



**Agenda Item 4                      Review of Task Forces Activities, CARSAMPAF and ALACPA**  
**4.5                      Report of the Airport Infrastructure Adequacy Task Force**

**TAXIWAY DESIGNS AND PROCEDURES TO MINIMIZE RUNWAY INCURSIONS**

(Presented by Captain Heriberto Salazar Eguiluz,  
 Vice-Chairman AGE Committee, IFALPA  
 and Rapporteur, George I. Legarreta, US FAA)

**SUMMARY**

The first report by the task force concentrates on minimizing runway incursions by recommending specific taxiway geometries, avoiding particular entrance taxiway designs that have shown a tendency for pilot confusion, and correctly using high-speed taxiways only as exits from a runway.

Section 1 provides the International Federation of Air Line Pilots Association’s (IFALPA) viewpoints on how and where airport authorities should construct taxiways to and around a runway. Besides their recommendation that operators of airplanes and vehicles use a common frequency and language while operating on the airside, IFALPA encourages the use of specific taxiway surface markings and signage relative to how taxiway are used by pilots.

Section 2 provides aerial views of various taxiway geometries where higher rates of runway incursions have occur by using the FAA Runway Safety Report titled: “Runway Incursion Airport Diagrams for 75 U.S. Airports, 1997-2000.”

This paper suggests that airport authorities should use the recommendations of section 1 for future taxiway construction and section 2 to reconstruct any existing taxiway entrances that resemble the illustrated taxiway geometries that are more prone to receive runway incursions.

<b><i>Strategic Objectives</i></b>	<i>This working paper is related to Strategic Objectives A and D.</i>
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**1.                      IFALPA Recommendations to Minimize Runway Incursions**

*Runway safety*

1.1                      At IFALPA we are convinced that the best way to avoid a problem such as runway incursions is to avoid crossing the runway, for which we have insisted that always, when physically possible, taxiways to and around a runway should be constructed following a design that avoids a runway intersection.

1.2 There are many good examples of airports where the design makes it possible to avoid crossing the runway through surrounding taxiways, such as the Denver International Airport. (figure #1)



*Figure #1. Denver International Airport*

1.3 In other cases, the taxiway geometric allows avoiding crossing runways such as the München Airport in Germany (figure #2) or Washington Dulles International IAD (figure #3).



*Figure #2. München International Airport*



*Figure #3. Washington Dulles International Airport.*

1.4 In both types of airports, where the design contributes to avoid Pilots or Air Traffic Controllers errors, safety statistics are very good.

1.5 Wherever THIS IS NOT POSSIBLE to be done, different procedures could be implemented to significantly contribute to the operational safety of an airport:

- IFALPA considers that always the order of the utilized nomenclature and standardization of signalling can positively improve situational conscious of the pilot while taxing at the airport (a document “naming” taxiways is being attached).
- Other tool to avoid errors is the “stop barrette”, which should be used 24 hours a day without considering the meteorological conditions existing in the airport. References: Annex 14 paragraph 5.3.19, and **Appendix B**, Figure 5-24, *Taxiway lighting*.
- The entrance to the runway should be done ONLY from perpendicular taxiways, preferably at the end of the runway. Likewise, when the crossing of a runway cannot be avoided, this should be done perpendicularly and at the runway extremes. If this is done, the possibility of error is minimized since at the runway extremes the speed of the aircrafts departing or landing is less; and if crossing is done at 90° with reference to the runway, the visibility from the pilot cabin is adequate for checking if there is no other traffic that can be affected.

- All aircrafts or vehicles that operate in the runway area should communicate with the Air Traffic Controller in the same frequency and, preferably, in the same language. This establishes another safety barrier, and in case someone makes an error that could risk safety due to the reduction of the minimum separation between two or more aircrafts or vehicles, this can be easily noticed.
- Once the advantages of crossing runways only at 90°-taxiways and in those protected by stop barrettes have been determined, rapid exit taxiways should be used only to EXIT the runways, likewise the use of this taxiways should be restricted using signs of “Entrance Forbidden” (figure #4).



*Figure #4. “Entrance Forbidden”*

- The difference between an inadequate design without safety barriers and another having the necessary measures to prevent an error to become an accident are relatively simple to implement. The collaboration of all parties involved, such as air traffic controllers, administrators, service renderers, and pilots, among others, is indispensable for a safe operation without mishaps.

#### 1.6 Summarizing and Figure #5.

- Standardize a mode and order for taxiways naming
- Runway crossing only at 90° and at end of runways
- Entrance to runways only in perpendicular taxiways
- All the operators in the runway area should communicate with the air traffic controller in the same frequency and preferably in the same language
- Continuous use of Stop barrettes
- Signals of Entrance Forbidden should be placed at the taxiways exit.



*Figure #5. Summarizing*

## 2. Collection of Various Taxiway Geometries to Avoid

2.1 In 2000 the US FAA issued a runway safety report titled: “*Runway Incursion Airport Diagrams for 75 U.S. Airports 1997-2000*” that identified the locations and types of runway incursions experienced at these airports, i.e., Operational Error [OE], Pilot Deviation [PD], and Vehicle/Pedestrian Deviation [V/PD]. Please see *Appendix C, Chicago Midway - Airport Runway Incursion Airport Diagrams for 1997-2000*. The diagrams in turn allow the reader to use Google Earth, Bird’s View, or other similar web based links to obtain “aerial views” to determine which “common” taxiway geometric designs, if any, experienced higher rates of runway incursions. *Appendix A* provides some aerial views for the various types of taxiway geometries listed below [sections 2.1 – 2.5] that incurred higher rates of runway incursions.

- “Y-shape” taxiway connectors that excludes high-speed exits;
- Crisscrossing high-speed exits with entrance taxiways;
- Excessive paved areas using multi-taxiway intersections;
- Extra-wide entrances and multi-taxiway intersections; and
- Dual use of asphalt and concrete at taxiway entrances.

## 3. Suggested Action

3.1 Members of AGA/AOP/SG take notice of these recommendations and avoid such geometric taxiway geometries.

**APPENDIX/APÉNDICE A**

*“Y-shape” taxiway connectors that excludes high-speed exits*

**SNA – Santa Ana/John Wayne Arprt**



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**SNA: Total 15 incursions**



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### SLC - Salt Lake City Intl Arprt



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## Partial Listing: Airports with Y-Shaped Taxiway Connectors

- STL [variant]: 1-PD, 1-OE; 1-V/PD, 2-OEs
- MEM: 1-PD
- LGB: Closed the Y-Taxiway/Rwy 6R/34L
- LGA: 1-PD, 1-V/PD; 1-PD; 2-OEs
- JFK: 1-PD
- FLL: 1PD; 1-PD, 1-OE, 1-V/PD
- DAB: 1-PD, 2-OEs
- CVG: 1-PD, 2-OEs - Now resigned
- BWI: 1-PD
- BOS: 4-PD, 2-OEs - redesigned
- SFO; HNL; DTW; DCA; CMH

*Crisscrossing high-speed exits with entrance taxiways*

**MKE**



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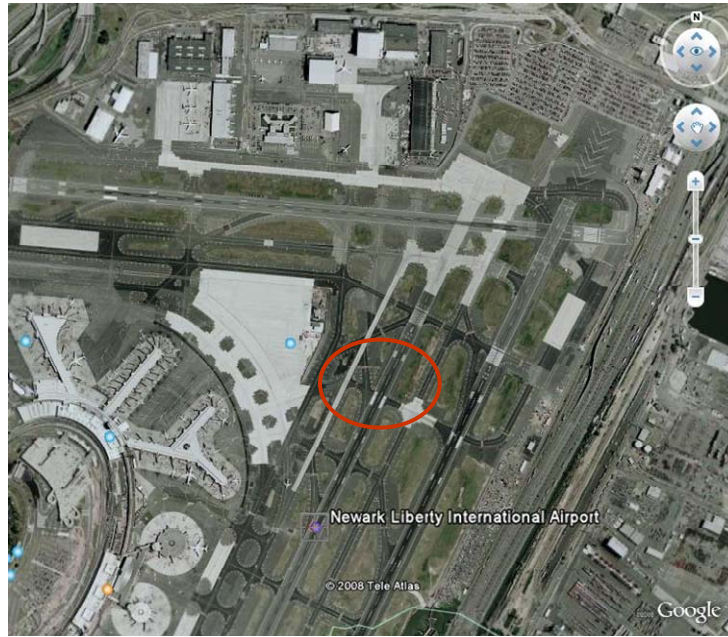
**MKE: 3-PDs**



Extra long holdline @ 277 ft + 90 ft – **HUMAN FACTORS**

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**ERW**



10

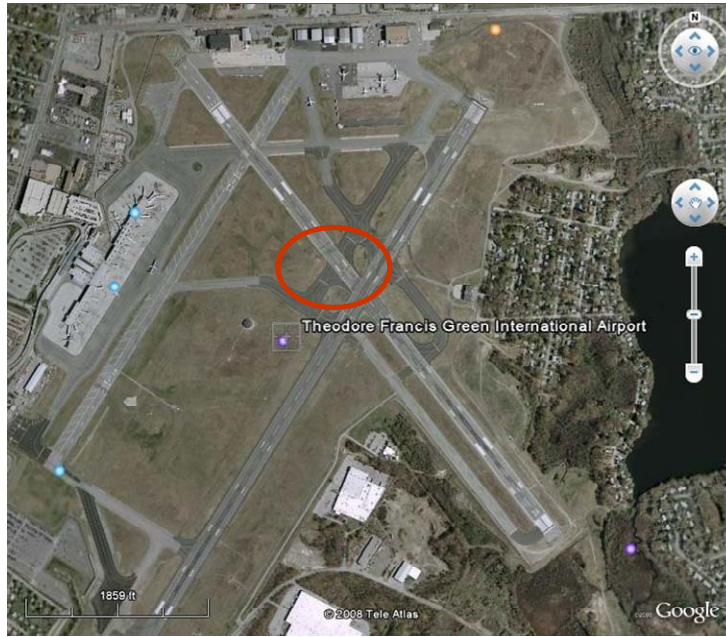
**EWR: 2-PDs, 2-OEs**



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*Excessive paved areas using multi-taxiway intersections*

**PVD**



17

**PVD: 2-PDs, 1-OE**



18

**BOS: 4-PDs, 2-OEs**



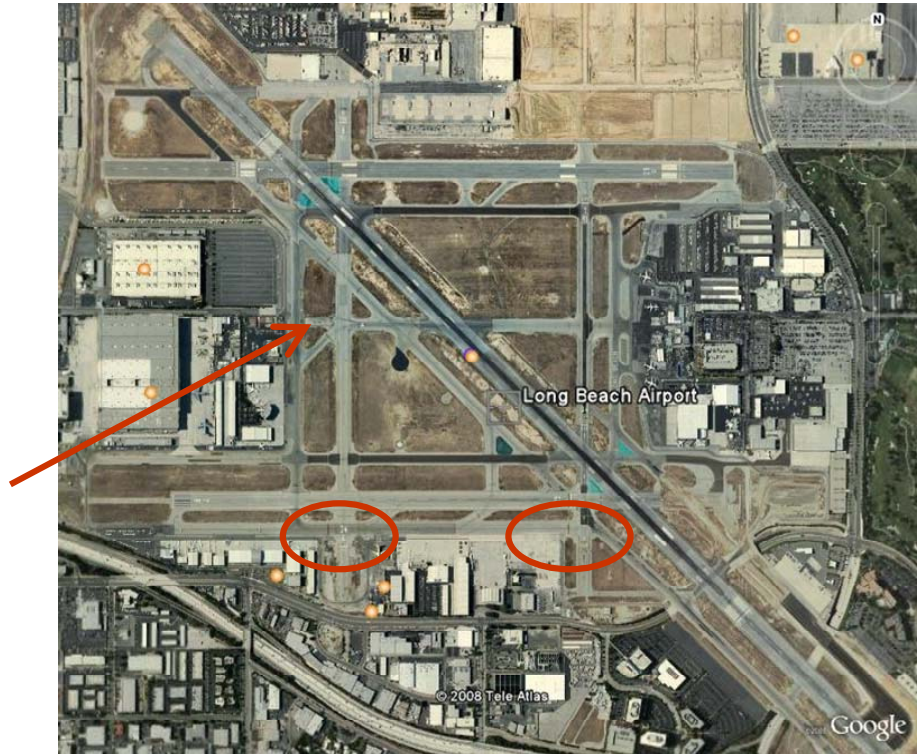
19

**CLE - 10-PDs + 3-PDs**



20

**LBG**



**LBG: 4-PDS**



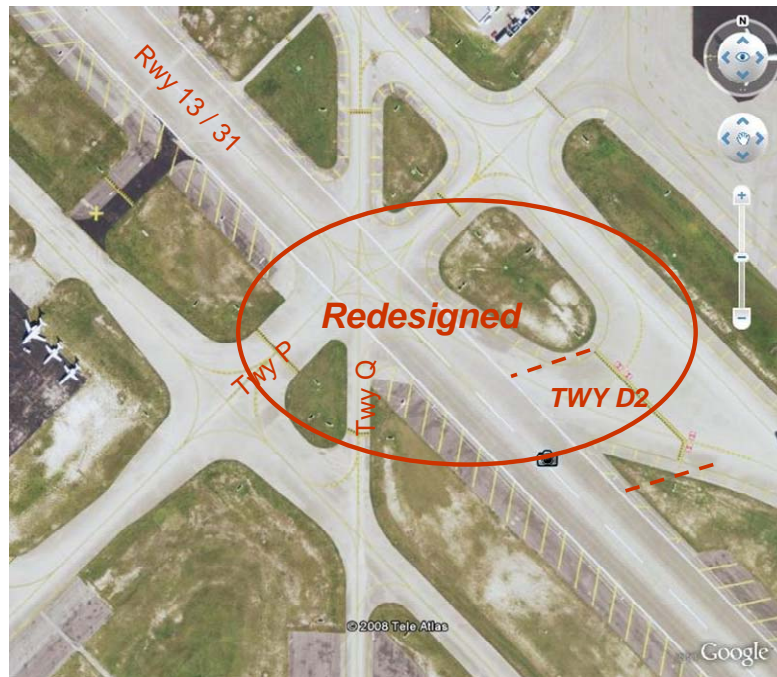
**TWY – Adjoining Aprons**

**LBG: 4-PDs, 1-V/PD**



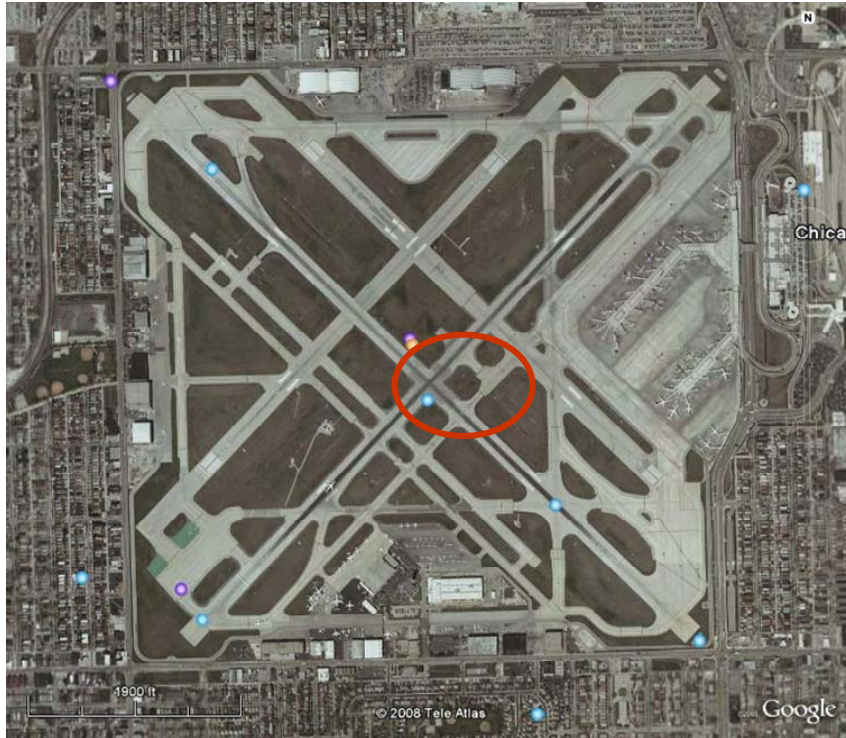
23

**FLL: 1-PS, 1-V/PD, 1-OE**



24

**MDW**

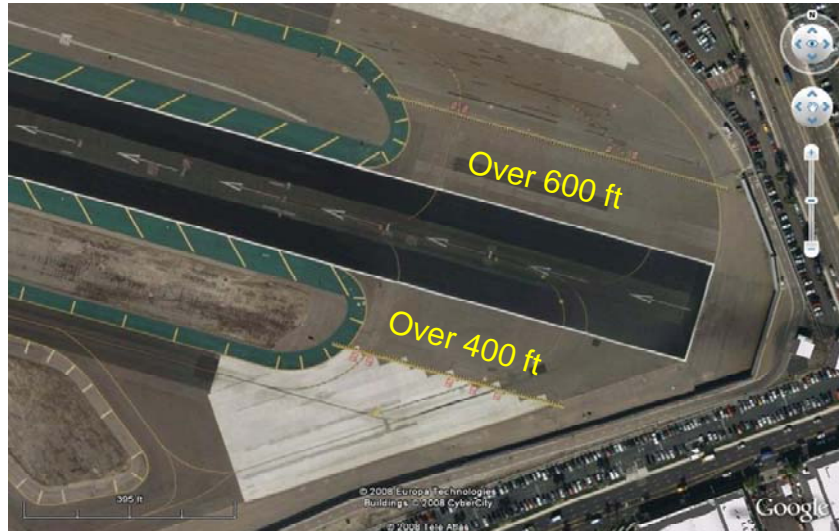


**MDW: 2-PDs, 3-OEs**



*Extra-wide entrances and multi-taxiway intersections*

SAN: 2-PDS, 1-OE



Lack of "GRASS ISLANDS". Hinders Vertical Signage  
MDW, LAS, IND, DFW, SBA

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STL

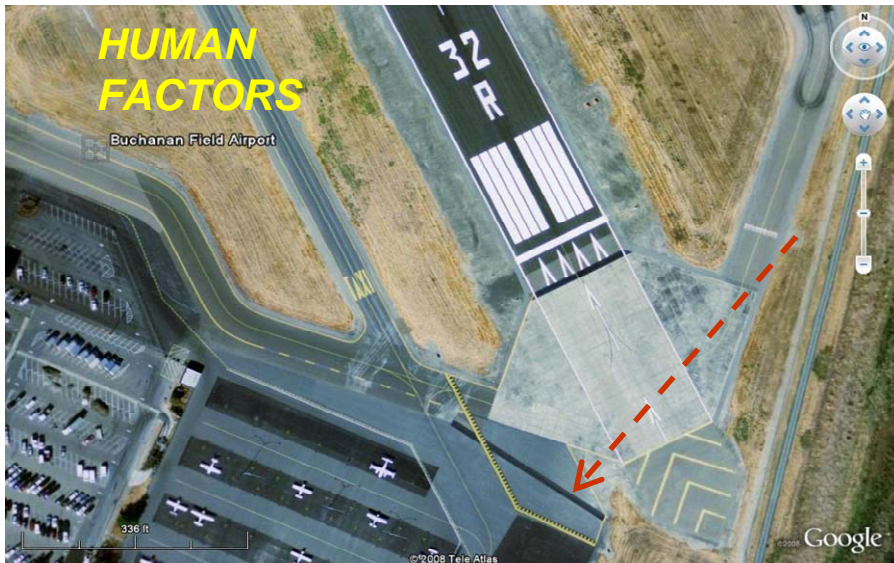


Extra Width of Entrance Approx. 1,200 FEET

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*Dual use of asphalt and concrete at taxiway entrances*

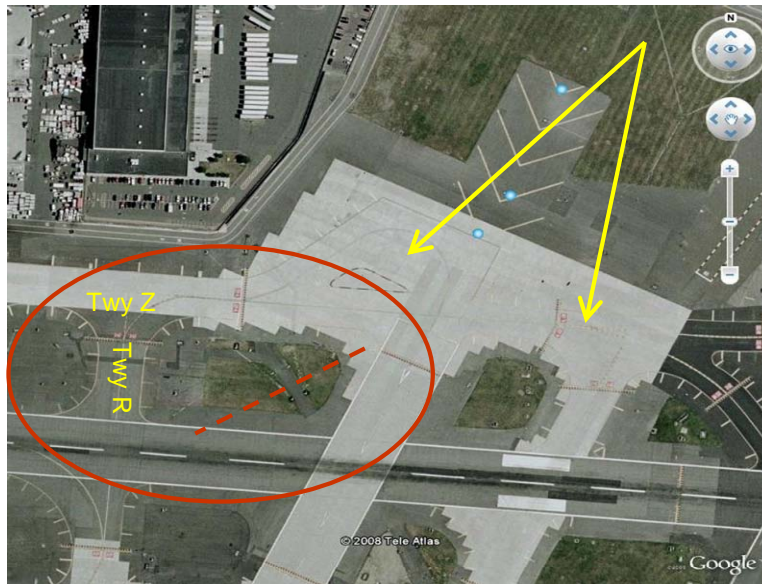
CCR: 5-PDs, 2-OEs



*Asphalt vs Concrete Why the "box" ?*

30

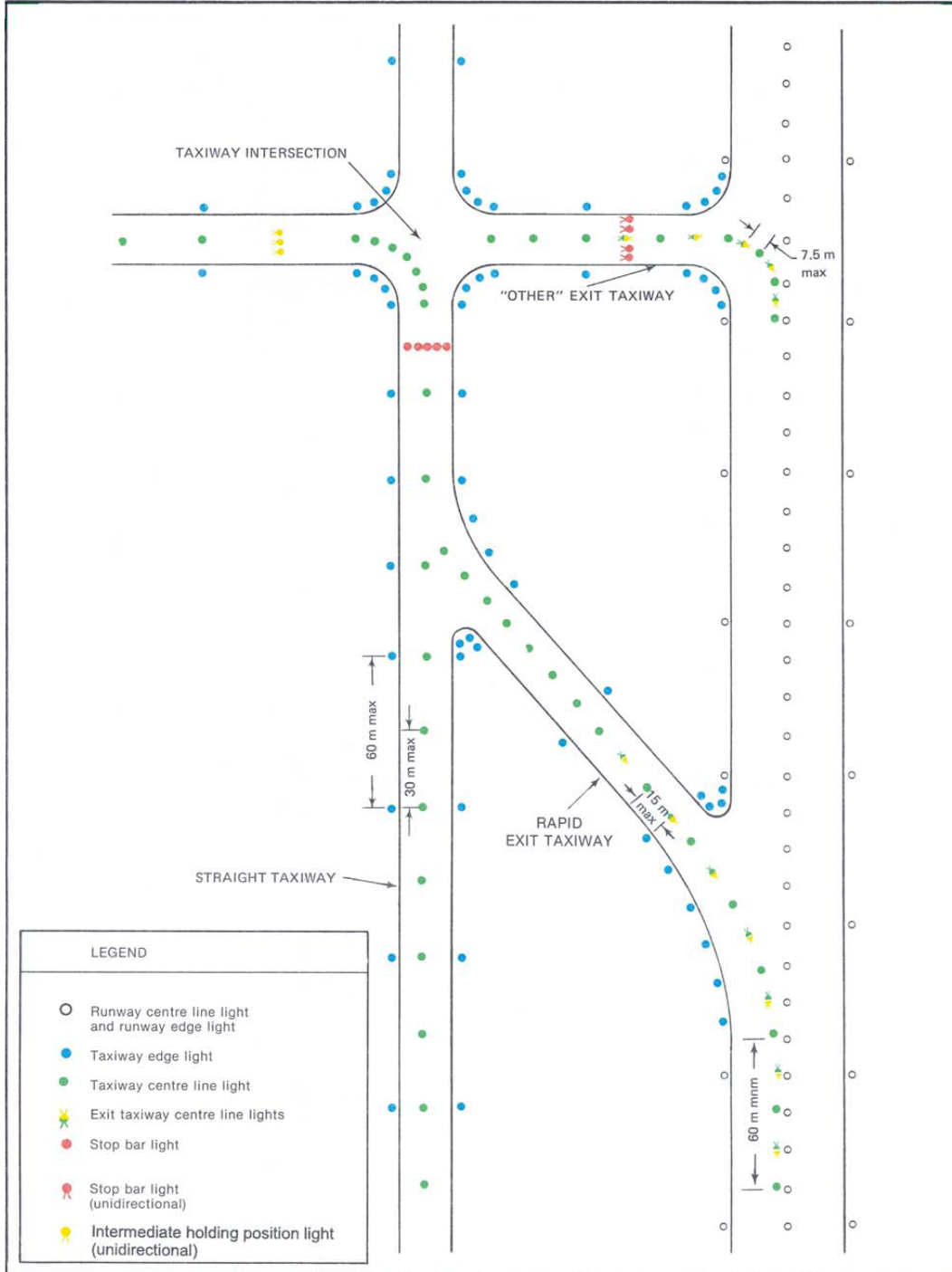
*ERW During Old Configuration - 5 PD, 1 OE*



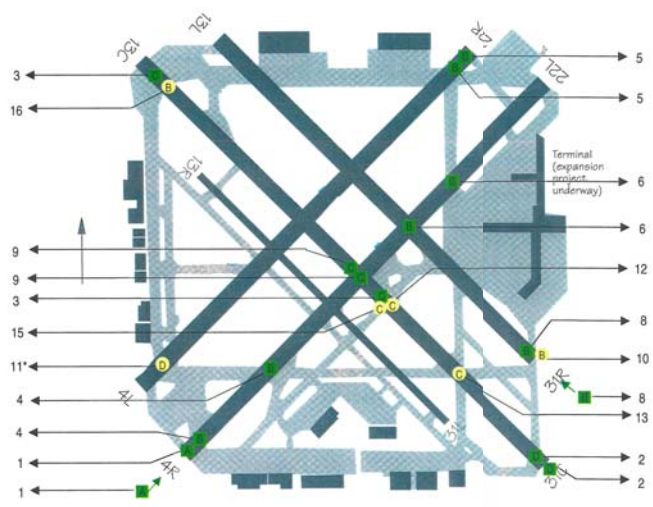
*Still Problems – Concrete/Asphalt Mixtures ?*

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**APPENDIX/APÉNDICE B**  
**Barras de Parada**  
**Anexo 14, Figura 5-24. Iluminación de calles de rodaje**



**APPENDIX/APÉNDICE C**  
**Chicago Midway Airport**  
**Runway Incursion Airport Diagrams for 1997-2000**



Key Locator	REPORT	RI Type	RI Category
1	MDWT-00-E-001	OE	A
2	MDWT-00-E-002	OE	D
3	MDWT-97-E-001	OE	C
4	MDWT-98-E-001	OE	B
5	MDWT-98-E-002	OE	B
6	MDWT-98-E-003	OE	B
7	MDWT-98-E-004*	OE	ID
8	MDWT-99-D-001	OE	B
9	MDWT-99-E-001	OE	C
10	PGLTMDW00001	PD	B
11	PGLTMDW00005**	PD	D
12	PGLTMDW97001	PD	C
13	PGLTMDW98001	PD	C
14	PGLTMDW99000P	PD	C
15	PGLTMDW99004	PD	C
16	PGLTMDW99005	PD	B

\* Insufficient Location Data  
 \*\* Insufficient data to determine exact location. Location estimated based upon available data.

Key	
○	Pilot Deviation
■	Operational Error
▲	Vehicle/Pedestrian Deviation

Note: For PD and VPDs, only the responsible aircraft or vehicles were plotted. However, for OEs both aircraft and/or vehicles were plotted.

— END/FIN —