xSNOWTAM – TEC

Mapping Document From SNOWTAM Messages Into AIXM 5.0

TECHNICAL ANALYSIS

Version 1.0

DOCUMENT DISTRIBUTION LIST

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17 Dec 2008	LLS	TIV	V0.1: first version	All
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1 Introduction

"*The conversion code shall be provided as a set of Java classes, which:*

- *Read a SNOWTAM text message (input data);*
- *Access an AIXM 5.0 source in order to get all necessary support data*
- *Write AIXM TEMPDELTA 5.0 TimeSlices for the necessary features, including SurfaceContamination values (output data).*"

Having defined under the mapping the additional considerations beyond the simple translation of the standard codes and message texts in the Mapping phase (both directions), there is a need to define a SNOWTAM reading rules table. This can be understood as an "automatic translator". As such, it has in the present application less terms to translate (code to words and vice-versa), but it has to be far more structured in terms of where the message applies to in terms of its observation and how it evolves. A "translator" addresses a fixed picture, a SNOWTAM gives information on how the situation may evolve and what alternatives (e.g. taxiways to use) are open.

One therefore needs to develop a level structure that addresses the weather phenomena, their intensity, the place where they occur, the alternatives and their future development in terms of remediation by action from the responsible authorities. SNOWTAM messages do this in a sequence of fields, AIXM 5.x as a structured database may very well combine these items in a smaller number of items, interrelated as can be benefited from the database rules.

1.1 Purpose of this document

The purpose of this document is to describe the technical details of the mapping between SNOWTAM Messages and AIXM 5.0.

The first chapter describes the format of the ICAO defined standard format, as it is detailed in ICAO Annex 15.

The second chapter describes how standard ICAO SNOWTAM message may be converted into AIXM 5.0 Timeslices.

Subsequent chapters examines local deviations to the standard and explains how these can (or cannot) be mapped into AIXM 5.0.

1.2 Definitions

"A special series NOTAM notifying the presence or removal of hazardous conditions due to snow, ice or standing water associated with snow, slush, and ice on the movement area by means of a specific format." (ICAO Annex 15, 10th Ed.).

SNOWTAMs are messages describing the winter conditions of the Runways, Taxiways and Aprons at an aerodrome (snow, ice…).

They consist of different fields, each identified by a letter, and the information they contain is almost entirely given in codes.

Each aerodrome has its own SNOWTAM series, numbered consecutively for the whole season, starting with 0001.

They are valid for at most 24 hours.

2 Requirements

Those requirements come from EUROCONTROL Technical Specification 3.0.

21. The mapping shall be provided in the form of a document detailing how the fields of **the ICAO SNOWTAM messages** can be converted into AIXM 5.0 records.

22. The mapping shall also cover typical European SNOWTAM examples, knowing that many States practice **deviations and simplifications** of the ICAO SNOWTAM format.

23. All eventual gaps and possibilities for improving the mapping shall be documented and provided to EUROCONTROL, as **changes proposals to AIXM 5.0**.

24. If necessary, the mapping document shall be **updated** after the publication of **AIXM 5.1**. For the evaluation of the effort, it shall be considered that changes between the current AIXM 5.0 model and the updated AIXM 5.1 version will not exceed 10%.

27. The **conversion code** shall be provided as a set of **Java classes**, which:

- **Read a SNOWTAM text message** (input data);
- Access an AIXM 5.0 source in order to get all necessary **support data**, such as AirportHeliport, RunwayDirection, Taxiway, Apron, etc. (support data);
- **Write AIXM TEMPDELTA 5.0 TimeSlices** for the necessary features (RunwayDirection, Taxiway, etc.) including SurfaceContamination values (output data).

28. Based on the current SNOWTAM approach by which contamination is specified for each third of a runway, the application shall also **create one ElevatedSurface for each third of the runway**. The width of the runway and the coordinates of the two thresholds shall be used for this calculation. If the necessary data is unavailable, then the ElevatedSurface records shall not be created.

29. ElevatedSurfaces for SurfaceContamination records for other features shall be created as far as geometrical data (centreline, width, shape, etc.) is available for these feature TimeSlices.

30. All information that cannot be converted shall be saved as "**Notes**" of the corresponding features.

31. The code shall be provided both in source form and as Windows executable, together with a number of 10 sample SNOWTAM messages, which can be used to test the code.

32. If necessary, the conversion code shall be updated after the publication of **AIXM 5.1**.
For the evaluation of the effort, it shall be considered that changes between the current AIXM 5.0 model and the updated AIXM 5.1 version will not exceed 10%.

3 ICAO SNOWTAM Messages

3.1 SNOWTAM Form

The following form shows the information, format and codes used by a SNOWTAM.

(COM heading)	(PRIORITY INDICATOR)	(ADDRESSES)	⋘≡
	(DATE AND TIME OF FILING)	(ORIGINATOR'S INDICATOR)	⋘≡
(Abbreviated heading)	(SWAA* SERIAL NUMBER) S W * *	(LOCATION INDICATOR)	DATE/TIME OF OBSERVATION / (OPTIONAL GROUP) ⋘≡(

SNOWTAM	(Serial number) →	
(AERODROME LOCATION INDICATOR)		A) →
(DATE/TIME OF OBSERVATION *(Time of completion of measurement in UTC)*)		B) →
(RUNWAY DESIGNATORS)		C) →
(CLEARED RUNWAY LENGTH, IF LESS THAN PUBLISHED LENGTH *(m)*)		D) →
(CLEARED RUNWAY WIDTH, IF LESS THAN PUBLISHED WIDTH *(m; if offset left or right of centre line add "L" or "R")*)		E) →
(DEPOSITS OVER TOTAL RUNWAY LENGTH *(Observed on each third of the runway, starting from threshold having the lower runway designation number)* NIL — CLEAR AND DRY 1 — DAMP 2 — WET or water patches 3 — RIME OR FROST COVERED *(depth normally less than 1 mm)* 4 — DRY SNOW 5 — WET SNOW 6 — SLUSH 7 — ICE 8 — COMPACTED OR ROLLED SNOW 9 — FROZEN RUTS OR RIDGES)		F) →
(MEAN DEPTH *(mm)* FOR EACH THIRD OF TOTAL RUNWAY LENGTH)		G) →
(FRICTION MEASUREMENTS ON EACH THIRD OF RUNWAY AND FRICTION MEASURING DEVICE MEASURED OR CALCULATED COEFFICIENT *or* ESTIMATED SURFACE FRICTION 0.40 and above — GOOD — 5 0.39 to 0.36 — MEDIUM/GOOD — 4 0.35 to 0.30 — MEDIUM — 3 0.29 to 0.26 — MEDIUM/POOR — 2 0.25 and below — POOR — 1 9 — unreliable — UNRELIABLE — 9 *(When quoting a measured coefficient, use the observed two figures, followed by the abbreviation of the friction measuring device used. When quoting an estimate, use single digit)*)		H) →
(CRITICAL SNOWBANKS *(If present, insert height (cm)/distance from the edge of runway (m) followed by "L", "R" or "LR" if applicable)*)		J) →
(RUNWAY LIGHTS *(If obscured, insert "YES" followed by "L", "R" or both "LR" if applicable)*)		K) →
(FURTHER CLEARANCE *(If planned, insert length (m)/width (m) to be cleared or if to full dimensions, insert "TOTAL")*)		L) →
(FURTHER CLEARANCE EXPECTED TO BE COMPLETED BY . . . *(UTC)*)		M) →
(TAXIWAY *(If no appropriate taxiway is available, insert "NO")*)		N) →
(TAXIWAY SNOWBANKS *(If more than 60 cm, insert "YES" followed by distance apart, m)*)		P) →
(APRON *(If unusable insert "NO")*)		R) →
(NEXT PLANNED OBSERVATION/MEASUREMENT IS FOR) *(month/day/hour in UTC)*		S) →
(PLAIN-LANGUAGE REMARKS *(Including contaminant coverage and other operationally significant information, e.g. sanding, de-icing)*)		T))⋘≡
NOTES: 1. *Enter ICAO nationality letters as given in ICAO Doc 7910, Part 2. 2. Information on other runways, repeat from C to P. 3. Words in brackets ( ) not to be transmitted.		

SIGNATURE OF ORIGINATOR *(not for transmission)*

3.2 SNOWTAM Messages

Here are some SNOWTAM message examples:

SWEN0393 ENHF 04200155
(SNOWTAM 0393 **A)** ENHF **B)** 04200243 **C)** 05 **F)** 48/7/47 **G)** 02/XX/03 **H)** 60/58/53 GRT **N)** 47 **R)** 47 **T)** RWY SANDED)

A)LSZH **B)**11070620 **C)**10 **D)**2200 **E)**40L **F)**4/5/4 **G)**20/10/10 **H)**30/35/30MUM **J)**30/5L **K)**YES L **L)**TOTAL **M)**0900 **P)**YES 12 **S)**11070920 **T)**FIRST 300M RWY 10 COVERED BY 50 MM SNOW, RWY CONTAMINATION 100%

GG LSZZSALF LEZZSALF EDZZSALF GOZZSDLF
070645 LFPOZPZX
SWLF0149 LFPO 11070620
SNOWTAM 0149
A)LFPO
B)11070620
C)08 **D) P)**
C)07 **D) P)**
R) NON
S) 11070920
T) DEGLACAGE

SWEN0497 ENGM 04200155
(SNOWTAM 0497 A) ENGM B) 04200155
C) 01L **F)** NIL/NIL/NIL **G)** XX/XX/XX **H)** 5/5/5 **N)** NIL
C) 01R **F)** NIL/NIL/NIL **G)** XX/XX/XX **H)** 5/5/5 **N)** NIL **R)** NIL)

LFQA REIMS PRUNAY
SWLF0014 LFQA 12290829
SNOWTAM
A)LFQA
B)12290730
C)07/25
F)4/4/4 7/7/7
G)15/15/15
H)9/9/9
S)12291100
T)NEIGE ET VERGLAS SUR RWY TWY PKG)

3.3 Description of SNOWTAM Fields

For this mapping, fields will be considered into 3 categories:

- Header: originator, date of validity…
- Header fields (A to C)
- *Processable* data: fields that can be translated into timeslices (D to S)
- Plain language remark: field that might not be automatically processed (T)

3.3.1 Header

The header has the following format:

`TTAAiiii CCCC MMYYhhmm (BBB)`

SNOWTAM CCCC

Example for PARIS/ORLY, observed 7th Nov at 06:20 UTC: *SWLF0149 LFPO 11070620*

Field	Example Value	Description
TT	SW	Constant. Stands for SNOWTAM
AA	LF	ICAO nationality letters as given in ICAO Doc 7910. Part 2.
iiii	0149	Serial number. Starting from 0001, for a whole season. Peculiar to the aerodrome specified in the A) field
CCCC	LFPO	ICAO 4 letter location indicator of the aerodrome
MMDDhhmm	11070620	Date/time of filing, UTC. Format: • MM: month • DD: day of month • hh: hours • mm: minutes
(BBB)	COR	Optional group to designate a correction to a preceding SNOWTAM with the same serial number. Note: the brackets indicate that the group is optional, but are not part of the data.

3.3.2 Header Fields

The value in the different fields of a SWNOTAM must follow some rules.
In the table below, rules are either mandatory or optional. Mandatory rules generate errors when violated. Optional rules generate warnings when violated. Errors in a SNOWTAM prevent it from being processed to the contrary of warnings. Optional rules can be disabled, i.e. not implemented. Mandatory rules cannot be disabled.

Id	Format	Example	Description
A*	CCCC	LFPO	ICAO 4-letter **location indicator** of the aerodrome, as defined in ICAO DOC 7910 - Location Indicators. **Mandatory reading rules:** 1. Field is mandatory 2. Format must be valid
B*	MMDDhhmm	11070620	**Date/time of observation**, UTC. Format: • MM: month • DD: day of month • hh: hours • mm: minutes **Mandatory reading rules:** 1. Field is mandatory 2. Format must be valid
C	##[L,R,C] or ##/##	08 02R 02/20	**Runway designator**, from the end with the lower designator/number. Example for RWY 08/26, use the lower number: 08. **Mandatory reading rules:** 1. Designator must be in [00-36] 2. Optional suffix is either L, R or C **Optional reading rules:** 1. Designator must be in [00-18]
D	####	3320	**Cleared runway length**, if less than published. Value is specified in meters. **Mandatory reading rule:** 1. Value <= runway published length **Optional reading rule:** 1. (**disabled**) length not cleared must be documented in field T
E	####[L,R]	01L 17	**Cleared runway width**, specified in meters If offset left or right of center line add "L" or "R" **Mandatory reading rules:** 1. Value <= runway published width 2. Optional suffix is either L or R

F	NIL or # #/#/#	48/7/47 4/5/4 NIL/NIL/NIL 75/75/7	**Types of deposits** over total runway length, observed at each third of the runway and starting from threshold having the lower runway designator number. Values for each third are separated by a slash (/). It is possible to use combinations in case there are multiple layers of deposits on the same third: the different layers will be mentioned from top to bottom. The following codes are used to describe the type of contamination: SNOWTAM Code **NIL**: Clear and dry **1**: Damp **2**: Wet or water patches **3**: Rime or Frost (depth normally < 1mm) **4**: Dry snow **5**: Wet snow **6**: Slush **7**: Ice **8**: Compact snow **9**: Frozen ruts or ridges **Mandatory reading rule:** 1. Format must be valid **Optional reading rule:** 1. Maximum 9 layers **Accepted deviation:** 1. NONE equivalent to NIL **Restriction:** 1. Maximum 9 layers accepted
G	## or 'XX' ##/##/##	02/XX/03 20/10/10 XX/XX/XX	**Mean depth** (in mm) for each third of the runway. Use 'XX' if depth can't be measured or is not significant. **Mandatory reading rule:** 1. Format is valid **Optional reading rule:** 1. Value <= 1000mm **Accepted deviation:** 1. X, x, Xx, xX also accepted
H	0.## or # (+FMD)	5/5/5 60/58/53 GRT 30/35/30MUM	**Friction Measurement** on each third of the runway and **friction measuring device**. When quoting a measured coefficient, observed two figures are used, followed by the friction measuring

			device used. When quoting an estimate, a single digit is used. Friction may be: **Measured or Calculated Coeff.** / **Estimated Surface Friction** 0.40 an above – 5 – Good 0.39-0.36 – 4 – Medium/Good 0.35-0.30 – 3 – Medium 0.29-0.26 – 2 – Medium/Poor 0.25 and below – 1 – Poor 9 = Unreliable – 9 – Unreliable Type of Measuring Equipment. Used: BRD, GRT MUM, RFT, SFH, SFL, SKH, SKL, TAP. Other equipment must be specified in clear text. (If other equipment is used, this shall be specified in plain language in item T). If 'unreliable' is used, it is because the contamination is outside the approved range of whatever equipment is used to measure the braking action. This could either be because the contamination is too deep, or of a type that the equipment is not approved for. For example, measured friction by Grip Tester (GRT) on wet ice is considered to be unreliable and the SNOWTAM will then have the value 9 in field H). **Mandatory reading rule:** 1. If measured coefficient, device code is mandatory **Optional reading rules:** 1. If estimated, no device can be specified 2. (**disabled**) if device used not in list, specify in field T
J	##/##[L, R, LR,BOTH]	30/5L	**Critical Snowbanks**. If present, height/distance from edge of runway in meters, followed by 'L', 'R' or 'LR' if applicable (starting from threshold having the lower runway designator number). Height in centimeters and distance in meters **Mandatory reading rule:** 1. If provided, format must be valid
K	YES (L, R, LR)	YES YES L YES	**Runway Lights.** YES if **obscured**, followed by 'L', 'R' or 'LR' if applicable (starting from threshold having the lower runway designator number). Empty otherwise.

			Mandatory reading rule: 1. If provided, format must be valid
L	#### or ####/### or TOTAL	TOTAL 1350 1350/20	**Further clearance.** If planned, length/width (both values in meters) to be cleared. 'TOTAL' for full clearance (total dimension). **Mandatory reading rule:** 1. If provided, format must be valid 2. Length < = published length **Optional reading rule:** 1. Width <= published width
M	hhmm	0900	**Completion time of further clearance.** UTC. hh in [00-24] mm in [00-59] **Mandatory reading rule:** 1. If provided, format must be valid 2. cannot be in the past **Accepted deviation:** 1. MMDDhhmm also accepted (date part ignored)
N	…. or NO	NO	**Taxiway.** Gives the conditions on the taxiways associated with the runway. The codes are the same as for the runway (field F), but the taxiways are not divided into thirds 'NO' if no appropriate taxiway is available / usable. Note: NIL seems to be used in Norway **Optional reading rule:** 1. (disabled) taxiway must exist for the airport 2. same format checks as for runway thirds in field F **Accepted deviations:** 1. see 4.6 below for deviations and syntax extensions
P	YES ##(#)	YES 12	**Taxiway snowbanks.** If more than 60 cm, 'YES' followed by distance apart (in m). **Optional reading rules:** 1. (disabled) if YES, lateral distance is mandatory 2. (disabled) lateral distance <= published taxiway width
R	# or NO	47	**Apron.** Type(s) of deposit if applicable. See field F more information. **Optional reading rules:**

			1. (disabled) apron must exist for the airport 2. (disabled) same rules as for field F **Accepted deviations:** 1. see 4.7 below for deviations and syntax extensions
S	MMDDhhmm	11070920	**Next planned date/time of observation**, UTC. Format: • MM: month • DD: day of month • hh: hours • mm: minutes Note: ICAO says 'MMDDhh', but in practice minutes are also always specified. **Mandatory reading rules:** 1. if provided, format must be valid 2. cannot be in the past
T			**Plain language remark** No check performed on contents

4 AIXM 5.0 Mapping

This section describes the mapping between a SNOWTAM message and AIXM5 timeslices.

We tried to do so with a progressive approach and by using “color-codes” to identify impacted features.

By “progressive approach”, we mean that we tried to ‘delve’ progressively into the information, by first identifying what each particular field was about, in regard to the SNOWTAM only. We then added a column to identify for which timeslice the field is relevant. We then added another identifying in which object(s) the information might be used.

4.1 SNOWTAM Content

Information contained in a SNOWTAM affects different levels / features. This is what the picture below tries to depict: a colour has been assigned to each one of those features.

SW	AHP	RWY	Contamination	TWY	APN

A)	*AHP Designator*	***EBBR***						
B)	Observation time	**01091720**						
C)	*Lower RWY design.*	***08***						
D)	Cleared RWY length	**2000**						
E)	Cleared RWY width	**15 L**						
F)	Deposits	**4**	**7**	**5**	**7**	**2**	**7**
G)	Mean depth	**3**		**3**		**10**	
H)	Friction coefficient + Friction device	**5**		**POOR**		**0.32**	
		SKH					
J)	Critical snowbanks	**20/5 LR**					
K)	RWY Obscured lights	**YES LR**					
L)	Further clearance	**TOTAL**	**1000**				
M)	Further clear. Time	**0905**					
N)	Taxiway	**23**					
P)	Taxiway snowbanks	**YES 10**					
R)	Apron	**2**					
S)	Next observ. Time	**01092100**					
T)	Plain language						

The different fields detail information about:

- the **SNOWTAM** itself
  - date/time of filing
  - date/time of observation
  - remarks
  - next planned observation

- the **Airport**
  - designator (used for lookup only)
- **Runways**
  - lower designator (used for lookup only)
  - cleared length and width
  - critical snow banks
  - obscured lights
  - further clearance (time and dimensions)
  - friction tester/device
- **Runway Thirds**
  - Layers
    - **contaminant**
  - mean depth
  - friction measurement
- **Taxiways**
  - (Layers)
    - **Contaminant**
  - Snow banks
- The **Aprons**
  - (Layers)
    - **contaminant**

In the perspective of AIXM 5, a SNOWTAM contains information about different features, timeslices and objects.

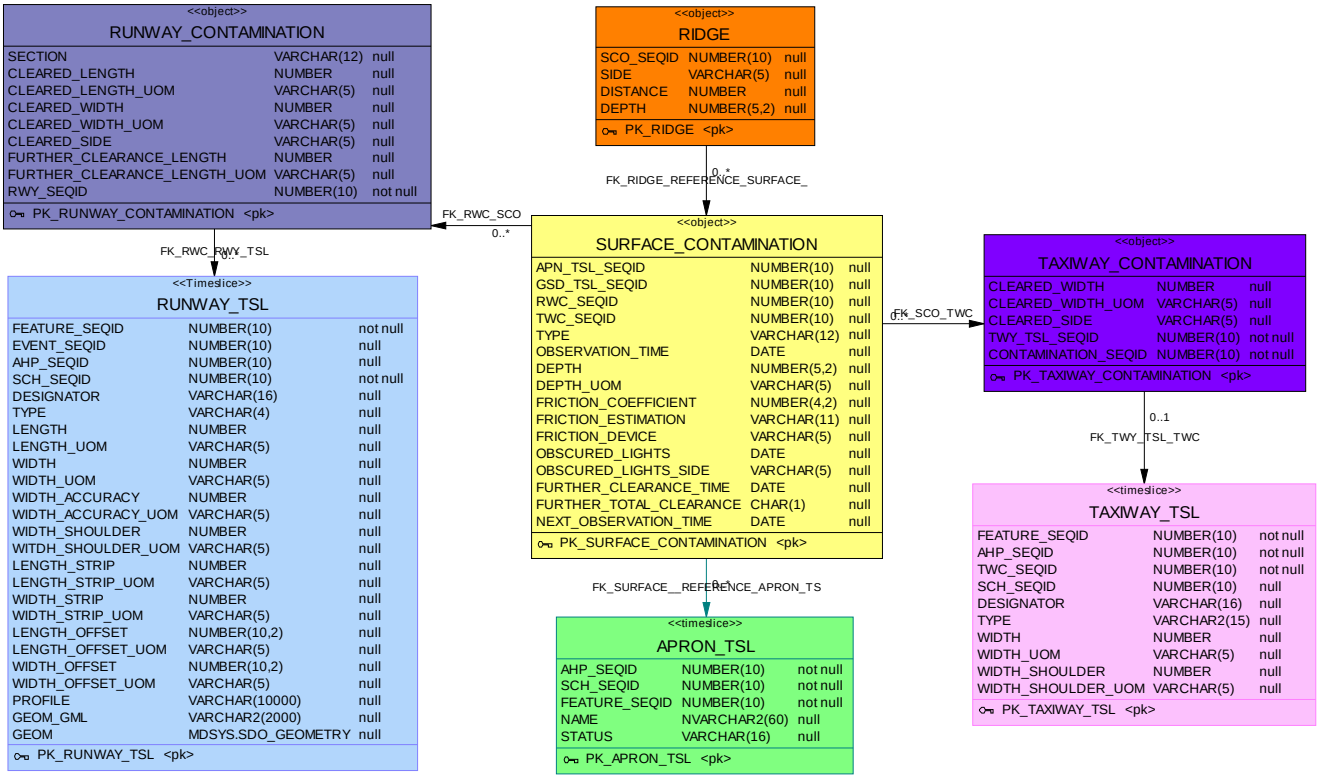
4.2 Impacted timeslices

The following table adds the "Impacted Timeslices" column. It explains which timeslice(s) will be impacted or need to be created to contain the information of the given field.

SNOWTAM Fields		Example Values						Impacted Timeslices		
A)	*AHP Designator*	***EBBR***						*Not mapped*		
B)	Observation time	**01091720**						**RWY**	**TWY**	**APN**
C)	*Lower RWY design.*	*08*						*Not mapped*		
D)	Cleared RWY length	**2000**						**RWY**		
E)	Cleared RWY width	**15 L**						**RWY**		
F)	Deposits	**4**	**7**	**5**	**7**	**2**	**7**	**RWY**		
G)	Mean depth	**3**		**3**		**10**		**RWY**		
H)	Friction coefficient + Friction Tester	**5**		**POOR**		**0.32**		**RWY**		
		SKH								
J)	Critical snowbanks	**20/5 LR**						**RWY**		
K)	RWY Obscured lights	**YES LR**						**RWY**		
L)	Further clearance	**TOTAL**		**1000**				**RWY**	**TWY**	
								RWY		
M)	Further clear. Time	**0905**						**RWY**	**TWY**	
N)	Taxiway	**23**						**TWY**		

P)	Taxiway snowbanks	**YES 10**	**TWY**		
R)	Apron	**2**	**APN**		
S)	Next observ. Time	**01092100**	**RWY**	**TWY**	**APN**
T)	Plain language		**RWY ?**	**TWY ?**	**APN ?**
			AHP ?		

The color-coded data diagram abstract below shows the impacted timeslices in the perspective of the database model and uses color codes similar to those used in the table above.



4.3 Affected timeslices

Given this, one SNOWTAM, which concerns a whole airport and, as such, one or more runways, taxiways and apron, will result in the following:

- **1 temporary delta per Runway**.
  - For each RunwayTimeslice, the number of RunwayContamination objects (RWC) to be created is determined as follow:
    - 3 x RWC (one for each runway third, independently of layers)
    - 3 x RWC (one for each runway third) x number of layers
    - 1 x RWC (for the whole RWY)
    - Each RWC will have 1 SurfaceContamination attached
- **1 temporary delta per Taxiway**[1]

[1] Assuming AIXM 5 provides a way to find the taxiways attached to a runway

- For each TaxiwayTimeslice, the number of TaxiwayContamination objects (TWC) to be created is determined as follow:
  - 1 x TWC (for the taxiway, independently of layers)
  - 1 x TWC x number of layers
  - Each TWC will have 1 SurfaceContamination attached

- **1 temporary delta per Apron**
  - For each ApronTimeslice, the number of SurfaceContamination objects (SCO) to be created is determined as follow:
    - 1 SCO x number of layers

- A) and C) fields are not mapped; they contain lookup values used to find the correct runway. They are not meant to change the value of the designators and as such are not saved in AIXM timeslices.

Note: *in AIXM 5, if one object is changed in a timeslice, all objects need to be copied over to the new timeslice. This makes it mandatory that a SNOWTAM results in a single timeslice per affected feature.*

4.4 Timeslices/Objects Mapping Overview

The "color-coded map" below gives an overview of how SNOWTAM fields will be mapped to timeslices and surface contamination objects. You may also refer to the xSNOWTAM DB diagram abstract later in this document, which uses the same color codes.

The "Impacted Objects/fields" column describes how <<objects>> will be created. This includes the full "path" from the timeslice to the surface contamination. For example, TWYTSL.TWC.SCO.TYPE means the information contained in the field will be mapped to the TYPE field of a SURFACE_CONTAMINATION through a TAXIWAY_CONTAMINATION object and a TAXWAY timeslice.

As sometimes fields in the SNOWTAM contain more than one meaningful information in regard of AIXM, such fields have been split accordingly.

For example, the E) field (*15 L*) has become "E-1 Cleared Runway width" (*15*) and "E-2 Cleared Runway Side' (*L*).

SW	AHP	RWY	RWC	SCO	TWC	TWY	APN	RIDGE

SNOWTAM Fields		Example Values	Impacted Timeslices			Impacted Objects/fields
A)	*AHP Designator*	***EBBR***	*Not mapped*			*Not mapped*
B)	Observation time	**01091720**	**RWY**	**TWY**	**APN**	**RWYTSL.RWC.SCO.OBSERVATION_TIME TWCTSL.TWC.SCO.OBSERVATION_TIME APNTSL.SCO.OBSERVATION_TIME**
C)	*Lower RWY design.*	*08*	*Not mapped*			*Not mapped*

D)	Cleared RWY length	2000						RWY			RWYTSL.RWC.CLEARED_LENGTH + UOM
E-1 E-2	Cleared RWY width Cleared RWT Side	15 L						RWY			RWYTSL.RWC.CLEARED_WIDTH + UOM RWYTSL.RWC.CLEARED_SIDE
F)	Deposits	4	7	5	7	2	7	RWY			RWYTSL.RWC.SCO.TYPE
G)	Mean depth	3		3		10		RWY			RWYTSL.RWC.SCO.DEPTH + UOM
H-1 H-2 H-3	Friction coefficient Friction estimation[2] Friction Tester	5 SKH		POOR		0.32		RWY			RWYTSL.RWC.SCO.FRICTION_COEFFICIENT RWYTSL.RWC.SCO.FRICTION_ESTIMATION + RWYTSL.RWC.SCO.FRICTION_DEVICE
J-1 J-2 J-3	Critical snowb.Depth Critical snowb.Distance Critical snowb.Side	20 / 5 LR						RWY			RWYTSL.RWC.SCO.RIDGE.DEPTH RWYTSL.RWC.SCO.RIDGE.DISTANCE RWYTSL.RWC.SCO.RIDGE.SIDE
K-1 K-2	RWY Obscured lights RWY Obs. Lights Side	YES LR						RWY			RWYTSL.RWC.SCO.OBSCURED_LIGHTS RWYTSL.RWC.SCO.OBSCURED_LIGHTS_SIDE
L-1	Further clearance	TOTAL						RWY	TWY		RWYTSL.RWC.SCO.FURTHER_TOTAL_CLEARANCE TWCTSL.TWC.SCO.FURTHER_TOTAL_CLEARANCE
L-2	Furth. Clear. Length	1000						RWY			RWYTSL.RWC.FURTHER_CLEARANCE_LENGTH + UOM
M)	Further clear. Time	0905						RWY	TWY		RWYTSL.RWC.SCO.FURTHER_CLEARANCE_TIME TWCTSL.TWC.SCO.FURTHER_CLEARANCE_TIME
N)	Taxiway (deposits)	23						TWY			TWCTSL.TWC.SCO.TYPE
P-1 P-2	Taxiway snowbanks Distance apart	YES 10						TWY			TWCTSL.TWC.SCO.RIDGE.DISTANCE + UOM
R)	Apron	2						APN			APNTSL.SCO.TYPE
S)	Next observ. Time	01092100						RWY	TWY	APN	RWYTSL.RWC.SCO.NEXT_OBSERVATION_TIME TWCTSL.TWC.SCO.NEXT_OBSERVATION_TIME APNTSL.SCO.NEXT_OBSERVATION_TIME
T)	Plain language							RWY ?	TWY ?	APN ?	xxxTSL.NOTE + LINGUISTIC_NOTE AHPTSL.NOTE.LINGUISTIC_NOTE
								AHP ?			

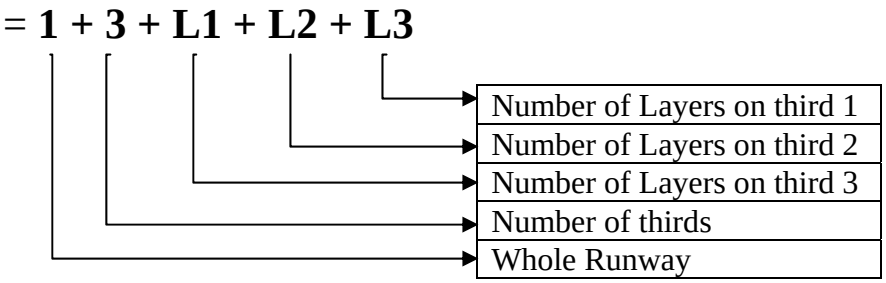
The “impacted timeslices” column shows that some field values will need to be copied in multiple places. For example, “S) Next observation time” value is shared between RWY, TWY and APN. This will probably lead to data duplication.

[2] Friction estimation depends on the value of friction coefficient, see 3.3.2Header Fields

4.5 Runway Timeslices

Information about runways needs to be processed in a particular way, because that information may affect multiple levels: some fields specify information for the whole runway (cleared length...) whereas others concern runway thirds (mean depth...) or layers over runway thirds (deposits).

This implies that multiple RWC and SCO objects will be created. Number of [RWC+SCO]



We propose to have:

- one [RWC+SCO] object with information about the whole runway (=RWC[whole])
- one [RWC+SCO] by runway third (=RWC[third])
- one [RWC+SCO] by contamination layer (=RWC[layer])

Whenever relevant, a value available at a higher level (runway for example) will be copied into lower level objects.

For example, the "observation time", specified at the runway level in the SNOWTAM will also be used in each and every SCO object created for that runway, theirs thirds and layers and for affected taxiways (if the information is available in the database).

This also means that RWC[x] of a runway will contain redundant information about each runway third (two layers on the same runway third will share the same depth and friction values).

The mapping for Runways will take the following fields into account:

- B) Observation time
- D) Cleared RWY length
- E-1 + E-2) Cleared RWY length
- F) Deposits
- G) Mean depth
- H-1 + H2 + H3) Friction coefficient + testing device
- J-1 + J-2 + J3) Critical snow banks
- K-1 + K-2) Obscured lights
- L) Further clearance
- M) Further clearance time
- S) Next observation time

SNOWTAM Fields		Example Values	Impacted Objects	Field
B)	Observation time	**01091720**	**SCO**	**RWC[x].SCO.OBSERVATION_TIME**
D)	Cleared RWY length	**2000**	**RWC**	**RWC[0].CLEARED_LENGTH + UOM**

E-1 E-2	Cleared RWY width Cleared RWT Side	**15** **L**									**RWC**			**RWC[0].CLEARED_WIDTH + UOM** **RWC[0].CLEARED_SIDE**	
F)	Deposits	**4**	**7**	**5**	**7**	**2**	**7**				**SCO**			**RWC[x].SCO.TYPE**	Those values will be mapped In multiple SCO objects, see below.
G)	Mean depth	**3**		**3**		**10**					**SCO**			**RWC[x].SCO.DEPTH + UOM**	
H-1 H-2 H-3	Friction coefficient Friction estimation[3] Friction Tester	**5**		**POOR**		**0.32**					**SCO**			**RWC[x].SCO.FRICTION_COEFFICIENT** **RWC[x].SCO.FRICTION_ESTIMAION**	
		SKH									**SCO**			**RWC[0 + x].SCO.FRICTION_DEVICE**	
J-1 J-2 J-3	Critical snowb.Depth Snowb.Distance Critical snowb.Side	**20 /** **5** **LR**									**RWC**	**SCO**	**RIDGE**	**RWC[0].SCO.RIDGE.SIDE** **RWC[0].SCO.RIDGE.DEPTH** **RWC[0].SCO.RIDGE.DISTANCE**	
K-1 K-2	RWY Obscured lights Obsc. Lights Side	**YES** **LR**									**SCO**			**OBSCURED_LIGHTS** **OBSCURED_LIGHTS_SIDE**	
L-1 L-2	Further clearance	**TOTAL**									**SCO**			**FURTHER_TOTAL_CLEARANCE**	
		1000									**RWC**			**FURTHER_CLEARANCE_LENGTH**	
M)	Further clear. Time	**0905**									**SCO**			**FURTHER_CLEARANCE_TIME**	
S)	Next observ. Time	**01092100**									**SCO**			**NEXT_OBESERVATION_TIME**	

4.5.1 Information about the whole runway

Fields about the whole runway, like cleared runway length/width, further clearance length and critical snow banks will be mapped into a single RunwayContamination object (RWC[0]).

The SCO following fields will be explicitly filled in:

- rwc.section = null
- rwc.cleared_length (+ uom)
- rwc.cleared_width (+ uom)
- rwc.further_clearance_length (+ uom)
- sco.observation_time
- sco.friction_device (it is supposed that the same device is used for the whole runway)
- sco.obscured_lights + sco.obscured_lights_side
- sco.further_clearance_time and sco.further_clearance_total
- sco.next_observation_time

4.5.2 Information about runway thirds

Information about runway thirds will be mapped in 3 [RWC+SCO] object pairs (1 pair by third).

The following fields will be explicitly filled in:

- rwc.section = 1_THIRD, 2_THIRD or 3_THIRD
- sco.depth (+ uom)
- sco.friction_coefficient or sco.estimation

Also, the following fields will be copied from the runway:

- sco.observation_time
- sco.friction_device
- sco.obscured_lights and sco.obscured_lights_side
- sco.further_clearance_time

[3] Friction estimation depends on the value of friction coefficient, see 3.3.2Header Fields

- sco.next_observation_time

4.5.3 Information about layers

One [RWC+SCO] pair will be created for each layer on each third.

Example:
Deposits = 7/57/287 → 1 layer on 1_THIRD, 2 layers on 2_ THIRD and 3 layers on 3_ THIRD = 6 [RWC+SCO]
Deposits = 7/5/7 → 1 layer on 1_ THIRD, 1 layer on 2_ THIRD and 1 layers on 3_ THIRD = 3 [RWC+SCO]

The following fields will be explicitly filled in:

- sco.layer
- sco.type

Also, the following field will be copied from the runway:

- sco.observation_time

Remark:
There's no need to duplicate runway or runway third geometry information into surface contamination since this information is kept at the runway level. The temporality mechanism allows for retrieving the geometry valid at snowtam observation time.

4.5.4 Example mapping

The example above will result in the following AIXM5 Objects. Because there are two layers of contaminant, 1 + 3 + 2 + 2 + 2 = **10** RWC and SCO are needed. Each SCO is associated with the RWC having the same serial number (column with '#' header). So the SCO #1 applies to RWC #1. The Rigde (snow bank) only applies to the whole runway.

Black and bold values are explicitly specified for an object. Gray and non-bold values apply to the object too, but not explicitly, they are inherited from a higher level.

The first header line lists AIXM 5.x fields, whereas the second header line lists the corresponding SNOWTAM Fields.

RUNWAY CONTAMINATION								
#	SECTION	CLEARED_LENGTH	UOM	CLEARED_WIDTH	UOM	CLEARED_SIDE	FRTH_CLEAR_L™	UOM
	F/G/H	D	(m)	E-1	(m)	E-2	L-2	(m)
1	---	**2000**	**m**	**15**	**m**	**BOTH**	**1000**	**m**
2	**1_RD**	---	---	---	---	---	---	---
3	1_RD	---	---	---	---	---	---	---
4	1_RD	---	---	---	---	---	---	---
5	**2_RD**	---	---	---	---	---	---	---
6	2_RD	---	---	---	---	---	---	---
7	2_RD	---	---	---	---	---	---	---
8	**3_RD**	---	---	---	---	---	---	---
9	3_RD	---	---	---	---	---	---	---
10	3_RD	---	---	---	---	---	---	---

Ridge					
#	SIDE	DISTANCE	UOM	DEPTH	UOM
	J-3	J-2	(m)	J-1	(cm)
1	**BOTH**	**5**	**m**	**20**	**cm**

Surface Contamination														
#	LAYER	TYPE	OBSERVATION_TIME	DEPTH	UOM	FRICTION_COEFFICIENT	FRICTION_ESTIMATION	FRICTION_DEVICE	OBSCURED_LIGHTS	OBSCURED_LIGHTS_SIDE	FRTH_CLEAR_TIME	FRTH_TOTAL_CLEAR.	NEXT_OBS_TIME
	F	F	B	G	(mm)	H-1	H-2	H-3	K-1	K-2	M	L-1	S
1	---	---	**2009/01/09 07:20**	---	---	---	---	**SKH**	**YES**	**BOTH**	**11:15**	**YES**	**9/01/2009 21:00**
2	---	---	**2009/01/09 07:20**	**3**	**mm**	---	**GOOD**	SKH	YES	BOTH	11:15	---	9/01/2009 21:00
3	**1**	**DRY_SNOW**	2009/01/09 07:20	---	---	---	---	---	---	---	---	---	---
4	**2**	**ICE**	2009/01/09 07:20	---	---	---	---	---	---	---	---	---	---
5	---	---	**2009/01/09 07:20**	**3**	**mm**	---	**POOR**	SKH	YES	BOTH	11:15	---	9/01/2009 21:00
6	**1**	**WET_SNOW**	2009/01/09 07:20	---	---	---	---	---	---	---	---	---	---
7	**2**	**ICE**	2009/01/09 07:20	---	---	---	---	---	---	---	---	---	---
8	---	---	**2009/01/09 07:20**	**10**	**mm**	**0,32**	---	SKH	YES	BOTH	11:15	---	9/01/2009 21:00
9	**1**	**WATER**	2009/01/09 07:20	---	---	---	---	---	---	---	---	---	---
10	**2**	**ICE**	2009/01/09 07:20	---	---	---	---	---	---	---	---	---	---

4.6 Taxiway Timeslices

In SNOWTAM messages, contamination data is provided on a runway by runway basis. Taxiway contamination data is summarized for all the taxiway linked to a runway and provided along with this runway data but in field N.

Since there's no link between runways and taxiways in AIXM 5 data model, we apply the following processing logic:

If the snowtam contains deposits for taxiway(s)
and
if taxiways features are available for the airport
and
if the snowtam contains only one runway or if all the taxiway deposits are identical for each runway

then the mapping will consider that all the taxiways of the airport are impacted and create appropriate timeslices for each of them:

- 1xTWC + 1xSCO (for the taxiway, independently of layers)
- 1xTWC + 1xSCO per layer
- Each TWC

Beside this, if field N contains 'NO', it means no taxiway is usable i.e. all the taxiway of the concerned runway are contaminated and unusable. Once again, since there's no link between runways and taxiways, this situation will be represented by a note at the level of the runway contamination.

In some cases, SNOWTAM messages can contain more complex data in field N. In order to process these SNOWTAM messages anyway, we've extended the accepted syntax.
Beside standard values in field N, we also recognise the following extensions:

- Contamination data can contain a taxiway designator
- Contamination on more than one taxiway can be described in one field N

Here's the regular expression used to parse the value of field N:

```
^AS RWY*|^NIL*|^NONE*|^NO*|^([0-
9]{1,4})(/GOOD|/POOR|(/MEDIUM(\\s(GOOD|POOR)))*)|(([A-Z1-9a-z]{1,1}[A-Z1-9a-z \\-]{0,}(-
[A-Za-z ]{1,}[a-zA-Z0-9 ]{0,}){0,})((/([1-
9]{1,4}|NIL|NONE))(/GOOD|/POOR|(/MEDIUM(\\s(GOOD|POOR))*)){0,1}))( |)*
```

And here are some samples of the valid values:

NO	Anonymous contamination
NIL	Anonymous contamination
NONE	Anonymous contamination
AS RWY	Anonymous contamination
123	Anonymous contamination
123/GOOD	Anonymous contamination
123/MEDIUM POOR	Anonymous contamination
A1/12	Named contamination

A2/123/POOR	Named contamination
A2 B6/45	Named contamination
A2 B6/5/POOR	Named contamination
TWY B-NORTH/45/MEDIUM GOOD	Named contamination
A1/12 B2/3/MEDIUM POOR A2 B6/5/POOR	Multiple named contamination
TWY B EAST/245 TWY C 2/1	Multiple named contamination

In this table, an anonymous contamination is a contamination without taxiway designator.
A named contamination is a contamination that begins with a taxiway designator.
A multiple named contamination is a list a named contaminations separated by spaces.

Named and anonymous contaminations cannot be intermixed.

If the SNOWTAM message contains only anonymous and identical taxiway contaminations, add the same contamination on all the airport taxiways.

If the SNOWTAM message contains only anonymous taxiway contaminations, but not the same for each runway, save the contaminations in airport/heliport notes.

If the SNOWTAM message contains multiple named contaminations, add the corresponding contaminations to the taxiways.

When the designator of a contaminated taxiway is not recognised (not found in the database) the contamination is kept in a note (of the form “TWY-<designator> deposit(s) <value>”) at the airport/heliport level.

If the field N corresponding to a runway contains NO, a note containing the text “Taxiways are unavailable/ Unusable” is attached to the runway.

4.7 Apron Timeslices

The contaminations of apron are handled a way equivalent to the taxiway contaminations, i.e. same parsing is applied to field R and same logic is used to create timeslices.

4.8 AirportHeliport Timeslices

One AirportHeliport timeslice needs to be created to record the T field (plain language remark). This will be stored as a Note.

Due to the free text nature of this field, it is inconceivable to analyze its content. Some specific information about runways, taxiways and aprons (sanding...) may thus be attached to the airport.

5 Technical Architecture

REMINDER: EAD dataset vs. Airport Dataset => SNOWTAM from EAD don't override Airport Snowtam

5.1 Overview

The mapping of Snowtam to AIXM5 is based on a multi-component system:

1. The SnowtamReader to read a SNOWTAM contained in an XML file
2. The SnowtamConverter to convert a snowtam to an AIXM5 snowtam and various time slices
3. The SnowtamPersistenceManager to save an AIXM5 snowtam in a database
4. The SnowtamConversionManager is a standalone program build upon the three others to process snowtam files.

5.2 SnowtamReader

The SnowtamReader is in charge of reading a snowtam message file and extracting the snowtam text to produce a SnowtamMessage which is a structured view of the snowtam text.

The extraction of the snowtam message is performed in two steps:

- The raw text is extracted from the file contents, which is supposed:
  - To be a well-formed XML
  - To contain a <SnowtamText> tag around the raw message text
- The raw text is parsed and loaded into a SnowtamMessage object ready for conversion.

The SnowtamReader is able to process a single file as well as a list of files. In this case, it returns a list of SnowtamMessages.
The parsing is a syntactical check of the text structure according to description given in [3 ICAO SNOWTAM Messages, page 7].
The parsing of the raw text can result in miscellaneous errors and warnings if the text if not well-formed. However, to some extents, the parsing is fault-tolerant in the sense that some minor discrepancies regarding the message syntax are accepted by the parser.
Parsing warning and errors are kept within the message.
Parsing errors prevent from converting a SnowtamMessage (see SnowtamConverter below) but parsing warnings allow conversion.

5.3 SnowtamConverter

The SnowtamConverter is in charge of converting a SnowtamMessage object into a Snowtam object which contains all the AIXM5 "timeslices" and other objects necessary to represent the snowtam according to AIXM 5.0 Mapping page 4 above.
The conversion process consists in several steps:

- Create a snowtam object
- Based on the SnowtamMessage object build by the parser, and if and only f it doesn't contains any error:
  - Create an AirportHeliport timeslice
  - Create Runway timeslices
  - Create Taxiway timeslices
  - Create Apron timeslices

- Load SnowtamMessage errors/warnings into snowtam object
- Return snowtam object

5.4 SnowtamPersistenceManager

The SnowtamPersistenceManager is in charge of saving a Snowtam object into an AIXM5 database. It is available as a service and as such, can be injected like any other service. And it is used by the GUI to "publish new observations" (see user manual for details).

Saving a Snowtam in the database is divided into two steps:

- Update the current Snowtam if any
  - Finish snowtam valid when current snowtam starts
  - Finish current snowtam when next snowtam starts
  - The combination of these two changes corresponds to inserting the current snowtam between the previous and the next snowtam if any. Next snowtam only exists if current snowtam is actually created in the past.
- Calculate contamination status for new Snowtam
  - Calculate a summary of the contamination state of the airport which will be used to determine the icon used in Airport Overview Page to mark the airport on the map. See the user manual for the logic used.
- Save the new Snowtam
  - If the snowtam contains parsing or conversion errors, set its state to REJECTED, otherwise set it to ACCEPTED.
  - Save the snowtam in database.

5.5 SnowtamConversionManager

The SnowtamConversionManager is a standalone application able to process snowtam XML files. It can receive a file name or a directory name as parameter and process either the file or all the XML files in the directory and produce the corresponding AIXM5 snowtams.
This application is intended for being called by a scheduler for instance, which could trigger the conversion of snowtam files as they arrive.