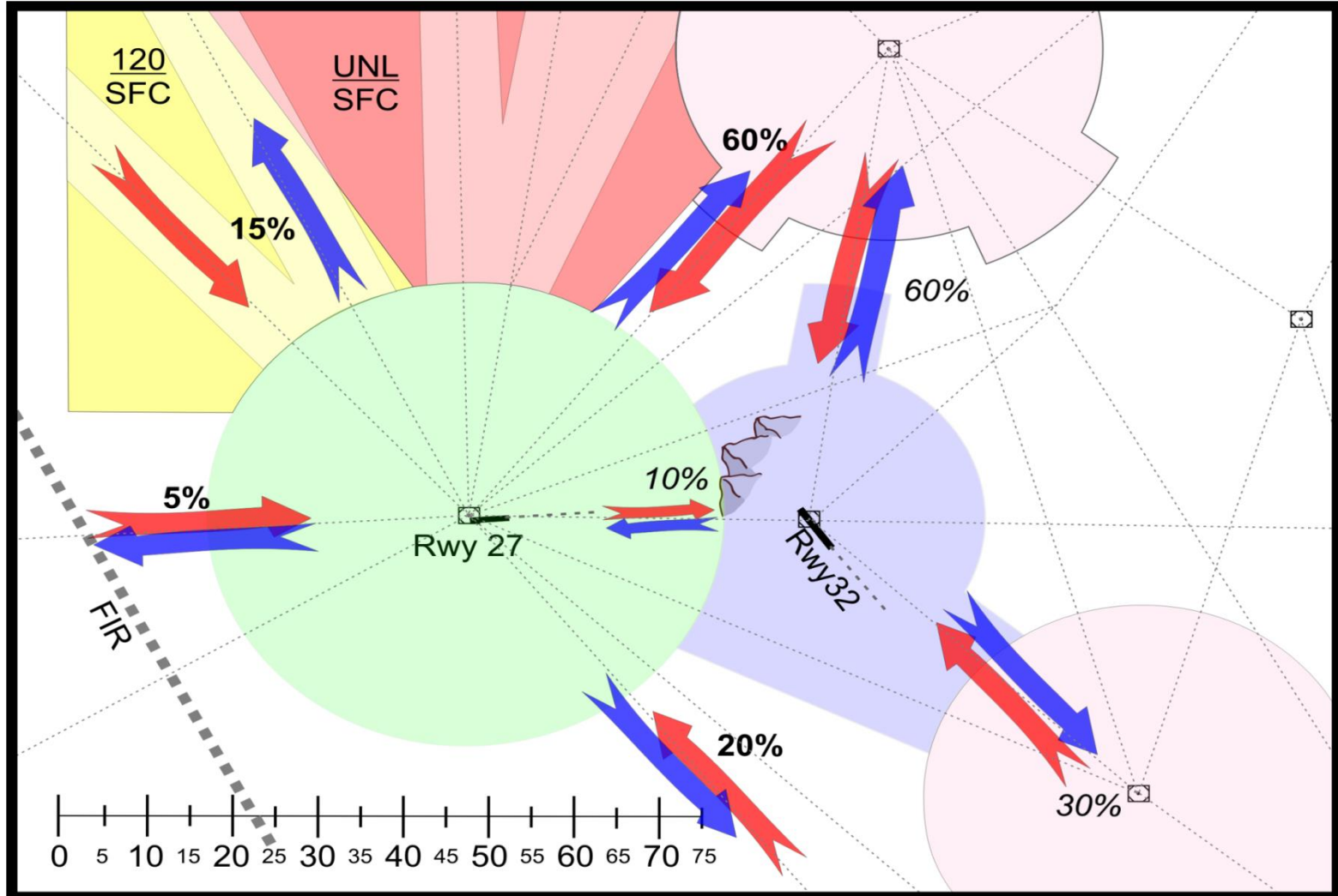
Domestic Traffic



Analysis – Sample Traffic Distribution



Analysis – Sample Traffic Distribution



Sample – Traffic Capability

- **90% GNSS Equipped**
- **40% DME/DME**
- **All RNAV5 Approved**
- **90% RNAV1 Approved**
- **80% RNP Approved with RF**
- **5% Retrofittable**
- **5% too old**

Design Phase - Overview

- ❖ **airspace design is an iterative process**
- ❖ **significant reliance on the qualitative assessment**
- ❖ **operational judgement:**
 - **Controllers**
 - **Pilots**
 - **airspace designers**
 - **procedure designers**

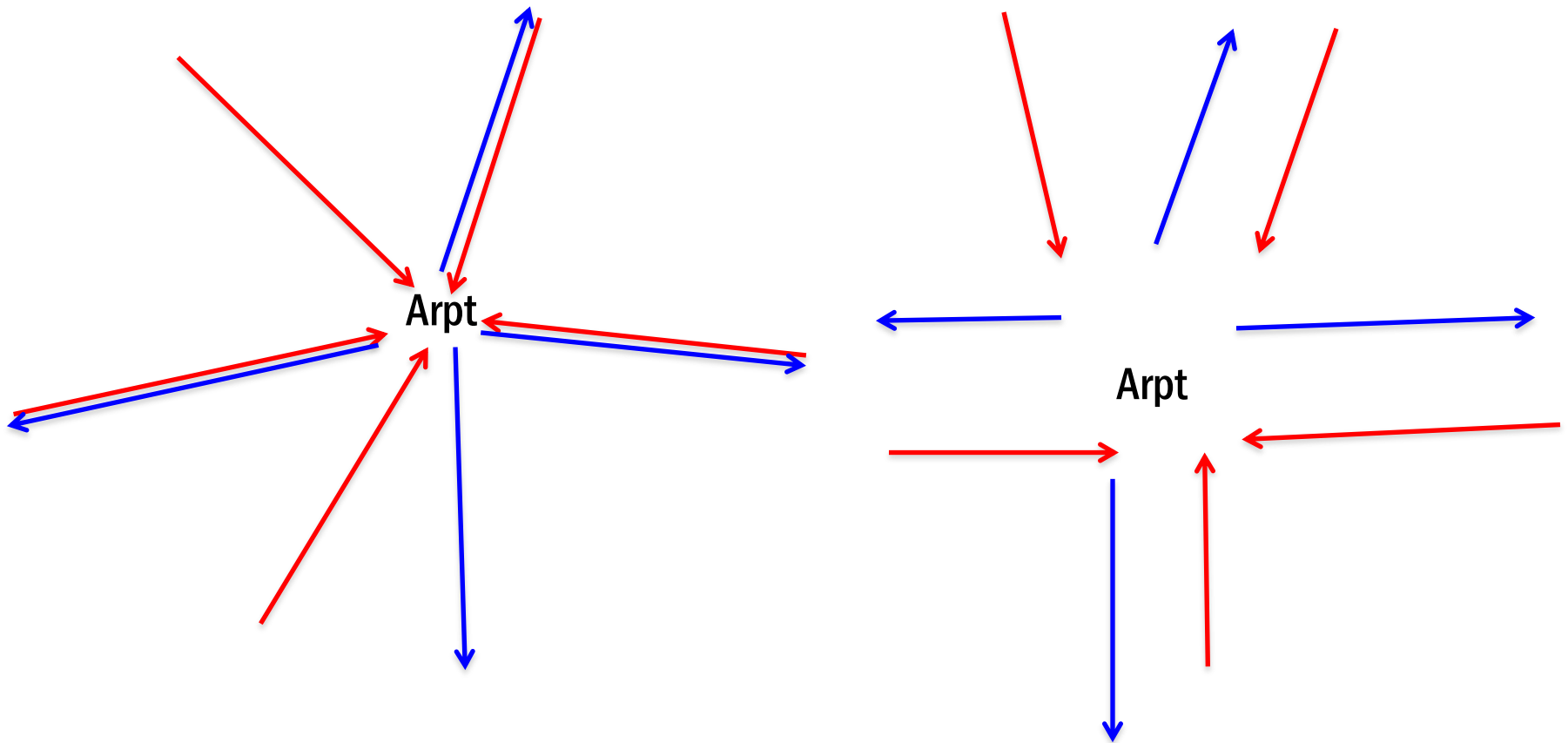
Design Considerations

- ❖ **Design by facts**
 - **Airport placement**
 - **Terrain**
 - **Optimum aircraft altitudes**
- ❖ **Facts drive LOA's not the other way around**
- ❖ **Determine ideal crossing altitudes/points–routes**
- ❖ **Start with shortest routes – least time in sector, adjust as appropriate**
- ❖ **Balance ATC intervention with distances required**
- ❖ **Consider links with conventional structure**

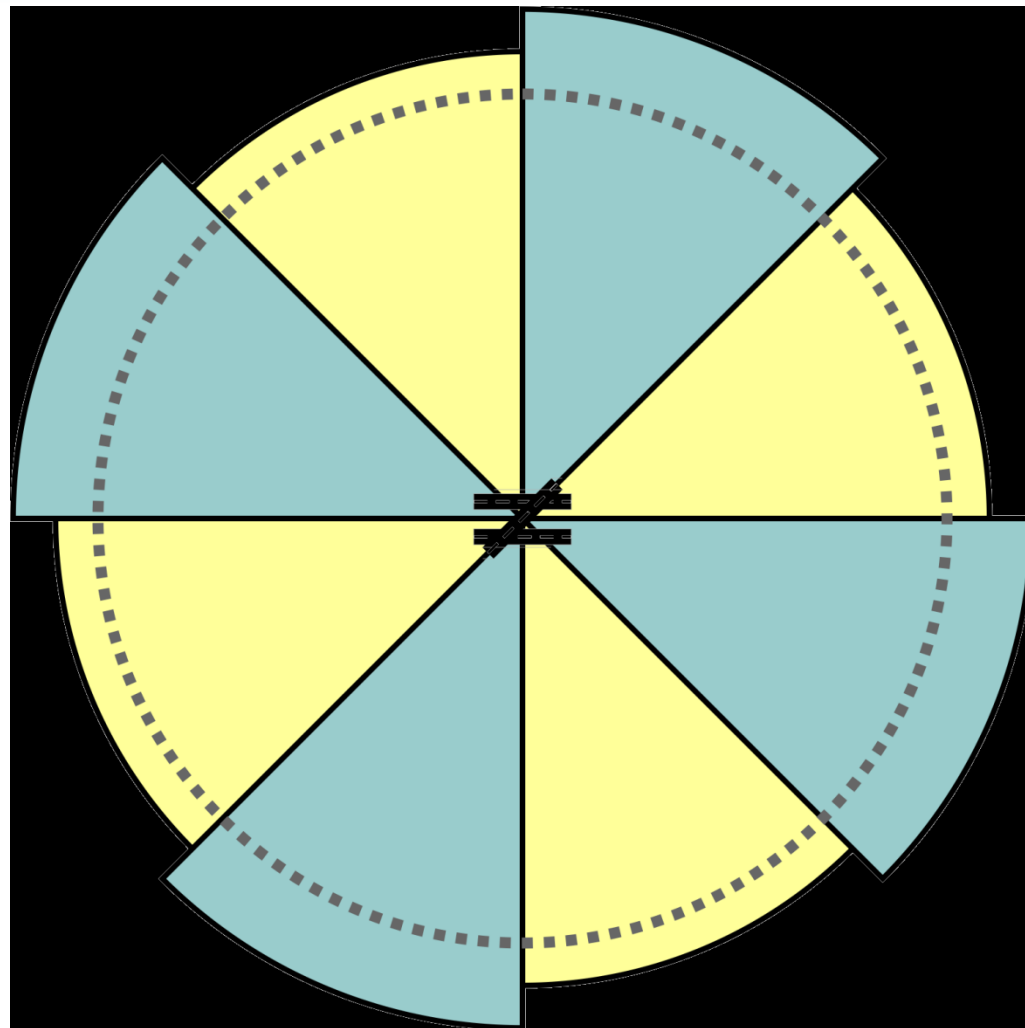
Design Considerations



NAVAID Centric vs PBN



Segregate
Arrivals and
Departures
Laterally
and/or
Vertically

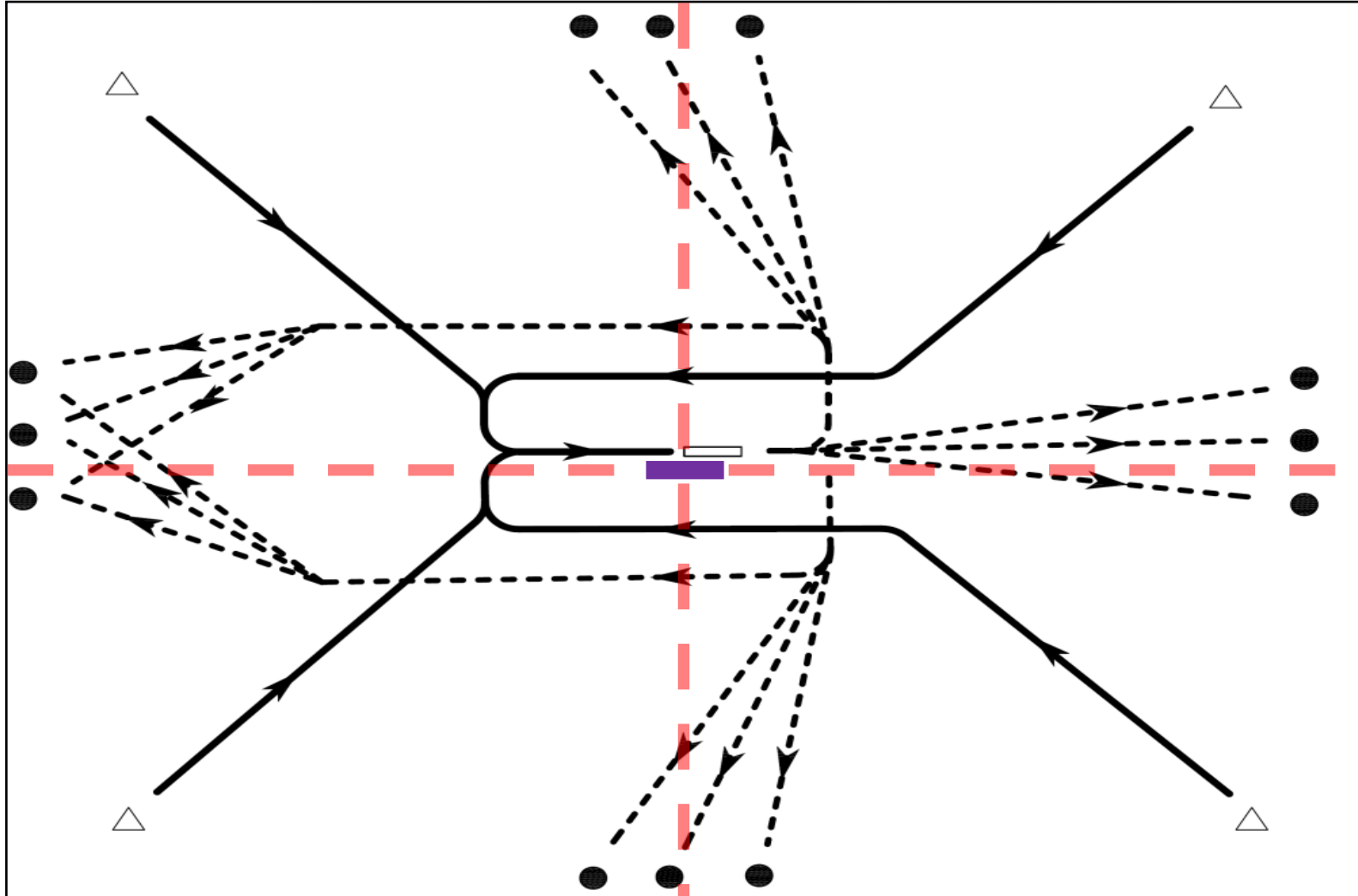


Good Design Practice



- **Four Corner-Post used for restructuring of ATS routes (SID, STAR) in many major airports;**
- **STARs directed to the four corners of the TMA and the SIDs exit at the midpoints of these routes.**

Good Design Practice



Good Design Practice



Generic CORNER-POST example:

Flows by quadrant

Helps segregate

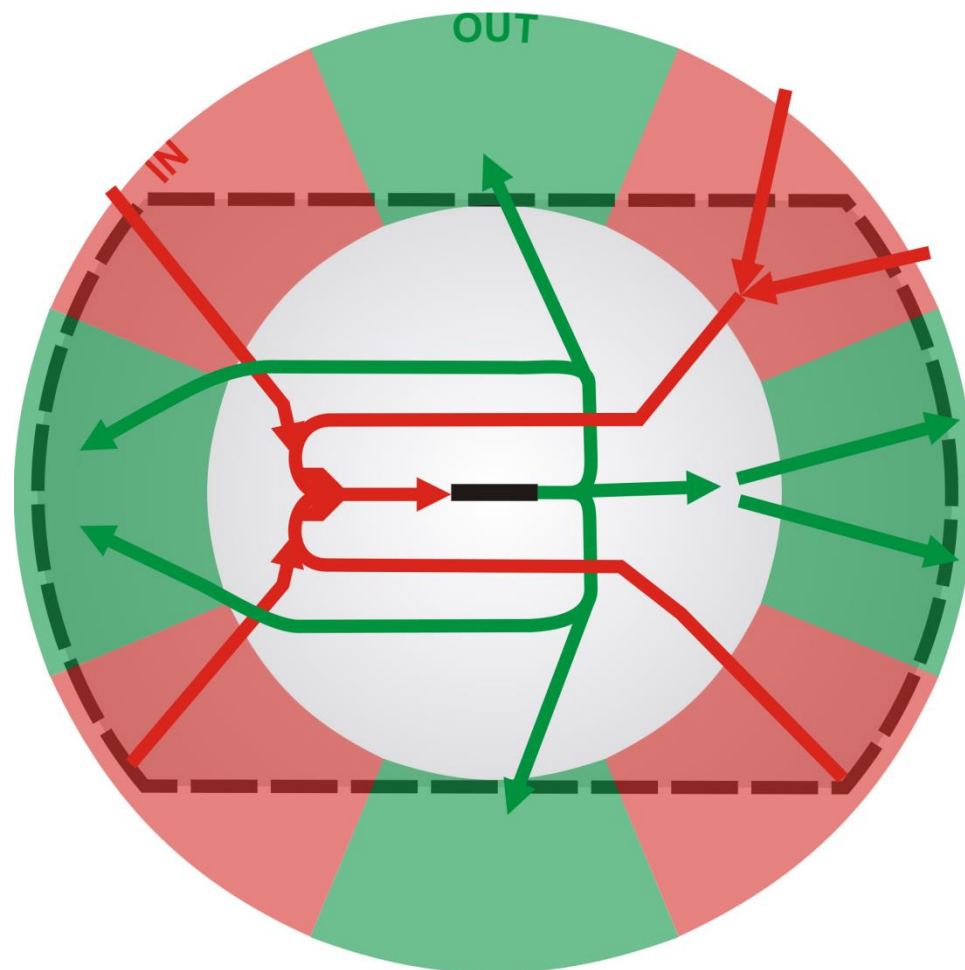
Arrivals

Laterally and/or

Vertically

From

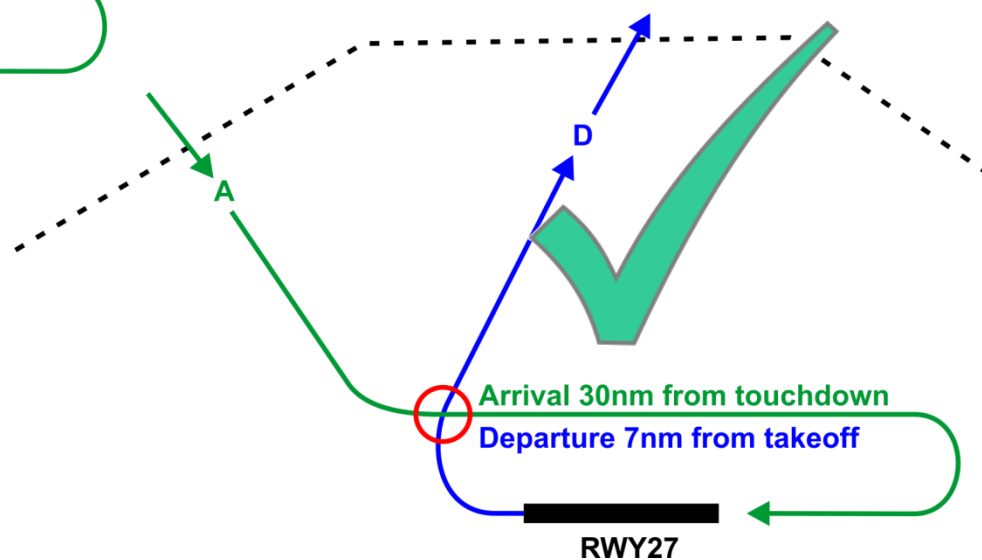
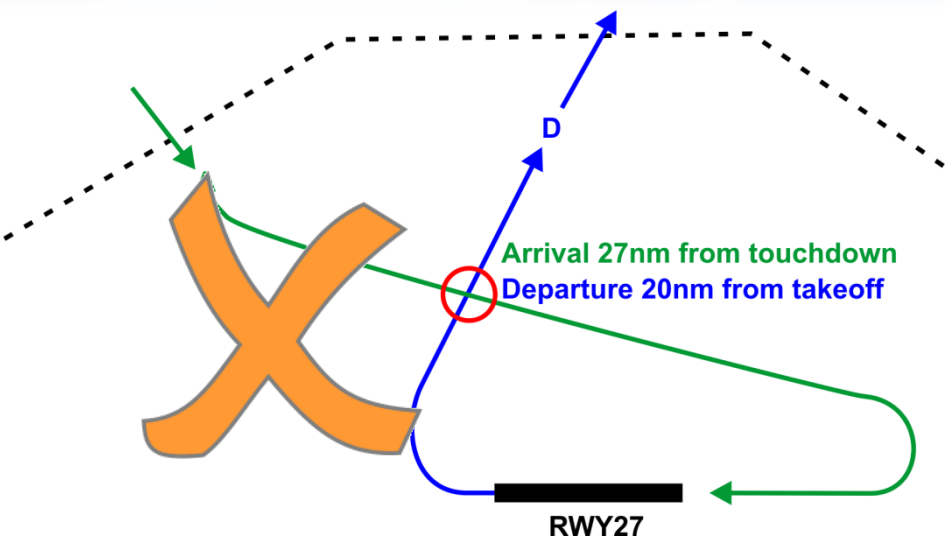
Departures



Good Design Practice



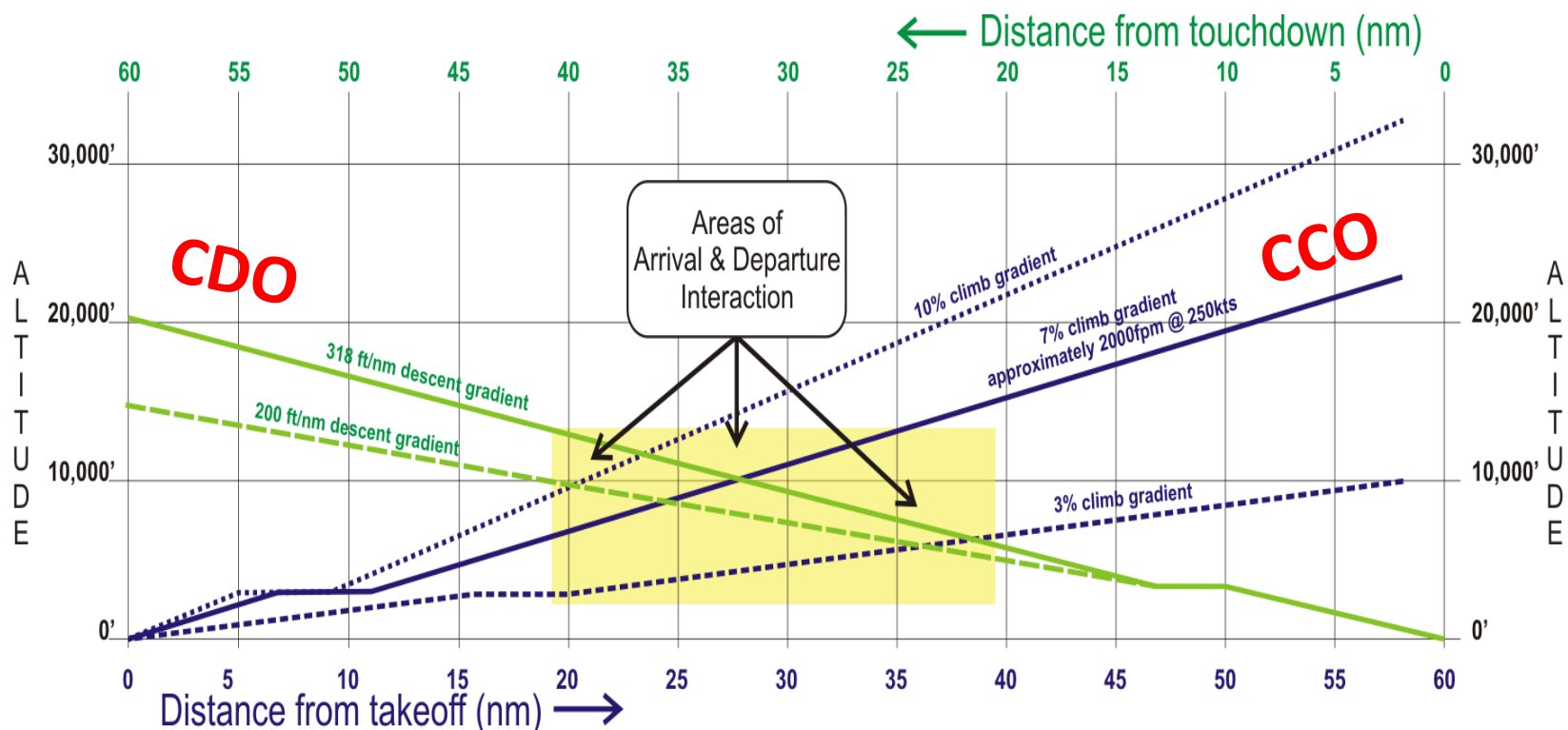
Plan crossover distances for efficient vertical separation



Good Design Practice

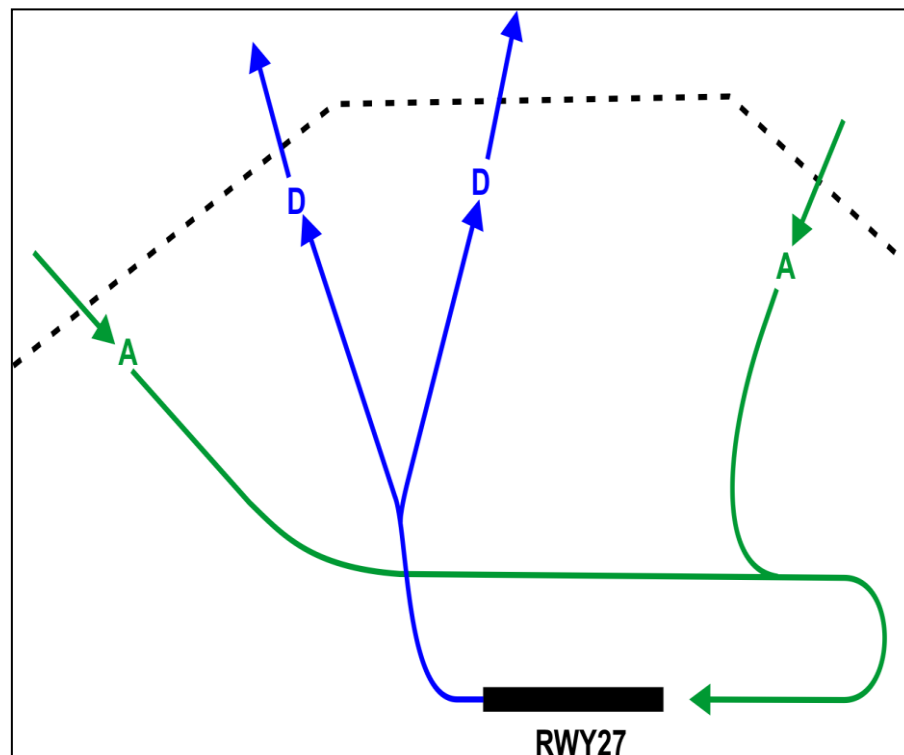
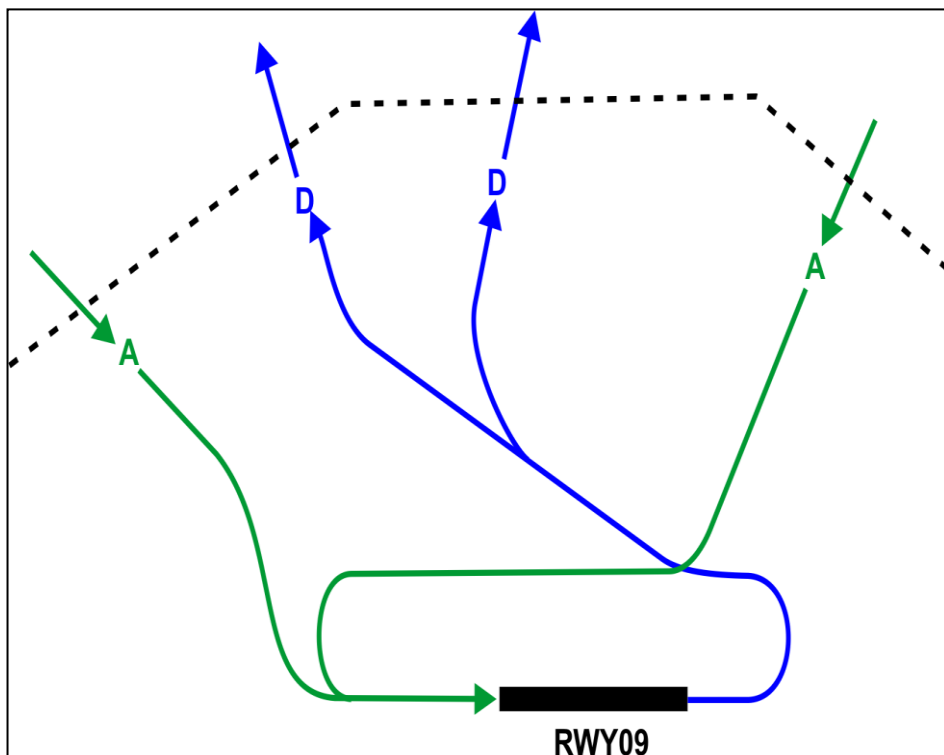


Plan crossover distances for efficient vertical separation



Good Design Practice

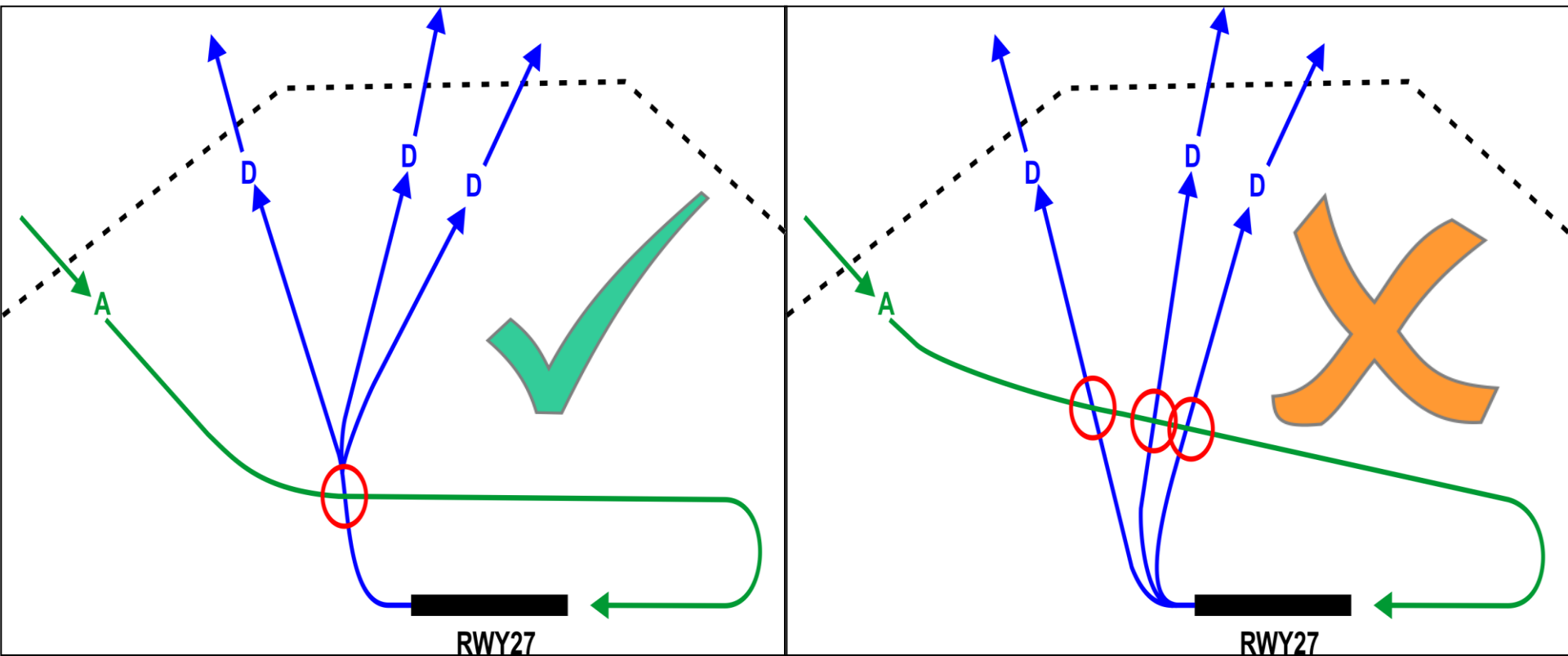
- ✈️ Fix the same **Exit/Entry** points for different **RWY** configurations
- ✈️ Handoff between **ACC and APP** the same with different **RWY** configuration



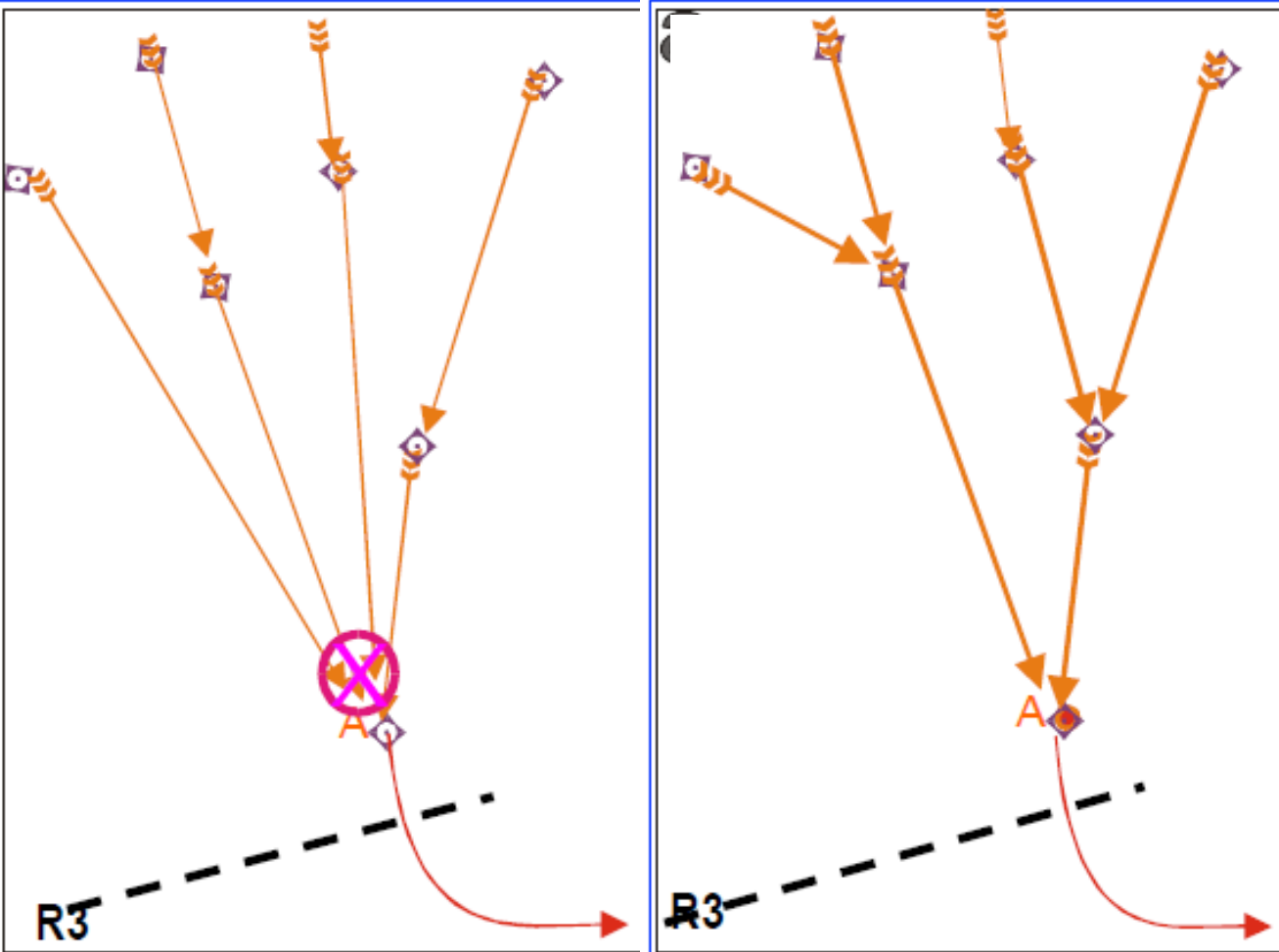
Good Design Practice



Minimise Crossing Complexity



Good Design Practice

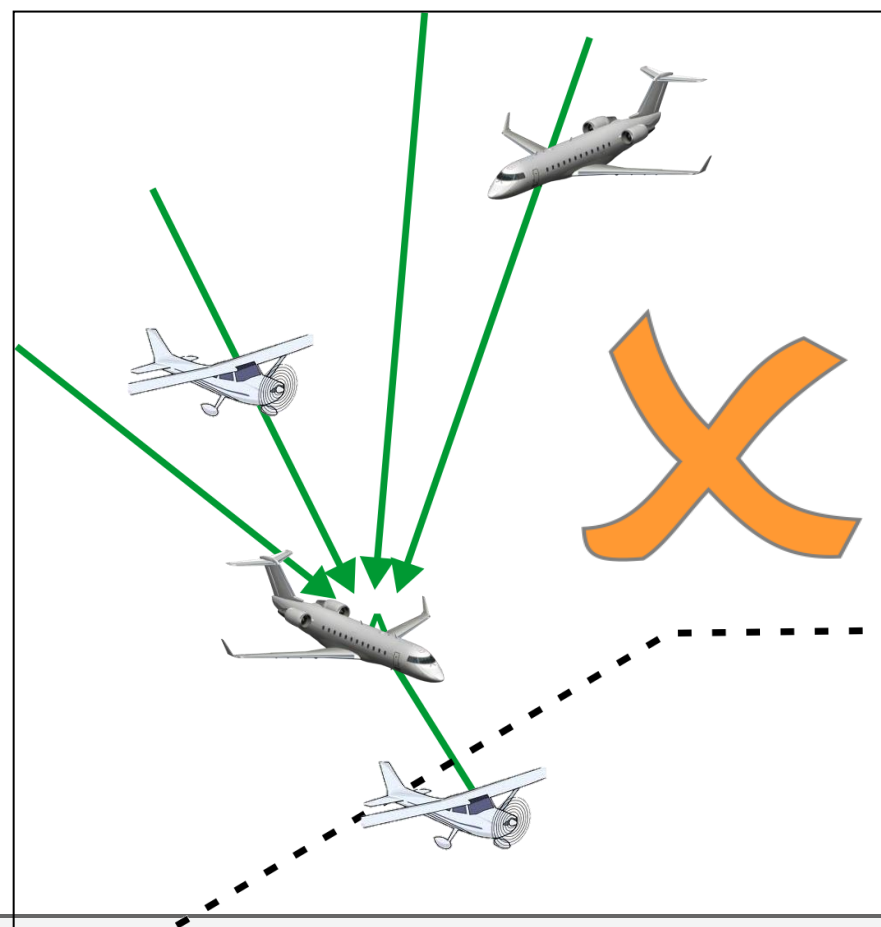
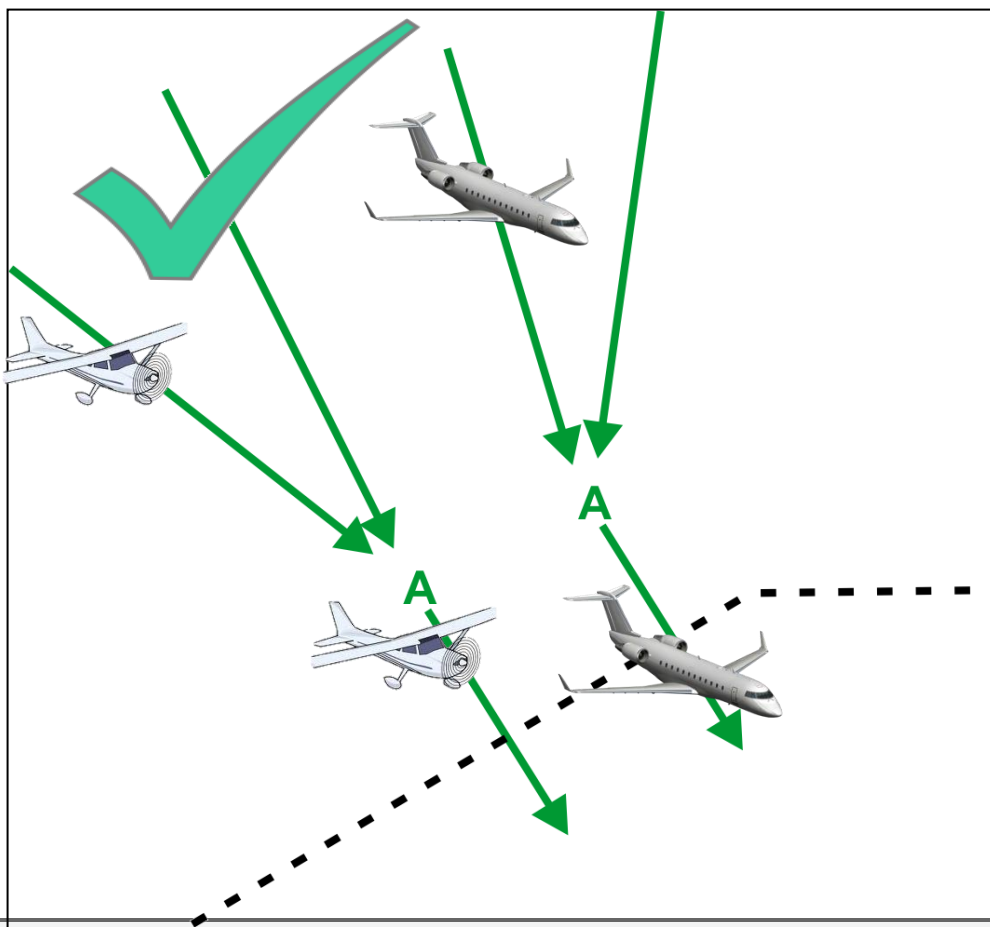


**Gradually
converge
inbound
flows**

Good Design Practice



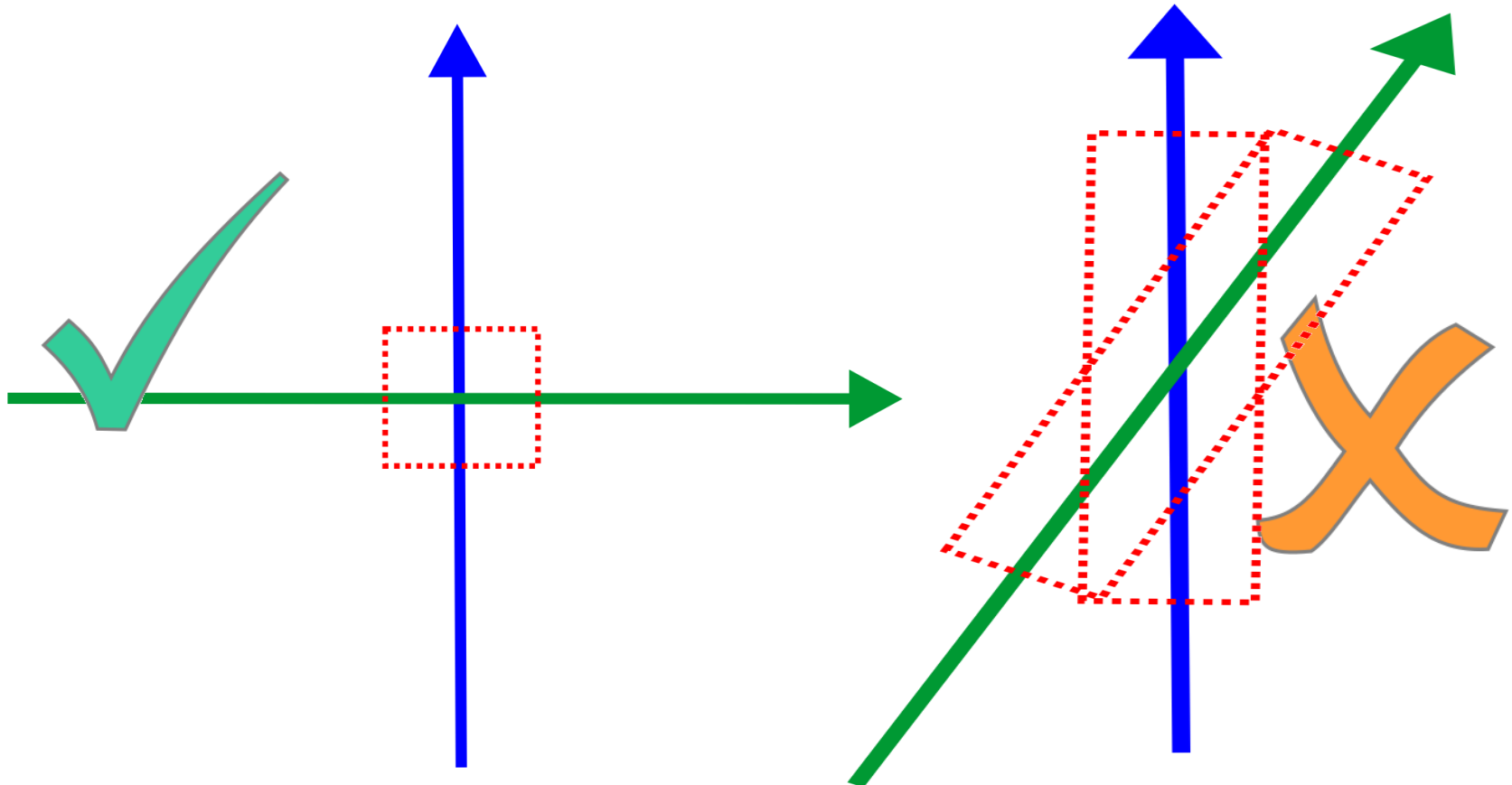
Group similar performance flows



Good Design Practice



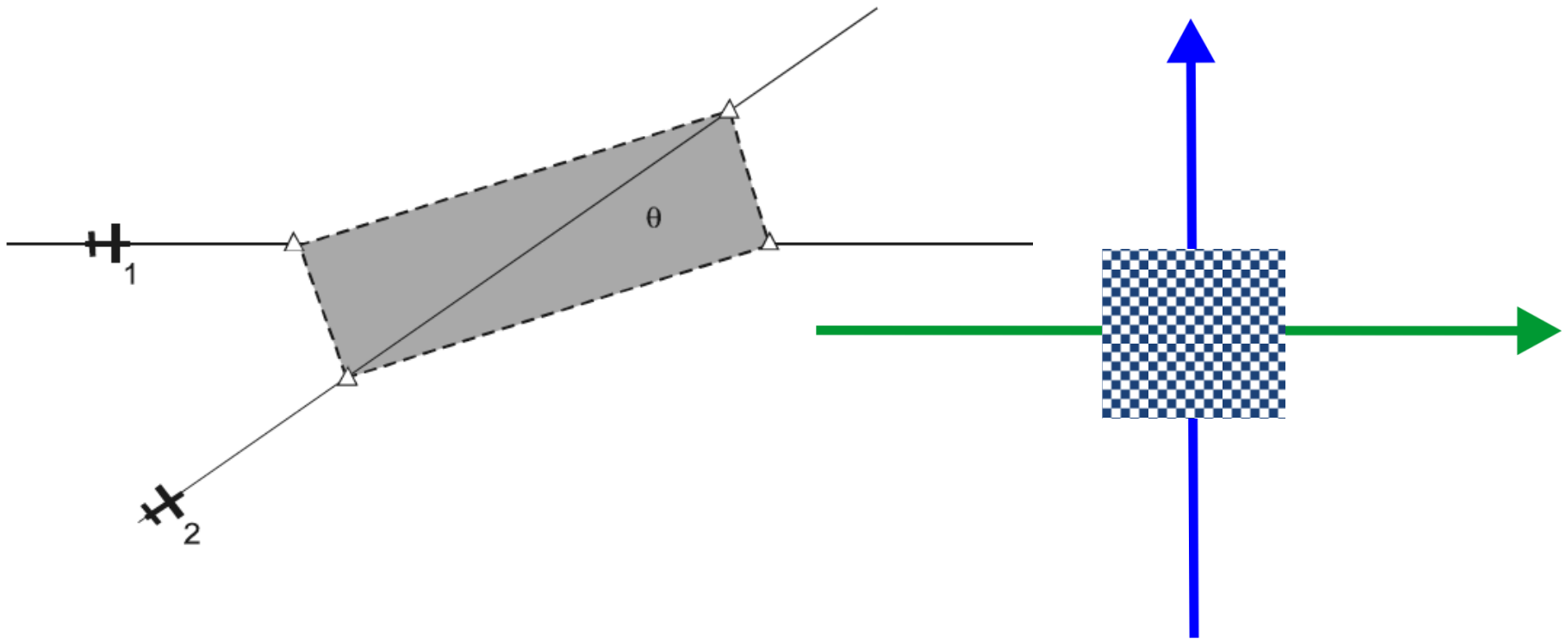
Minimise Crossing Interaction



Good Design Practice



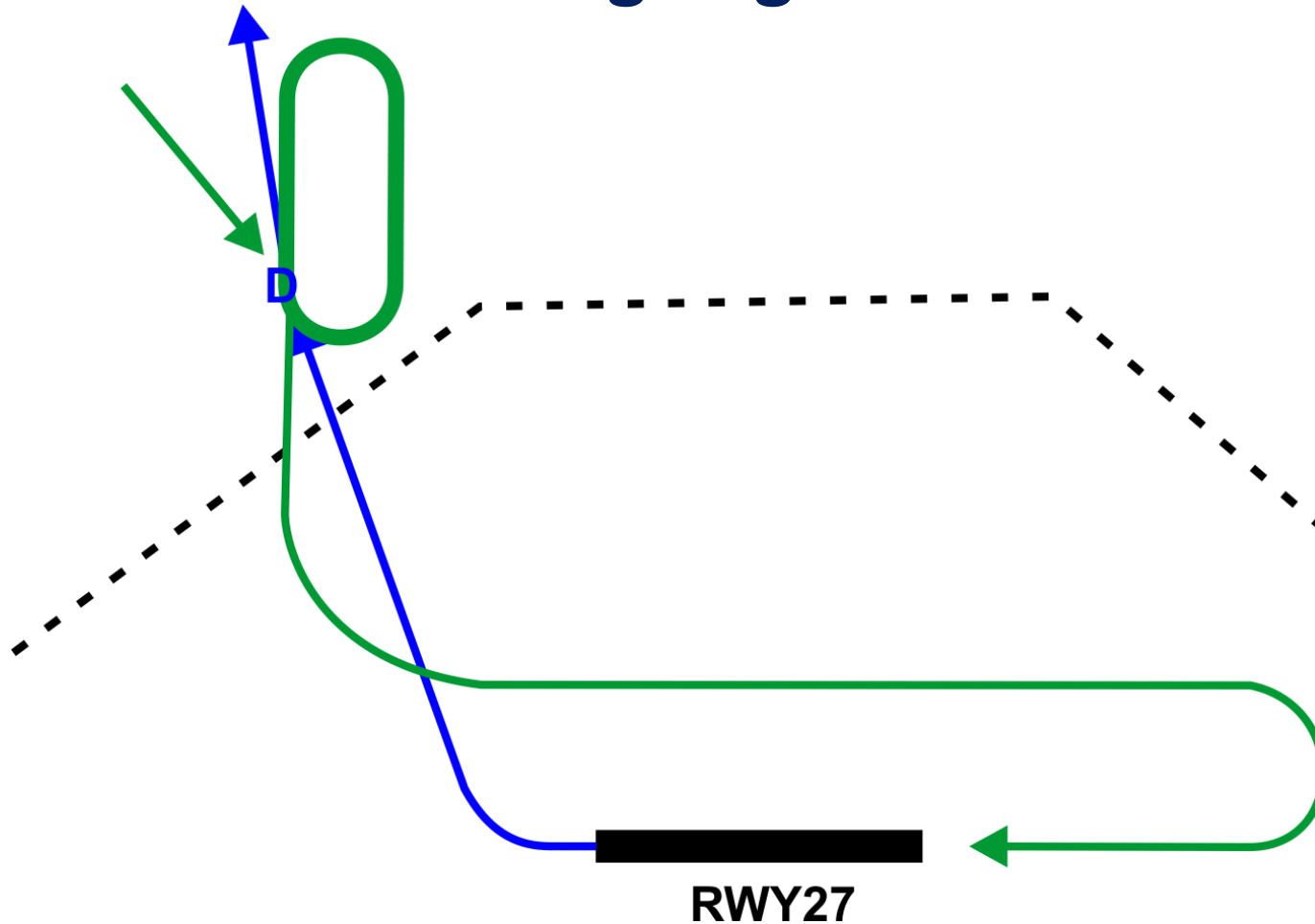
Minimise Crossing Interaction



Good Design Practice



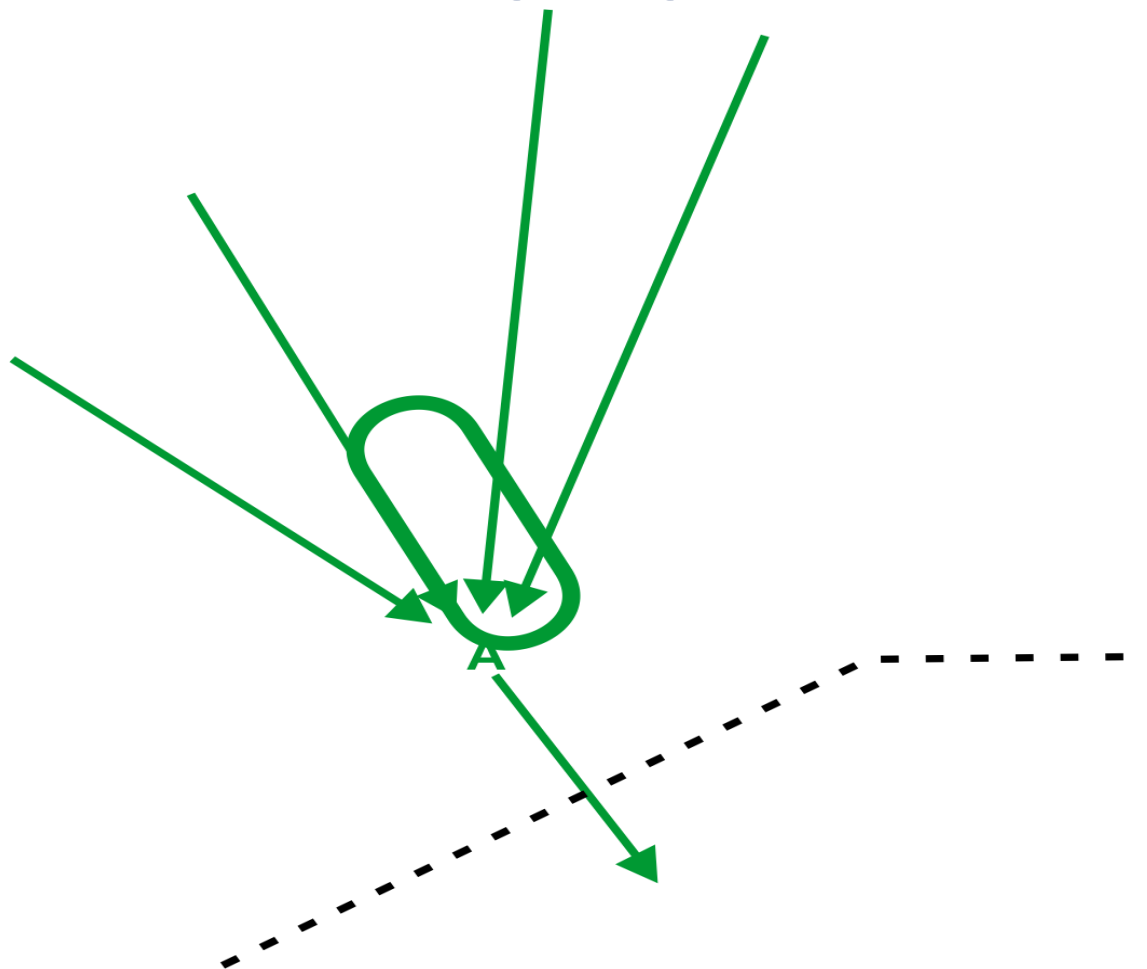
Designing Holds



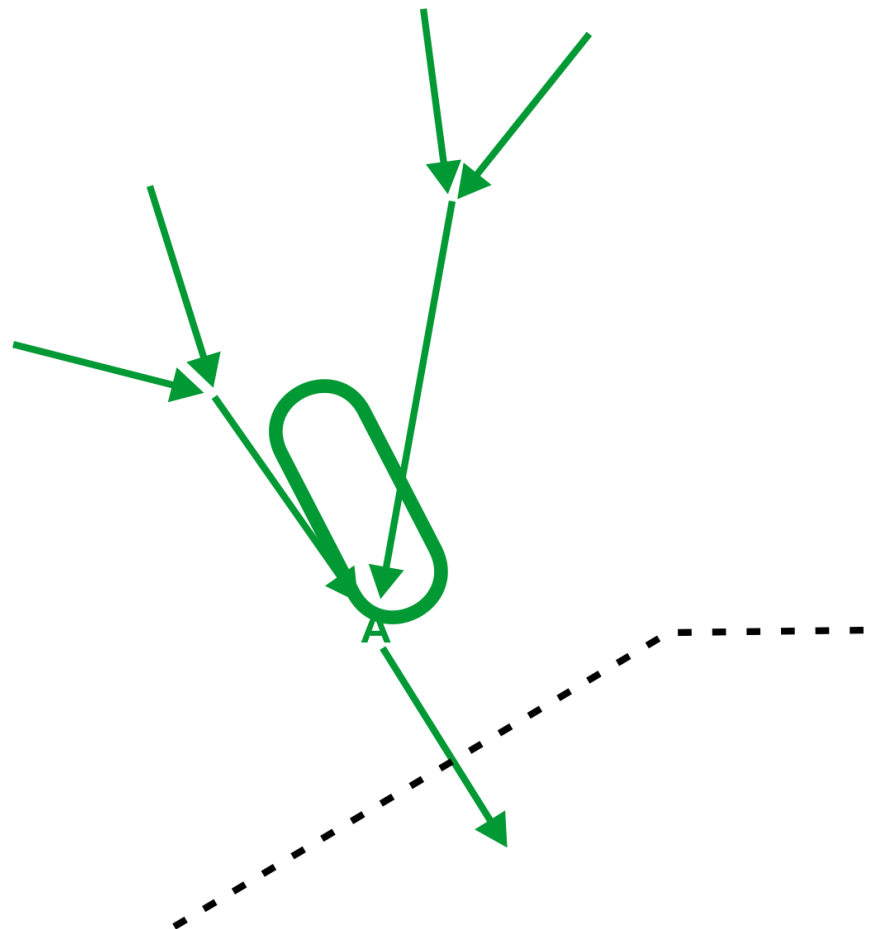
Good Design Practice



Designing Holds



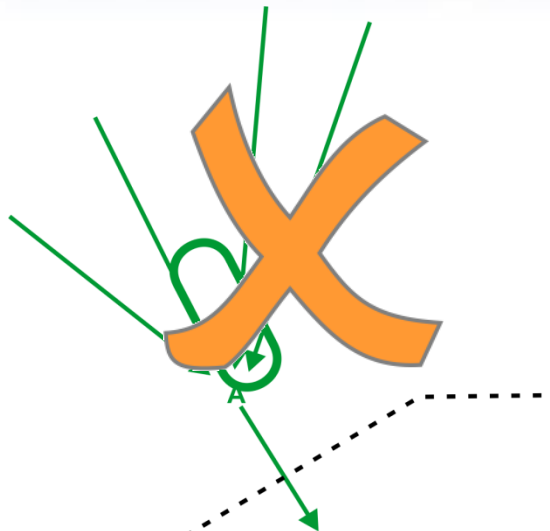
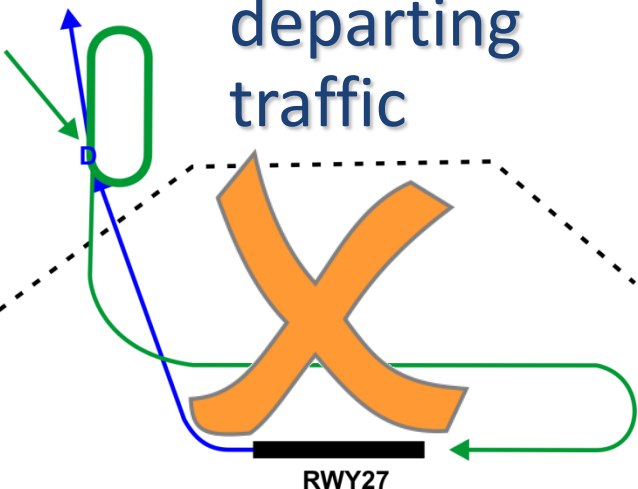
Designing Holds



Good Design Practice

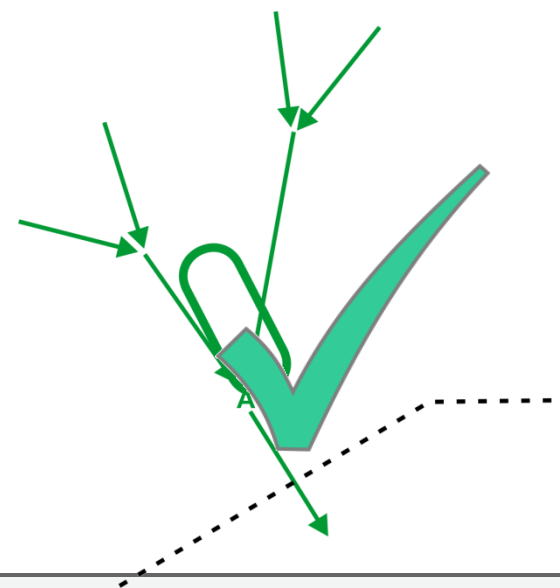
- Holding:

- Holding on exit fixes may block departing traffic



- Multiple merging at holding may be complex

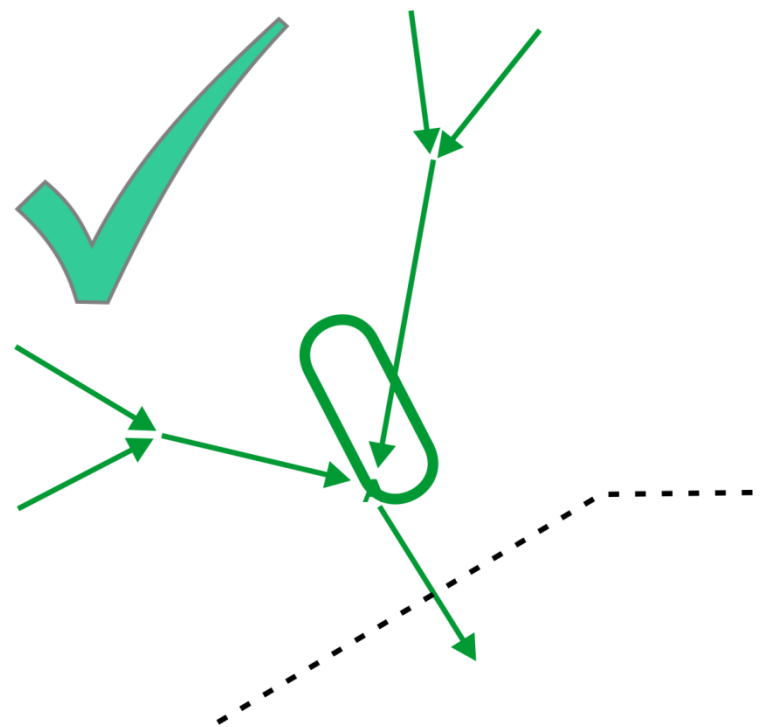
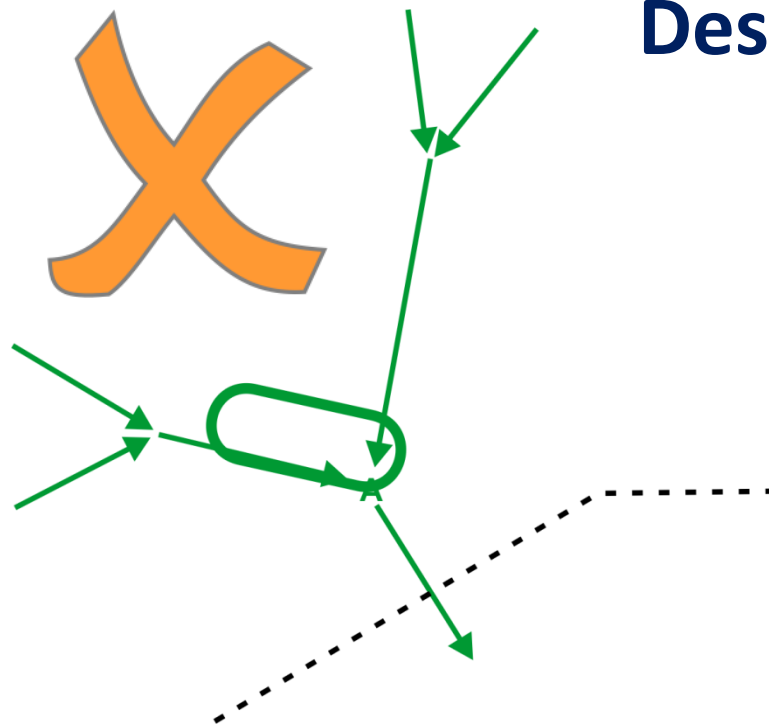
Designing Holds



Good Design Practice



Designing Holds

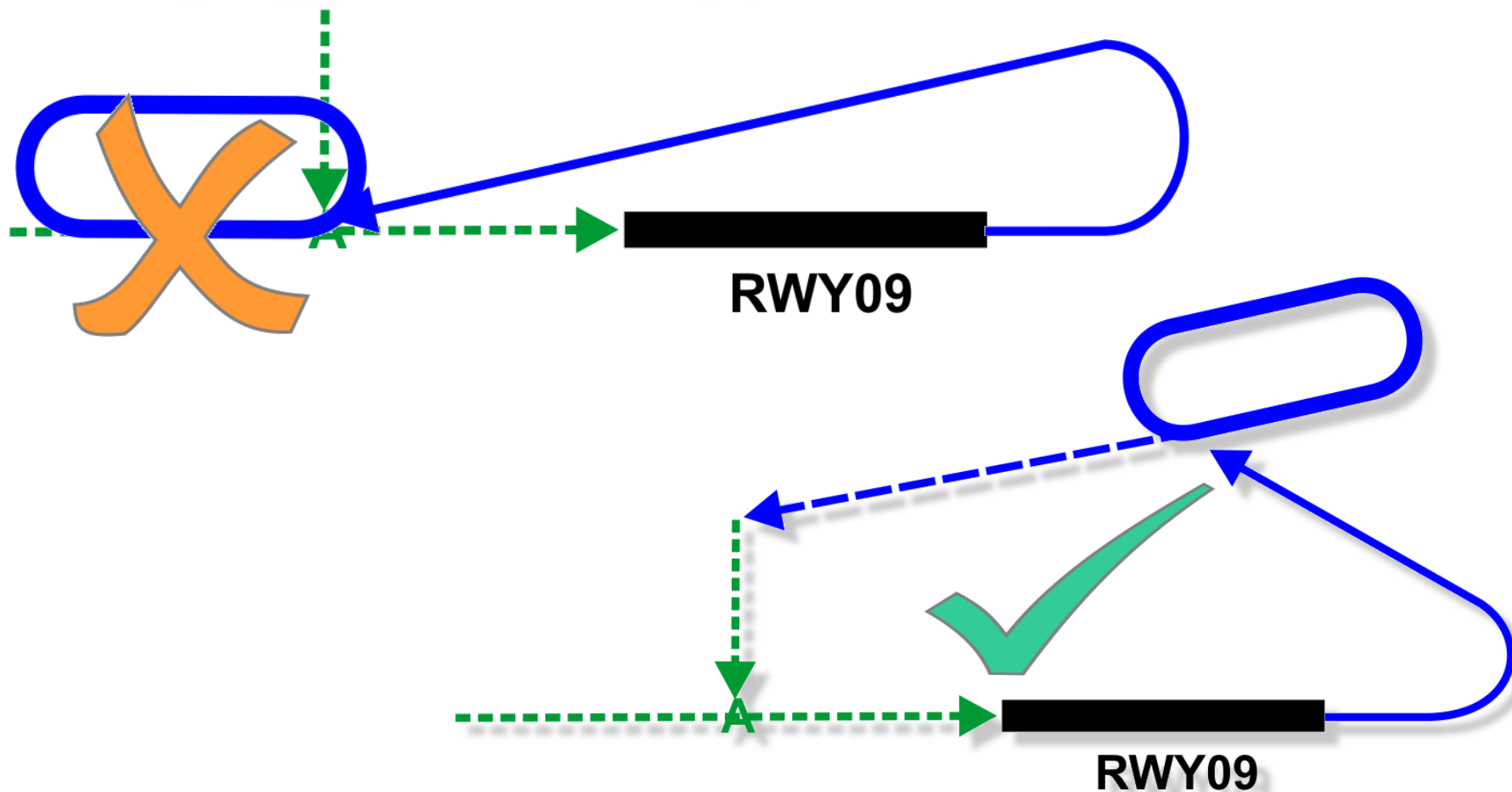


Align Holds with exit tracks

Good Design Practice



→ Segregate Missed Approach from Arrival Traffic

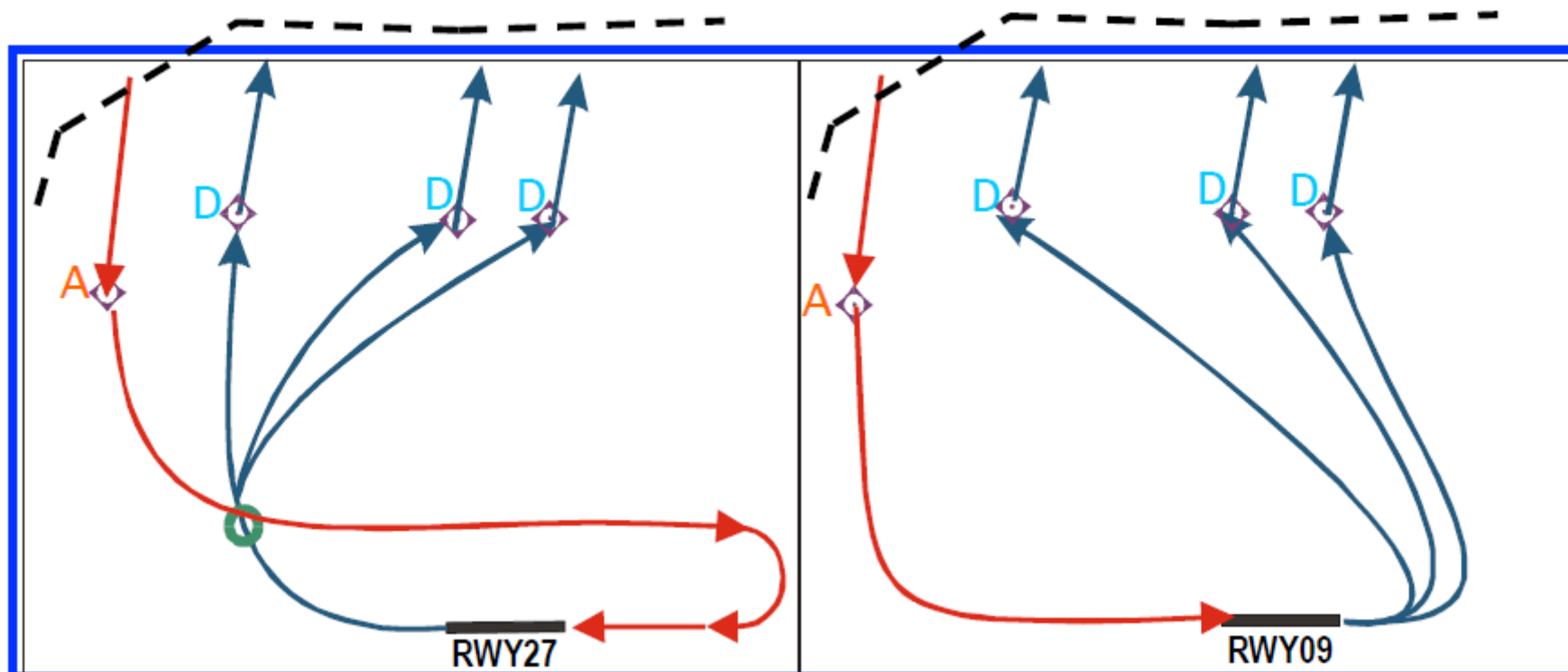


Good Design Practice



Fix the same Exit/Entry points for different RWY configurations

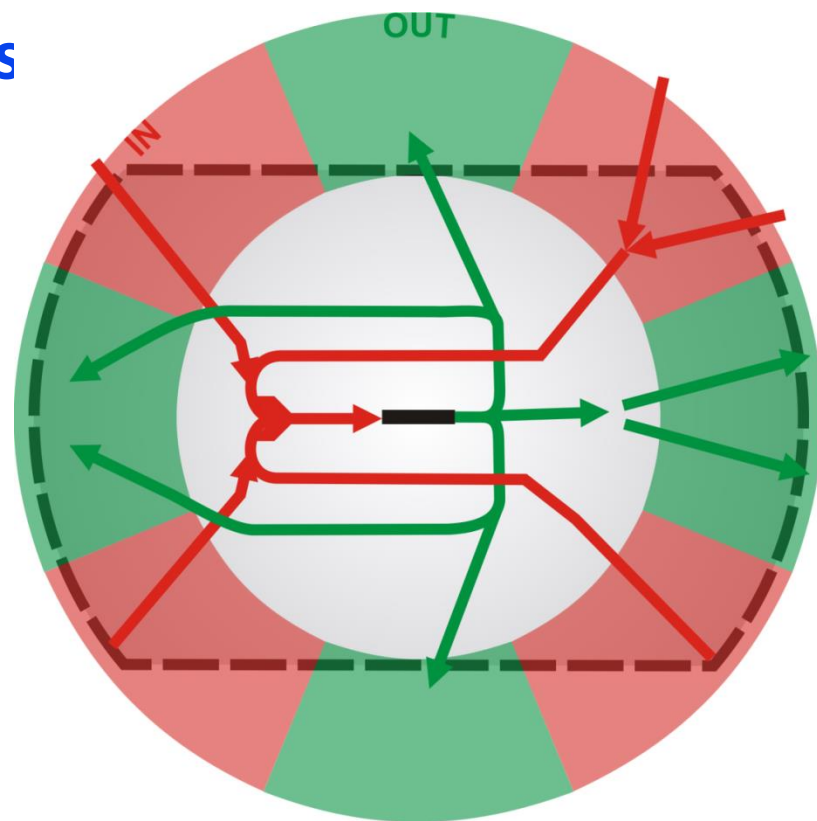
Handoff between ACC and APP should not change with RWY configuration



Good Design Practice Summary



- **Generic CORNER-POST**
- **Segregate Arrivals & Departures**
- **Segregate Entry and Exit Points that match for both RWY ends**
- **Crossing Complexity & Interaction**
- **Gradually converge**
- **Efficient crossovers**
- **Hold Placement and track**
- **Group similar inbound & Performance flows**
- **Sectorisation after route design**





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Dakar

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North Atlantic
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Questions?



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Thank You