Procedures

by AirportTools, Inc.

Introduction

This tutorial reviews advanced SIMMOD Procedures.

It assumes that the student is already familiar with the basic techniques of entering/editing procedures data in the Visual SIMMOD environment.

Therefore, screen snapshots will be presented, it is the student's duty to enter this data if they desire to replicate the situations presented themselves.

The data will be provided in totality in the Visual SIMMOD applications included with this tutorial.

Independent/Dependent Procedures

Procedures can be one of the most difficult data inputs to understand.

Significant amounts of data are associated with procedures and the relationships between procedures can be easily misunderstood.

To review, a procedure:

- Defines time and distance restrictions necessary to maintain a clear runway, plus any restrictions required to manage associated runways.
- Is defined for every landing or takeoff that will be executed during the simulation.
- Can be linked to other procedures to block other takeoffs or landings while the primary procedure is being executed.
- Constitutes permission for an aircraft to start a takeoff or landing.

The definition of any procedure includes two basic items of information:

- The distance from the airport within which an aircraft will block runways and related procedures
- The time interval after the start of an aircraft's runway roll within which the runway and related procedures must remain blocked.

Independent/Dependent Procedures

It must be noted that:

- Arrival procedures do not block, or otherwise delay in any manner, any arrival procedures.

  For an arrival followed by an arrival, aircraft are usually separated in the airspace through node and wake turbulence separations.

  Therefore, the time and distance procedure separations for arrival-arrival situations can normally be left at zero.

  If they are not left at zero then an arrival which is blocking another arrival will cause the second arrival to have a missed approach.

- Departure procedures do not block, or otherwise delay in any manner, any arrival procedures.

  For a departure followed by an arrival, the arrival is never delayed. If the arrival encroaches upon the runway while the departure is active then the arrival executes a missed approach.

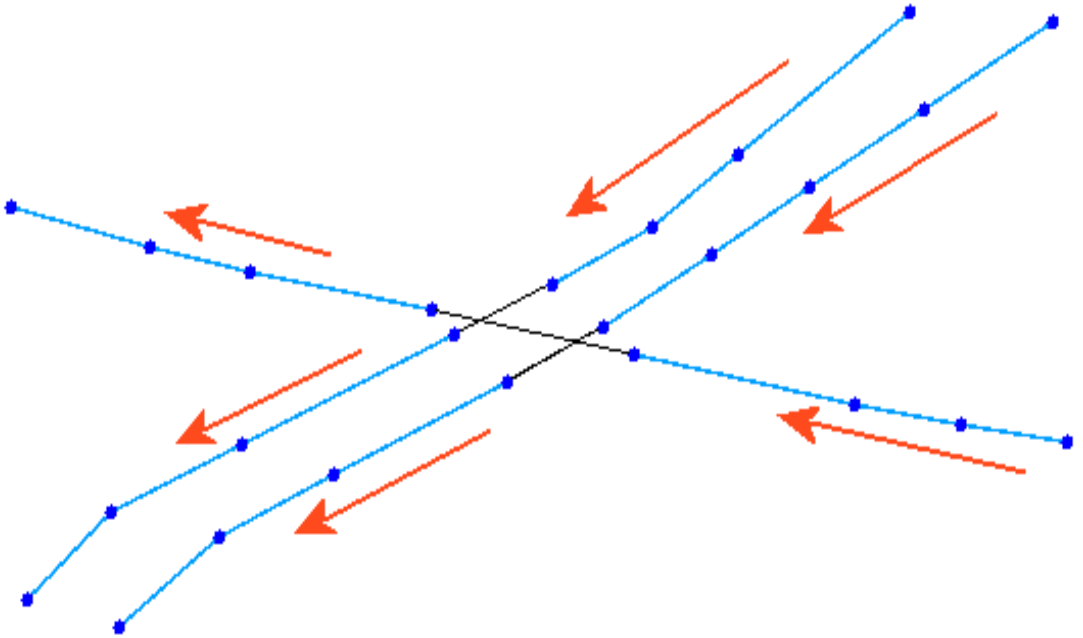
  The solution to this problem is for the analyst to specify sufficient time and distance values such that the arrival procedure can block the departure procedure.

- Arrivals executing an arrival procedure do block associated departures executing a departure procedure.

- Departures executing an departure procedure do block associated departures executing a departure procedure.

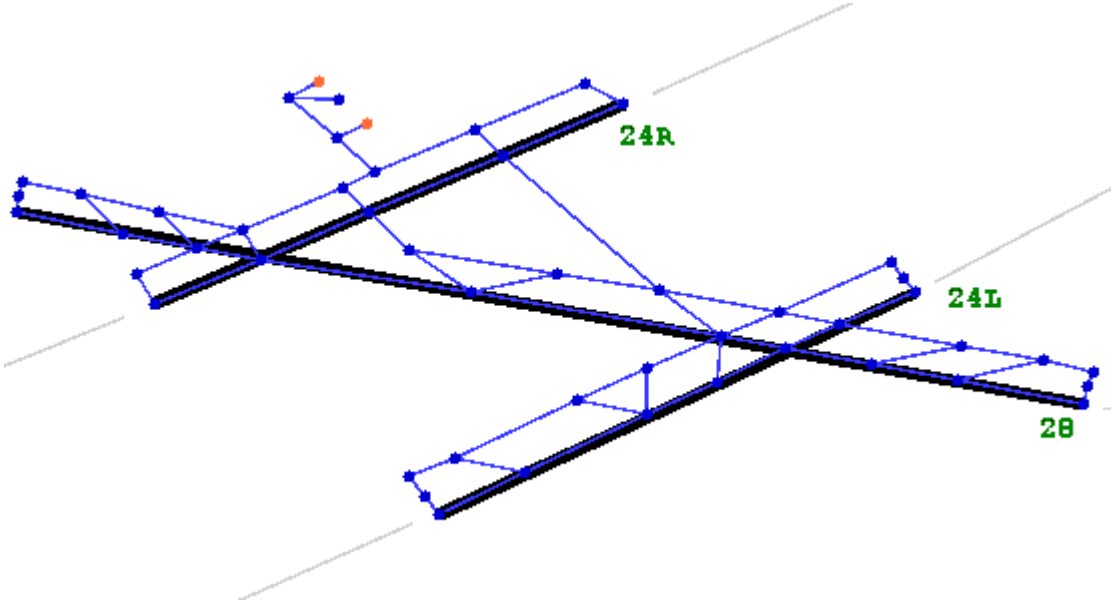
Independent/Dependent Procedures

This tutorial will be based upon the following airspace layout (arrows indicate direction of travel for aircraft):



Independent/Dependent Procedures

This tutorial will also be based upon the following airfield layout:



You should note that:

- The two parallel runways, 24L and 24R, operate independently of each other. Thus, no operation upon 24L will impact an operation on 24R, nor will any operation on 24R impact a 24L operation.
- Runways 24L and 24R both block departure operations on runway 28.
- Runway 28 blocks departure operations upon runways 24L and 24R.

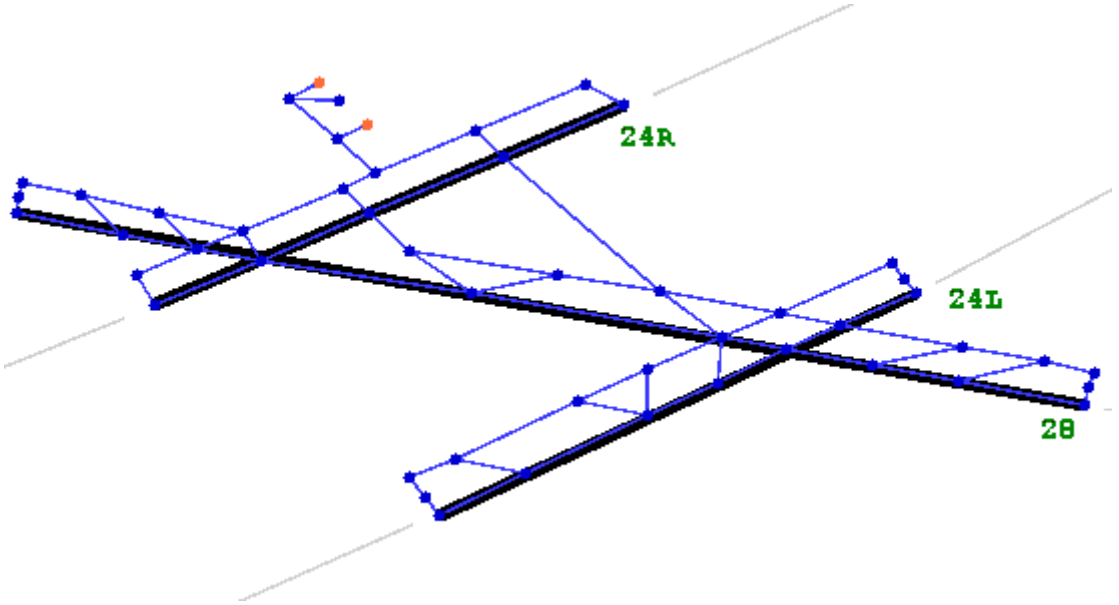
Independent/Dependent Procedures

Continuing with the previous discussion, usually airports which are configured similarly to the tutorial airport shown below will only utilize the runways in a more limited manner.

Such as, runways 24R and 24L might be devoted entirely to arrivals while runway 28 might be devoted to departure operations.

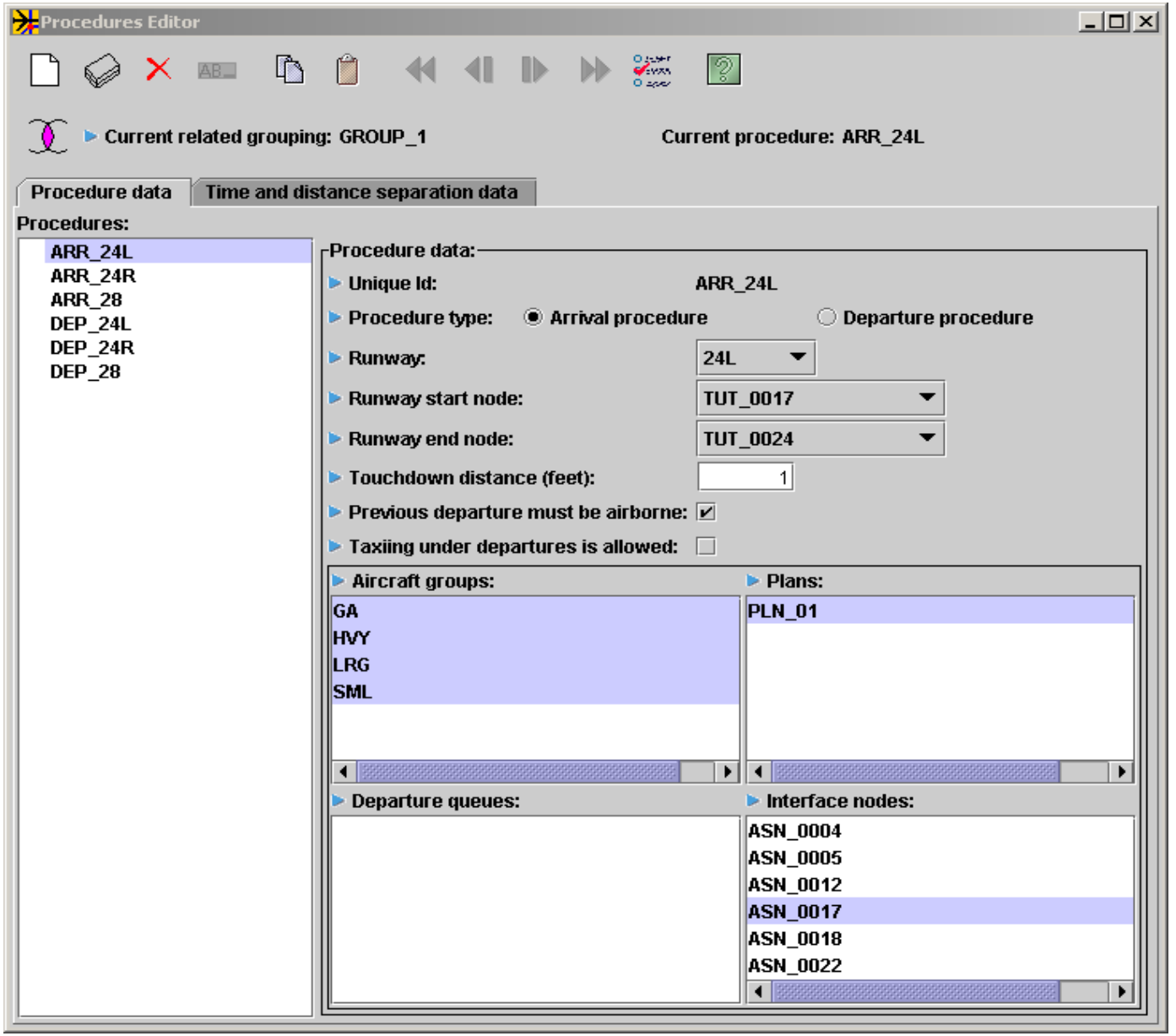
Utilizing the runways in such a manner as described above lessens the safety risks substantially.

For the purposes of this tutorial all three runways will be utilized for both arrivals and departures.



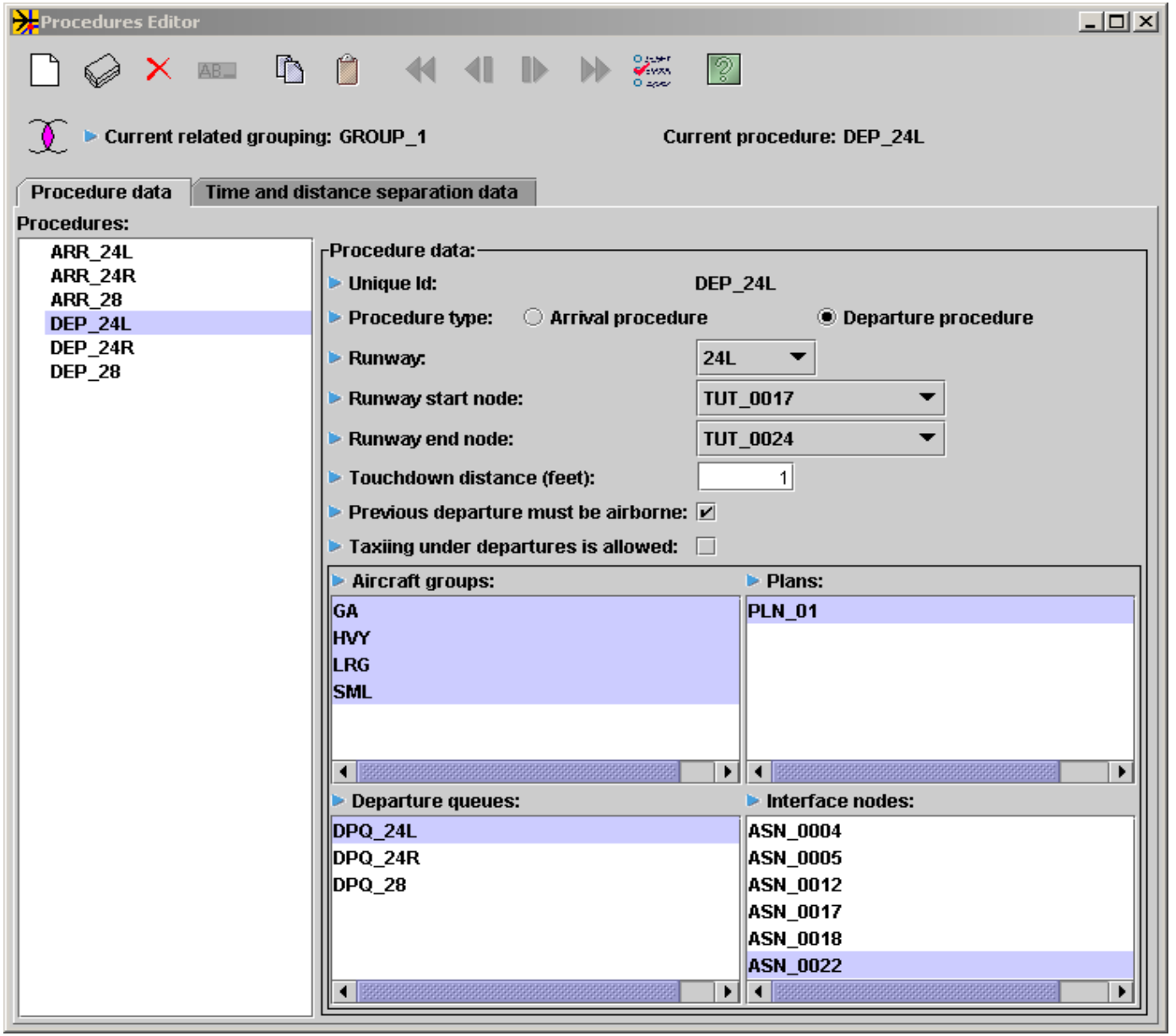
Independent/Dependent Procedures

The following example arrival procedure data has been defined for this airport:



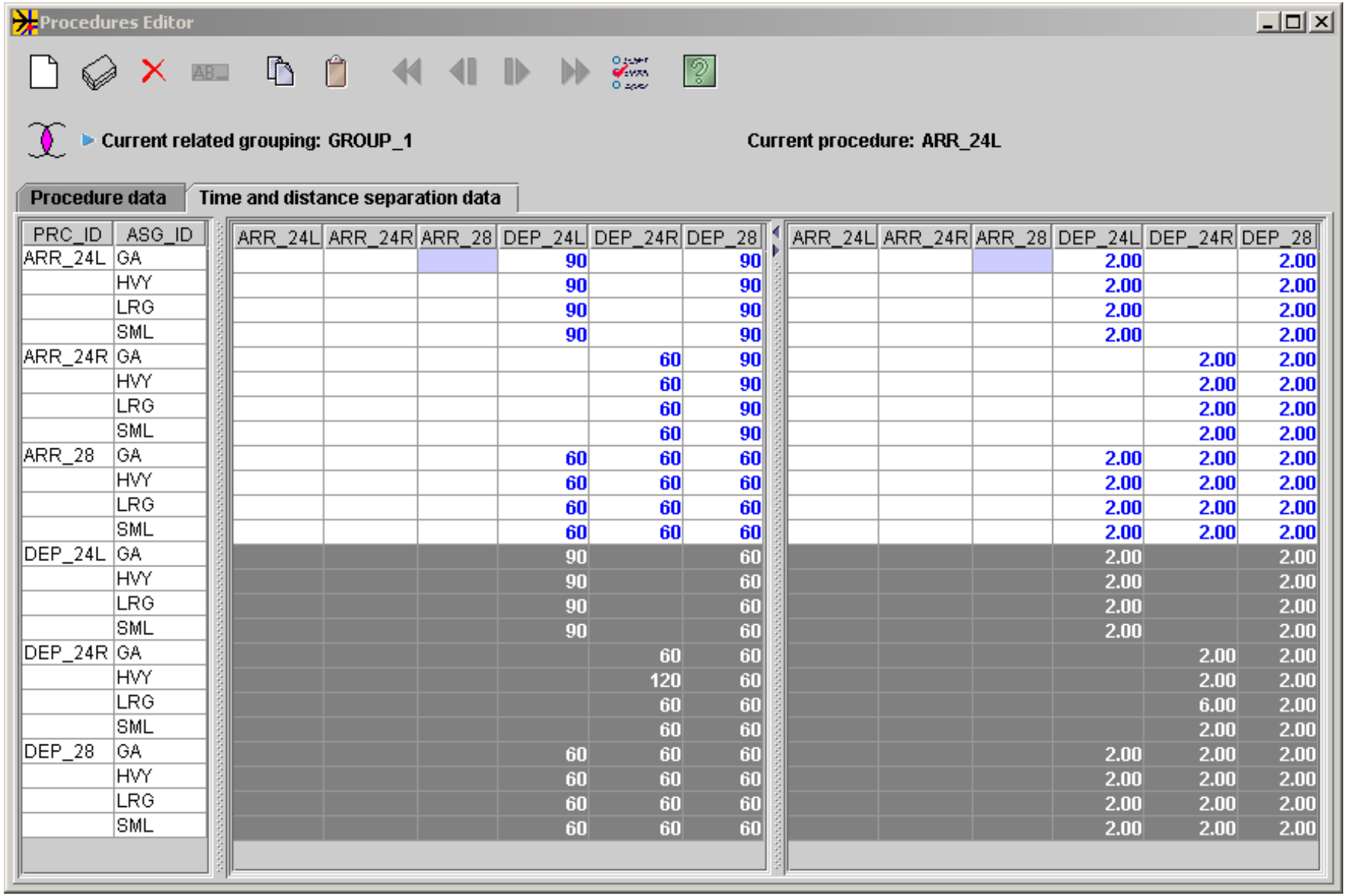
Independent/Dependent Procedures

The following example departure procedure data has been defined for this airport:



Independent/Dependent Procedures

The following time and distance separation data has been defined for this airport. Please note that no time or distance separation data has been entered for any arrival blocking because arrivals are not blocked by any other procedures.

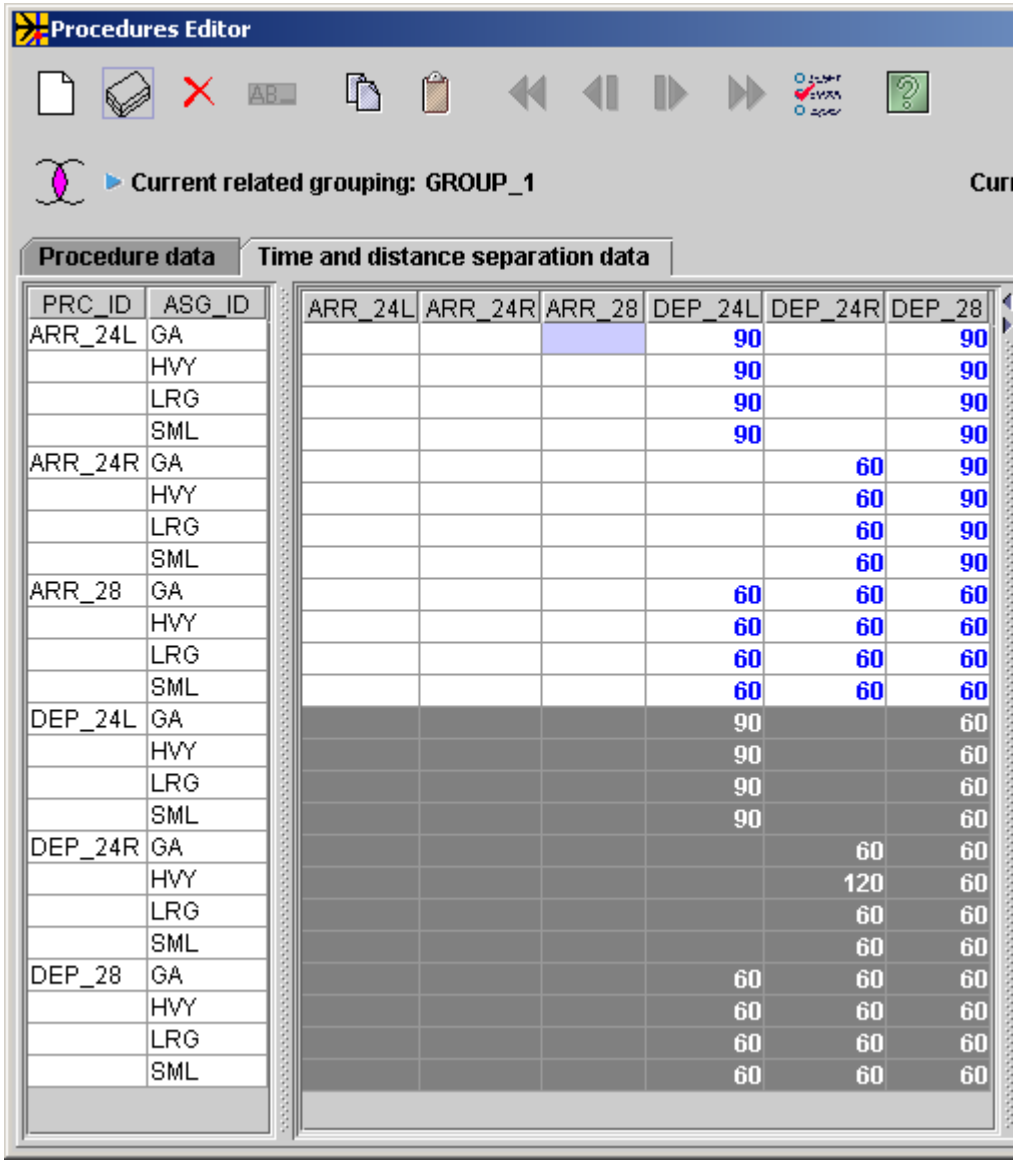


PRC_ID	ASG_ID	ARR_24L	ARR_24R	ARR_28	DEP_24L	DEP_24R	DEP_28	ARR_24L	ARR_24R	ARR_28	DEP_24L	DEP_24R	DEP_28
ARR_24L	GA				90		90				2.00		2.00
	HVY				90		90				2.00		2.00
	LRG				90		90				2.00		2.00
	SML				90		90				2.00		2.00
ARR_24R	GA					60	90					2.00	2.00
	HVY					60	90					2.00	2.00
	LRG					60	90					2.00	2.00
	SML					60	90					2.00	2.00
ARR_28	GA				60	60	60				2.00	2.00	2.00
	HVY				60	60	60				2.00	2.00	2.00
	LRG				60	60	60				2.00	2.00	2.00
	SML				60	60	60				2.00	2.00	2.00
DEP_24L	GA				90		60				2.00		2.00
	HVY				90		60				2.00		2.00
	LRG				90		60				2.00		2.00
	SML				90		60				2.00		2.00
DEP_24R	GA					60	60					2.00	2.00
	HVY					120	60					2.00	2.00
	LRG					60	60					6.00	2.00
	SML					60	60					2.00	2.00
DEP_28	GA				60	60	60				2.00	2.00	2.00
	HVY				60	60	60				2.00	2.00	2.00
	LRG				60	60	60				2.00	2.00	2.00
	SML				60	60	60				2.00	2.00	2.00

Independent/Dependent Procedures

Reviewing just the time separation data (distance data can be explained in the same manner) you will note:

- No time or distance separation data has been entered for any arrival blocking because arrivals are not blocked by any other procedures.
- ARR_24L procedure blocks DEP_24L for 90 seconds. Thus for 90 seconds after touchdown on 24L departures will not be allowed off runway 24L.
- ARR_24L procedure blocks DEP_28 for 90 seconds. Thus for 90 seconds after touchdown on 24L departures will not be allowed off runway 28.
- ARR_24R procedure blocks DEP_24R for 60 seconds.
- An arrival utilizing the ARR_28 procedure blocks departures off all three runways using procedures DEP_24L, DEP_24R, and DEP_28.

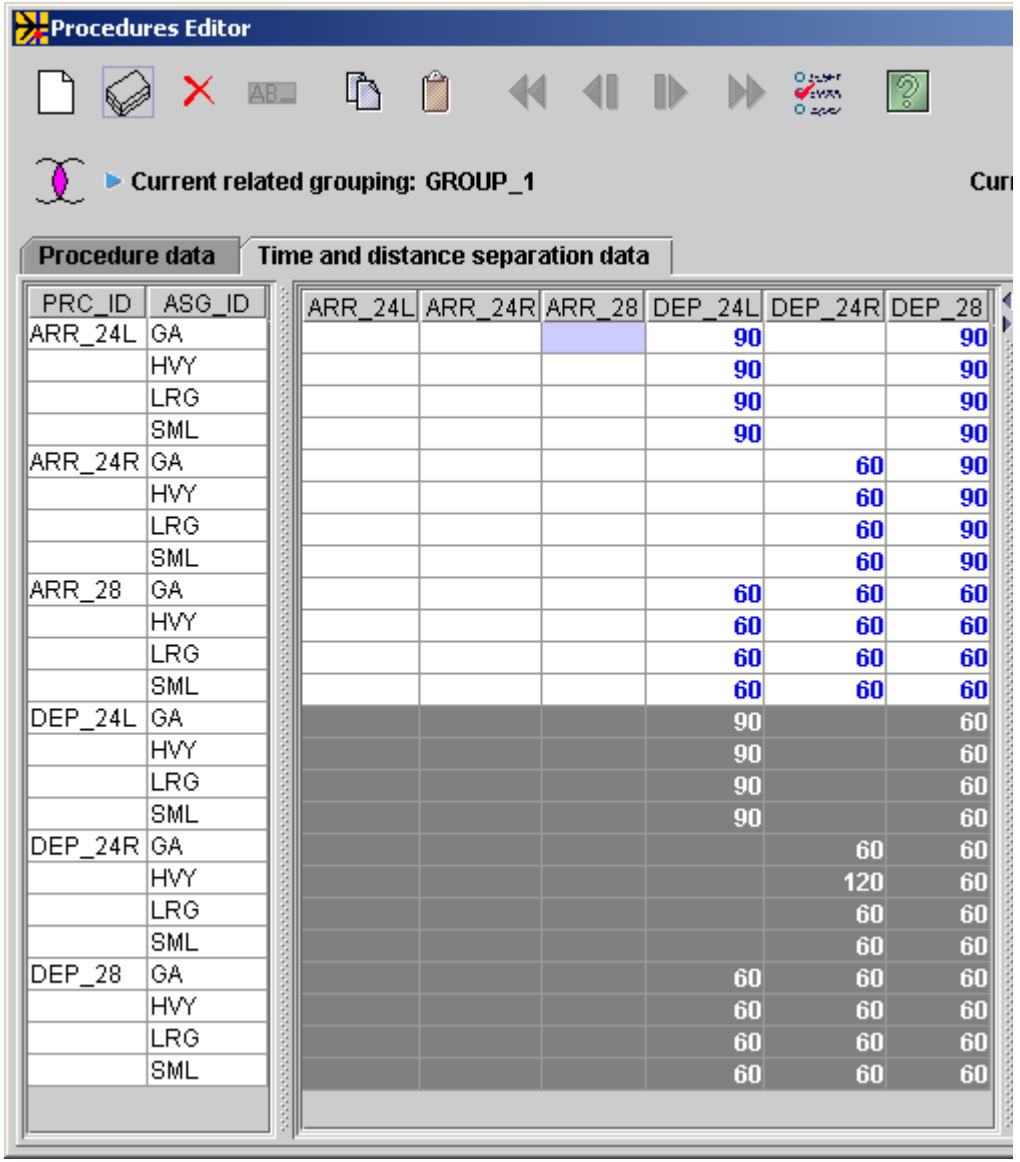


PRC_ID	ASG_ID	ARR_24L	ARR_24R	ARR_28	DEP_24L	DEP_24R	DEP_28
ARR_24L	GA				90		90
	HVY				90		90
	LRG				90		90
	SML				90		90
ARR_24R	GA					60	90
	HVY					60	90
	LRG					60	90
	SML					60	90
ARR_28	GA				60	60	60
	HVY				60	60	60
	LRG				60	60	60
	SML				60	60	60
DEP_24L	GA				90		60
	HVY				90		60
	LRG				90		60
	SML				90		60
DEP_24R	GA					60	60
	HVY					120	60
	LRG					60	60
	SML					60	60
DEP_28	GA				60	60	60
	HVY				60	60	60
	LRG				60	60	60
	SML				60	60	60

Independent/Dependent Procedures

You will also note:

- No time or distance separation data has been entered for any arrival blocking because arrivals are not blocked by any other procedures.
- DEP_24L procedure blocks DEP_24L for 90 seconds. Thus, for 90 seconds after departure on 24L another departure may not take off on 24L
- DEP_24L procedure blocks DEP_28 for 60 seconds. Thus for 60 seconds after a takeoff on 24L another takeoff on 28 will not be permitted.
- DEP_24R procedure blocks DEP_24R for 60 seconds for GA, LRG, and SML aircraft groups. 90 seconds for the HVY aircraft group.
- DEP_24R procedure blocks DEP_28 for 60 seconds.
- A departure utilizing the ARR_28 procedure blocks departures off all three runways using procedures DEP_24L, DEP_24R, and DEP_28.

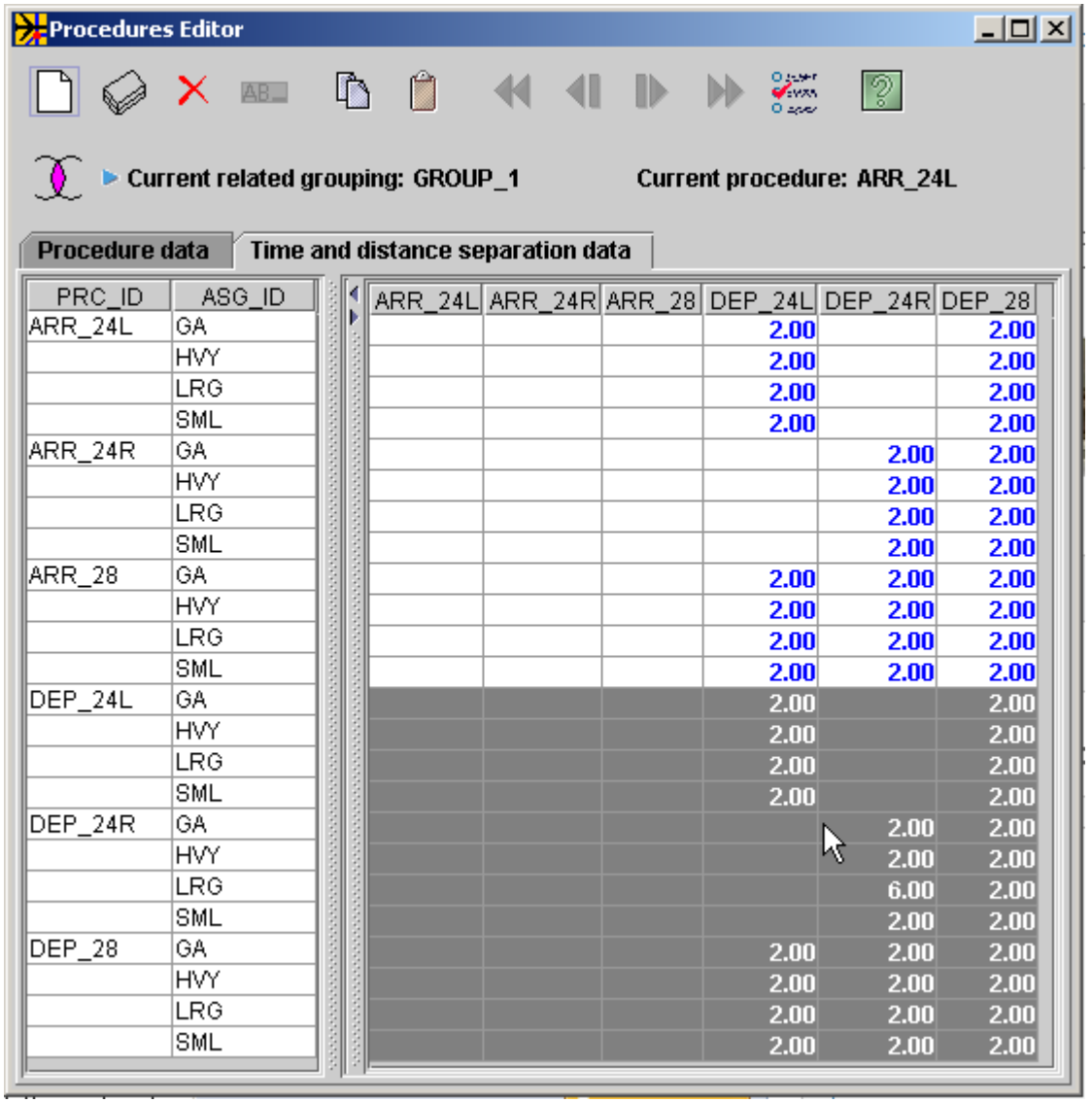


PRC_ID	ASG_ID	ARR_24L	ARR_24R	ARR_28	DEP_24L	DEP_24R	DEP_28
ARR_24L	GA				90		90
	HVY				90		90
	LRG				90		90
	SML				90		90
ARR_24R	GA					60	90
	HVY					60	90
	LRG					60	90
	SML					60	90
ARR_28	GA				60	60	60
	HVY				60	60	60
	LRG				60	60	60
	SML				60	60	60
DEP_24L	GA				90		60
	HVY				90		60
	LRG				90		60
	SML				90		60
DEP_24R	GA					60	60
	HVY					120	60
	LRG					60	60
	SML					60	60
DEP_28	GA				60	60	60
	HVY				60	60	60
	LRG				60	60	60
	SML				60	60	60

Independent/Dependent Procedures

Reviewing just the distance separation data you will note:

- No time or distance separation data has been entered for any arrival-arrival blocking because arrivals are not blocked by any other procedures.
- ARR_24L procedure blocks DEP_24L for 2.0 nautical miles. Thus when an arrival is 2.0 NM away from runway 24L it will begin blocking departures off 24L.
- ARR_24L procedure blocks DEP_28 for 2.0 NM. Thus when an arrival is 2.0 NM away from runway 24L it will begin blocking departures off 28.
- ARR_24R procedure blocks DEP_24R for 2.0 NM.
- An arrival utilizing the ARR_28 procedure blocks departures off all three runways using procedures DEP_24L, DEP_24R, and DEP_28 when the aircraft is 2.0 NM from runway 28.

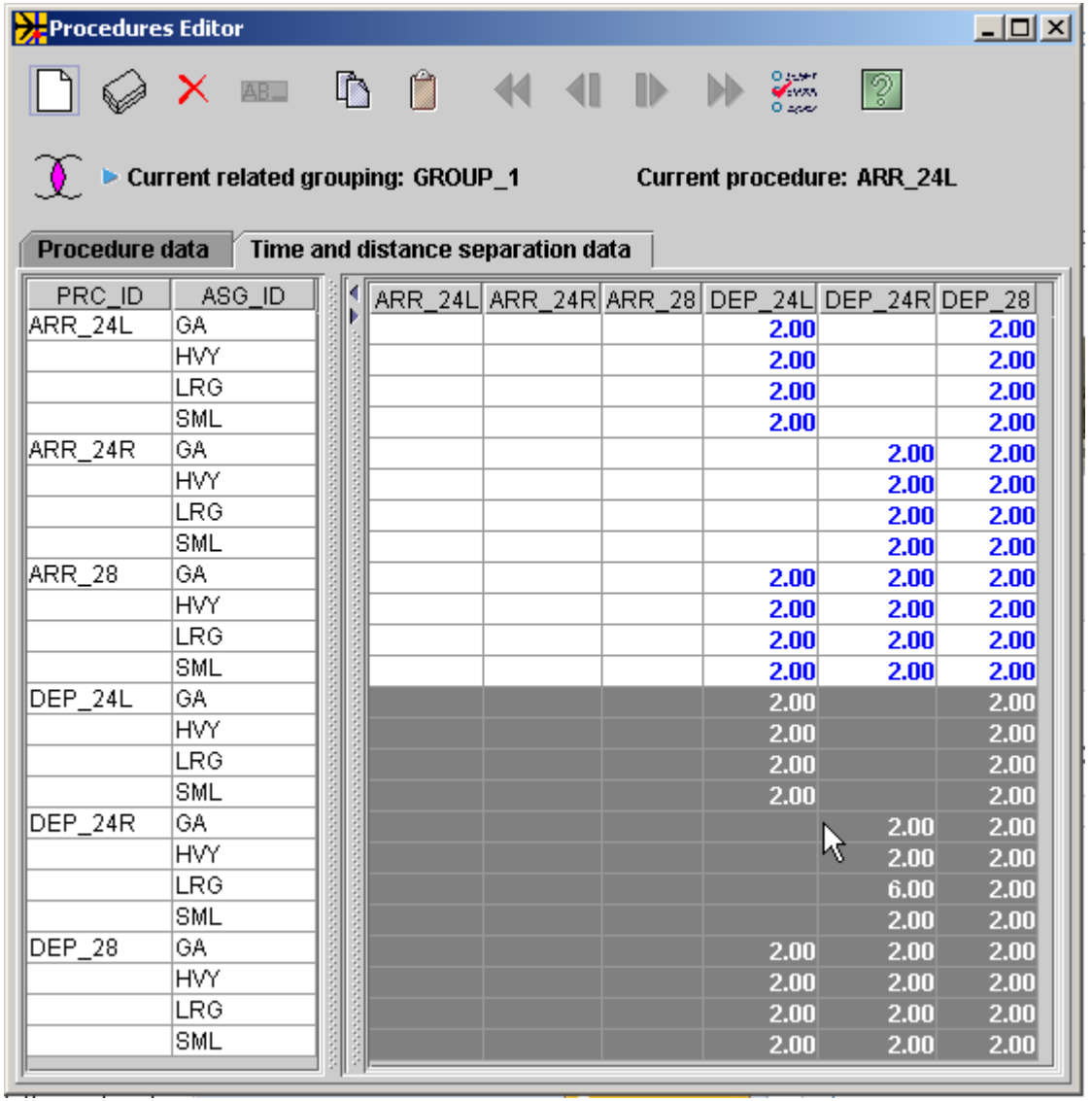


PRC_ID	ASG_ID	ARR_24L	ARR_24R	ARR_28	DEP_24L	DEP_24R	DEP_28
ARR_24L	GA				2.00		2.00
	HVY				2.00		2.00
	LRG				2.00		2.00
	SML				2.00		2.00
ARR_24R	GA					2.00	2.00
	HVY					2.00	2.00
	LRG					2.00	2.00
	SML					2.00	2.00
ARR_28	GA				2.00	2.00	2.00
	HVY				2.00	2.00	2.00
	LRG				2.00	2.00	2.00
	SML				2.00	2.00	2.00
DEP_24L	GA				2.00		2.00
	HVY				2.00		2.00
	LRG				2.00		2.00
	SML				2.00		2.00
DEP_24R	GA					2.00	2.00
	HVY					2.00	2.00
	LRG					6.00	2.00
	SML					2.00	2.00
DEP_28	GA				2.00	2.00	2.00
	HVY				2.00	2.00	2.00
	LRG				2.00	2.00	2.00
	SML				2.00	2.00	2.00

Independent/Dependent Procedures

You will also note:

- No time or distance separation data has been entered for any arrival blocking because arrivals are not blocked by any other procedures.
- DEP_24L procedure blocks DEP_24L for 2.0 NM. Thus, until a departure off 24L is 2.0 NM away from runway 24L it blocks another departure off 24L.
- DEP_24L procedure blocks DEP_28 for 60 seconds. Thus, until a departure off 24L is 2.0 NM away from runway 24L it blocks another departure off 28.
- DEP_24R procedure blocks DEP_24R for 2.0 NM for GA, HVY, and SML aircraft groups. 6.0 NM for the LRG aircraft group.
- DEP_24R procedure blocks DEP_28 for 2.0 NM.
- A departure utilizing the ARR_28 procedure blocks departures off all three runways using procedures DEP_24L, DEP_24R, and DEP_28 until it is 2.0 NM away from the end of runway 28.



PRC_ID	ASG_ID	ARR_24L	ARR_24R	ARR_28	DEP_24L	DEP_24R	DEP_28
ARR_24L	GA				2.00		2.00
	HVY				2.00		2.00
	LRG				2.00		2.00
	SML				2.00		2.00
ARR_24R	GA					2.00	2.00
	HVY					2.00	2.00
	LRG					2.00	2.00
	SML					2.00	2.00
ARR_28	GA				2.00	2.00	2.00
	HVY				2.00	2.00	2.00
	LRG				2.00	2.00	2.00
	SML				2.00	2.00	2.00
DEP_24L	GA				2.00		2.00
	HVY				2.00		2.00
	LRG				2.00		2.00
	SML				2.00		2.00
DEP_24R	GA					2.00	2.00
	HVY					2.00	2.00
	LRG					6.00	2.00
	SML					2.00	2.00
DEP_28	GA				2.00	2.00	2.00
	HVY				2.00	2.00	2.00
	LRG				2.00	2.00	2.00
	SML				2.00	2.00	2.00

Independent/Dependent Procedures

Included with this tutorial is an example of how arrivals do not block arrivals. This example is called

"tutorial_procedures_after_procs_no_alink_alink_blocking"

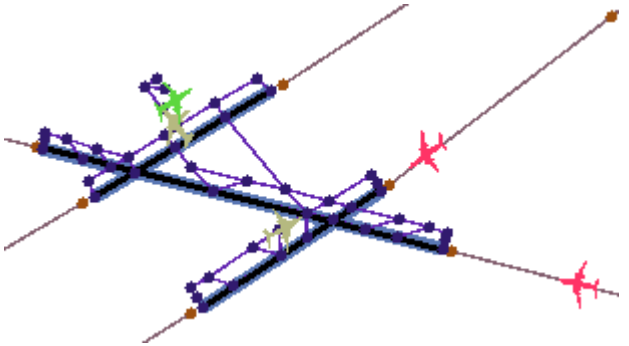
You will find this example on the AirportTools website on the same page you found this tutorial.

After downloading and installing the example please open the Application using the 2D Animation tool.

You will notice at time 7:36:30 that two arrival aircraft are within 300 feet of their respective runways.

The two runways in question (28 and 24L) physically cross and the aircraft on those runways respective final approachs are definitely performing operations which are either pilot and/or controller error conditions:

This is an example of how SIMMOD does not delay one arrival procedure for another arrival procedure.



Independent/Dependent Procedures

You may ask “If an arrival procedure cannot block another arrival procedure, then how can the analyst prevent an arrival from landing while another arrival is on a dependent runway?”

An arrival may be blocked by another arrival by one of the following means:

- Configure the final approach links of each dependent runway such that they block each other. The card is known as LINKBLOCKING and it is an airspace input.

- Configure the final approach links of each dependent runway such that they all belong to an airspace sector. Set the sector's capacity to one. The card itself is known as SECTORS and it is an airspace input.

This tutorial utilizes the LINKBLOCKING method which utilizes the following tables:

AIR_LINK_AL_BLOCKING

File Edit Data Options

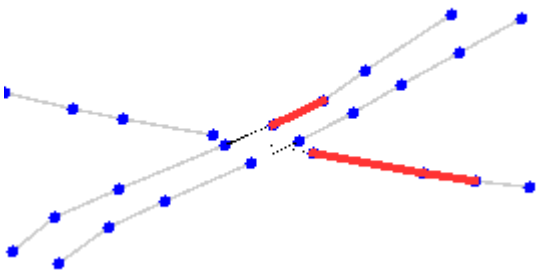
AAB_ID	ASL_ID
AAB01	ASN_0003~TO~ASN_0004
AAB03	ASN_0011~TO~ASN_0012
AAB02	ASN_0016~TO~ASN_0017

AIR_LINK_AL_BLOCKING_LINKS

File Edit Data Options

AAB_ID	ASL_ID
AAB01	ASN_0011~TO~ASN_0012
AAB01	ASN_0010~TO~ASN_0011
AAB02	ASN_0011~TO~ASN_0012
AAB02	ASN_0003~TO~ASN_0004
AAB03	ASN_0016~TO~ASN_0017
AAB03	ASN_0003~TO~ASN_0004
AAB03	ASN_0015~TO~ASN_0016
AAB03	ASN_0002~TO~ASN_0003

Airspace link ASN_0003~TO~ASN_0004, when in use, blocks links ASN_0011~TO~ASN_0012 and ASN_0010~TO~ASN_0011



Independent/Dependent Procedures

An example with the LINKBLOCKING implemented can be found in the application:

"tutorial_procedures_after_procs_with_alink_alink_blocking"

You will find this example on the AirportTools website on the same page you found this tutorial.

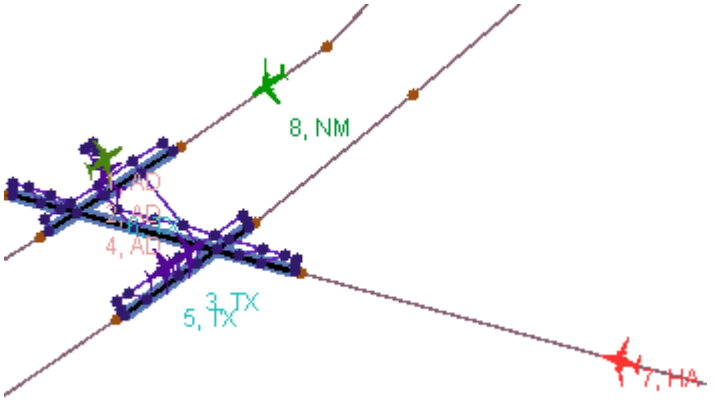
After downloading and installing the example please open the Application using the 2D Animation tool.

You will notice at time 7:16:30 that two arrival aircraft are approaching their respective final approaches

But, in this case, the aircraft on runway 24R is blocking the aircraft on final approach for runway 28.

This is an example of how SIMMOD can delay one arrival for another arrival.

But, critically, the technique is not via any utilization of procedures.



Independent/Dependent Procedures

The same application:

"tutorial_procedures_after_procs_with_alink_alink_blocking"

also contains several displays of how procedures block each other.

From time 7:00:00 AM until time 9:00:00 AM only arrival operations occur at the airport so that you may witness the LINKBLOCKING capabilities.

From time 10:00:00 AM until time 12:00:00 noon only departure operations occur at the airport so that you may witness the procedure blocking capabilities.

At time 10:37:33 you will notice two aircraft. One of the two is departing on runway 24R and the other is departing on runway 24L. This is because the procedure data entered did not establish any relationship between these two runways. You may view this operation below:

From 13:00:00 PM until time 15:00:00 PM both arrival and departure operations occur at the airport so that you may witness the arrivals blocking departures and departures blocking departures.