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EXECUTIVE SUMMARY

This section summarizes the scenarios and procedures, and prioritizes the next steps for the Procedures Group meeting.

1 INTRODUCTION

1.1 Purpose

This document has the purpose to serve as basis for the development of detailed operational procedures or automated processes at any airport, in order to prepare and anticipate for Adverse Conditions that may impact on the airport capacity, loss of operational efficiency or recovery time of that airport.

The document builds upon and assumes Airport CDM concept elements, as described in the Airport CDM Implementation Manual (reference 1), have been implemented.

1.2 Audience

The audience for this document is therefore operational staff and management of all airport partners in charge of the development of procedures and processes, and have sufficient knowledge of the Airport CDM concept.

1.3 Justification & background

A consequence of adverse conditions is a drop in capacity for a short or longer term. The aim is to manage these situations more efficiently in order to utilise remaining capacity efficiently, and recover available capacity in the shortest time possible.

Improved situational awareness by information sharing between all airport partners and CFMU is the main driver for this document. Currently adverse conditions lead to reduced use or even a temporary stop of Airport CDM processes, where Airport CDM should in fact provide the backbone for operations based on accurate status information per aircraft.

Airport CDM under adverse conditions should contribute to more automated detection of events, e.g. de-icing start and finish, and lead to more automated inputs in the Airport CDM platform to update planning parameters. Automation of processes should reduce human workload and error, and contribute to accuracy and reliability of aircraft progress information. However the human role in adverse conditions should be to verify progress of aircraft status, and always remain to be able to adjust parameters based on operational expertise.

1.4 Definitions

To a great extent, this document shall lean on definitions applied in the AEA documentation, reference 4. Added to this, or where deviating, additional definitions are listed below.

ID.	Term	Definition
1	Adverse Condition	Adverse Condition is the situation where airside and or landside conditions of the airport are such that capacity drops, causing airlines to cancel flights, and the airport partners to use special designed

		procedures to minimise operational costs and utilise available capacity efficiently.
2	De-icing	Procedure by which frost, ice, slush or snow is removed from an aircraft in order to provide clean surfaces.
3	Local Frost Prevention	Precautionary procedure which provides against formation of local frost in cold soaked wing tank areas during transit stop.
4	Local Frost Removal	
5	Anti-Icing	Precautionary procedure which provides against formation of frost or ice and accumulation of snow or slush on treated surfaces of the aircraft for a limited time (holdover time).
6	Remote	TBD Proposal by Fieandt / Nyflot
7	Heavy Weather Conditions	TBD Proposal by Fieandt / Nyflot
8	Medium Weather Conditions	TBD Proposal by Fieandt / Nyflot
9	Engine Ice Removal	Procedure by which frost or ice is removed from the fan blades by hot air.

1.5 Acronyms

A-DPI	ATC - Departure Planning Information Message
ACARS	Aircraft Communications Addressing and Reporting System
ACC	Area Control Centre
ACZT	Actual Commence of De-icing Time
ACGT	Actual Commence of Ground Handling Time
ACT	Activation (message)
ADIT	Actual De-Icing Time
AEZT	Actual End of De-icing Time
AIBT	Actual In-Block Time
ALDT	Actual Landing Time
ARDT	Actual Ready Time
ASAT	Actual Start-Up Approval Time
ASBT	Actual Start Boarding Time
ASRT	Actual Start-Up Request Time
AMAN	Arrival Manager
AO	Aircraft Operator
ATC	Air Traffic Control
ATOT	Actual Take Off Time
C-DPI	Cancel – Departure Planning Information Message
CFMU	Central Flow Management Unit
CTOT	Calculated Take Off Time (CFMU)
DCL	Departure Clearance
DMAN	Departure Manager
DPI	Departure Planning Information Message
E-DPI	Early – Departure Planning Information
ECZT	Estimated Commence of De-icing Time

EDIT	Estimated De-Icing Time
EET	Estimated Elapsed Time
EEZT	Estimated End of De-icing Time
EIBT	Estimated In-Block Time
ELDT	Estimated Landing Time
EOBT	Estimated Off-Block Time
EXIT	Estimated Taxi-in Time
EXOT	Estimated Taxi-Out Time
FDPS	Flight Data Processing Systems
FIR	Flight Information Region
FPL	Filed Flight Plan
FSA	First System Activation
FUM	Flight Update Message
GH	Ground Handler
MTTT	Minimum Turn-round Time
MVT	Movement Message
SOBT	Scheduled Off-Block Time
T-DPI	Target – Departure Planning Information Message
TMA	Terminal Manoeuvring Area
TOBT	Target Off-Block Time
TSAT	Target Start-Up Approval Time
TTOT	Target Take Off Time
TWR	Aerodrome Control Tower
VTT	Variable Taxi Time

1.6 References

1. Airport CDM Implementation Manual – version 4 – April 2009 – Airport CDM team – EUROCONTROL
2. Total Airport Management – version 1 – April 2009 – Airport Planning - EUROCONTROL
3. Eurocontrol Airport CDM website: www.euro-cdm.org
4. RECOMMENDATIONS FOR DE-ICING/ANTI-ICING OF AIRCRAFT ON THE GROUND EDITION 24, August 2009, AEA

5. Title – Version – Date - Authors – Organisation

2 SCOPE, OBJECTIVES & METHODOLOGY

2.1 Scope

The aim of the document is to derive new generic Airport CDM procedures which are considered essential to minimise the impact of any capacity reduction and minimise the length of recovery times. To define these procedures a representative list of potential causes needs to be identified, in order to detect any gaps between existing procedures and need for new ones. The scope of this document is set by the adverse conditions defined by the CFMU (approved by the operational director), which maps upon the IATA delay codes.

The scenarios are described according to a generic methodology, and categorized into four main categories of adverse conditions, each having several sub-categories.

1) METEO

Weather related conditions that occur either expectedly or unexpectedly and have severe impact on airport operations.

a) De-Icing
b) Thunderstorms/CB
c) Heavy Rain
d) Wind
e) Ceiling
f) Snow
g) Fog/Low Visibility

It must be noted that bad weather conditions can be further subcategorised based on the occurrence and strength of the condition. Different levels are defined in AEA or ICAO documentation, such as reference 4.

2) AIRPORT

a) Aerodrome Capacity
b) Accident/Incident
c) Equipment (Non-ATC)
d) Industrial Action (Non-ATC)
e) Environmental Issues
f) Ground OPS Issues
g) Increased Security Levels
h) New System Procedures
i) Runway Configuration
j) Staff Shortages
k) Technical Failure
l) Work In Progress

3) ATC

a) ATC Capacity

b) ATC Staffing
c) Equipment (ATC)
d) Industrial Action (ATC)

4) OTHER

Other related conditions that occur unexpectedly and have severe impact on airport operations. These other conditions are currently not included in this report for simplicity reasons. They may be added in later versions of the document.

a) Military Activity
b) Special Events
c) ATC Routing
d) Other (Non-Defined)
e) Sector Configuration
f) System Maintenance
g) Vulcan Activity

In the chapters below different scenarios in each of the categories are described in detail. This description is done according to a methodology described in section 2.3.

Conditions that do not lead to new procedures are left out to avoid unnecessary overhead. Of course, when multiple conditions apply at the same time, the complexity increases and multiple processes need to be applied in sequential or parallel order. Locally additional processes may be applicable.

2.2 Objectives

Based on the scope, the following main objectives can be derived:

1. Determine operational consequences for each Adverse Conditions scenario
2. Derive impact from operational consequences on Airport CDM key parameters
3. Compare impact of different conditions and identify overlap
4. Develop generic automated processes based on common impact

For each of the conditions, additional milestones that are complementary to the generic milestones defined in Airport CDM implementation manual need to be defined, and related procedures harmonised.

2.3 Condition Description Methodology

For each condition described in the sections below the following content is derived:

1) Description of the condition. Each condition contains a description that leads to a set of operational consequences that may become applicable on the airport.

2) Operational consequences of each adverse condition. A list of consequences with explanation is defined and harmonised for each adverse condition.

3) Impact on planning due to the operational consequences with differentiation on primary or secondary impact. The list of operational consequences is presented in a table where the impact on planning parameters is assessed.

4) Action Responsibilities derived from the impact. Explanation which parameters must be updated or modified. This is determined in the table in section 2.3.2.

5) Process to ensure planning parameters are modified. A description which describes the process how to modify the parameters and who to inform of the change.

Below the planning parameters are introduced. Most are event clock time values; some are durations of a process. All values have tolerances which are based on uncertainty caused by several factors.

2.3.1 Planning Parameters

To develop processes, an assessment must be made to determine impact of a certain condition, either weather or crises, on the turnround planning parameters. The planning parameters are the following Airport CDM time parameters:

- Calculated Take-Off Time (CTOT)
- Estimated In-Blocks Time (EIBT)
- Estimated Commence of De-icing Time (ECZT)
- Estimated De-icing Time (EDIT) – duration and variation
- Estimated Landing Time (ELDT)
- Estimated Ready for De-icing Time (ERZT)
- Target Off-Block Time (TOBT)
- Target Start-up Approval Time (TSAT)
- Target Take-Off Time (TTOT)
- Variable Taxi Time (VTT) – duration and variation
    - Estimated Taxi Out Time (EXOT) – duration and variation
    - Estimated Taxi In Time (EXIT) – duration and variation

The impact of the main weather conditions on the above parameters will derive new processes.

2.3.2 Action Responsibility

When impact is foreseen on the planning process, and in particular the time planning parameters, all actors in the airport have an obligation to adjust their parameters to realistic values, given the current or forecasted adverse conditions. Taxi times will be longer and more uncertain to predict accurate, de-icing times need to be forecasted based on many aircraft and fluid-mix related factors, runway separation values are increased reducing capacity, and all parties have their input to tune based on their needs and knowledge.

The action of a time parameter is usually to set or adjust the value. However some parameters require optimisation once the resource has become a bottleneck in the airport operations. The following set of input actions in the fields of the table should be applied for each adverse condition:

1. Set
2. Adjust
3. Optimise

Each impacted time parameters is legally owned by one partner, however can be influenced (receive inputs) by several parties with relevant knowledge. Hence the visualisation in a table, in order to show which partners have a responsibility to input new prediction values for the relevant planning parameters, listed in section 2.3.1.

Parameter	Responsible Partner					
	Airline operator	Ground Handler	De-icing Handler	Airport Operator	Air Traffic Control	CFMU
	Time Parameters					
ELDT					Adjust	
EXIT					Adjust	
EIBT				Adjust		
MTTT		Adjust	Adjust			
TOBT	Adjust	Input/Adjust				
TSAT					Optimise	
ECZT			Set			
EEZT			Set			
EDIT			Adjust			
EXOT					Adjust	
TTOT					Optimise	
CTOT						Adjust
	Other Parameters					
MET status					Adjust	
...						
...						
...						
...						

Table 1: example overview of responsible partners for condition relevant time parameters

2.4 Accountability of Planning Responsibility

In order to achieve planning to be accurate, all partner organisations and their staff should feel the obligation to communicate on planning updates, especially under adverse conditions. Not contributing and acting on accuracy of predictions will lead to chaotic situations of traffic management, as we do have today under adverse conditions. Hence, all parties and staff must be held accountable for communication and quality of information with respect to planning. This responsible behaviour will enable the needed culture change on both operation and management level of organisations, which is inevitable in order to achieve the benefits that are resulting from Airport CDM under Adverse Conditions.

2.5 Predictability of Situations

In the Airport CDM Implementation Manual section 3.6 describes adverse conditions which can be either predictable or unpredictable events or situations. Predictable events should be handled with predictable procedures that are already available, or are developed in this document. Predictable events or situations should therefore lead to minimised impact on operations or loss of airport capacity.

Unpredictable events however should be handled as much as possible as if the event is predictable. That is, operations should be handled with special procedures which are familiar by all operational staff and with the appropriate training. Identifying any special situations is only possible with improved communication by airport partners regarding the airport operational status and coordinated through an airport centralised coordination centre. This status communication serves the need for awareness by all partners and operational staff.

The airport CDM partner coordination centre can be an APOC, or Airport operational centre of Coordination. This centre is the permanent management of centralized airport operations, where representatives of all or most partners are in a joint room to handle the dynamic state of the airport in Collaborative Decision Making. More on the APOC can be found in reference 4.

2.6 Dependencies between Time Parameters

When one time parameter is impacted due to some condition, there is usually a direct link to other parameters which are affected. In most cases the planning for future parameters are delayed as the first parameter. For example, if the landing time of a flight is delayed, so will be the TOBT and hence TTOT.

2.6.1 Causal Dependencies

This dependency is caused by actual events which influence future events due to delay. An example is shown in Figure 1. It shows how the change of condition with Fog can lead to delay of several parameters, and finally a need to regulate on TSAT, based on TTOT and TOBT.

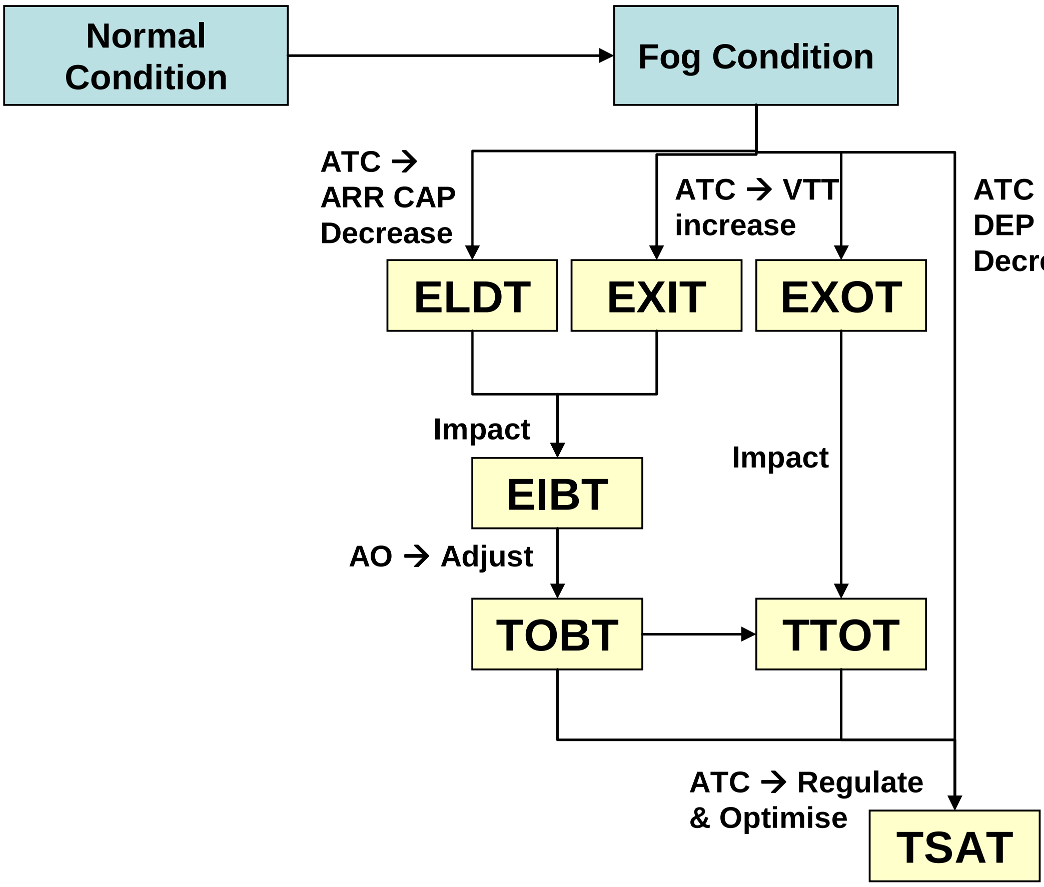


Figure 1: Impact Dependency of time parameters in Fog Condition

There are reactions on the new adverse condition by ATC, which automatically impact on successive parameters. When the taxi-in time is increased, the EIBT will be postponed. Hence TOBT is postponed. With longer taxi-out time, also TTOT is postponed. TSAT then needs optimization, based on TTOT sequence or on stand planning needs.

To distinguish between primary impact and secondary impact, the tables in the next chapter contain “P” and “S” to clarify which parameter is directly hit, and which indirectly.

2.6.2 Sequence Dependencies

This type dependency is caused by sequence planning of one resource, which influences the planning of another resource that applies earlier in time. E.g. if the runway is the bottleneck the TTOT planning will be done prior to the TSAT calculation. Similar, remote de-icing ECZT planning also impacts on TSAT planning.

Examples of sequence planning dependencies are described and visualised in ANNEX II.

3 METEO

In this chapter adverse condition scenarios and operational consequences are described which are related to meteorological causes. For each condition scenario operational conditions and impact on the Airport CDM key parameters is determined.

3.1 De-icing

3.1.1 Description - TBD

De-icing conditions can be broken down into the following icing operations:

- Apron and Remote aircraft de-icing and anti-icing
- Stand aircraft de-icing anti-icing and aircraft engine heating.
- runway de-icing anti-icing and snow removal
- apron, taxiway de-icing anti-icing and snow removal

Snow conditions are left out of in this section to avoid complications.

3.1.2 Impact to Planning Parameters

Table 2 lists the consequences that are likely to occur in case of fog or low cloud base conditions and provides impact of each consequence to the main planning parameters.

To distinguish between primary impact and secondary impact, the table contains “P” and “S” to clarify which parameter is directly hit, and which indirectly.

Operational Consequence	Impact on Parameter								
	ELDT	EXIT	EIBT	MTTT	TOBT	TSAT	EDIT	EXOT	TTOT
	Procedures Activation								
Communication & Coordination Increase									
…									
	De-icing								
On-Stand De-icing									
Apron & Remote De-icing									
Hold Over Time Exceeded									
…									
	Capacity								
Arrival Capacity Reduction									
Departure Capacity Reduction									
Stand Capacity Reduction									
Runway Configuration Change									
Ground Handling Time Increase									
…									
	Restrictions								
Taxiway Restriction									
Apron Restriction									
Stand Restriction									
Resource Restriction									

Table 2: Operational Consequences and their Impact on Planning Parameters

Explanation of consequences:

- Runway configuration changes are occurring more often due to de-icing and anti icing operations on the runway, apron, or taxiway
- Runway capacity reduction is the reduced amount of aircraft that can take-off or land due to increased separation values
- Aircraft stand de-icing and anti-icing becomes necessary
- Aircraft apron or remote de-icing and anti-icing becomes necessary
- Hold over times for stand de-icing and anti-icing becomes necessary
- Hold over times for apron and remote de-icing and anti-icing becomes necessary
- Due to stand de-icing and anti-icing reduced stands are available
- Increased communication and coordination between parties and the involved de-icing companies occurs
- Due to extra de-icing operations staff and equipment availability can be reduced
- Turnround times are increased affecting pushback time and airline fleet schedules

Remarks

- Local environmental restrictions may apply as a consequence under winter conditions (e.g. icing fluids), impacting on VTT and TTOT, CTOT
- Snow may have similar effects on visibility as Fog, but not necessary lead to LVP.
- On Stand de-icing: Improving CTOT's and TSAT's should not be improved unnecessary for short time gains, since it may impact operations planning.
- Remote de-icing: bringing forward CTOT or TSAT is not affecting operations and is welcome.
- Need for harmonised acronyms for runway closure for snow removal or de-icing.
- Apron de-icing is considered remote de-icing, as the stand has been left, and TOBT/TSAT and AOBT have passed.
- ECZT is related to TSAT and EXOT, and can be influenced by TTOT or CTOT. See optimisation scenarios in ANNEX II.

3.2 Thunderstorm

3.2.1 Description

A thunderstorm is a weather phenomenon characterized by the presence of lightning (atmospheric discharge of electricity) and thunder (a sonic shock wave caused by the rapid heating and expansion of the air surrounding and within a bolt of lightning) produced from a strongly developed cumulonimbus cloud. Both features occur at the same time, but the thunder is usually heard after the lightning is seen because light travels faster than sound.
Thunderstorms are a major hazard to aviation as it usually is accompanied by heavy rainfall, strong winds, hail, and sometimes even tornadoes or funnel cloud.

IATA Airside Management & Safety Document (AHM630): §6.5.1.2 Lightning
For lightning activity the notification process may be broken down into 3 phases:
a. Alert: Lightning activity is detected at a distance in excess of 8km (5 miles) from your operation

b. Stop/Suspend the activities: Lightning activity is detected within 5km (3 miles) of your operation
c. All Clear: Lightning activity has moved beyond 5km (3 miles) and is heading away from your operation.
The distances referred to above may vary dependent upon local climatic parameters.

Local procedures should specify additional details on the actions to be taken, e.g. at Brussels airport:
a) When there is a danger of lightning stroke, the meteorological service informs the Airside Inspection from the moment there is a danger within a 5 km radius around the airport. The Airport Authority in his turn informs the companies by phone: CAUTION: IMMEDIATE RISK OF THUNDERSTORM AND LIGHTNING STROKE.
b) When the danger is estimated over (finished), the MET Supervisor informs the Airside Inspection by phone and the companies are notified in the same way as when the danger started: END OF THUNDERSTORM AND LIGHTNING STROKE WARNING.
c) When there is a sustained alarm, the MET Supervisor must update the situation every 15' to the Airside Inspection.
d) In case of an alarm, TWR Supervisor notifies "LIGHTNING PROCEDURE IN PROGRESS" on the
ATIS with code: LTNG.
e) When there is a danger of lightning stroke, it is forbidden to conduct the following activities on the airside:
- Fuelling aircraft
- Carrying headsets and use of headset connection with aircraft
- Loading/unloading (inclusive catering)
- To be out in the open or beneath an aircraft

In addition to the lightning hazard great chance exists that "thunderstorms/Cb" will impact the runway direction for take-off/landing. A change of runway-in-use may be the result requiring the departure and arrival sequence to be re-directed.

3.2.2 Impact to Planning Parameters

Operational Consequence	Impact on Parameter								
	ELDT	EXIT	EIBT	MTTT	TOBT	TSAT	EDIT	EXOT	TTOT
	Procedures Activation								
Lightning Procedure Activation	P	S	P	P	P	P		P	P
Communication & Coordination Increase	P	S	P	P	P	P		S	P
	Capacity								
Arrival Capacity Reduction	P		P	S	S				
Departure Capacity Reduction			P	S	P	P			P
Runway Configuration Change	P	S	S	P	P	P		S	P
	Restrictions								
Taxiway Restriction		P						P	
Apron Restriction				S	P	S			

Stand Restriction			P	S	P	S			
	Environmental								
Rule Violation	P								P

3.3 Heavy Rain

TBD

3.4 Wind

TBD

3.5 Ceiling

3.5.1 Description

In aviation and in many meteorological text books the word “Ceiling” is used and this **may not be confused** with cloud base. In the official WMO definition ceiling is defined as the height of the lowest layer of clouds (or obscuring phenomena) below 6000m (20000ft) with a minimal coverage of 5/8 (= broken or overcast).
The height of the lowest layer of clouds is decisive for the service rate at airports which is directly impacted by the available landing systems and related infrastructure.

3.5.2 Impact to Planning Parameters

Operational Consequence	**Impact on Parameter**								
	ELDT	**EXIT**	**EIBT**	**MTTT**	**TOBT**	**TSAT**	**EDIT**	**EXOT**	**TTOT**
	Procedures Activation								
Low Visibility Procedure Activation	P	S	S			P	S	S	P
Communication & Coordination Increase	P				S	P	S	S	P
	De-icing								
On-Stand De-icing						P			
Apron & Remote De-icing						P			P
Hold Over Time Exceeded						P			P
	Capacity								
Arrival Capacity Reduction	P								
Departure Capacity Reduction									P
Runway Configuration Change	P	S	S			P		S	P
	Restrictions								
Taxiway Restriction		P						P	
Apron Restriction				S	P				

Stand Restriction				S	P				
	Environmental								
Rule Violation	P								P

3.6 Snow

TBD

3.7 Fog and Low Visibility

3.7.1 Description

Visibility, both in the horizontal as in the vertical plane, is one of the most important features in aviation as it largely affects air traffic, especially during landing and take off.
Visibility can be reduced due to both meteorological (precipitation, type of air mass, high humidity,...) or non meteorological parameters (pollution, smoke,…). Anyway, at most airports special “low visibility procedures” exist and meteorological services generally issue special warnings if visibility is expected to drop beneath certain threshold values.
Visibility reducing weather phenomena:
- Fog: horizontal visibility is reduced to less than 1 km. In winter fog can be composed of ice crystals.
- Mist: visibility between 1 and 5km, with a relative humidity of 80% and more.
- Haze: visibility between 1 and 5km, with a relative humidity of less than 80%.
- Precipitation: is one of the dominating factors in reducing the visibility. This reduction in visibility depends largely on the intensity and the type of the precipitation.

3.7.2 Impact to Planning Parameters

Operational Consequence	**Impact on Parameter**								
	ELDT	**EXIT**	**EIBT**	**MTTT**	**TOBT**	**TSAT**	**EDIT**	**EXOT**	**TTOT**
	Procedures Activation								
Low Visibility Procedure Activation	P	S	S			P	S	S	P
Communication & Coordination Increase	P				S	P	S	S	P
	De-icing								
On-Stand De-icing						P			
Apron & Remote De-icing						P			P
Hold Over Time Exceeded						P			P
	Capacity								
Arrival Capacity Reduction	P								
Departure Capacity Reduction									P
Runway Configuration Change	P	S	S			P		S	P
	Restrictions								
Taxiway Restriction		P						P	

Apron Restriction				S	P				
Stand Restriction				S	P				
	Environmental								
Rule Violation	P								P

4 AIR TRAFFIC CONTROL

In this chapter adverse condition scenarios and operational consequences are described which are related to air traffic control causes. For each condition scenario operational conditions and impact on the Airport CDM key parameters is determined.

4.1 Capacity

TBD

4.2 Staffing

4.2.1 Description

The ATC capacity is partially based on the number of working positions manned by the traffic demand. At large busy airports there might be several TWR/RWY/Local controller working positions, each of which has their own area of responsibility. This often means possibility to use several runways dependently, independently etc.

In ACC environment lack of staffing means decrease in capacity due to fewer open airspace sectors. In the airport environment the impact is practically the same. This condition has nothing to do with the runway, apron, stand etc. capacity. The aim is to describe the impact of the shortage of ATC staff compared to the traffic demand.

4.2.2 Impact Assessment of Operational Consequences

Impact Table

To distinguish between primary impact and secondary impact, the table contains “P” and “S” to clarify which parameter is directly hit, and which indirectly.

Operational Consequence	Impact on Parameter								
	ELDT	EXIT	EIBT	MTTT	TOBT	TSAT	EDIT	EXOT	TTOT
	Procedures Activation								
Locac traffic regulation activated						S			P
CFMU regulation requested	P		S		S	S			P
	Capacity								
Arrival Capacity Reduction	P		S		S				
Departure Capacity Reduction						P		S	P
ATC Frequency conquest		P	S			P		P	S
Runway Configuration Change	P	S	S			S		S	P
	Restrictions								
Start up approval restrictions						P			S
Taxi restrictions		P	S					P	
Runway crossing restictions		P	S					P	S

Table 3: Operational Consequences and their Impact on Planning Parameters

Explanation to Impacts

1. Local traffic regulation may be considered touching only departing traffic. This is a situation where CFMU based regulation has been seen too heavy but the ATC capacity (usually Ground controller or LOCAL CONTROLLER) if still foreseen to be crossed. Target take of times (TTOT) might be deployed in a longer sequence, start up clearances might be delayed, runway capacity dropped temporarily and fewer traffic allowed to the movement area at the time.
   This consequence has a straight impact to the TTOT time if the local regulation is done through the TTOT deployment. It might have the primary effect to the TSAT time as well, if the regulation is made through the TSAT restriction. Both of these parameters, however, affect in the first hand in to each others.

2. If CFMU traffic regulation is requested do to problems in ATC staffing this action has an effect both to the arriving and departing traffic. The regulation is accepted only if the new published capacity is lower than the predicted demand. The estimated landing times, and therefore the estimated in-block times are delayed as well the target take of times according to the CTOTs.
   This consequence to the departing traffic has an same effect as the local regulation (item 1) had. The flexibility of the system is just worse because given CTOT's has to be honored. The primary effect to the arriving traffic parameters is to the estimated landing time (ELDT). This in turn has as an effect to the estimated (calculated) in-block time. If the time of arrival is delayed due to regulation there is a risk that the TOBT time also has to be delayed do to MTTT.

3. Arrival capacity reduction due to ATC staffing is usually the result of understaffing. It might also be a result of problematic license combination within the controllers in shift etc. By every mean this may cause arrival capacity reduction due to non optimal runway combination, inability to use optimal working procedures etc.
   This consequence has a primary effect to the estimated landing time (ELDT) which in turn has an (secondary) effect to the estimated in block time (EIBT). If the time of arrival is delayed due to regulation there is a risk that the TOBT time also has to be delayed do to MTTT.

4. Departure capacity reduction has basically the same effect as the local traffic regulation in consequence 1. If it is a matter of understaffing, it might be that traffic is not restricted at the gate but queue pops up at the runway holding area. If the controller, because of an increased work load due to insufficient number of working position, is not able to use the runway at its maximum capacity, a taxi delay may occur during the departure phase.
   This consequence has a primary effect to the TTOT and/or STAT parameters and an secondary effect to the EXOT time.

5. ATC frequency conquest due to ATC staffing problems is a result of insufficient number of working positions.
   This consequence may have a primary impact (if any) to the EXIT/EXOT times. When the controller is under a high workload traffic on ground is usually the one which has not the priority versus traffic in air. Therefore taxi clearances might be delayed and

taxi times increased. It is the same with the ASAT time (not directly to the TSAT time unless local or CFMU regulation is in use).

6. Runway configuration change might have to be done if ATC has problems with stuffing. The sufficient number of runways might not be kept open or all the working procedures might not be used (parallel approaches, runways wide apart to each other, etc).
   This consequence might have a primary impact to ELDT and TOBT due to reduced runway capacity, which in turn is a result of the usage of fewer numbers of runways, environmental restrictions of the runway s being able to use etc. Runway configuration change is a very local procedure and the impact has to be defined case by case.

7. Start up approval restrictions are impact of a reduced ATC capacity.
   This consequence has a direct primary impact to the TSAT calculation and secondary impact through the process calculation to the TTOT.

8. Taxi restrictions or runway crossing restriction due to ATC staffing are both based on the thought, that the controller has a wider area of responsibility than usual (either in work load or area of his expertise and experience) and the controller has to work slower and take more time to make decisions as usual. Because the work is not so intensive as it might be in an ideal situation some delays in taxi and runway crossing may occur in the name of safety.
   This consequence has a primary impact to the EXIT / EXOT times and secondary impact to the EIBT / TTOT (ATOT) times.

4.2.3 Related Adverse Conditions

This condition is a condition which may occur in every weather related condition as well as in most of the crisis condition. Industrial action of ATC is close to this condition though not the same.

4.3 Equipment

4.3.1 Description

This condition describes situation, where some of the critical ATC equipment either related to the airport operations (runway lights, communication systems, radar display, weather display system, electronic flight strip or to the ATM network (flight plan processing, AFTN network, etc.) fails.

Because of such a wide spectra of different equipment, here it is supposed that the equipment failure is somewhere in the flight plan processing network.

4.3.2 Impact Assessment of Operational Consequences

Impact Table

To distinguish between primary impact and secondary impact, the table contains “P” and “S” to clarify which parameter is directly hit, and which indirectly.

Operational Consequence	Impact on Parameter								
	ELDT	EXIT	EIBT	MTTT	TOBT	TSAT	EDIT	EXOT	TTOT
	Procedures Activation								
Manual flight plan processing activation	S		S	S	S	P			P
CDM process downgrading	S		S		P	P			P
Traffic regulation activation	P		S			S			P
	De-icing								
De-icing order information unavailable						S		P	S
De-icing position allocation information missing					P	S		S	S
	Capacity								
Information mismatch	S		S		S	S			S
Flight plan information non-existence	S		S		S	S			S
CDM information sharing system failure	P	S	P		P	P		S	P
Radar capacity reduced	P		S			S			P
Clearance Delivery capacity reduced					S	P			S
Ground surveillance equipment failures		P	S			S		P	S
Local (TWR) controller capacity reduced	P		S			S		S	P
	Restrictions								
Arrival capacity reduction	P		S		S				
Start up delays						S			P
ATC frequency congestion		P				S		P	P

Table 4: Operational Consequences and their Impact on Planning Parameters

Explanation to Impacts

1. Manual flight plan processing activation

Due to missing electronic flight plan information and related electronic tools, manual procedures and back up flight plan files has to be taken into use. Manual procedure might mean for example paper flight strips instead of use of electronic flight strips, usage of flight parking information instead of FPL information ETC.

2. CDM process downgrading

CDM process based on flight planned flights has to be ceased.

3. Traffic regulation activation

Because of non standard situation normal ATC/Airport capacity can not be reached and traffic regulation has to be activated.

4. De-icing order information unavailable

Because of lost flight plan information data flights can not be identified in the CDM / DEICING coordination system any more and thus the information about de-icing orders might have been lost (depends on who makes the coordination and where the information has been stored).

5. De-icing position allocation information missing

Because of lost flight plan information data flights can not be identified in the CDM / DEICING coordination system any more and thus the information about de-icing position allocation might have been lost (depends on who makes the coordination and where the information has been stored).

6. Information mismatch

Because the flight plan information is not up to date at the moment a mismatch between different data sources may exist. When the information is unsure it may necessarily not be used by the ATC, gate allocation etc.

7. Flight plan information non-existence

ATC doesn't receive information about the new flight but little by little there are no new flights in the ATC or related systems.

8. CDM information sharing system failure

Because of missing flight plan information the CDM application is not able to process its tasks but may fall into numerous alerts, information discrepancies etc.

9. Radar capacity reduced

Radar display system is partly based on the flight plan processing. When the flight plan data disappears also the identification of the flight on the radar screen disappears.

10. Clearance Delivery capacity reduced

ATC clearance delivery is totally dependent of the flight plan information which is then connected to the ATC system. As soon as flight plan information disappears it may cause an extra amount of work while trying to find out if the flight plan overall exists. This may take time and requires usually a lot of communication between the appropriate parties (AIS, PILOT, Airline Operator, etc.).

11. Ground surveillance equipment failures

Ground surveillance equipments, like the air radar display system, use flight plan information processing to connect the flight information to the radar data. When flight plan information is lost only raw radar information can be shown.

12. Local (TWR) controller capacity reduced

Due to lot of information usually used to control traffic will be missing also the normal capacity of the local controller in the name of safety is dramatically reduced.

4.4 Industrial Action

TBD

5 AIRPORT

In this chapter adverse condition scenarios and operational consequences are described which are related to air traffic control causes. For each condition scenario operational conditions and impact on the Airport CDM key parameters is determined.

5.1 Aerodrome Capacity

5.1.1 Description

- Basic elements : Almost all items from Impact Assessment action list apply. With exeption/adjustment of :
  - Airport : increased security levels , new system procedures.
  - Other : only special events, system maintenance apply

Examples on 3 different airports :

- Paris CDG : ATC strikes
- LHR/LGW : winter conditions
- AMS : persistent fog conditions, strong NWly winds

5.1.2 Impact Assessment of Operational Consequences

Impact Table

Operational Consequence	Impact on Parameter								
	ELDT	EXIT	EIBT	MTTT	TOBT	TSAT	EDIT	EXOT	TTOT
	Procedures Activation								
Communication & Coordination Increase					P	P			
Incident/Accident Status Activation					P	P			
	De-icing								
	Capacity								
Arrival Capacity Reduction	P	P	P		S	S			
Departure Capacity Reduction				S	S	P	P	P	P
Stand Capacity Reduction		S	P	S	S				
Runway Configuration Change	P	S	S				S	S	P
Ground Handling Time Increase					P	S	S		S
…									
	Restrictions								
Taxiway Restriction		P	S			S		P	S
Apron Restriction		S	P	P		S			

Stand Restriction			S	P		S			
Resource Restriction			S	P	P				
…									
	Safety								
	Security								
Rule Violation				P	S				
Risk Increase			S	P	S				
	Environmental								

Table 5: Operational Consequences and their Impact on Planning Parameters

5.1.3 Related Adverse Conditions

- ATC capacity
- Staffing / Industrial Action
- Meteo
- Special Events

5.2 Accident or Incident

Basic Elements :

- Ground ops issues
- Increased security levels
- Technical Failures
- Work in progress
- Emergency status

Examples

1. LHR : B777 crash landing
2. DUS : Terminal fire
3. XYZ :hijacking / order disturbance

5.2.1 Impact Assessment of Operational Consequences

Impact Table

Operational Consequence	**Impact on Parameter**								
	ELDT	**EXIT**	**EIBT**	**MTTT**	**TOBT**	**TSAT**	**EDIT**	**EXOT**	**TTOT**
	Procedures Activation								
Communication & Coordination Increase				P	P	S			
Incident/ Accident Status Activation	P			S	P				P
	De-icing								
On-Stand De-icing					P	S			
Apron & Remote					S	P			

De-icing									
	Capacity								
Arrival Capacity Reduction	P								
Departure Capacity Reduction						P			P
Stand Capacity Reduction		P	S						
Runway Configuration Change			P			P	S	P	S
Ground Handling Time Increase				P	P	S			
Airport Terminal Capacity Reduction				P	S	S			
	Restrictions								
Taxiway Restriction		P	S				S	P	
Apron Restriction		S	S	P	S				
Stand Restriction		S	S	P	P				
Resource Restriction ATC	P	P						P	P
Rescource Restriction Handler				P	P				
	Safety								
Risk Increase		S	S	P	P	P	S		
	Security								
Risk Increase			S	P	P				
	Environmental								

Table 6: Operational Consequences and their Impact on Planning Parameters

5.2.2 Related Adverse Conditions

- Ground ops issues
- Military/Police activity
- Increased security Levels
- Technical Failures

5.3 Equipment

5.3.1 Description

This Adverse Condition describes lack of Equipment availability of de-icing vehicles, snow sweeping equipment, Luggage handling, or gate bridges, etc. This condition does not consider technical failure of computer related systems for planning, FIDS, or ATC systems.

5.3.2 Impact Assessment of Operational Consequences

Impact Table

Lack of equipment availability leads to reduced capacity for flight operations. Either new material has to replace broken equipment, or repair works will delay the activities of flights. The lack of equipment described here only applies for when impact occurs on airport scale.

The impact mainly applies on the turnround process, as the cause is mostly the responsibility of the airport.

Table 2 below reflects possible primary and secondary impacts. To distinguish between primary impact and secondary impact, the table contains “P” and “S” to clarify which parameter is directly hit, and which indirectly.

Operational Consequence	**Impact on Parameter**								
	ELDT	**EXIT**	**EIBT**	**MTTT**	**TOBT**	**TSAT**	**EDIT**	**EXOT**	**TTOT**
	Procedures Activation								
Communication & Coordination Increase				P	P	P	P	S	S
	De-icing								
On-Stand De-icing					P	S			S
Apron & Remote De-icing						S	P	P	S
Hold Over Time Exceeded						S	P	P	S
…									
	Capacity								
Stand Capacity Reduction			P		S	S			
Ground Handling Time Increase				P	S	S			S
	Safety								
Risk Increase					P	P			S
	Security								
Risk Increase					P	S			S

Table 7: Operational Consequences and their Impact on Planning Parameters

Explanation to Impacts

1. Operational Consequence “Communication and Coordination primarily impacts on MTTT and TOBT, as most communication reflect the landside processes such as boarding, and the Turnround process. Secondary impacts on TSAT and TTOT are the result of ATC regulations of the surface traffic.
2. Operational Consequence “On-Stand De-icing” primarily impacts on TOBT, as de-icing is included in the turnround process. Secondary impacts on TSAT and TTOT as a consequence of that primary impact.
3. Operational Consequence “Apron and Remote De-icing” primarily impacts on EXOT, as de-icing time is included in the taxi time. Secondary impacts on TSAT and TTOT as a consequence of that primary impact.
4. Operational Consequence “Arrival Capacity Reduction” primarily impacts on ELDT as the separation values between aircraft must be increased. Secondary impact occurs on EIBT as the late landing results in late in blocks.
5. Operational Consequence “Departure Capacity Reduction” primarily impacts on TTOT as the separation values between aircraft must be increased. Secondary impact occurs on TSAT as a consequence of restrictions on the runway and taxiway.
6. Operational Consequence “Stand Capacity Reduction” primarily impacts on EIBT as limited stands are available. Secondary impact occurs on TOBT and TSAT, as a consequence of that primary impact.
7. Operational Consequence “Ground Handling Time Increase” primarily impacts on MTTT as the turnround process takes longer. Secondary impact occurs on TOBT,

TSAT and TTOT as the late landing results in late in blocks, which creates a knock-on effect.

8. Operational Consequence “Safety Risk Increase” primarily impacts on TOBT as manual checks of system output may need verification and hence require more time. Secondary impact occurs on TSAT and TTOT as a knock-on effect.
9. Operational Consequence “Security Risk Increase” primarily impacts on TOBT as security measures in landside may require more time. Secondary impact occurs on TSAT and TTOT as a knock-on effect.

5.3.3 Related Adverse Conditions

Other Adverse Conditions related to this scenario are New System Procedures and Technical Failure.

5.4 Industrial Action

5.4.1 Description

This Adverse Condition describes Industrial Action in airport, airline, ground handlers, or other service organizations. Industrial action can mean strikes of staff of any organization or work to rule. It does not describe industrial action in ATC.

5.4.2 Impact Assessment of Operational Consequences

Impact Table
Industrial Action will result in reduced availability of airport services, such as:

- Apron Control
- Ramp Handling
- Tarmac Bus Services (Boarding, Disembarkation)
- Passenger- and Baggage Handling
- Security Control
- etc.

Table 2 below reflects possible primary and secondary impacts. To distinguish between primary impact and secondary impact, the table contains “P” and “S” to clarify which parameter is directly hit, and which indirectly.

Operational Consequence	Impact on Parameter								
	ELDT	EXIT	EIBT	MTTT	TOBT	TSAT	EDIT	EXOT	TTOT
	Capacity								
Arrival Capacity Reduction	P	S	S		S	S		S	S
Departure Capacity Reduction						P		S	S
Stand Capacity Reduction	P	S	S		P	S		S	S
Ground Handling Time Increase				P	P	S			S
	Restrictions								
Apron Control Restriction	P	P	S		S	P			S
Reduced Tarmac Bus Services (Pax disembarkation / boarding)	S	P	S		P	S			S

Security Control Reduction	S	P	S		P	S			S

Table 8: Operational Consequences and their Impact on Planning Parameters

Explanation to Impacts

1. Operational Consequence “Arrival Capacity Reduction” primarily impacts on ELDT as the separation values between aircraft must be increased. Secondary impact occurs on EIBT as the late landing results in late in blocks.
2. Operational Consequence “Departure Capacity Reduction” primarily impacts on TTOT as the separation values between aircraft must be increased. Secondary impact occurs on TSAT as a consequence of restrictions on the runway and taxiway.
3. Operational Consequence “Stand Capacity Reduction” primarily impacts on EIBT as limited stands are available. Secondary impact occurs on TOBT and TSAT, as a consequence of that primary impact.
4. Operational Consequence “Ground Handling Time Increase” primarily impacts on MTTT as the turnround process takes longer. Secondary impact occurs on TOBT, TSAT and TTOT as the late landing results in late in blocks, which creates a knock-on effect.
5. Operational Consequence “Apron Control Restriction” primarily impacts on ELDT and EXIT, as the Arrival Capacity Reduction is the first measure and consequence of reduced apron control availability. Secondary impact occurs on EIBT and outbound parameters, as consequence of that primary impact.
6. Operational Consequence “Stand restriction”

5.4.3 Related Adverse Conditions

Other Adverse Condition related to this scenario is Staff Shortages.

5.5 Environmental Issues

5.5.1 Description

Basic Elements :

- Weather
- Regulations e.g. noise abatement regulations (SIDs, STARs/CDAs, runway availability, …)
- Time of day, season
- Bird migration

Examples

1. AMS : restricted use of runways
2. ABC : bird migration (e.g. geese) depending season (sunrise, sunset)
3. XYZ : weather, de-icing (from 1 to 2 steps deicing) > delays

5.5.2 Impact Assessment of Operational Consequences

Impact Table

Operational Consequence	Impact on Parameter								
	ELDT	EXIT	EIBT	MTTT	TOBT	TSAT	EDIT	EXOT	TTOT
	Procedures Activation								
Communication & Coordination Increase	P				S	P			P
…									
	De-icing								
On-Stand De-icing						P	S		P
Apron & Remote De-icing							P		
Hold Over Time Exceeded									P
…									
	Capacity								
Arrival Capacity Reduction	P		S						S
Departure Capacity Reduction						P	S	S	P
Runway Configuration Change	P	P	S			P	S		P
	Restrictions								
Noise Abatement impact	P					P			P
…									
	Safety								
Risk Increase					P	S			P
	Security								
	Environmental								
Rule Violation	P					P			P
Risk Increase	P					S			P

Table 9: Operational Consequences and their Impact on Planning Parameters

5.5.3 Related Adverse Conditions

- Runway configuration
- ATC capacity
- Aerodrome capacity
- Sector configuration
- Vulcano activity
- All meteo parameters applicable

.

5.6 Ground OPS Issues

TBD

5.7 Increased Security Levels

5.7.1 Description

The reason for Increased security level at an airport may be due to the following occurances

- Bomb scare/threat received
- Unidentified baggage found in terminal
- Evacuation of terminal due to a security alert
- Irregularities, additional restrictions in connection with flights to US (TSA, ESTA, API data issues)
- Etc.

Above may result in tighter/stricter security measures, additional screenings and longer process times at the security check points and / or data processing

Breakdown of screening equipment, missing passengers at the gate etc. are covered by other processes.

5.7.2 Impact Assessment of Operational Consequences

Impact Table

To distinguish between primary impact and secondary impact, the table contains "P" and "S" to clarify which parameter is directly hit, and which indirectly.

Operational Consequence	Impact on Parameter								
	ELDT	EXIT	EIBT	MTTT	TOBT	TSAT	EDIT	EXOT	TTOT
	Procedures Activation								
Increased Security Level Activation	P	P	S			S		S	S
Communication & Coordination Increase									
	Increased Security Level								
Bomb scare/Threat	P	P	S		P	S			S
Unidentified baggage found in Terminal	P	P	S		P	S			S
IRR in connection with US flights	P	P	S		P	S			S
	Capacity								
Arrival Capacity Reduction	P	S	S		S	S		S	S
Departure Capacity Reduction									
Stand Capacity Reduction	P	P	S		P	S		S	S
Ground Handling Time Increase					P				

Table 10: Operational Consequences and their Impact on Planning Parameters

Explanation to Impacts

- Handling activities may be stopped or will be delayed in case of Increased security level at an airport
- Departing aircrafts are delayed and blocking parking space and gates. As a consequence gate and congestion with increased taxi-in times
- Air Traffic Control may issue flow control measures to reduce number of inbound flights and movements
- Airline schedule is disrupted, Terminals may be congested.

5.7.3 Related Adverse Conditions

- Staffshortages, Aerodrome Capacity

5.8 New System Procedures

5.8.1 Description

This Adverse Condition describes the introduction of New System Procedures at the airport. Examples are security enhancements such as new body scanners, new terminal buildings, or new baggage sort systems. Existing procedures or systems such as CDM, DMAN-AMAN, or advanced ATC systems are assumed to be existing, hence they are not part of this scenario.

5.8.2 Impact Assessment of Operational Consequences

Impact Table

New landside system procedures always require time to make both airport staff and in some case also passengers familiar with them. This time is mostly consumed in the airport itself, but has therefore a possible impact on the turnround time of aircraft, and hence TOBT.

New airside system procedures such as use of new gates, aprons, de-icing or information boards, may have operational consequences that may impact on stand or movement capacity.

Table 2 below reflects possible primary and secondary impacts. To distinguish between primary impact and secondary impact, the table contains “P” and “S” to clarify which parameter is directly hit, and which indirectly.

Operational Consequence	Impact on Parameter								
	ELDT	EXIT	EIBT	MTTT	TOBT	TSAT	EDIT	EXOT	TTOT
	Procedures Activation								
Low Visibility Procedure Activation	P	P	S			S		P	P
Communication & Coordination Increase				P	P	P	P	S	S
…									
	De-icing								
On-Stand De-icing					P	S			S
Apron & Remote De-icing						S	P	P	S
Hold Over Time Exceeded						S	P	P	S
…									
	Capacity								
Arrival Capacity Reduction	P		S						

Departure Capacity Reduction						S			P
Stand Capacity Reduction			P		S	S			
Runway Configuration Change		P	S			S		P	S
Ground Handling Time Increase				P	S	S			S
…									
	Safety								
Risk Increase					P	P			S
	Security								
Risk Increase					P	S			S

Table 11: Operational Consequences and their Impact on Planning Parameters

Explanation to Impacts

1. Operational Consequence “Low Visibility Procedure Activation” primarily impacts on all inbound and outbound surface parameters such as ELDT and TTOT. Secondary impacts on EIBT and TSAT as a consequence of slower taxi times, and TTOT optimization.
2. Operational Consequence “Communication and Coordination primarily impacts on MTTT and TOBT, as most communication reflect the landside processes such as boarding, and the Turnround process. Secondary impacts on TSAT and TTOT are the result of ATC regulations of the surface traffic.
3. Operational Consequence “On-Stand De-icing” primarily impacts on TOBT, as de-icing is included in the turnround process. Secondary impacts on TSAT and TTOT as a consequence of that primary impact.
4. Operational Consequence “Apron and Remote De-icing” primarily impacts on EXOT, as de-icing time is included in the taxi time. Secondary impacts on TSAT and TTOT as a consequence of that primary impact.
5. Operational Consequence “Hold Over Time Exceeded” primarily impacts on EDIT and EXOT, as de-icing needs to be repeated. Secondary impacts on TSAT and TTOT as a consequence of that primary impact.
6. Operational Consequence “Arrival Capacity Reduction” primarily impacts on ELDT as the separation values between aircraft must be increased. Secondary impact occurs on EIBT as the late landing results in late in blocks.
7. Operational Consequence “Departure Capacity Reduction” primarily impacts on TTOT as the separation values between aircraft must be increased. Secondary impact occurs on TSAT as a consequence of restrictions on the runway and taxiway.
8. Operational Consequence “Stand Capacity Reduction” primarily impacts on EIBT as limited stands are available. Secondary impact occurs on TOBT and TSAT, as a consequence of that primary impact.
9. Operational Consequence “Runway Configuration Change” primarily impacts on EXOT as the taxi time changes. Secondary impact occurs on TSAT and TTOT as the (pre-) departure sequence changes also.
10. Operational Consequence “Ground Handling Time Increase” primarily impacts on MTTT as the turnround process takes longer. Secondary impact occurs on TOBT, TSAT and TTOT as the late landing results in late in blocks, which creates a knock-on effect.

11. Operational Consequence “Safety Risk Increase” primarily impacts on TOBT as manual checks of system output may need verification and hence require more time. Secondary impact occurs on TSAT and TTOT as a knock-on effect.
12. Operational Consequence “Security Risk Increase” primarily impacts on TOBT as security measures in landside may require more time. Secondary impact occurs on TSAT and TTOT as a knock-on effect.

5.8.3 Related Adverse Conditions

Other Adverse Conditions related to this scenario are Equipment (Non ATC) and Technical Failure.

5.9 Runway Configuration

5.9.1 Description

Basic elements of the condition :

- Weather (e.g. snow, thunderstorms)
- Regulations
- Works in progress
- Environmental (e.g bird migration)

Examples :

1. AMS : runway conflicts in/outbound peaks, restricted use of RWYs
2. CDG : noise abatement,
3. XYZ : airports with restricted use of rwys during low vis ops

Impact Table

Operational Consequence	Impact on Parameter								
	ELDT	EXIT	EIBT	MTTT	TOBT	TSAT	EDIT	EXOT	TTOT
	Procedures Activation								
Low Visibility Procedure Activation	P	S	S			P	S	S	P
Communication & Coordination Increase	P				S	P	S	S	P
…									
	De-icing								
On-Stand De-icing						P			
Apron & Remote De-icing						P			P
Hold Over Time Exceeded						P			P
…									
	Capacity								
Arrival Capacity Reduction	P								
Departure Capacity Reduction									P
Runway	P	S	S			P		S	P

Configuration Change									
…									
	Restrictions								
Taxiway Restriction		P						P	
Apron Restriction				S	P				
Stand Restriction				S	P				
…									
	Safety								
	Security								
	Environmental								
Rule Violation	P								P

Table 12: Operational Consequences and their Impact on Planning Parameters

5.9.2 Related Adverse Conditions

- ATC capacity
- ATC staffing
- Environmental issues
- Work in Progress
- Special Events
- System Maintenance
- All weather elements

5.10 Staff Shortages

5.10.1 Description

Staffshortages of services which are provided by the airport operator affect the operation at an airport.
Reason for staffshortages is the result of sickness, planning errors, late staff due to e.g. traffic jams etc.

- Apron Control
- Ramphandling
- Tarmac Bus Services (Boarding, Disembarkation)
- Passenger- and Baggage Handling
- Security Control
- etc.

Above services may be provided at some airports by other contractors like ATC, handling agents or 3 rd parties. Industrial actions (Non ATC) are covered by another process.

5.10.2 Impact Assessment of Operational Consequences

Impact Table

To distinguish between primary impact and secondary impact, the table contains “P” and “S” to clarify which parameter is directly hit, and which indirectly.

Operational Consequence	Impact on Parameter								
	ELDT	EXIT	EIBT	MTTT	TOBT	TSAT	EDIT	EXOT	TTOT
	Staff shortages								
Apron Control	P	P	S		S	P			S
Tarmac Bus Services (Pax disembarkation / boarding)	S	P	S		P	S			S
Security Control	S	P	S		P	S			S
	Capacity								
Arrival Capacity Reduction	P	S	S		S	S		S	S
Departure Capacity Reduction						P		S	S
Stand Capacity Reduction	P	S	S		P	S		S	S
Ground Handling Time Increase					P	S			S
	Restrictions								
Taxiway Restriction									
Apron Restriction									
Stand Restriction									
Resource Restriction									

Table 13: Operational Consequences and their Impact on Planning Parameters

Explanation to Impacts

- Longer taxi-in time and start-up delays may occur in case of staffshortage at Apron Control
- Flights are delayed as a result of missing passenger due increased waiting times at security and longer transfer time of connecting passengers
- Air Traffic Control may issue flow control measures to reduce number of inbound flights and movements
- Lack of stands, gate- and ramp congestion as a further consequence of reduced capacity due to staff shortage

5.10.3 Related Adverse Conditions

- Aerodrome Capacity, Increased Security Levels

5.11 Technical Failure

5.11.1 Description

This Adverse Condition describes failure of any system with technical causes and operational consequences. Such failure could be the blackout of flight information displays, the planning system for passengers of some airline, or the failure of navigation or ATC systems in the tower. Technical failures of one aircraft are not considered, as the impact of one flight to the whole airport not expected to be large scale.

5.11.2 Impact Assessment of Operational Consequences

Impact Table

Technical failures within the airline or ground handler organizations (e.g. planning computers) will have impact on Turnround time and hence TOBT. Technical failures within the Airport can have technical impact on capacity, e.g. when the surface lighting or ILS fails to work. Inside the terminal building technical failure may impact on the boarding process, and hence TOBT. Technical failure within ATC has impact on traffic movements, as manual control may be the best alternative apart from closing the airport. Table 2 below reflects possible primary and secondary impacts.

To distinguish between primary impact and secondary impact, the table contains “P” and “S” to clarify which parameter is directly hit, and which indirectly.

Operational Consequence	Impact on Parameter								
	ELDT	EXIT	EIBT	MTTT	TOBT	TSAT	EDIT	EXOT	TTOT
	Procedures Activation								
Communication & Coordination Increase					P	S			S
	Capacity								
Arrival Capacity Reduction	P		S						
Departure Capacity Reduction						S			P
Runway Configuration Change						S		P	S
Ground Handling Time Increase				P	S	S			S
	Safety								
Risk Increase					P	S			S
	Security								
Risk Increase					P	S			S

Table 14: Operational Consequences and their Impact on Planning Parameters

Explanation to Impacts

1. Operational Consequence “Communication and Coordination primarily impacts on TOBT, as most communication reflect the landside processes such as boarding, and the Turnround process. Secondary impacts on TSAT and TTOT are the result of ATC regulations of the surface traffic.
2. Operational Consequence “Arrival Capacity Reduction” primarily impacts on ELDT as the separation values between aircraft must be increased. Secondary impact occurs on EIBT as the late landing results in late in blocks.
3. Operational Consequence “Departure Capacity Reduction” primarily impacts on TTOT as the separation values between aircraft must be increased. Secondary impact occurs on TSAT as a consequence of restrictions on the runway and taxiway.
4. Operational Consequence “Runway Configuration Change” primarily impacts on EXOT as the taxi time changes. Secondary impact occurs on TSAT and TTOT as the (pre-) departure sequence changes also.
5. Operational Consequence “Ground Handling Time Increase” primarily impacts on MTTT as the turnround process takes longer. Secondary impact occurs on TOBT, TSAT and TTOT as the late landing results in late in blocks, which creates a knock-on effect.

6. Operational Consequence “Safety Risk Increase” primarily impacts on TOBT as manual checks of system output may need verification and hence require more time. Secondary impact occurs on TSAT and TTOT as a knock-on effect.
7. Operational Consequence “Security Risk Increase” primarily impacts on TOBT as security measures in landside may require more time. Secondary impact occurs on TSAT and TTOT as a knock-on effect.

5.11.3 Related Adverse Conditions

Other Adverse Conditions related to this scenario are Equipment (Non ATC) and New System Procedures.

5.12 Work In Progress

Basic elements of the condition.

- Equipment (ATC + non ATC)
- Runway configuration
- Technical failure
- System Maintenance

Examples :

1. AMS : renewal of antiskid layer on RWY
2. FRA : removal of rubber deposits
3. CDG : adjustment of TWYs

5.12.1 Impact Assessment of Operational Consequences

Impact Table

Operational Consequence	Impact on Parameter								
	ELDT	EXIT	EIBT	MTTT	TOBT	TSAT	EDIT	EXOT	TTOT
	Procedures Activation								
Communication & Coordination Increase	S	P				P		P	S
…									
	De-icing								
On-Stand De-icing						P			
Apron & Remote De-icing						P			
…									
	Capacity								
Arrival Capacity Reduction	P		S						
Departure Capacity Reduction						P		S	P
Stand Capacity Reduction		S	S	P	S				
Runway Configuration Change	P	S	S			P		S	P
…									

	Restrictions								
Taxiway Restriction		P	S			S		P	
Stand Restriction									
…									
	Safety								
Risk Increase		P						P	
	Security								
	Environmental								
Rule Violation	P								P

Table 15: Operational Consequences and their Impact on Planning Parameters

5.12.2 Related Adverse Conditions

- Accident/Incident
- Ground Ops issues
- Technical Failure
- System Maintenance
- All meteo elements

6 PROCESSES

This chapter will contain the resulting processes after a mapping is made from the operational consequences and their impact on the key parameters. The processes described below are only example processes, presented in the format of the Generic Processes for Airport CDM, as agreed by the Airport CDM Procedures Group meeting in 2009.

The Timeline for development of this chapter is expected to be for the second half of 2010, however may be taken over by SESAR IP2, work package 6.6.2.

6.1 METEO

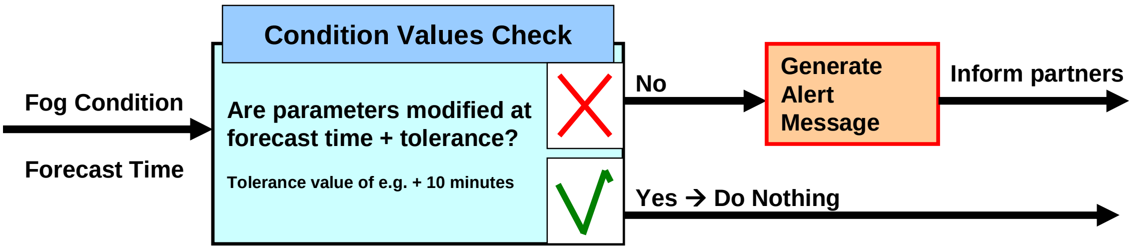
6.1.1 Processes Applicable in Fog Conditions

6.1.1.1 Process for Weather Status: Change to Fog Conditions

This Milestone is Highly Recommended

Objective
First step: To inform all relevant Airport CDM partners of Status Fog Conditions in the Airport CDM platform.

Second step: To check if all parameters have been modified according to Fog Conditions.



Description
Inform of fog conditions when it occurs or forecasted. In case relevant parameters are not adjusted to these winter conditions, all relevant partners should be informed, and CDM platform and planning parameters updated to default fog condition values.

Trigger
Setting of fog conditions
Meteorological forecast report

Pre-condition

Status of non-fog conditions

Input
Default planning parameter values for fog conditions.
Time of forecast
Partner reaction period tolerance [minutes]

Process
Fog condition or forecast is recorded in the Airport CDM platform after triggering by a meteorological report or manual input. At the time of forecast or current time + tolerance a check is made to detect if the parameters for fog conditions have been adjusted.

Output
When the process is triggered a message is sent to all relevant partners to inform them on the winter conditions. After the reaction period a check is made to determine if planning parameters have been adjusted.

Response to Messages
All partners to increase planning parameter values based on statistical and operational experience during similar fog conditions. ; or to decide and inform the CDM platform to ignore the alert message, and insert a clarification for the action.

Consequences of No Action following Alert Messages
Default parameters for winter conditions must be set, and the partners should be informed.

Remarks
Describe particularities.

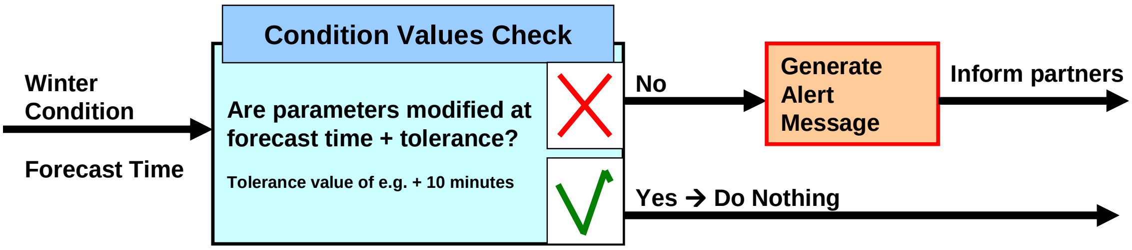
6.1.2 Processes Applicable in De-icing

6.1.2.1 Process for Weather Status: Change to Winter Conditions

This Milestone is Highly Recommended

Objective
First step: To inform all relevant Airport CDM partners of Status Winter Conditions in the Airport CDM platform.

Second step: To check if all parameters have been modified according to Winter Conditions.



Description
Inform of winter conditions when it occurs or forecasted. In case relevant parameters are not adjusted to these winter conditions, all relevant partner should be informed, and CDM platform and planning parameters updated to default winter condition values.

Trigger
Setting of winter conditions
Meteorological forecast report

Pre-condition
Status of non-winter conditions

Input
Default planning parameter values for winter conditions.
Time of forecast
Partner reaction period tolerance [minutes]

Process
Winter condition or forecast is recorded in the Airport CDM platform after triggering by a meteorological report or manual input. At the time of forecast or current time + tolerance a check is made to detect if the parameters for winter conditions have been adjusted.

Output
When the process is triggered a message is sent to all relevant partners to inform them on the winter conditions. After the reaction period a check is made to determine if planning parameters have been adjusted.

Response to Messages
All partners to increase planning parameter values based on statistical and operational experience during similar winter conditions; or to decide and inform the CDM platform to ignore the alert message, and insert a clarification for the action.

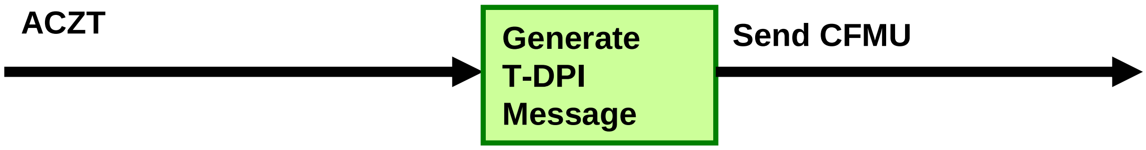
Consequences of No Action following Alert Messages
Default parameters for winter conditions must be set, and the partners should be informed.

Remarks
Describe particularities.

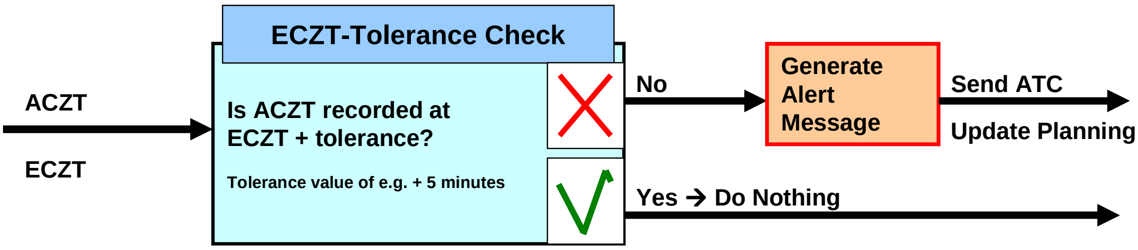
6.1.3 Process for Milestone: Commence of Apron/Remote Aircraft De-icing

This Milestone is Highly Recommended

Objective
First step: To inform all relevant Airport CDM partners of Actual Commence of De-icing Time (ACZT) in the Airport CDM platform.



Second step: To check if ACZT is in accordance to ECZT and to alert all relevant airport CDM partners that de-icing has not started according to plan.



Description
Inform of ACZT when it occurs. In case commence of de-icing is not started at ECZT + tolerance, all relevant partner should be informed, and the de-icing sequence planning updated.

Trigger
ACZT: Automated input from de-icing coordinator or vehicle.
ECZT has passed.

Pre-condition
Actual Off-block Time is recorded.
Taxi clearance is recorded.
Weather status set to winter conditions.
Flight crew has requested de-icing.

Input
ACZT and ECZT

Process
ACZT is recorded in the Airport CDM platform after the de-icing company started de-icing operation. At ECZT + tolerance a check is made to detect if the start for de-icing is missing.

Output

ACZT is recorded in the Airport CDM platform and sent to the AO/GH and T-DPI message to CFMU with De-icing field status activated, or an alert message is sent to all relevant partners.

Response to Messages
ATC
ATC should provide taxi clearance or flight should be re-sequenced for pushback or take-off to assign new TSAT or TTOT.

AO/GH/De-icing Company
Flight should be re-sequenced for de-icing to assign new ECZT.

Consequences of No Action following Alert Messages

Not Applicable

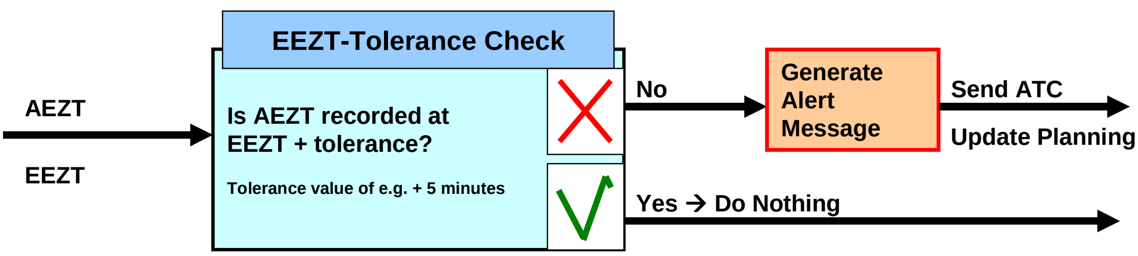
Remarks
Describe particularities.

6.1.4 Process for Milestone: End of Apron/Remote Aircraft De-icing

This Milestone is Highly Recommended

Objective
First step: To inform all relevant Airport CDM partners of Actual End of De-icing Time (AEZT) in the Airport CDM platform and that the aircraft has resumed taxi from de-icing platform.

Second Step: To check if AEZT is in accordance to EEZT and to alert all relevant airport CDM partners that de-icing has not ended according to plan.



Description
Inform of AEZT when it occurs. In case commence of de-icing is not started at EEZT + tolerance, all relevant partner should be informed, and the take-off sequence planning updated.

Trigger
AEZT: Input from de-icing coordinator or vehicle.
EEZT has passed.

Pre-condition
ACZT

Input
AEZT and EEZT

Process
AEZT is recorded in the Airport CDM platform after the de-icing company ended de-icing operation. At EEZT + tolerance a check is made to check if the end for de-icing is missing.

Output
AEZT is recorded in the Airport CDM platform and sent to the AO/GH and A-DPI message to CFMU with De-icing field status activated, or an alert message is sent to all relevant partners.

Response to Messages
ATC
Flight should be re-sequenced for take-off to assign new TTOT.

Consequences of No Action following Alert Messages
Not Applicable

Remarks
Describe particularities.

6.2 ATC

6.3 AIRPORT

6.4 OTHER

ANNEX I BEST PRACTICES

This chapter describes current best practices applied in European airports, where focus is on coordination between airport partners, and communication procedures deviating from normal procedures.

A. Helsinki De-icing and Anti-icing service

De-/anti-icing is performed at the apron area at the terminal gate and/or stand positions and at the remote area serving one runway direction (situation as of 2009). Additionally the airport has some so called outer apron areas that may be used for de-/anti-icing activity but is limited in operation due to environmental restrictions. All operation requirements are descried by the airport de-/anti-icing requirements.

The basis for any de-/anti-icing is that the airline/aircraft contacts the Helsinki de-icing coordinator and indicates the need for a de-/anti-icing. The coordinator will then, after (or prior) consultation with ATC and other necessary stakeholders, allocate a position at the airport were the de-/anti-icing operation will take place. After this the airline/aircraft is directed to the appropriate service provider for further instructions noting any necessary ATC communication in between.

Any special request such as engine ice melting, under wing de-icing, tactile checks and company and/or aircraft manufacturer requirements prior to a/c movement will be noted and if necessary the operation allocated to such position where this can be performed.

The de-/anti-icing is performed by 5 different service providers at the airport (situation as of 2009). The only common procedure is established for the remote area. Apron positions are operated as individual service provider operations without any further communication between the Helsinki coordinator and/or ATC.

The main activity is a so called Two-step procedure using Type-I for the de-icing step and Type-IV for the anti-icing step. In the beginning and at the end of the winter season (i.e. September-October and April-May respectively) a one-step procedure using Type-I only is usually performed (mainly for frost contamination cases). It is not common to perform a so called local frost prevention at arrival and prior to departure as this upper wing frost event is no longer so common with current a/c types at the airport, although it can be provided. Other special procedures that can be provided is a so called forced air procedure in which the snow (mainly dry snow) is blown from the surfaces prior to a “normal” de-/anti-icing procedure as required. Also a full de-/anti-icing operation in the early morning hours may be performed a few hours prior to scheduled departure in order to try to ease the peak departure while de-/anti-icing may be required or anticipated.

The most critical elements at the airport regarding the whole de-/anti-icing process is to have a good and clear communication line with ATC of what aircrafts are departing from what runway and when (order) and how the runway cleaning is planned and is proceeding. Also the suction trucks need to be in cooperation as some de-/anti-icing operations are performed at such positions where environmental issues need to be noted prior to the start of the de-icing. The apron control of a/c positioning is one important stakeholder in order to try to get a smooth flow of aircrafts to and from different positions at the airport. Last but not least are the other service providers that need to be on line and report capacity and progress as it reflects in particular the remote operations. Weather forecasting and airline requirements need to be noted as well.

B. Oslo De-icing and Anti-icing service

General

At the moment we use the following aircraft de-icing chemicals at the airport:

- Hot water for de-icing/defrosting (may be mixed with hot Aircraft De-icing Fluid type I, depending on the outdoor temperature)
- Hot type I Aircraft De-icing Fluid (ADF) for de-icing/defrosting, mixed with hot water.
- Cold type II ADF for anti-icing (secondary stage after de-icing).
- Hot type II ADF for local frost prevention

We allow only monopropylene glycol for aircraft de-icing of environmentally reasons.

The de-icing operations are based on environmental requirements given by the Norwegian Environmental Authorities, and the EU Ground Handling Directive 96/67/EC.

Requirements set by the airport administration
Local regulations include:
Regulations and rules for de-icing service providers at OSL.
The regulations include requirements to capacity like staff, de-icing vehicles and type of services (de-/anti-icing, local frost prevention, mechanical snow removal equipment and fan blade heating), regulations due to collaboration between the service providers and environmental requirements.
Regulations for remote de-icing operations.
Regulations for local frost prevention.
Regulations for the de-icing coordinator (iceman).
These regulations include the responsibility and the traffic control on the remote de-icing platforms.

Location of de-icing operations
Ordinary de-icing and anti-icing operations that give Hold Over Time (HOT) according to international specifications are done on four remote de-icing platforms situated at the ends of the two runways (figure 1). Each platform has a capacity of 4-6 code C aircrafts (MD 80, Boeing 737 etc). Under heavy snow conditions two remote platforms can be used at the same time to increase the capacity. **Ordinary de-icing operations at stands or gates are not allowed.**

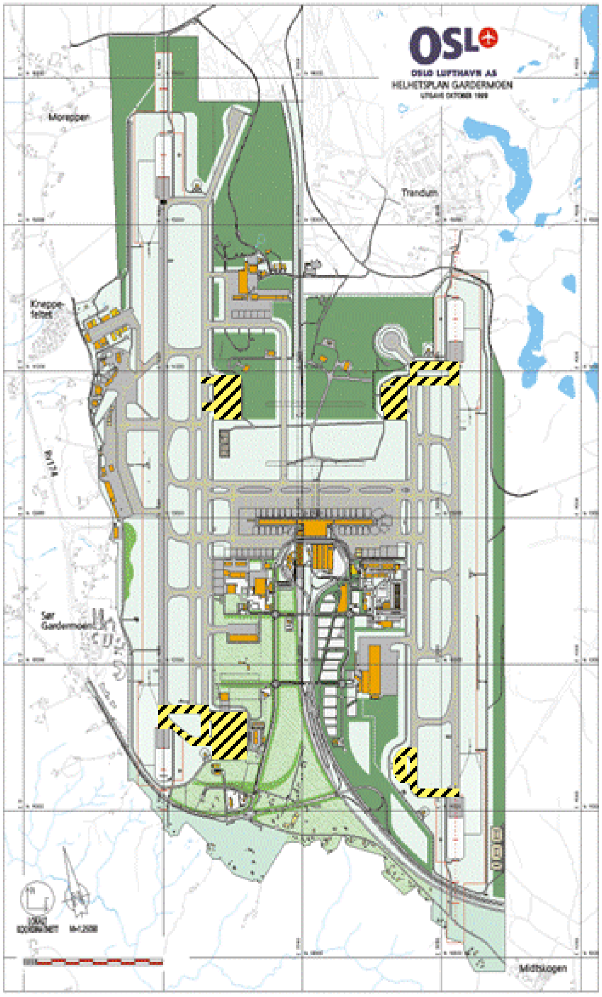


Figure 1. Remote de-icing platforms at Oslo Airport.

At stands/gates we allow"Local Frost Prevention", a local procedure based on hot type II (or IV) ADF with a maximum chemical consumption of 20 litres per Aircraft. This procedure does not give any HOT, and the aircrafts have to be inspected for ice and frost before take-off. This procedure can only be used in weather conditions without precipitation. The idea of this procedure is to avoid frost and ice to occur while parking at stand with cold wings and cold fuel tanks etc.

Storage tanks and heating

The airport/de-icing service providers have one central tank farm with a total storage capacity of approximately 300 m3 fluid:

- 3 tanks à 50 m3 hot type I fluid
- 2 tanks à 50 m3 hot water
- 1 tank à 20 m3 hot type II (local frost prevention)
- 1 tank à 35 m3 cold type II

At the second busiest platform there is a minor tank farm with:

- Hot type I fluid XX m3
- Hot water XX m3
- Cold type II fluid XX m3

De-icing vehicles

Besides inspection vehicles all ordinary de-icing vehicles should be of the proportional mixing system. Special vehicles for Local Frost prevention are being used, and some of the de-icing vehicles do have blowers for removing dry snow.

Ordinary de-icing vehicles (approx 20) have 3 tanks:
- Hot water tank
- De-icing fluid tank (hot type I)
- Anti-icing tank (cold type II)

De-icing methods
The temperature is measured every 15 minutes. Based on the real outdoor temperature the water-/glycol mixture is set, according to the international standards and the actual procedure.

The mixing system is in the nozzle.
De-icing procedures
- One-step de-icing procedure with type I
- Two-step de-icing procedure with type I
- Two-step de-/anti-acing procedure with type I and type II

C. De-icing Service Provider Perspective at OSL

The following parameters are decisive: Ambient temperature, amount of snow and ice built up on aircraft, aircraft type an size/severity of currant precipitation, deicing (wither) fluid/glycol concentration, aircraft surface temperature, relatives humidity, wind direction ,equipment, deicing personal qualifications, climate-and weather related influence, temperature(water & fluid) in storage tank and vehicles, Co-ordination, forecast radar (live) and of cause correct manpower at the right time.

The main difference in capacity is snow condition , sweeping on runways and gates and hold over time (hold over time is the period of time when ice and snow is prevented from adhering to the surface of an aircraft ,i.e the amount of time between application and take off).

SAS is the largest of de-anti/Icing services at Oslo Airport/Gardermoen, operating remote deicing at four different platforms. Snow removal is performed by blower or manual sweepers. Frost removal and local frost prevention is done on cold soaked wings. Remote deicing is the safest, fastest and the most efficient way of deicing the aircraft. Engines are running under the deicing process.

In close radio contact with the cockpit crew the supervisor has direct contact with the de-icing units. A thorough de-icing treatment is carried out-within minutes- the aircraft taxi on for clean take off. This minimizes the time between treatment and take off.

Not only clean snow and frost contamination is done, the aircraft is also prevented from forming as well directly on the gate in two different methods: Local Frost Prevention on cold soaked wings (in area on the wing over the main landing gear) on short ground stops and frost removal for overnight flights. That means that we can prevent overnight flights by spraying the wings and stabilizator. The next morning, the flight can leave without delay, saving potential costs and reduce passenger inconvenience. But these two methods can only be done in correct weather condition.

In Oslo the following deicing management system is used: www.deicing.org.

D. ATC Perspective at OSL

During weather conditions where deicing of aircraft is necessary, ATC´s role is as follows;

When the aircraft is on parking stand the pilot in command (PiC) will decide whether deicing is necessary in cooperation with the relevant ground staff.

On first contact with ATC on freq. 121.6 mhz to obtain airways clearance, the pilot will state if deicing is necessary.

The controller will then mark the box on the electronic flightstrip (EFS), and select the mode deicing and the box for that purpose turns in to the blue color.

By doing that, this information will be forwarded to the deicingcoordinator.

At Gardermoen runway in use will tell the pilot which deicingplatform is in use.

The pilot will also inform the deicingcoordinator, on a dedicated freq, which treatment he wants on the aircraft.

This ensures that when the aircraft is ready for startup, everybody in the loop is aware that the aircraft needs deicing.

When the aircraft is ready to taxi, the pilot will get clearance to taxi to the deicingplatform.

Before taxiclearance is issued, ATC will take into consideration any restrictions (CTOT, EOBT) that may be valid for that specific flight. It may be necessary to reorder the aircraft in the queue, if there is one.

The expressions used to give the aircraft taxiclearance is as follow; "Taxi via taxiway N to Alpha South for deicing, contact deicingcoordinator on freq 131,85, monitor and contact TWR freq 118,3 when deicing is completed".

When the aircraft approaches the deicerplattform the pilot contacts the coordinator and will be assigned a track to use on the platform.

The pilot call ATC and reports deicing completed. ATC will then issue taxiclearance to the holding position.

If two aircraft are ready at the same time it will be necessary to sort out who is going to be number one and two on which route they are flying, EOBT or other applicable restrictions.

When snow clearance is in progress it may be necessary to hold aircraft on gate, to let the snow clearance vehicles do their job.

The focus and aim of this process should be such that when snow clearance is in progress, the aircraft needing deicing should be ready for TKOF immediately when the runway is reopened.

In addition to the above, the supervisor in the tower contacts the Metoffice the evening before and obtains the forecast for the next day's weather.

In cooperation with the deicingcoordinator ATC will apply the necessary restrictions in traffic. The deingcoordinator will as soon as possible after the deicing has started, give an estimat of how long time is needed on average for the deicing of one aircraft. Based on that information the traffic will be adjusted as required.

E. Aircraft Operator Perspective

Many decisions taken during adverse conditions are based on assumptions and best guess, not of evil will, but due to lack of communication and lack of agreed command lines.
Under normal weather conditions, the turn around of an aircraft is a study in logistics. When one adds snow, ice and heavy delays, the need for CDM will increase radically, to allow airlines to make the right decisions and priorities based on internal KPI's.
Airlines are of course obliged to communicate their decisions into the open as well, to secure full awareness.

Below some examples of why CDM in adverse de-icing conditions is essential for airline operators:

Sequence:
Operators must be included in the departure sequence (line up for de-icing).
Often, decisions regarding line up sequence will favourite flights with a CTOT.
This approach is understandable, but not always in line with the operators wish. E.g. a flight from ENGM to LEAL with a CTOT will have no onward passenger connections to other flights out of LEAL, whereas a flight from ENGM to EDDF with no CTOT could have up to 100 passengers with onward connections out of EDDF. In this case, the operator naturally wants to secure a departure as close to EOBT as possible, for the ENGM-EDDF flight.
Other reasons for prioritising a flight not affected by CTOT could be curfew, crew duty hours and use of conditional routings in filed flight plan.

In ENGM, and only during severe adverse weather conditions, SAS has a local agreement with OSL allowing tower to update SAS' FPL's in case of excess taxi and de-icing time. In such situations, tower is seen as the CDM partner with the best overview of when a flight is ready for take-off.

Airports with on-stand de-icing, or a mix of on-stand and remote de-icing, will often add even more pressure on the sequencing process. Below some examples:

- You are next in line". Is this in 5 minutes or 20 minutes? If the flight in front of you has been at an airport overnight, ice can be quite thick.
- Who dedicate trucks to which flights? Is it first come first serve?
- If equipment is sufficient, bottleneck will move from de-icing to RWY or taxiway capacity. Who will prevent too much line up at threshold? Also evident in case of snow sweeping?

Fuel Saving:
The longer time a flight can be kept on gate without engines running, the more fuel is saved. A well-coordinated traffic flow from gate to de-icing platform, will secure minimum excess burn for taxi and line-up.

Recovery:
In very harsh adverse winter conditions, an airport will often request operators to start cancelling flights that they do not intend to operate.
This is in line with what "hub carriers" do, consolidating and concentrating on basic operations.
"Point to point" carriers with no obligations towards passengers and baggage with onward connections, will not have the same incitement to cancel their operations.
As a "hub carrier" one could wish for a system, where operators cancelling flights in accordance with an airports guidelines, also get rewarded with a more optimal prioritization on its remaining operating flights.

Accurate timings:
In adverse weather conditions the inbound traffic will often suffer as much as the outbound traffic, in terms of delays, diversions and cancellations.
Accurate timings, informing the operators about pushback from gate for de-icing, will allow for better decision making within the airlines:

- How long can we await 30 connecting passengers arriving late from another flight?
- When shall push back tractor be ready?
- Is there sufficient time for catering lift-up?
- Is it possible to arrange direct baggage transfer from another late incoming flight?

Any Adverse scenario will lead to loss of capacity. From an airline perspective, CDM is seen as a way to secure maximum airport throughput in a degraded situation.

F. Amsterdam Schiphol Experiences

G. Bad Weather Experience

TBD – This section can include a best practice from some airport where bad weather caused major disruption of the airport, and where experiences are documented and for use as reference material.

H. Airport Crisis Experience

TBD – This section can include a best practice from some airport where a crisis caused major disruption of the airport, and where experiences are documented and for use as reference material.

ANNEX II CHECKLIST FOR ADVERSE CONDITIONS

ANNEX III REMOTE DE-ICING SEQUENCE PLANNING

A. Introduction

This annex aims to describe parameters and optimisation scenarios for remote de-icing sequence planning on an Airport CDM enabled airport. These scenarios propose a transparent process which can be used as a stand alone automated enabler, or integrated into pre-departure sequence planning. In the last section, three planning processes are described based on operational bottlenecks of the airport, and the optimisation that needs to be implemented to maximise throughput of these blocking points. Once activated, aircraft de-icing will seriously impact on airport operations and frustrate the throughput and planning processes.

B. Justification

Robust and reliable automated planning of remote aircraft de-icing operations is currently the missing link in many outbound planning processes, or automated planning support tools. Complexity and unpredictability of de-icing operations often make it a reactive process which can seriously challenge traffic management and thereby results in reduced capacity and throughput.

With Airport CDM implemented at an airport, the remote de-icing planning process should increase predictability (compared to the current situation), due to the presence and reliability of the Target Start-up Time, Variable Taxi Time, and improved and timely knowledge of available capacity and airport resources.

Although many factors and uncertainties of taxi and de-icing times increase the complexity of the planning process, a transparent process can still be determined based on accurate assessment of the airport bottlenecks and the impact on the planning priority on the blocking point throughput.

C. Factors complicating Planning Processes

There are a number of primary factors which can make accurate predictions of remote de-icing operations more complex:

1. Taxiway Layout – distance and taxiway route to/from the de-icing platform
2. Capacity of the de-icing platforms, aircraft throughput
3. Airport blocking points: Gates, Aprons, Taxiways, Runways, or De-icing platform
4. Number of De-icing companies
5. Availability of resources
6. Duration of de-icing times for each aircraft
7. Human factor and uncertainty
8. Weather (humidity, precipitation, temperature, etc)
9. De-icing product hold-over times

Secondary factors influencing duration of de-icing operations and remaining taxi time to the runway:

1. Wind direction during de-icing operations
2. Change of runway configuration and de-icing platform in use.
3. Runway closures for snow/ice clearance

D. Optimisation Parameters

During winter conditions airport blocking points must form a priority to ensure the optimisation of operational throughput and maximise available capacity. The usual areas are the de-icing throughput (EZCT), apron (TSAT), or runway (TTOT). Departure Manager tool should be flexible to optimisation of the relevant planning parameters, depending on the conditions of the airport on different moments in the day, or under different conditions.

The most restraining parameters to the planning process are:

1. HOT – Hold Over Time
2. TOBT – Target Off-Block Time

The key parameters to optimise are:

1. TSAT for apron optimisation
2. ECZT for remote de-icing optimisation
3. TTOT for runway optimisation

The main time factors influencing the optimisation due to their uncertainty are:

1. EDIT - Estimated De-icing time (duration)
2. VTT – Variable Taxi Time, or EXOT – Estimated Taxi Out Time
    a. VTT before de-icing to platform
    b. VTT after de-icing to runway

EDIT and VTT contain the largest uncertainty. This uncertainty must be taken into account as they impact the reliability of the planning. The factors mentioned in section C are impacting heavily on the accuracy of these times.

Other relevant factors are based on lay-out of airport, and conditions of airport:

1. Runway capacity (throughput rate)
2. Taxiway capacity (throughput rate)
3. Stand/gates capacity (throughput rate)
4. Apron capacity (throughput rate)
5. De-icing platform capacity (throughput rate)

The available capacity or throughput rates are less dynamic parameters but can still fluctuate, e.g. when the runway capacity drops. Such drop in capacity of one or multiple resources will lead to new optimisation scenarios.

E. Optimisation Scenarios

Apron Blocking points

In case of airports with limited aircraft parking stands, apron space, or taxiway lay-out, apron optimisation will most probably be applied on the pushback planning, with forward calculation of variable taxi time, de-icing sequence and finally take-off sequence planning. In this scenario optimisation is prioritised on TSAT, before calculation of the consequent start of de-icing (ECZT) and TTOT. TOBT and apron-stand capacity are the physical constraints to start from.

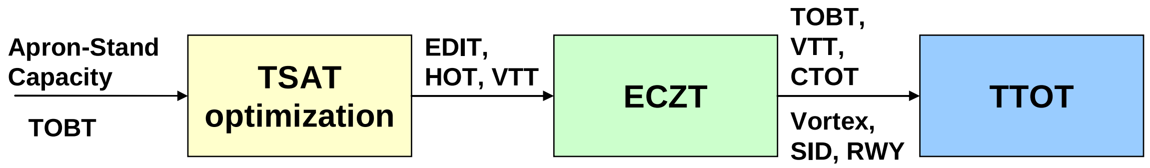


Figure 2: TSAT Optimization Priority – Forward calculation

De-icing blocking points

In case of airports with limited resources or space for de-icing areas, compared to runway and stand capacity, the airport optimisation changes during icing conditions due to this new bottleneck. In this scenario de-icing sequence optimisation is prioritised on ECZT, before calculation of TSAT and TTOT. TSAT is then calculated based on the ECZT de-icing sequence planning; TTOT is calculated based on VTT and EEZT. TOBT and de-icing resources and platform capacity are the physical constraints to start from. This becomes more important during precipitation or in snow conditions when aircraft de-icing hold-over times are seriously compromised

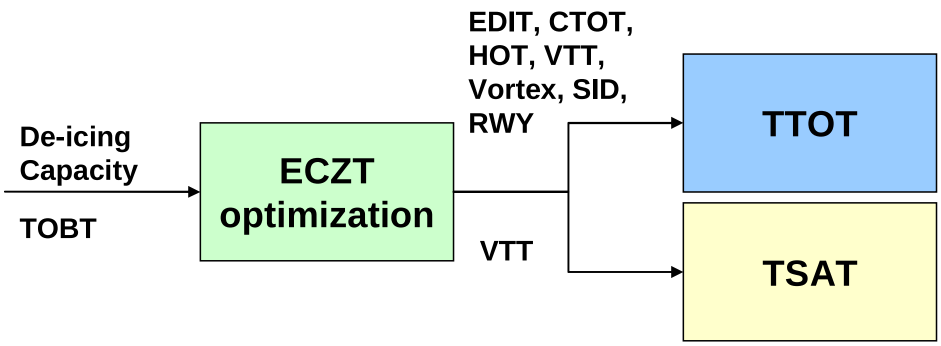


Figure 3: ECZT Optimization Priority – Forward and Backward Calculation

Runway bottleneck

In case of airports with limited runway capacity, compared to the de-icing and stand capacity, the airport optimisation changes towards runway sequence planning before pushback planning and de-icing planning. This is the most complex form of planning, since it requires backward calculation with estimates and large uncertainty for taxi time and de-icing operation impacting accuracy of planning. VTT, HOT and EDIT are the main factors to determine TSAT and ECZT given TTOT sequence. TOBT, runway capacity, and various runway factors such as SID, CTOT, and vortex then make the calculation complex.

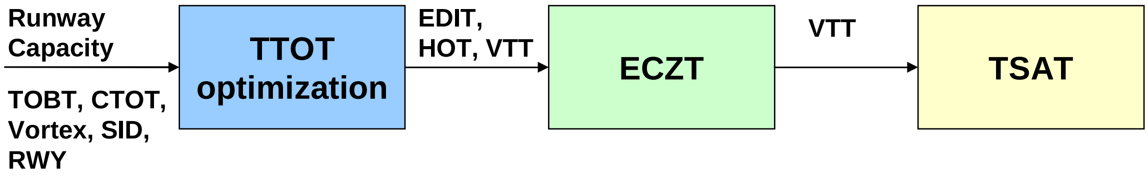


Figure 4: TTOT Optimization Priority – Backward Calculation

TTOT optimisation is very uncertain since it lies further in the future. Hence the term backward calculation, since TSAT is derived from TTOT and ECZT.