

# A-B-C... it should be easy as 1-2-3!

## How to design a simple, safe and efficient taxiway designation system

by Gaël le Bris and Magali Kintzler

### Introduction

An airside where all users can find their way easily is a key issue to help improve the safety of the manoeuvring area and to reduce mental workload for pilots and controllers. The European Action Plan for the Prevention of Runway Incursions (EAPPRI) states that the inherent difficulties of communicating on the manoeuvring area mean that aerodrome design, visual aids and infrastructure naming conventions play an important part in reinforcing the intended instructions passed by the air traffic controller.<sup>1</sup>

The designation of the taxiways plays a major role in the airside safety. Taxiway naming should be simple, logical and intuitive as far as practicable. However, many existing airports have only grown through incremental development in recent decades and they do not always have a fully harmonised designation system.

Paris-CDG celebrated its 40th anniversary last year. From the opening of the airport in 1974 to the entry into service of RWY08R/26L in 1999, all the runway entrance and exit taxiways were designated by a single number: from 10 to

19 for RWY09/27 (the Northern runway now called RWY09R/27L) and from 20 to 28 for RWY08/26 (the Southern runway now called RWY08L/26R). The connecting and parallel taxiways were designated by adding a suffix to these numbers. For instance, "10" was rapid exit taxiway (RET) Y3. "10.1" and "10.2" were the name of the two segments of taxiway DA1 used just after "10" for joining Terminal 1. All the major taxiways not directly related to the runways were divided into portions – for example N1 to N13 were defined for each portions of the taxiways now called UNIFORM and CHARLIE.

1 - European Action Plan for the Prevention of Runway Incursions (EAPPRI),  
Appendix B – Guidelines for Local Runway Safety Teams, edition 2.0, ERSI, April 2011, page B5,  
<http://www.skybrary.aero/bookshelf/books/1862.pdf>

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These designations changed to letters and numbers on the South side when a second parallel runway was built along RWY08/26 in 1999. The taxiways on the North side changed in a similar way when a fourth parallel runway was built close to the former RWY09/27.

With subsequent developments of the airside and the expansion of Terminal 2, other particularities and exceptions appeared. We lost the simplicity of the initial plan. Many of the mnemonics to help controllers, pilots and the drivers of the movement area to precisely and easily locate themselves ceased to be valid. Consequently, it was time to change the entire designation system to a more coherent and simple format.



## Working together

A dedicated workgroup of representatives from the airport operator (Aeroports de Paris) and the ANSP (DSNA) was created to oversee the project. In parallel, meetings were held by each of these entities with their respective acting staff in order to involve all airside operations' stakeholders. In particular the airport operator included movement area drivers in these meetings. They are – a workforce which has a different perception and perspective of ground movements to that of pilots and controllers, and they must be taken into account in taxiway naming projects, especially at airports subject to winter conditions.

Pilots were involved in the project through their representatives on the Local Runway Safety Team (LRST). The general principles and then the modification of the runway exit taxiway naming were presented and discussed at LRST meetings. Details of the planned re-designation were then sent to the pilots and airline representatives participating in the LRST and the airport Safety Risk Management (SRM) processes for their comments and validation.

This collaborative approach is a good practice which met both European and national<sup>2</sup> recommendations.

## Keep it simple and logical

The first and main principle followed was to designate infrastructure elements in a logical manner that was instinctive to both pilots and manoeuvring area vehicle drivers, as recommended by the European Action Plan for the Prevention of Runway Incursions (EAPPRI)<sup>3</sup>. This approach can be summarised into the "keep it simple and logical" of the U.S. Federal Aviation Administration (FAA) in the Advisory Circular 150/5340-18F.<sup>4</sup>

2 - Dispositions relatives à la dénomination des voies de circulation sur les aérodromes, Notice d'Information Technique, DGAC/DSAC, édition 1, October 2012, p3  
[http://www.developpement-durable.gouv.fr/IMG/pdf/2-6-NIT\\_2012-10-23-Denominationvoies\\_de\\_circulation-Ed01\\_signee.pdf](http://www.developpement-durable.gouv.fr/IMG/pdf/2-6-NIT_2012-10-23-Denominationvoies_de_circulation-Ed01_signee.pdf)

3 - European Action Plan for the Prevention of Runway Incursions (EAPPRI), Appendix K – Aerodrome Design Guidance for the Prevention of Runway Incursions, édition 2.0, ERSI, April 2011, page K3, <http://www.skybrary.aero/bookshelf/books/1862.pdf>

4 - Standards for Airport Sign Systems, AC 150/5340-18F, Section 4 – Developing taxiway designations, August 2010, pp. 2-3  
[http://www.faa.gov/documentLibrary/media/Advisory\\_Circular/150\\_5340\\_18f.pdf](http://www.faa.gov/documentLibrary/media/Advisory_Circular/150_5340_18f.pdf)



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The other basics were the following:

- The numbering grows from the West to the East, and then from the North to the South.
- The letters I, O and X are not used for taxiway designation in order to avoid confusions with 1, 0 and crossing or closure symbols. This is an ICAO recommendation<sup>5</sup>, confirmed by the European Certification Specifications for Aerodrome Design (CS ADR-DSN)<sup>6</sup>.
- Two different taxiways cannot have the same name<sup>7</sup>.
- A same infrastructure element cannot have two names, except when it is a de-icing pad.
- An active runway entry taxiway cannot have the same number as that of the runway it connects with<sup>8</sup>.

These rules were applied on the movement area for naming the taxiways and apron taxiways:

- All major taxiways are designated by a single letter e.g.: A, B, Q, S.
- Subsidiary taxiways are designated by two letters and a number e.g. GE1.
- Links between two major taxiways are designated using the combined letters of the two taxiways plus a number. For instance, links between taxiways BRAVO and QUEBEC are designated BQ1, BQ2, etc.
- The taxilanes (taxiways serving an apron and only used for this purpose) are designated by letters and a number e.g. GE1. The main taxilanes are called by a single letter and a number e.g. E1.

Specific provisions were made for taxiways at the runway complexes due to the criticality of the vicinity of the take-offs and landings. These taxiways must be clearly identified for preventing runway incursions, but also runway excursions by differentiating the straight and rapid exit taxiways:

- The runway entry taxiways of the outer runway use a specific letter followed by a unique number for each one e.g. all the entry taxiways of RWY08R/26L are designated V + a number like – V1, V2, V3, etc.
- The same rule applies for the inner runways, but straight (entry) and rapid exit taxiways are designated with a different letter so as to distinguish them. e.g. the straight taxiways of RWY08L/26R are designated T1 to T12, and the rapid exit taxiways (RET) are named W1 to W6.
- In the case of straight (entry) taxiways, their designation begins with a letter which is the same as that of the first parallel taxiway they connect with e.g. the taxiways between SIERRA and RWY08L/26R are taxiways S1 to S9.
- The letters and the numbers used for the designation of the two continuous taxiways on each side of a runway are different.

Finally, this project provided an opportunity to remove unusual designations and deviations from extant standards and the best practices:

- The prefixes "Outer" and "Inner" were removed from taxiway ALPHA ("Inner ALPHA" became A3 in 2011). Coincidentally, this good practice became a European standard in February 2014 when the EASA issued the CS ADR-DSN6.
- Two non-continuous adjacent but different taxiways cannot have the same name<sup>7</sup>.
- All taxiways and taxilanes must have a designated name.

East-West oriented taxilanes are designated GOLF + a number when they lead northward to Terminals 2A to 2G, but designated PAPA + a number when they lead southward.

North-South taxilanes are designated using FOXTROT + a number.

Intermediate holding points (IHP) are designated as TANGO (like "Terminal" or "Traffic area") + the letter of the apron in their vicinity + a number e.g. TA1 and TA2 when entering and exiting apron ALPHA.

When an intermediate holding point is located on a short taxiway, this taxiway takes the name of the IHP.

A de-icing area has the name of the cardinal point of the airport where it is located (NW, NE, SW, SE) or the apron where it is collocated (ROMEO or JULI-

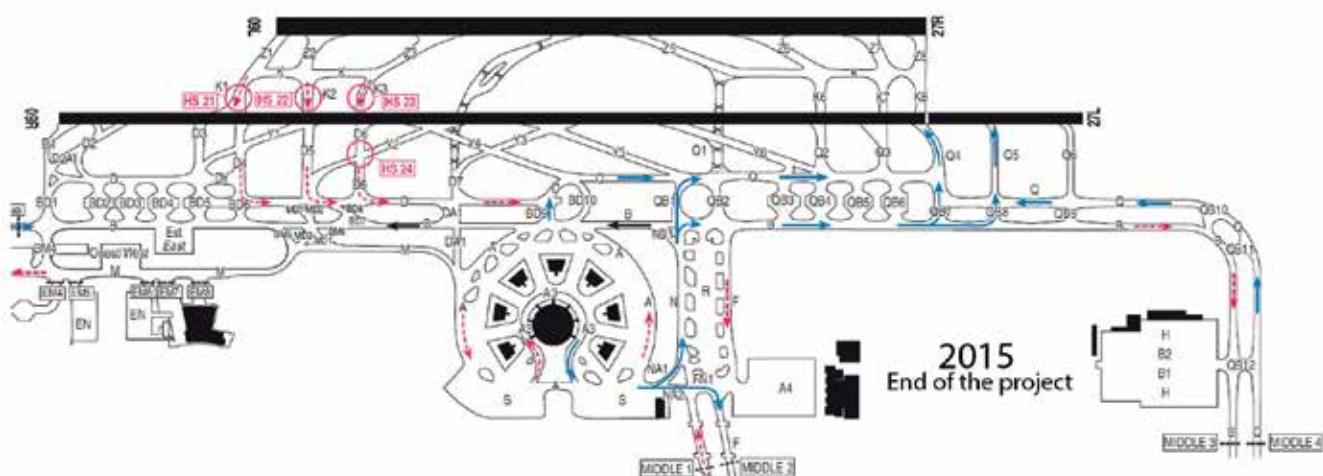
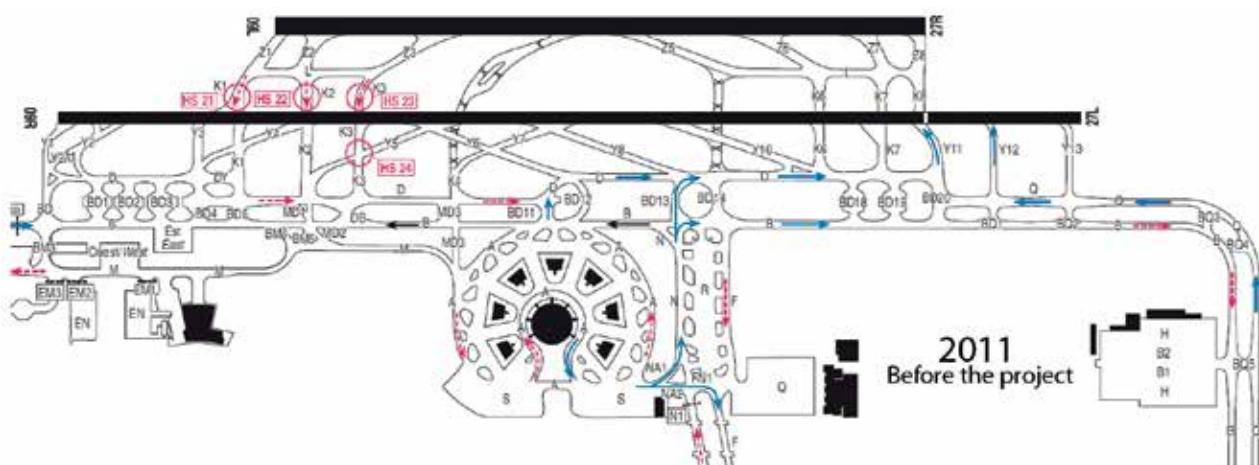
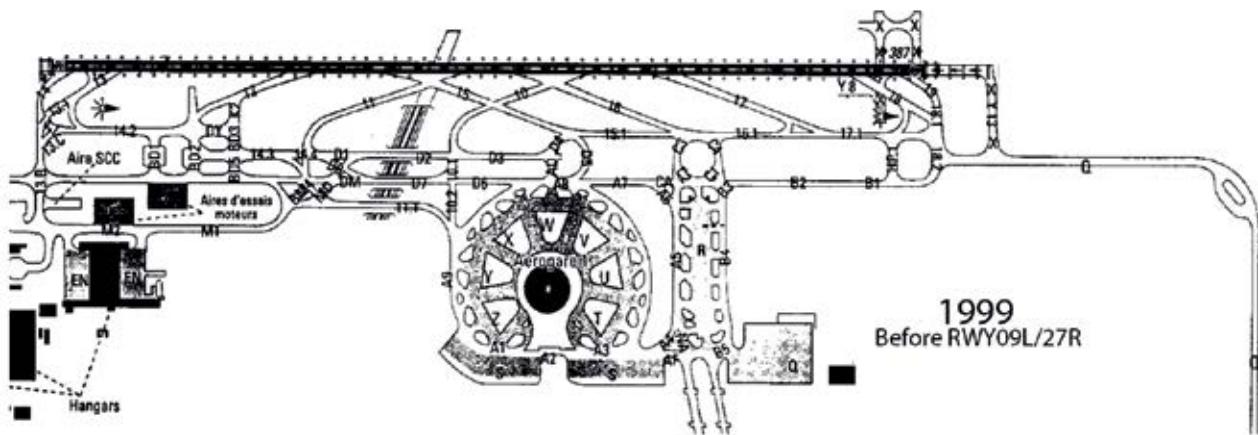
5 - Annex 14 Volume I – Aerodromes, chapter 5 Visual aids for navigation, section 5.4.3 Information Signs, article 5.4.3.36, 6th edition, ICAO, July 2013

6 - CS.ADR-DSN, Chapter N – Visual Aids for Navigation (Signs), CS ADR-DSN.N.785, Issue 2, EASA, January 2015, p137-138

<http://easa.europa.eu/certification-specifications/cs-adr-dsn-aerodromes-design>

7 - These rules follow or are inspired by the propositions of the IFALPA to the ICAO for taxiways naming convention.

8 - French law "arrêté du 28 août 2003 (modifié le 15 mai 2007) relatif aux conditions d'homologation et aux procédures d'exploitation des aérodromes" so-called CHEA, Appendix A, article I.5.2.3.1, [https://www.sia.aviation-civile.gouv.fr/dossier/texteregle/CHEA\\_A\\_01\\_V2.pdf](https://www.sia.aviation-civile.gouv.fr/dossier/texteregle/CHEA_A_01_V2.pdf)



**Figure 1: Evolution of the taxiway designations (Northern part of the airport)**

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ETT). A de-icing pad within a de-icing area has the name of the de-icing area + a number e.g. NW1 to NW4. Because of their particular function and the re-categorisation as part of the non-movement (or traffic) area when activated, the de-icing pads have a specific name even when they are co-located with a taxiway. But the two names are not used at the same time. For instance, taxiway BD2 is only called NW1 when it is operated as a de-icing pad.

### Phasing the change

To limit the initial mental workload just after changes to names and to have a practicable plan for the modification, we phased-in the changes over 4 years. Each phase are performed in a single night to coincide with an AIRAC cycle date.

In September 2011, the Southern runway complex was modified. September 2013 was the turn of the Northern runway complex and the taxiways around BRAVO, DELTA and QUEBEC. On the same night in September 2014, the taxiways serving aprons ECHO, NOVEMBER and INDIA were re-designated. Also, the taxilanes serving apron PAPA, previously without a name, became C1 and C2. Finally, September 2015 will see the completion of this multi-year project with the modification designations in the vicinity of Terminals 2A to 2G.

### Preventing the incidents and learning from the recent events

The best practices applied to the taxiway naming were selected following a risk-based approach with strong safety assurance roots. For example, this is why the letters and the numbers of a taxiway crossing a runway are different on each side of this runway. Indeed, clearance misunderstanding due to the continuity of a taxiway name on both sides was identified by the ATC as a possible cause of some runway incursions.

### Maintenance of the designation system

In addition of complying with the standards and the best practices, the project followed a risk-based approach. In order to correct any unexpected "side effects" of the changes, we put in place a safety assurance program to monitor their efficiency. This proved to be particularly helpful in identifying a need for improvement just after the changes to Northern taxiways naming. Here, it appeared that the phraseology at the end of the ground routings to Threshold 27L could be a source of confusion with the name of taxiways used for alignment. For instance, for taxiing to Q4 from BRAVO, the controllers typically gave the following clearance: "taxi N, B taxiway to holding point Q4". But safety reports showed verbal and mental shortcuts which were conducive to understand that taxiing was through "BQ4". Because taxiways BQ3 to BQ6 can be activated as de-icing pads, it was decided that

this could generate a serious hazard if an unexpected aircraft passed through without clearance. These issues were addressed in September 2014 when all the links between taxiways BRAVO and QUEBEC were re-designated QB + a number instead of BQ + a number.

This is an example of how the user feedback and the safety assurance can help to improve a naming system even after the completion of the programme. When designing the project, the airside operations community wanted something simple and logical for pilots, controllers and drivers. But we also envisaged the creation of a robust and stable system in which minor changes could be easily performed to correct short-term local safety issues. Also, this system should be capable of taking into account the long term infrastructure development with limited further modification. The first years of operational feedback are positive about the completion of these objectives. **■**

