

## Case Study: Molded Palm Fronds for Artificial Trees

**Client:** Manufacturer of Artificial Palm Trees

**Client Problem:** Needed to develop realistic palm fronds for use in the artificial trees. The palm fronds must look and perform as real palm fronds and they must withstand harsh environmental conditions, including high winds, UV degradation, extreme temperature cycles, freezing rain, and snow loads. The palm fronds must avoid breakage and have a minimum 10 year lifetime.

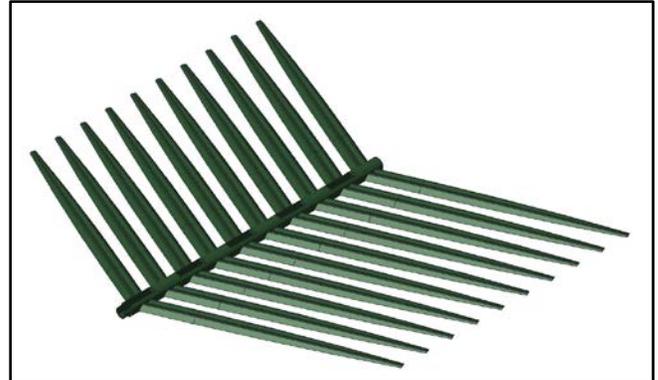
**GEOMETRIXDESIGN Solution:** Developed an injection molded solution to directly mold the palm fronds. All detail of real palm fronds were designed into the molded palm fronds. A precolored High Density Polyethylene (HDPE) resin was used to mold the palm fronds, providing high strength, excellent chemical and UV resistance, and excellent flow properties.

**Design Details:** Two varieties of palm fronds were developed:

- Phoenix Date Palm
- Canary Date Palm

A real, mature Phoenix Date palm frond grows in length from 4 to 6 feet and has uniform length leaves. To allow variation in frond length, a one foot segment was designed for the body of the frond and a separate end segment was designed for the tapered leaves at the tip of the frond. The body and end segments had interlocking ends and were inserted onto an aluminum flex rod along the stem of the frond to the finished length. The flex rod had a square profile to keep the frond segments in alignment along the stem. A single rivet underneath the tip of the end segment secured it to the rod. A clasp at the base of the frond secured the body segments and locked the frond into the palm tree receiver head (see below).

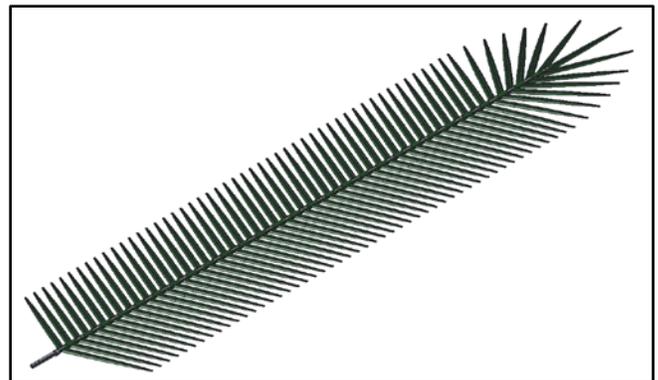
The leaf profile and tapered shape were designed to replicate a true Phoenix Date palm leaf. Slight texture was added in the mold to provide the grain texture in the real leaf.



Injection molded Phoenix Date palm body segment



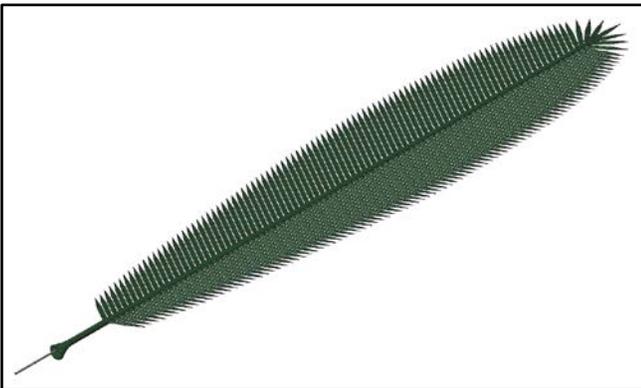
Injection molded Phoenix Date palm end segment



Completed Phoenix Date palm frond assembled on an aluminum flex rod with base clasp

The flow properties of HDPE allowed for complete mold fill along all the thin leaf cavities. The finished leaves had realistic bending under slight wind loads and texture when touched. Directly after molding, the HDPE allowed for a permanent set in the leaves by placing them into fixtures to add a variations to the leaf curvature.

A real, mature Canary Date palm frond grows to about 3½ feet and has varying length leaves. This shorter frond length with shorter leaves allowed the palm frond to be designed as one part and insert molded directly onto a round aluminum flex rod. The stem was designed with thickness variations and tapering at the end. A high level of leaf detail with a realistic profile and tapering was used. A permanent set was applied after molding to add to the realism.



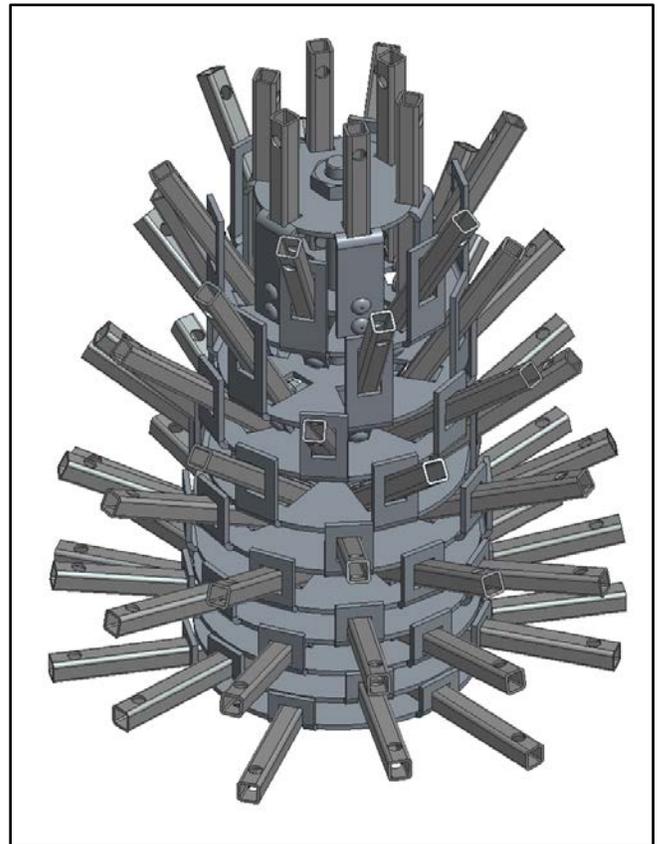
Injection molded Canary Date palm frond insert molded on aluminum flex rod



Detail of the leaves in the Canary Date palm frond

A receiver head was designed for use at the top of the tree for mounting the palm fronds and provide realistic angle separation and spacing. The receiver head was required to withstand high loading at the base of the palm fronds and securely lock the palm fronds.

The receiver head was designed for easy adjustability for use in various height trees and various number of palm fronds. Circular aluminum plates with varying angle elevated square tubes around the perimeter were designed. The square tubes accepted the locking clasps of the palm fronds. A central threaded rod secured the circular plates together and provide mounting at the top of the tree. By varying the number and type of circular plates, the receiver head could be customized for each tree variety.



Received head for supporting palm frond at the top of the tree. Adjusting the stack up and type provide customization for each application

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