Helicopter Aided Construction (What to Know for Efficient and Cost-Effective Projects)

Shane Watson P.E.

"Engineering with Distinction"

ECI

ELECTRICAL CONSULTANTS, INC.

ECI has designed hundreds of miles of lattice tower and steel poles lines that employed helicopter construction methods ranging from minimal use to hand dug foundations and 100% helicopter access.

We have been able to use our experience to work with contractors to both reduce costs and risks associated with helicopter construction

Helicopter specific concerns

- Aggregation of work within a geographic area
- Safety
- Landing zone
- Fuel
- Dust abatement
- Rotor wash
- Noise
- Highway
- Airspace clearance

Support aspects

- Ground crews
  - Experienced crewmembers
  - Adequate and appropriate rigging
  - Understanding of safety
  - Appropriate radios
- Aerial Crews
- Engineering
- Environmental

Phases- Planning /Design and Construction

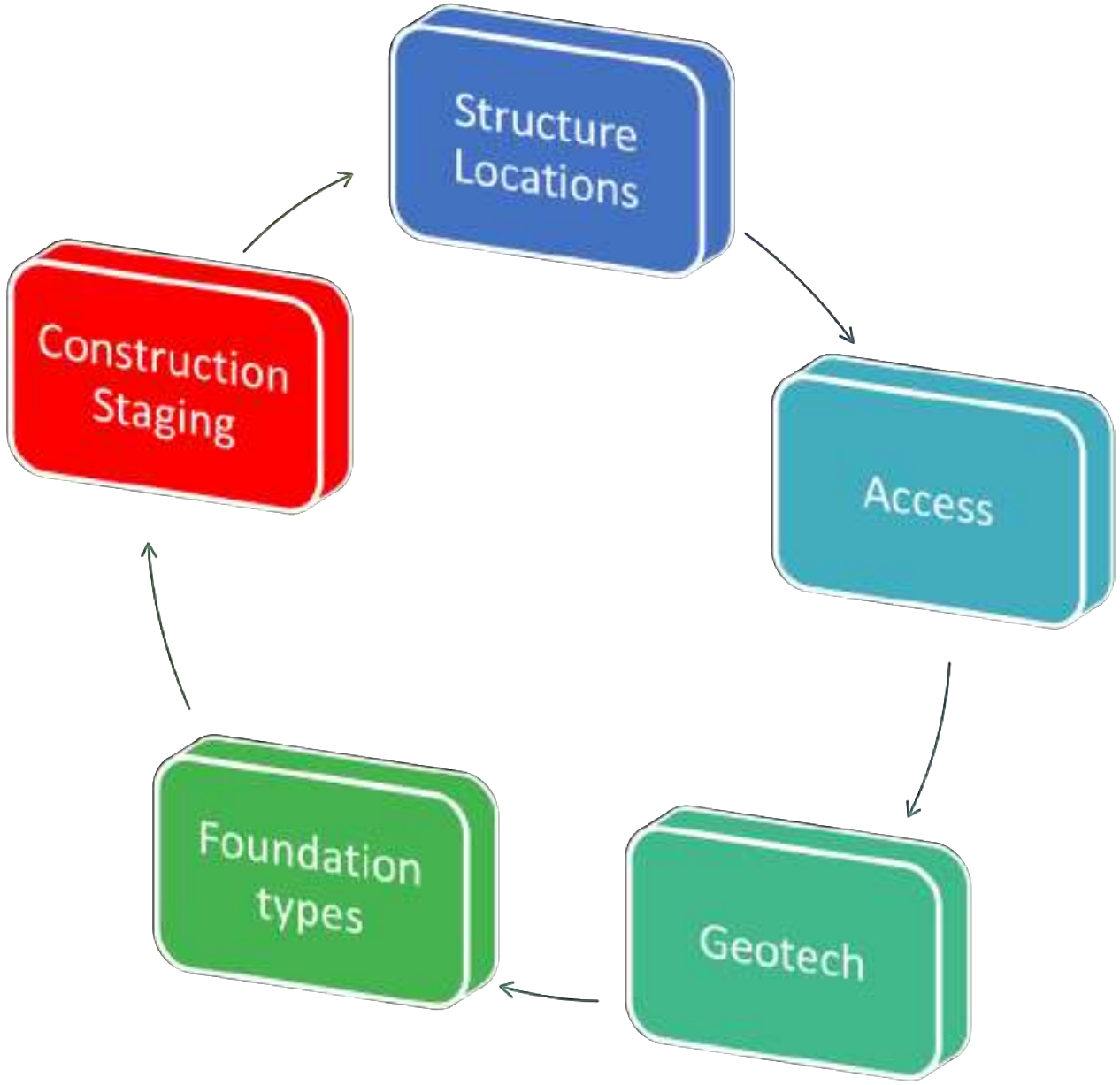
The **planning/design phase** should be started years before construction.

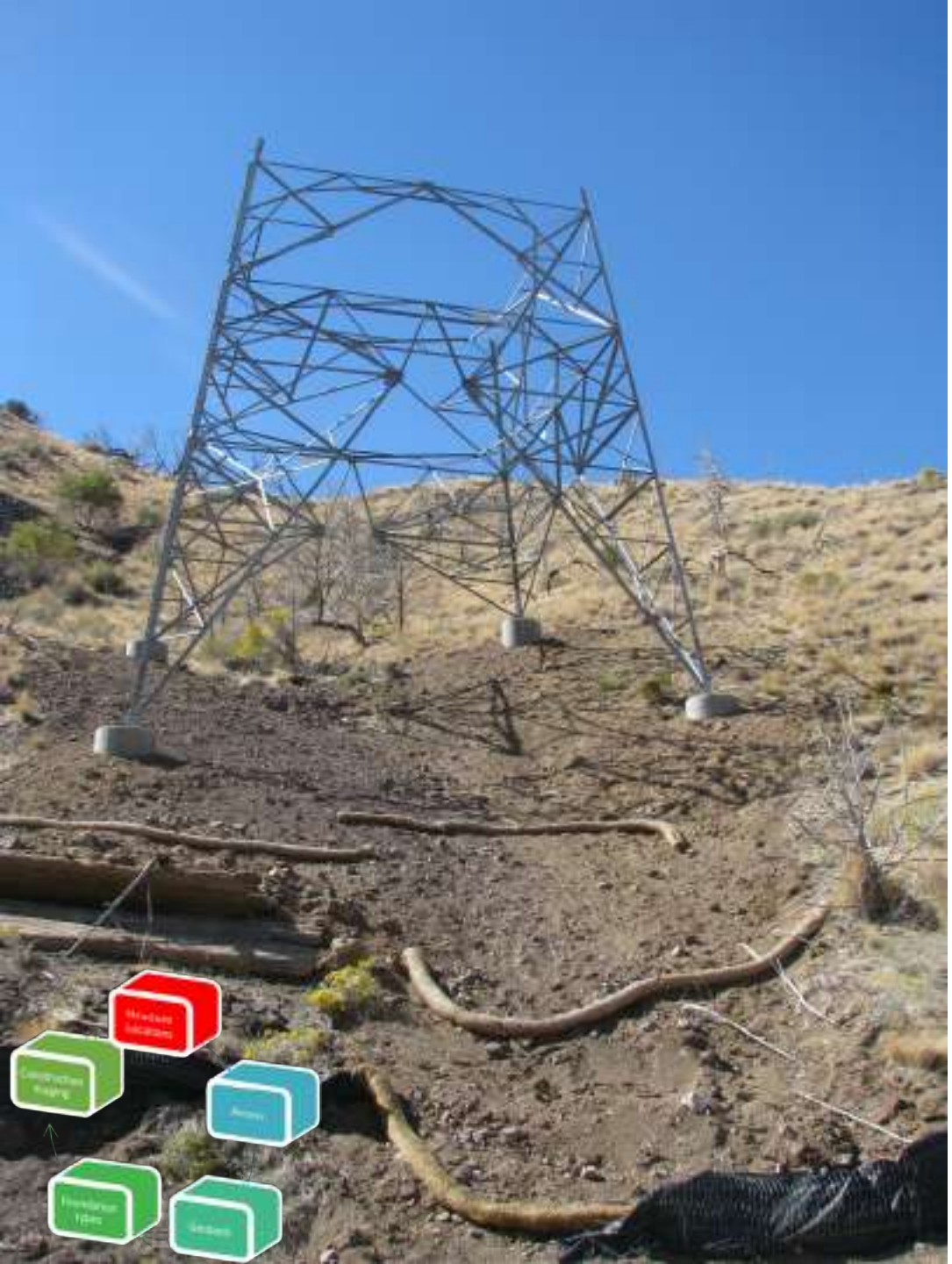
Should include-

- basic line route
- structure types
- access and environmental restrictions

Construction phase should be allowed to modify aspects of the design as issues are discovered.

Concurrent Planning and Design





Structure Locations

- Typical structure capacity, height, line clearance design
- Can we keep the structures close to access or away from environmental/cultural considerations?
- Soil types, foundations options?

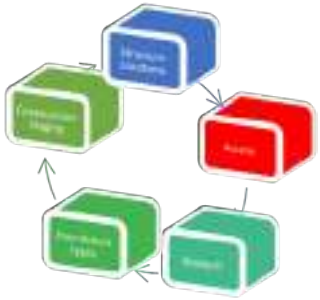
- LiDAR survey is very helpful
- Ground survey of actual locations and critical clearance issues
- Helicopters can increase the range and effectiveness of survey crews

Route and Structure Access

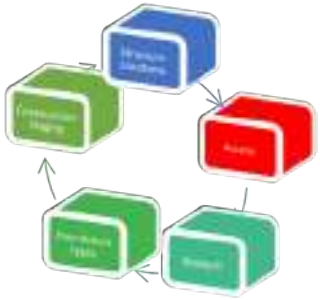
Full Access

Route and Structure Access

Only tracked Equipment



Seasonal
Access

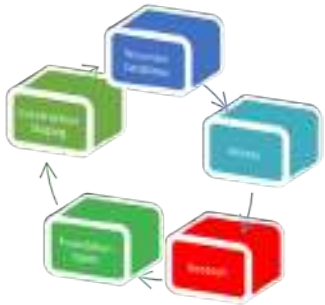


No Heavy
Equipment

- High profile golf course
- Limited acceptance of matting or construction traffic

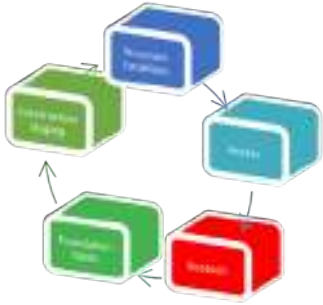
Geotechnical Investigations

- Typically done using a truck mounted drill to collect samples from depths ~ 50’
- Tracked rigs and balloon tired ATV rigs are available



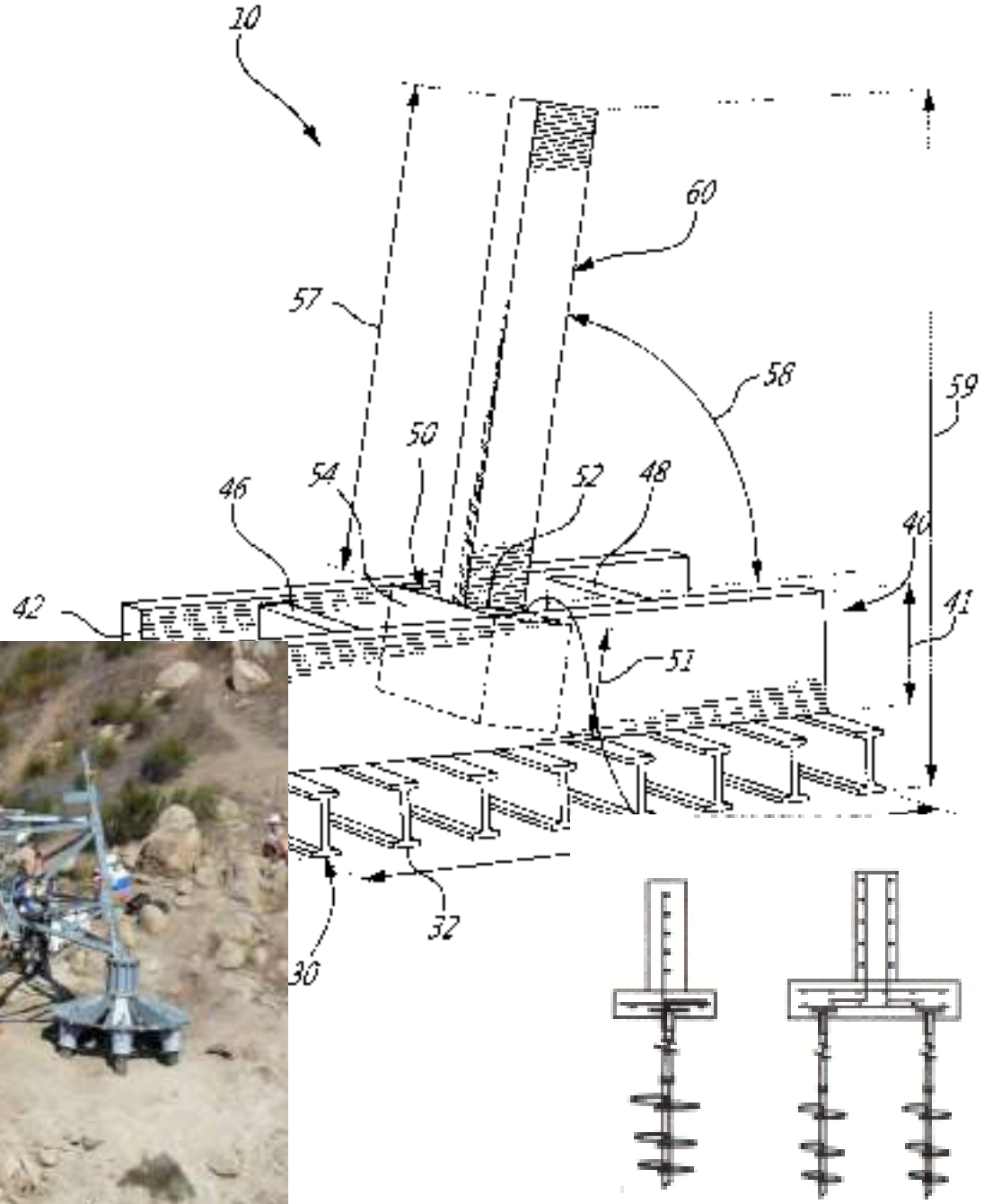
Alternative Geotech Methods

- Rock Mapping
- Seismic Refraction
- Historical data
- Others?



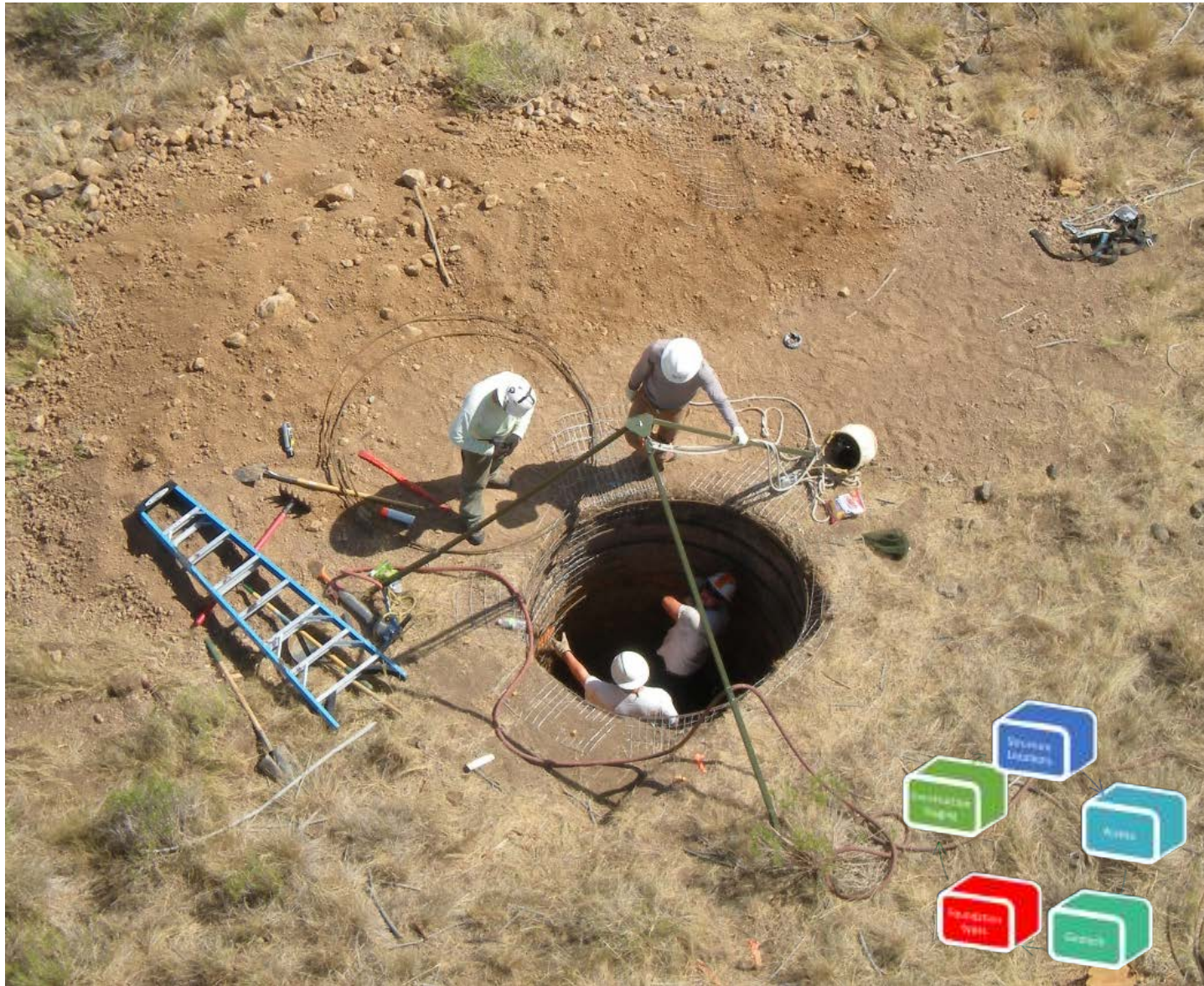
Foundation Options

- Direct embedded
- Drilled piers
- Hand-dug piers
- Grillages
- Spread footing
- Rock anchors
- Micro-piles
- Helical piers



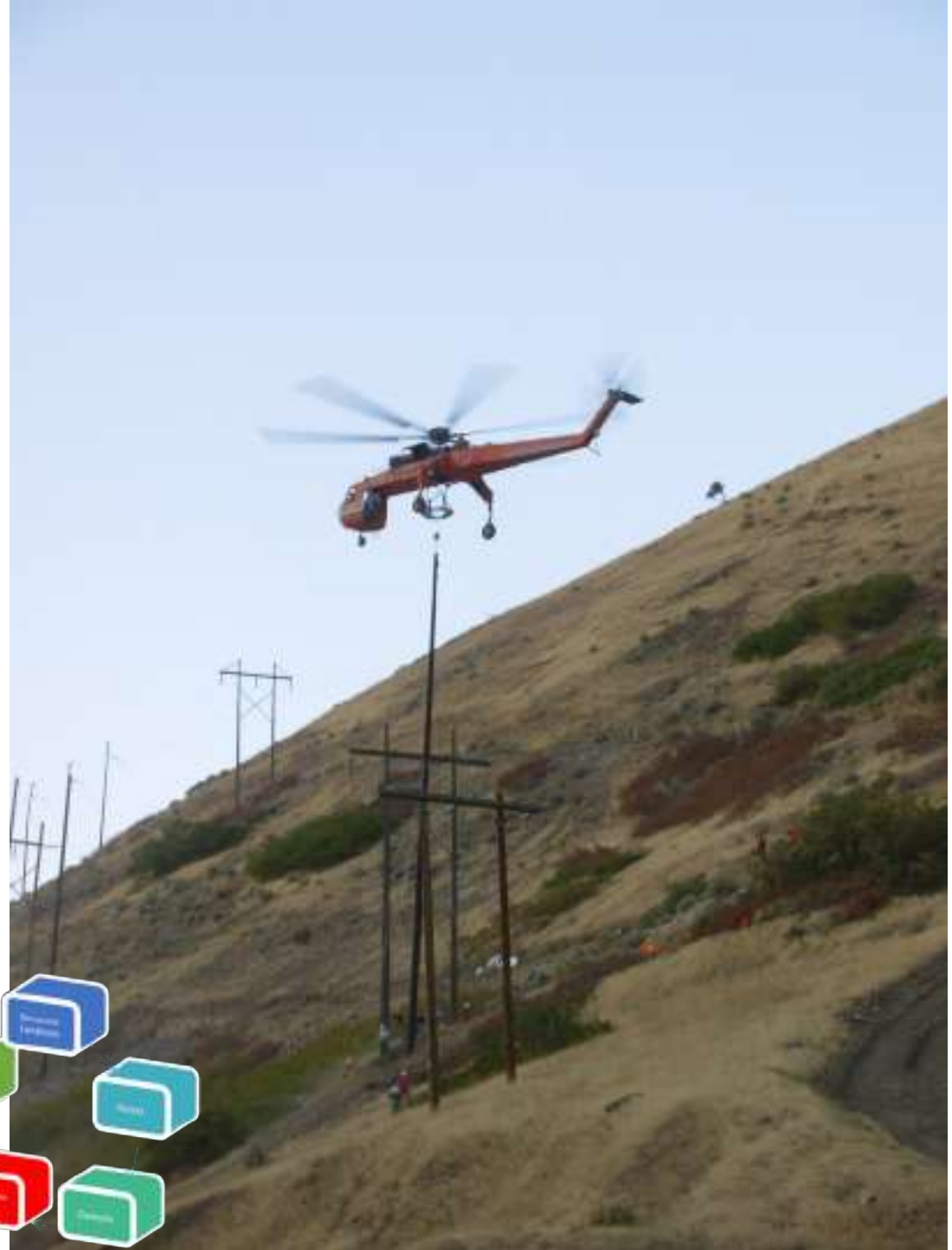
Hand Dug Foundation Considerations

- Spoons and long-handled shovels typical for direct embedded poles
- Elbow room- less than 4ft diameter is not practical to build
- Soil type-
  - Rock can shrink foundation size
  - Water?
  - Casings required?
- Safety
  - Shoring inside excavation
  - Fire danger

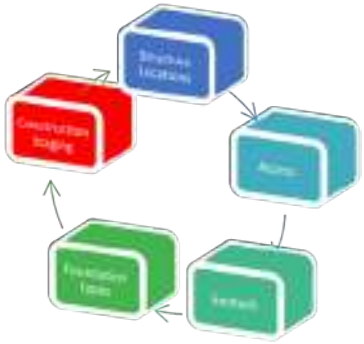


Helicopters are used to-

- Haul personnel
- Generators
- Jackhammers
- Large compressors
- Survey equipment
- Rebar
- Concrete forms
- Hand tools
- Porta potty
- Emergency equip
- Lunch…



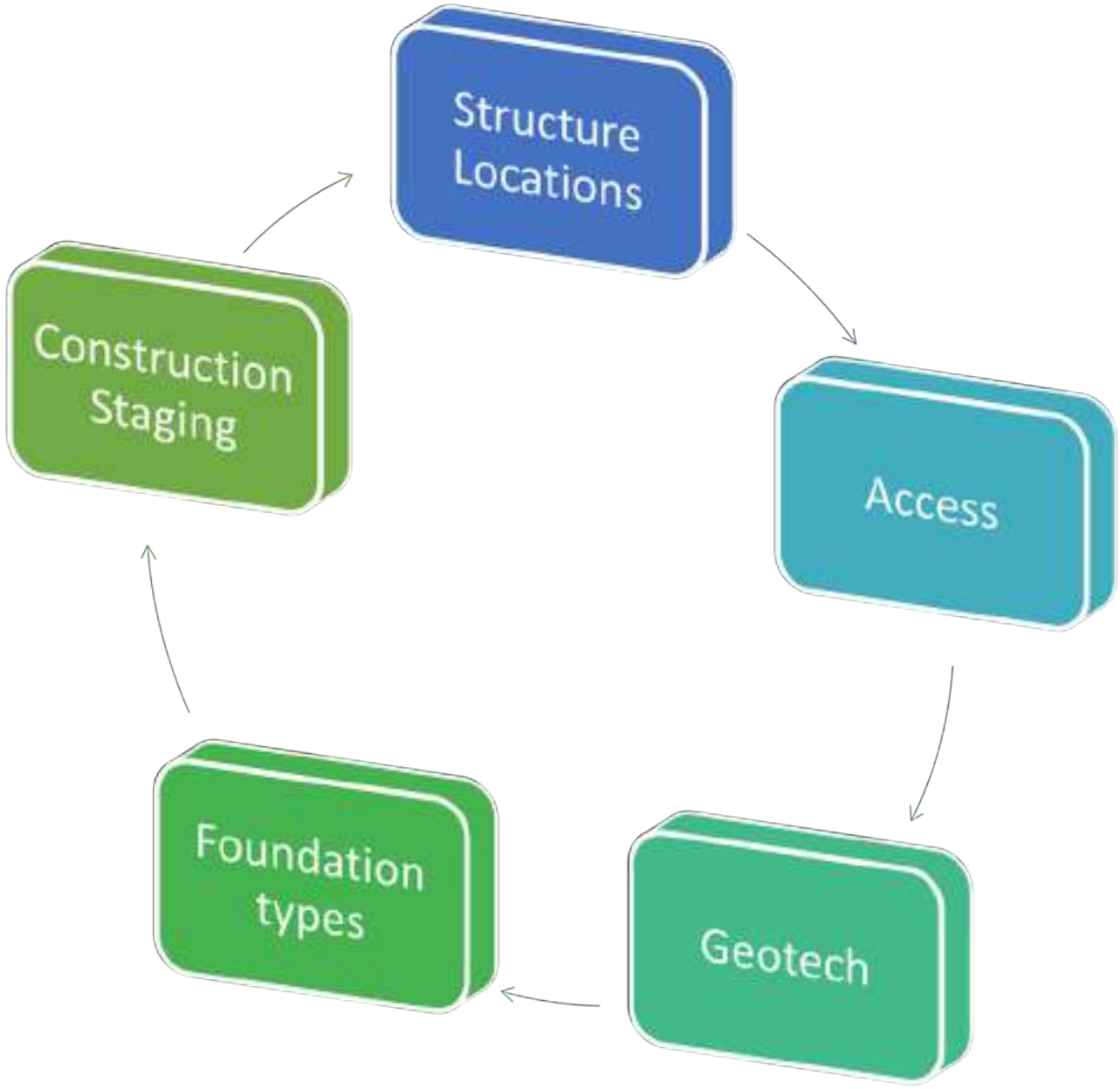
Construction Staging



- Good access by truck
- Close to the work area
- Assembly and storage of structures in condition ready to fly
- Allowances for fuel and water (fire fighting) storage

- Fuel
- Dust
- Rotor Wash
- Fire fighting
- Radio
- Matted landing area
- Safe approach

Concurrent Planning and Design



Construction Phase-

Prepping for Concrete

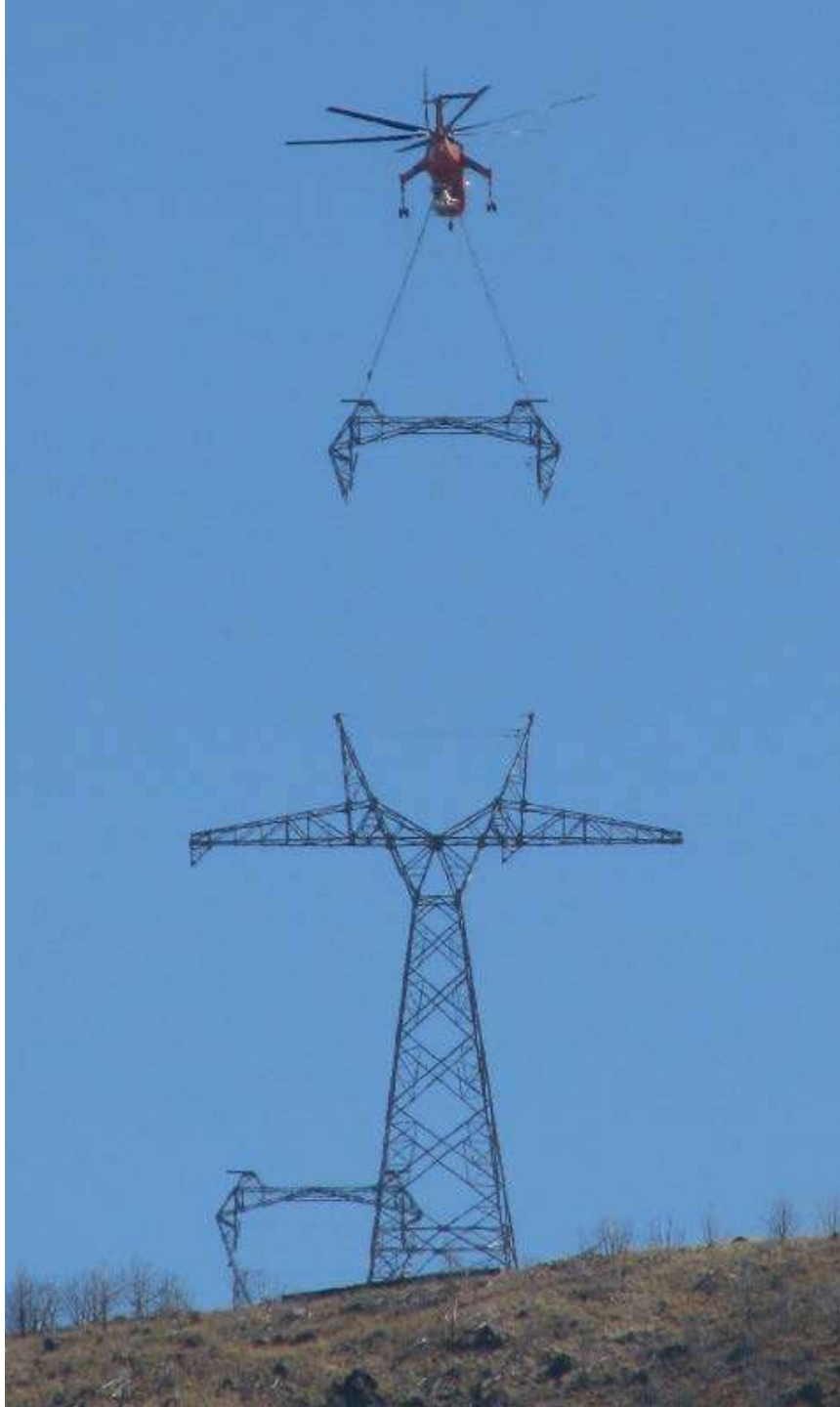
Hauling Concrete

- Comparatively labor, time and flight intensive
- Typically requires a medium lift capacity helicopter with 3,000-5,000lb payload capacity at your project elevation
- Concrete weighs approximately 150lb/cu-ft, or 4,000lb/cu-yd
- Flights will typically haul ½-1cu-yd of concrete each, or **25 flights for a single 18cu-yd pier**

Concrete Considerations

- Increased set time (adding chemical delay)
  - Try to get the entire pier placed prior to concrete setting
- Lightweight aggregate?
  - 125lbs/cu-ft vs. 145lbs/cu-ft
  - Only a 540lb savings, or 4.5cu-ft additional capacity
- Small load volumes per truck
  - Frequent changeover = fresh concrete
- Testing pre and post haul to determine changes of slump and air content
- Provisions and Engineering for unplanned joints

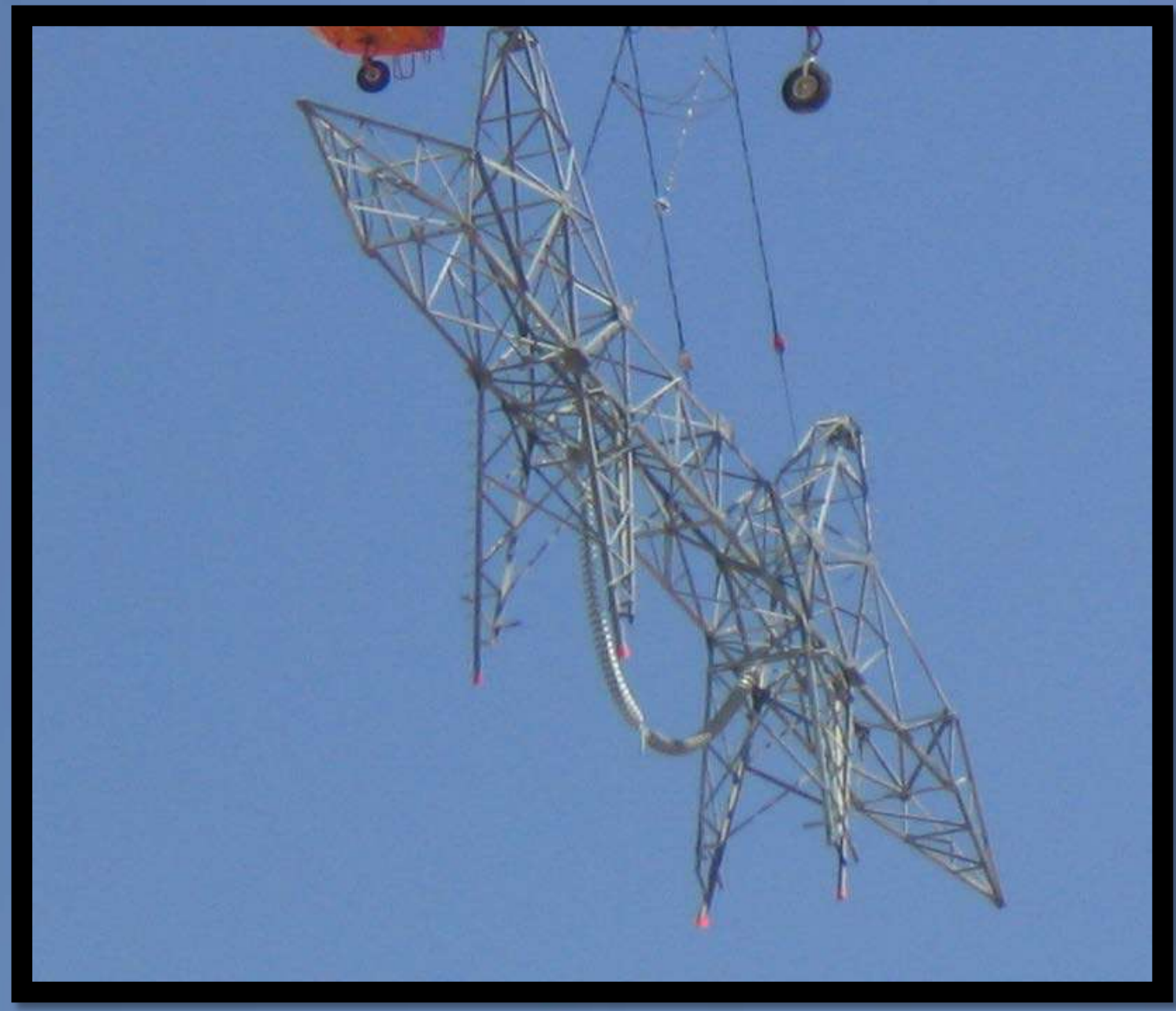
Setting Structures



Very dependent on the size of helicopter used.

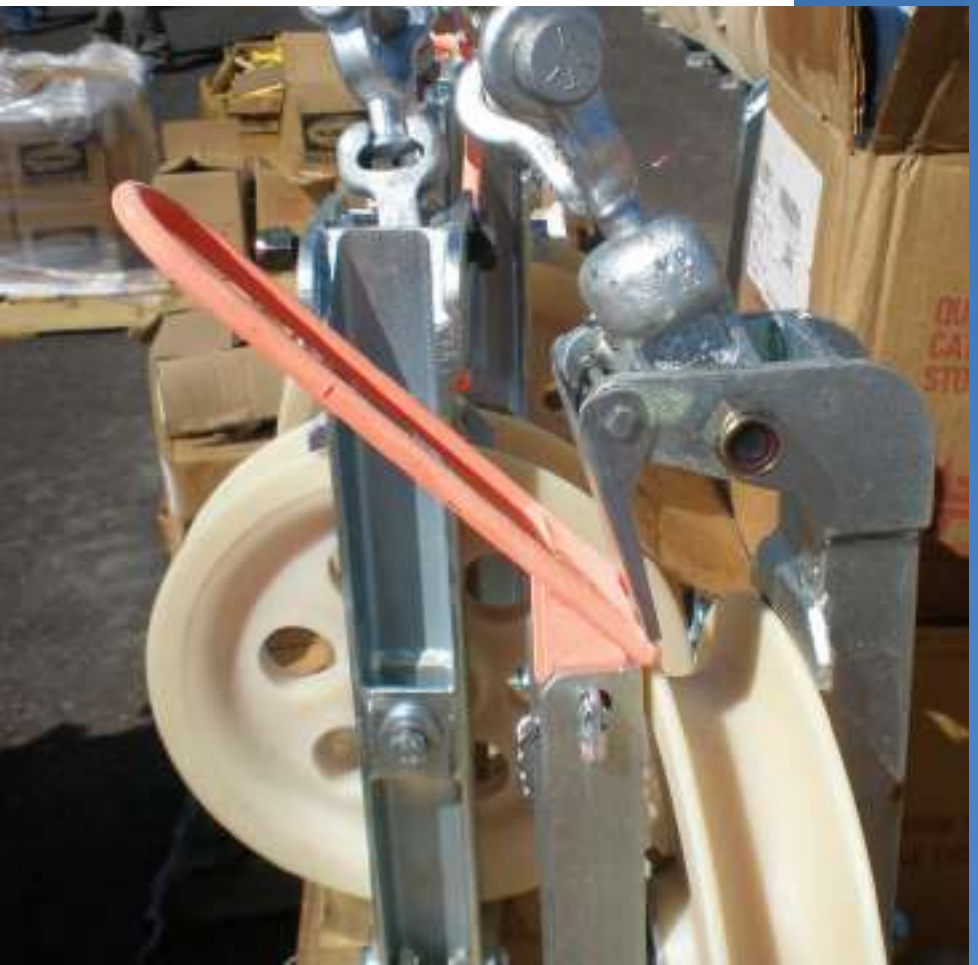
Usually a fast process, 3-5 picks per hour.

Tower components should be previously assessed by the engineer and the helicopter company to determine suitability for flying and breakdown.



Wire Stringing

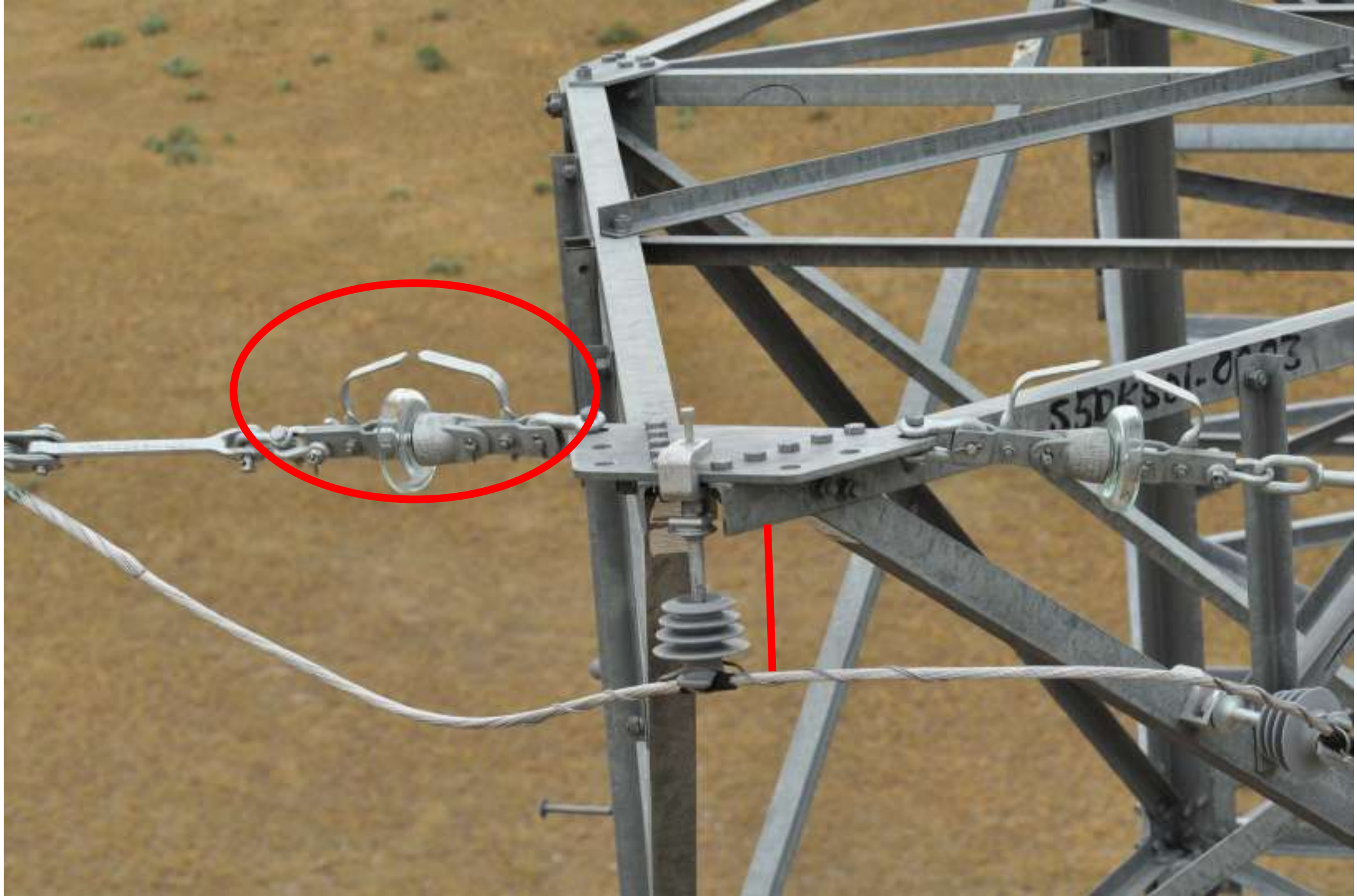
- Among the most common uses of helicopters in T-line construction
- **Often a very economical method of stringing**
- Pulling sock line
- Installing marker balls and bird diverters
- Clipping



- 2800ft double spans
- Large bundled conductor
- No mid-span access

Problem Solving, Inspection and Environmental

Visible Casting Numbers



Common Questions

- What kind of helicopter do I need?
  - Light
  - Medium
  - Heavy
- How much can be done in a day/week?
  - Concrete: ¾ cu-yd every 5-10 minutes
  - Structures: 10-50 picks per day
  - Stringing: 1-2 pulls/week at 3-5 miles each


NWPPA
Northwest Public Power Association
ECI
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QUESTIONS?