



# MAXIMUM SAFETY WITH MINIMUM MASS

**Exel Composite Towers and Fencing**

**exel**

[www.exel.net](http://www.exel.net)



## APPROACH LIGHTING MASTS

### Poles

For single lights, **three sizes** for heights ranging from 0,3 m to 4,5 m. For heights **above 2 m a hinged base plate** is supplied for easy maintenance of luminaries on ground level. Exel poles can be fitted with **any approach light brand and model**.

In addition to low light heights, the poles are recommended for use **in front of ILS localizer array**. Exel poles are made of fibre glass material which is **transparent** to electromagnetic signals. Neither can the localizer system "see" vertical cables which run inside the pole.

Exel poles provide an **adjustment range of  $\pm 200$  mm** at the site. Delivery includes base plates and anchor bolts.

### Lattice Masts

For multiple lights, from 1,5 m to 13,5 m height in **full fibre glass design**. Also for single light applications, where the light height exceeds performance of poles. All Exel Safety Approach Masts are **tiltable** for maintenance of luminaries. The basic model has a **base hinge** which is attached to the mast to be lowered and then removed after the mast is raised back to the vertical position.

For taller masts which would require more manpower for lowering and raising, **a centre-hinged design** is well-suited. The entire tilting and maintenance procedure can be completed by **one service engineer** in a matter of minutes. However, in most countries, work safety regulations require the presence of two persons in all electrical maintenance work. Please consult the local code.

The light height can be **adjusted  $\pm 250$  mm** at the installation site. Delivery includes the mast and base frame, foundation bolts and casting template as well as UV-protected cover tubes for cabling.

The standard colour of Exel poles and lattice masts is **aviation yellow**, other colours are available on request.

### Extra Tall Lattice Masts

ANNEX 14 and Aerodrome Design Manual Part 6 stipulate that the bottom section of masts exceeding 12 m height can be made of non-frangible material. The Exel solution is to stack a centre-hinged mast on top of a steel post or fit a fibre glass mast on a hinged steel foot. **The maximum practical height** that can be reached with this design is **35 m**. Both solutions are **counter-balanced** and **feature safe lowering of masts**, managed by one or two service engineers at **ground level**.

Once the approach light system has been installed, sighted and commissioned, lowering of any Exel mast for maintenance of luminaries can be done without fear of deformation and need for re-alignment of the lights. The mast brings the lights back to exactly the same position where they were before lowering.

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CAT I  
 CAT II/III  
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 SIMPLE SYSTEM...

## ILS GLIDE PATH TOWER

*“Similarly, structures located within the graded portion of the runway strip not meeting the frangibility requirement, such as an existing non-frangible ILS glide path antenna, should be replaced by a frangible structure, if practicable, and relocated within the non-graded portion of the runway strip.”*

Exel GP-tower follows the same lattice structure concept as the approach masts, but is made to cope with the demanding requirements of **extremely high rigidity** and **frangibility**. The tower is made of 5 m tall sections, with total height of 10 or 15 metres.

**Delivery includes** anchor bolts and casting template, sub-assemblies for on site assembly of tower sections, antenna brackets that allow adjustment of antennas both vertically and horizontally, cable conduits, ladder and safety rail and finally, obstruction light. Project management support covers the same items as with approach systems.

## ILS LOCALIZER SUPPORTS

*“Existing structures located within a distance of 300 m from the runway end not meeting the frangibility requirement, such as an existing non-frangible ILS localizer antenna array, should be replaced by a frangible structure or relocated beyond a distance of 300 m from the runway end.”*

Exel poles and lattice masts have been **full scale impact tested to verify compliance** with frangibility ruling. Both types can be applied to support localizer antennas, subject to the height and the size of the antennas.

## FENCING

According to ANNEX 14 the intended function of airport fencing is to **prevent entrance of unauthorized persons** onto non-public areas of the aerodrome as well as into ground installations and facilities that are **essential for the safety of civil aviation** and are located **outside of the aerodrome**. To prevent animals large enough to be a hazard to aircraft, fencing should also be provided to the movement area entrance.

Aerodrome Design Manual Part 6 stipulates that *“...a lightweight frangible fence should be installed when located between frangible approach lighting towers or when located to protect the ILS critical and sensitive areas against unlawful interference.”*

Frangible **Exel fencing is transparent to electro-magnetic signals** and hence **does not interfere** with ILS or MLS systems. It is available in standard heights of 2,0 m or 2,5 m, with different spacing and colouring.



## RADAR REFLECTORS AND OTHER SUPPORT STRUCTURES

One of the items that Aerodrome Design Manual Part 6 specifies to be frangible is radar reflectors. Exel lattice masts are successfully supplied to the application with standard or customized reflector attachments.



## APPROACH MAST SYSTEM AND SERVICES

*“The supporting structures should be designed to withstand wind and ice loading typical of the local conditions in accordance with national standards when installed with all lighting equipment attached.”*

Each Exel approach mast system is designed to **match with local conditions** as much as there is data available. Mast sections are dimensioned to **serve decades** against the constantly changing winds under the sun of the equator or ice and snow of the Polar Circle. The light but firm fibre glass **lattice structure holds the lamps steady** as ruled by ICAO. Each component is manufactured of best quality materials, fibre glass with **UV-protection**, **maritime stainless steel** fixing hardware, **hot dip galvanized** anchor bolts and base frames with **option of stainless steel**.

Mast sections and other components are of **low mass composite** material. Pre-assembled modular design is very straightforward to install and **choice of tilting mechanisms** make Exel-masts safe and swift to use. Project management is supported with **foundation load calculations, pre-installation instructions** for preparation of foundations, cabling etc. as well as **full installation/maintenance manuals**. If needed, assembly training at site can also be arranged. The installation and maintenance instructions are supplied in both **electronic format** and a **printed copy**, with copies to the aviation authority, contractor and the airport maintenance. In case a mast is damaged, **some repair can be done at the location**. For severe damage **most spare parts** can be dispatched **within 24 hours** from receipt of order.

*“Once a navigational aids system is installed, its usefulness depends on its serviceability, which in turn depends on the effectiveness of the maintenance work carried out.”*

## WIND DIRECTION INDICATORS ANEMOMETERS TRANSMISSOMETERS FORWARD-SCATTER METERS

*“Support structures for wind direction indicators, transmissometers and forward-scatter meters should be tested for frangibility in accordance with procedures for approach lighting towers.”*

Exel poles and lattice masts have been full scale impact tested to verify compliance with frangibility ruling. Both types can be applied to support wind cones, subject to the size of the cone. **Wind cone masts** are supplied as **complete assemblies** with wind cone and obstruction light or as a **frangible support only**.

**For anemometers lattice masts** are used in most cases. Standard height is 10 m, supplied as centre or base hinged configuration. Other heights are available upon request.

Stability requirement of transmissometers usually requires use of lattice mast as the support structure while forward-scatter meters are mainly installed on poles. Heights and cross-sections of the frangible supports are **custom fitted** to the size of the instrumentation and local conditions.



*"High-speed, full-scale testing is a proven method for verification of frangibility."*

## FRANGIBILITY

### **"OBSTACLES TO BE MADE FRANGIBLE"**

*Obstacles are defined as all fixed objects, or parts thereof, that are located on an area intended for surface movement of aircraft or that extend above the surface intended to protect an aircraft in flight. The first objective should be to site objects so that they are not obstacles.*

*Nevertheless, certain airport equipment and installations, because of their function, must be located in an operational area. All such equipment and installations as well as their supports should be of minimum mass and frangible in order to ensure that impact does not result in loss of control of the aircraft."*

*"Airport equipment and installations which, because of their particular air navigation function, have to be located in an operational area include:*

- Approach lighting systems
- Wind direction indicators
- ILS localizer equipment
- ILS glide path equipment
- Radar reflectors
- Anemometers
- Transmissometers
- Forward-scatter meters
- Fencing"

### **"FRANGIBILITY REQUIREMENTS"**

*A frangible structure should be designed to withstand the static and operational wind or jet blast loads with a suitable factor of safety but should brake, distort or yield when subjected to the sudden collision forces of a 3000-kg aircraft airborne and travelling at 140 km/h (75 kt) or moving on the ground at 50 km/h (27 kt)."*

### **"TESTING FOR FRANGIBILITY"**

*Dynamic tests are recommended for verification of frangibility of navigational aids having an overall height in excess of 1.2 m and located in positions where they are likely to be impacted by an aircraft in flight. Such aids are approach lighting towers, wind direction indicators, transmissometers, ILS localizer and glide path antennas and MLS approach azimuth and elevation equipment*

*Upon impact, the tower may fragment into several components. The mass of these components and their manner of release should not cause a secondary hazard to the aircraft (e.g. enter through the windscreen, fuselage, tail surfaces)."*

**Exel is an experienced and reliable supplier for airport contractors.  
Some of the worldwide installations are shown on the map:**



**Exel** is the world's **leading supplier** of frangible support structures to airports. Exel masts, both pole and lattice type, are **full scale impact tested** to verify compatibility with the year 2005 frangibility requirements as specified in ANNEX 14 Volume I – 4th Edition, July 2004 and Aerodrome Design Manual, Part 6, Frangibility, 1st Edition, July 2006.

**Airport environment** has numerous needs where **transparency to electromagnetic signals, minimum maintenance, frangibility, low mass, rigidity**, etc. are features of **high value**. With more than 15 years of experience at airports Exel can satisfy these needs with composite materials, poles, lattice masts, fences etc.

Due to strong **lattice design** glass fibre reinforced composite masts adapt to the varying wind conditions of different airports. The structure is **rigid to withstand high winds** and jet blasts, but simultaneously features built-in frangibility and **breaks down on impact**. Thin wall tubes, produced with Exel's own manufacturing technology, are resistant to vertical forces caused by wind loads. These **low mass tubes** make Exel-masts **light weight**.

**Exel Oyj** is a technology company which designs, manufactures and markets composite industrial applications and sports equipment in two divisions. **Exel's** operations started in 1960 when three chemists founded a company which specialized in the production of electronic detonator caps. The manufacture of composite products was started in 1970's. Today **Exel** is the largest pultruder in the world consisting of the parent company **Exel Oyj**, which operates in Finland and operating subsidiaries worldwide.

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