

# TOPIC

#### ESSENTIAL CONTENT

Interpret demand forecasting models based on variable inputs to construct an airport demand forecast

The use of sensitivity testing to produce a high, medium and low forecast

#### SHORT-TERM FORECAST

Short-term forecasts generally involve some form of scheduling, which may include for example the seasons of the year, for planning purposes.

The cyclical and seasonal factors are more important in these situations. Such forecasts are prepared every six months or on a more frequent basis.

(ICAO, 2006)

#### SHORT-TERM FORECAST

The short-term forecast is produced by time-series methods. The steps involved are:

- A. TAKE HISTORICAL TIME SERIES THAT ARE TO BE FORECAST, BY MONTH. TYPICALLY TEN YEARS ARE AVAILABLE, BUT IN SOME CASES ONLY TWO OR THREE YEARS.
- B. ADJUST THE SERIES FOR ERRORS, ABNORMAL EVENTS, LENGTH OF THE MONTH, MOVEABLE HOLIDAYS SUCH AS EASTER, ETC.
- C. FORECAST EACH SERIES USING A PRE-SELECTED AUTO REGRESSIVE INTEGRATED MOVING AVERAGE (ARIMA) MODEL OR, IF NECESSARY, A SIMPLER MODEL (HOLT-WINTERS OR SIMPLE EXPONENTIAL SMOOTHING). THESE MODELS HAVE BEEN SELECTED ON OUT-OF-SAMPLE PERFORMANCE AT HORIZONS OF 1 TO 24 MONTHS.

(ICAO, 2006)

#### SHORT-TERM FORECAST

The short-term forecast is produced by time-series methods. The steps involved are:

D. CREATE FORECAST INTERVALS BY CALCULATING HOW ACCURATE THIS MODEL WOULD HAVE BEEN AT EACH FORECAST HORIZON IF USED IN EARLIER MONTHS.

E. IMPOSE CONSISTENCY WITHIN HIERARCHIES OF SERIES.



#### MEDIUM-TERM FORECAST

The medium-term forecast (MTF) has, at its core, a forecast of traffic between airport pairs for each of a set of scenarios. This "core forecast" provides the consistent foundation for a number of different, more specific forecasts, e.g.:

- A. TRAFFIC VOLUME BY ORIGIN-DESTINATION ZONE PAIR, ASSUMING CURRENT ROUTING PATTERNS
- B. TRAFFIC VOLUME BY ORIGIN-DESTINATION ZONE PAIR, ASSUMING THE SHORTEST ROUTE IN THE ROUTE NETWORK;
- C. FLIGHT HOURS BY AREA CONTROL CENTRE.

(ICAO, 2007)

#### MEDIUM-TERM FORECAST

MEDIUM-TERM FORECASTS ARE GENERALLY PREPARED FOR PLANNING, SCHEDULING, BUDGETING AND RESOURCE REQUIREMENT PURPOSES. THE TREND FACTOR AS WELL AS THE CYCLICAL COMPONENT PLAYS A KEY ROLE IN THE MEDIUM-TERM FORECAST BECAUSE THE YEAR-TO-YEAR VARIATIONS IN TRAFFIC GROWTH ARE AN IMPORTANT ELEMENT IN THE PLANNING PROCESS.

(ICAO, 2006)

# **MEDIUM-TERM FORECAST ANALYSIS PROCESS**

The five processes are:

- I. Forecast demand.
- 2. Forecast demand behavior
- 3. Forecast schedules.
- 4. Forecast flights.
- 5. Forecast flight details







#### LONG-TERM FORECAST

LONG-TERM FORECASTS ARE USED MOSTLY IN CONNECTION WITH STRATEGIC PLANNING TO DETERMINE THE LEVEL AND DIRECTION OF CAPITAL EXPENDITURES AND TO DECIDE ON WAYS IN WHICH GOALS CAN BE ACCOMPLISHED.

The trend element generally dominates long-term situations and must be considered in the determination of any long-run decisions.

(ICAO, 2007)

#### LONG-TERM FORECAST

CURRENTLY, THE LONG-TERM FORECAST IS PRODUCED BY EXTRAPOLATING GROWTH IN THE LATER YEARS OF THE MEDIUM-TERM FORECAST. PLANS HAVE BEEN MADE TO USE INSTEAD A METHOD MORE CLOSELY BASED ON THE MEDIUM-TERM FORECAST.

(ICAO, 2007)

This is based on the identification of the key variables and testing the impact on the forecasts of changing individual variables one at a time.

Sensitivity analyses are particularly useful when evaluating policies implications.

AN AIR FARES SENSITIVITY, FOR EXAMPLE, MIGHT ASSESS HOW MUCH AVIATION DEMAND WOULD CHANGE IF FARES WERE 5% HIGHER OR LOWER.

(ACRP, 2007)

AN ECONOMETRIC MODEL WITH A FLEXIBLE FUNCTIONAL FORM ALLOWS ELASTICITIES OF EXPLANATORY VARIABLES TO VARY FROM ONE MARKET TO ANOTHER.

The model shows how the elasticities of domestic and transborder markets vary as distance and market size change.

INDEED, ELASTICITIES WOULD VARY DEPENDING UPON SPECIFIC CONDITIONS PRESENT IN EACH MARKET: THE PRESENCE OF SPECIFIC INDUSTRIES, THE STRENGTH OR THE ABSENCE OF GROUND-MODE COMPETITION, THE TYPE OF AIR SERVICE, ETC.

(ACRP, 2007)

AN AIRPORT SENSITIVITY ANALYSIS EXAMINES POTENTIAL CHANGES OR IMPACTS TO THE AVIATION SYSTEM IN SEVERAL BROAD CATEGORIES. ALTHOUGH IT IS IMPOSSIBLE TO IDENTIFY ALL POTENTIAL FACTORS THAT COULD BE INCLUDED IN EACH OF THE CATEGORIES, THIS ANALYSIS HAS IDENTIFIED EXAMPLE SCENARIOS.

The major categories of potential system changes that are examined in the sensitivity analysis include the following: %Air Service Changes %Jransportation/Technology Changes %Airport System Changes

THE FIRST STEP IN ANALYZING ANY SCENARIO THAT MAY ARISE IS TO SPECIFICALLY IDENTIFY THE CHANGE AND/OR TREND THAT MAY BE AFFECTING THE AIRPORT SYSTEM.

While NOT EVERY TREND OR CHANGE THAT MAY BE IDENTIFIED WITHIN THE SYSTEM WILL WARRANT A SENSITIVITY ANALYSIS, IT IS IMPORTANT TO CONTINUOUSLY MONITOR THE SYSTEM AND DEFINE TRIGGER EVENTS THAT MAY WARRANT A FULL-BLOWN SENSITIVITY ANALYSIS.

THE FOLLOWING ARE SOME TYPES OF TRENDS OR SYSTEM CHANGES THAT WOULD LIKELY WARRANT A DETAILED ANALYSIS:

- SALE AND/OR CLOSURE OF A CORE SYSTEM AIRPORT (INCLUDED IN THE ADVANCED, INTERMEDIATE, OR BASIC FUNCTIONAL LEVEL)
- SIGNIFICANT DECREASES IN COMMERCIAL AIRLINE SERVICE LEVELS AT COMMONWEALTH AIRPORTS
- MAJOR CHANGES TO THE AIRLINE OPERATING ENVIRONMENT WHICH MAY INCLUDE AIRLINE MERGERS OR BANKRUPTCIES
- New security measures related to general aviation or commercial service airports that would impact a number of system airports

AFTER A SPECIFIC TREND OR SYSTEM CHANGE HAS BEEN IDENTIFIED AND DETERMINED TO WARRANT FURTHER EXAMINATION, THE NEXT STEP IN CONDUCTING A SENSITIVITY ANALYSIS IS TO IDENTIFY THE AIRPORTS THAT MAY BE IMPACTED.

While the process that will be used to identify impacted airports will vary significantly based on the scenario, the general goal of this process is to identify an order-of magnitude estimate of the number of airports that could be impacted, and specifically identify the impacted airports.

IN ADDITION TO IDENTIFYING THE IMPACTED AIRPORTS, SENSITIVITY ANALYSES MUST ALSO DEFINE POTENTIAL IMPLICATIONS OF ANY SCENARIO ON THE AIRPORT SYSTEM AS A WHOLE. IDENTIFYING THOSE SPECIFIC AIRPORTS THAT ARE IMPACTED BY A CHANGE OR TREND IS THE FIRST STEP IN THE PROCESS OF DETERMINING SYSTEM IMPLICATIONS.

This step in the process uses data on the impacted airports, as well as several other factors and data related to the airport system, to determine the importance or priority of addressing the impacts of any scenario.

ANY POTENTIAL SCENARIO THAT ARISES NEEDS TO BE EXAMINED TO DETERMINE THE ROLE, IF ANY, THAT THE DEPARTMENT FOR TRANSPORT MAY HAVE IN ADDRESSING IMPACTS TO THE SYSTEM.

THE CAA'S MISSION HAS BEEN DEFINED AS PROVIDING EXPERTISE AND ASSISTANCE IN THE DEVELOPMENT OF THE AVIATION SYSTEM. WITHIN THAT ROLE, A NUMBER OF RESPONSIBILITIES HAVE BEEN DELEGATED TO THE DFT, SOME SPECIFICALLY RELATED TO AIRPORT DEVELOPMENT GRANT FUNDING PROCESSES AS WELL AS AIRPORT LICENSING AND SAFETY INSPECTIONS.

For those scenarios in which the CAA may have a role in resolving impacts to the system, a thorough analysis of options is necessary.

The types of options that may be available to resolve impacts to the system resulting from potential trends and changes will need to be developed on a case-by-case basis for each scenario that may arise.

At the completion of the sensitivity analysis methodology that has been described, it is important to identify and work to implement the most feasible options for addressing the impacts of potential sensitivity scenarios.

THE OPTIONS THAT SHOULD BE PURSUED ARE THE ONES THAT MINIMIZE SYSTEM IMPACTS, MAINTAIN OR IMPROVE SYSTEM PERFORMANCE RELATIVE TO THE SASP BENCHMARKS, AND UTILIZE AVAILABLE RESOURCES GIVEN SYSTEM AND AIRPORT CHARACTERISTICS/ENVIRONS.





# **Sensitivity Analysis**

A Level & IB Business

Hosted by Jim Riley

#### REFERENCES

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