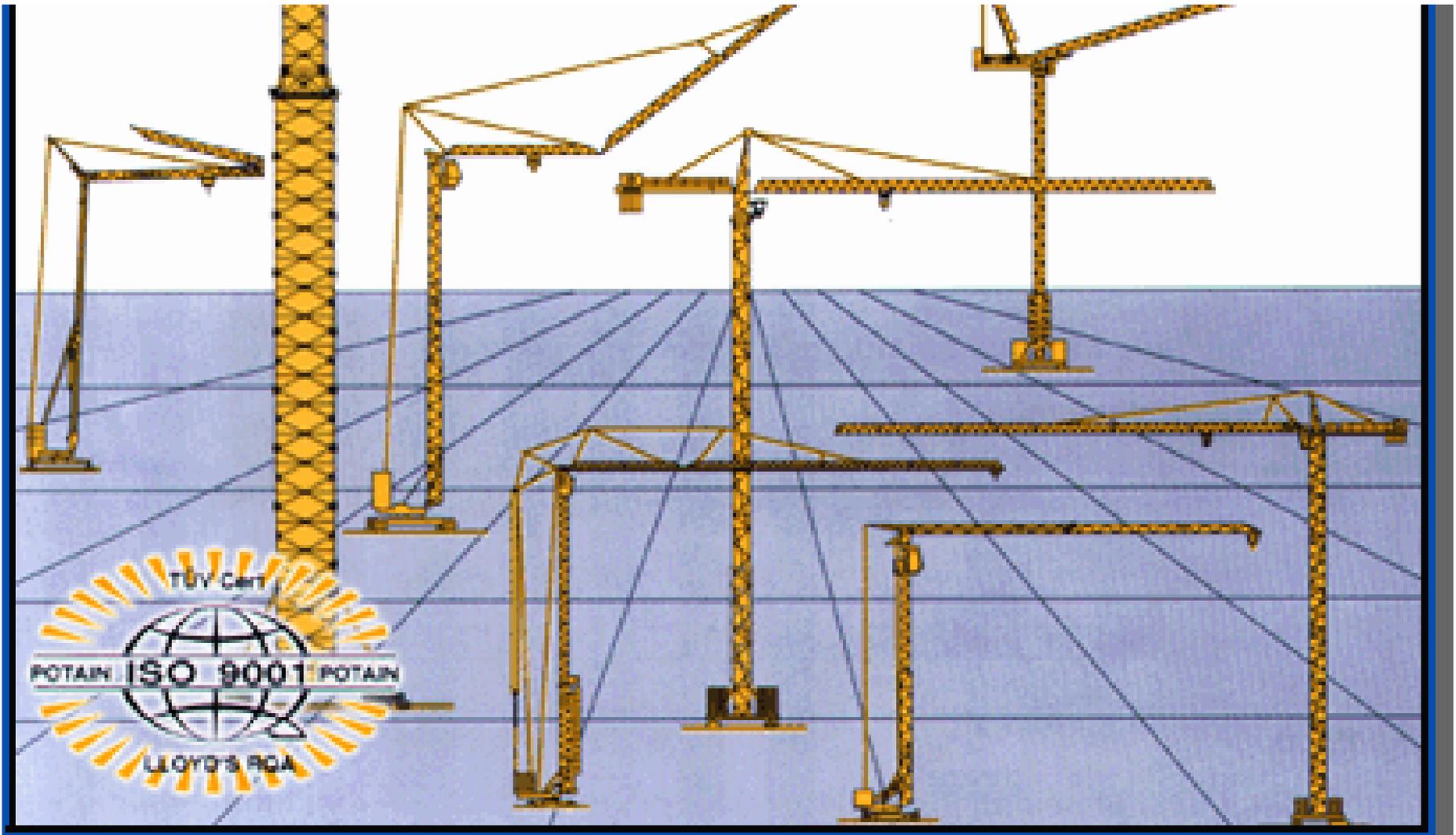


# TOWER CRANES



# TOWER CRANE TYPES



## Tower Cranes: Types

### Luffing Boom, Un-moveable Counter Weight

*(Large Capacity, Massive Counterweight and back moment, Heavy construction of all components.)*

### Luffing Boom, Moveable Counterweight

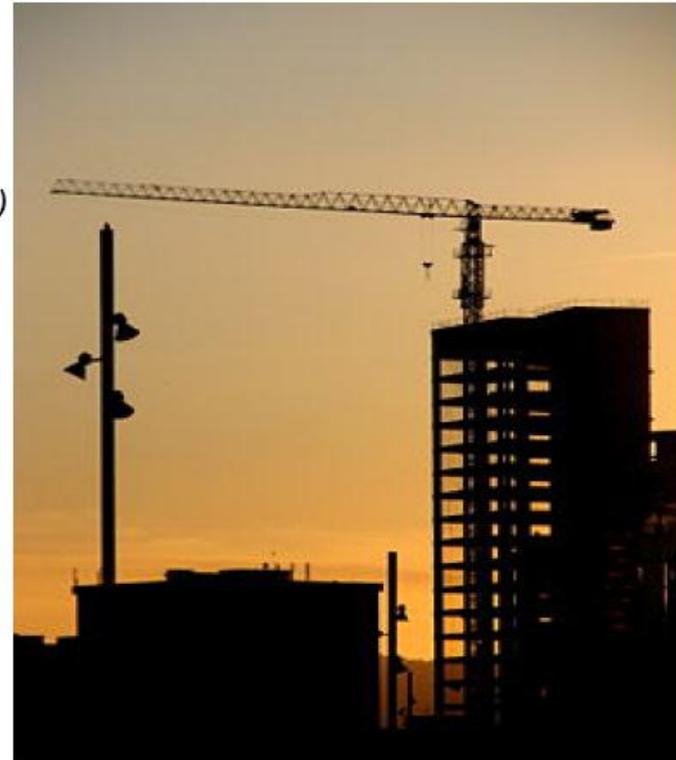
*(Greater capacity than standard cranes, ability to weathervane in tight locations.)*

### Hammerhead Crane

*(Smaller capacity, faster than Luffers, Takes up a large space when crane in in weathervane mode.)*

### Flat Top Hammerhead Crane

*(Same advantages as Standard Hammerhead but able to work in areas with height limitations, Airports, etc)*



**Could be remote control or cab operated.**

# TOWER CRANE ERECTION PROCEDURES



## PREPARATORY

1. **Manufacturers inst.**
2. **Erection procedure**
3. **Foundation design**
4. **Layout sketch**
  - Power lines**
  - Other structures**
  - Other cranes**
5. **AHA**
6. **Qualified person**



# TOWER CRANE ACTIVITY HAZARD ANALYSIS



**Designated qualified person**  
**List of weights for **each** piece**  
**Sketch of all adjacent areas**  
**Names and quals of operators**  
**Names and quals of riggers**  
**All crane structural support information**  
**System of communication**  
**Radio frequency approval**

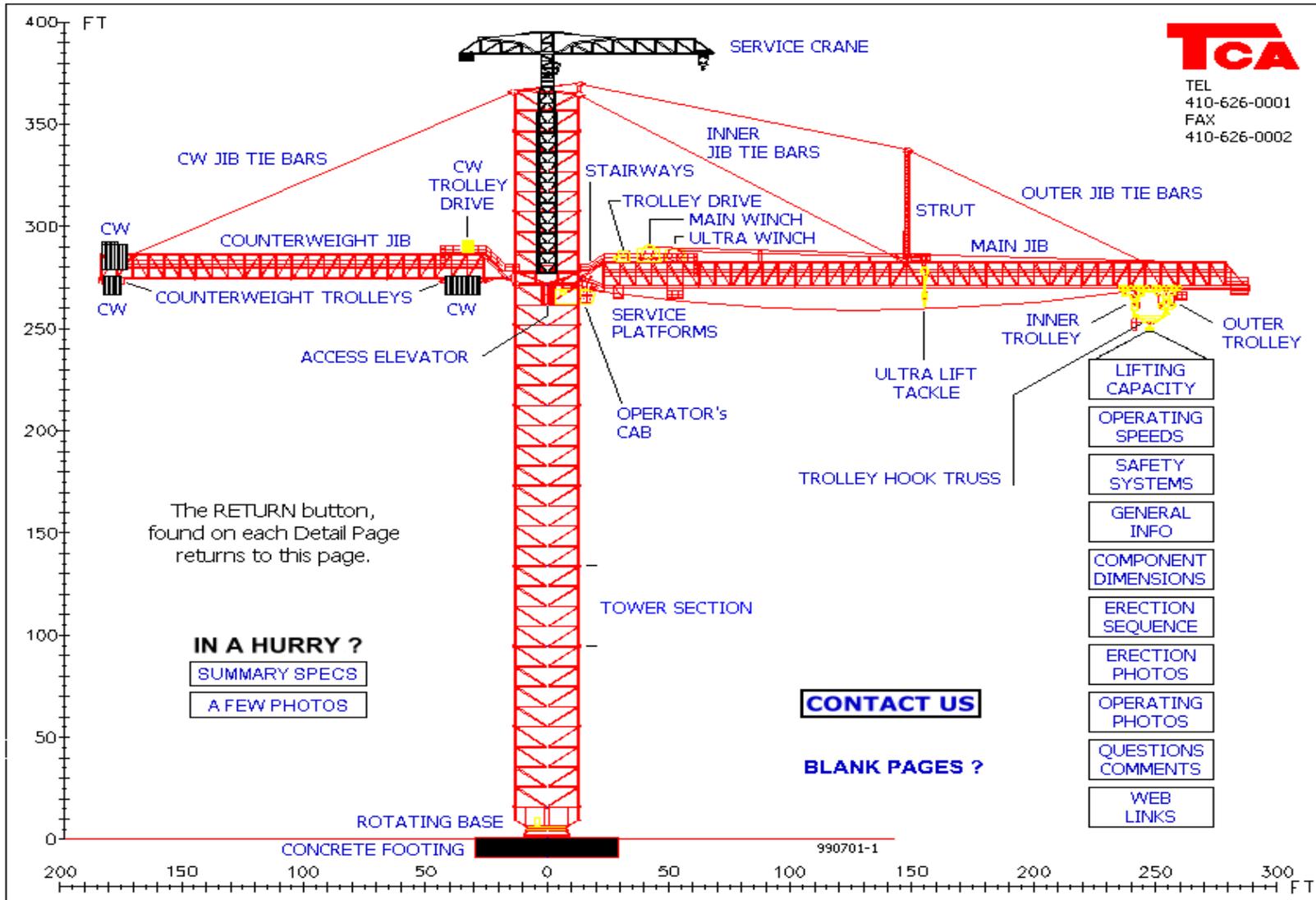


# CRITICAL KNOWLEDGE OF PARTS, WEIGHTS, ERECTION PROCEDURES



**TCA**

TEL  
410-626-0001  
FAX  
410-626-0002



# Tower Crane Post Erection Procedures



## Test Components

- 1. Crane Supports**
- 2. Brakes, clutches limit switches, all overload switches, audible/digital warning, locking & safety devices.**
- 3. Load hoisting & lowering.**
- 4. All swing motions**
- 5. Load testing IAW manufacturers printed instructions.**



# TOWER CRANE SAFETY PROCEDURES



**QUALIFIED OPERATORS**

**QUALIFIED RIGGERS**

**UNATTENDED CRANES  
MUST BE LEFT IN THE  
WEATHERVANE  
POSITION (FREE SWING)**



# EXAMPLE OF CONGESTED LOCATION



# TIGHT & UNIQUE LOCATIONS OF SOME TOWER CRANES



# TOWER CRANE DAILY OPERATION CONSIDERATIONS



- 1. WIND 20 MPH - or as per manufacturer**
- 2. Fall Protection-Access**
- 3. Communications & Signals by one person only!**



**COVER STORY SAFETY**

# Investigators Show the Routine Errors behind Jobsite Deaths

Bad training, mental lapses, gravity and vehicles take a toll

**O**n Oct. 9, driver Brian Anderson's dump truck knocked down and crushed James Lee Causey, a 60-year-old working for Moran Environmental Recovery, which was repairing a collapsed culvert at a former municipal dump in Gainesville, Fla. "The driver feels [that] the victim knew the truck was about to hit him," says a local

FACE report 9/2800-12

## Overloaded Bucket Hits Ohio Carpenter

IT WAS 8:30 IN THE MORNING ON Oct. 13, 1999, when the 50-year-old carpenter finished his break and returned to the roof of an Ohio library addition. He began removing

operator, who had 26 years of experience, radioed the spotter to clear the site. He shouted and the concrete crew fled to safety and the carpenter, working alone 25 ft away, started to

**•Crane Operations Carry The Greatest Potential For Disaster Than Nearly Any Other Activity On A Construction Project..**

PHOTO COURTESY OF THE NATIONAL ASSOCIATION OF CRANE AND DERRICK OPERATORS



**OVERLOAD** Operator sent radio warning as his crane wobbled.

not escape is less clear. The lift already was in progress when he arrived back from his break and it is possible that he did not notice that a load was in the air. Being at a loud, kinetic jobsite is nothing new to veteran workers, and events on the periphery sometimes go out of focus. "People get used to working around machinery and they don't concentrate on their surroundings," says Ian Scotty Paterson, president of the Construction Management Institute, Palo Alto, Calif. The carpenter "was probably just focusing on his work." Full report: [www.odc.gov/miosh/face/In-house/jul0200012.html#Photo](http://www.odc.gov/miosh/face/In-house/jul0200012.html#Photo)



**•The Crane Is Usually The Most Important And The Most Expensive Piece Of Equipment On The Jobsite.**



- Crane Accidents Are Often The Most Costly Construction Accidents When Measured Either In Lives Or Dollars.

A photograph of a yellow crane lifting a large, dark, spherical object. The crane's boom is extended upwards, and the object is suspended in the air. The background shows a cloudy sky and some industrial structures. A black rectangular box is overlaid on the center of the image, containing white text.

**90 % Of All Crane  
Accidents Are Caused  
By Operator Error**



## CERTIFICATION QUICK LINKS

[MOBILE CRANE OPERATOR SIGNAL PERSON](#)[TOWER CRANE OPERATOR RIGGER](#)[OVERHEAD CRANE OPERATOR](#)

## CERTIFICATION PROGRAMS

[Overview](#) | [Mobile Crane Operator](#) | [Tower Crane Operator](#) | [Overhead Crane Operator](#) | [Signal Person](#) | [Rigger](#) | [FAQs](#) | [State Licensing](#) | [Military Personnel](#)

### Tower Crane Operator

[Written Examination](#) | [Practical Examination](#) | [How Do I Test?](#)

[ABOUT NCCCO](#)[NEWS CENTER](#)[CERTIFICATION PROGRAMS](#)[RECERTIFICATION PROGRAMS](#)[TRAINING RESOURCES](#)[HOSTING CCO EXAMINATIONS](#)[PRACTICAL EXAMINER PROGRAM](#)[TEST SITE COORDINATOR LOGIN](#)[STATE LICENSING REQUIREMENTS](#)[MILITARY PERSONNEL](#)[TEST DATES & LOCATIONS](#)

[Find out when and where the next tests are being administered.](#)

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## Tower Crane Operator Available Certification Resources

### ELIGIBILITY

#### ABOUT

Requirements for certification include the following:

- Be at least 18 years of age
- Meet physical Requirements
- Comply with CCO's [Substance Abuse Policy](#)
- Pass Written Examination
- Pass Practical Examination - Candidates must pass the Written and corresponding Practical examinations within a twelve month timeframe.
- Comply with the [Code of Ethics](#)

#### TEST

### EXPERIENCE

#### STATE

CCO certification examinations are designed for operators who are trained and who currently work in crane operation.

Crane-related experience is defined as: operation, maintenance, inspection or training.

### PHYSICAL REQUIREMENTS

Certified crane operators must continue to meet ASME B30.3 physical requirements throughout their certification period and attest to their agreement to those requirements in their application.

Means of compliance with ASME physical requirements include, but are not limited to the following:

- [CCO Physical Examination Form](#) (valid for three (3) years)
- A current DOT (Department of Transportation) Medical Examiner's Certificate (valid for two (2) years)

### CCO WRITTEN EXAMINATIONS

The Tower Crane written exam consists of a single examination in Tower Crane operation. This examination has 55 multiple-choice questions, six (6) of which are load chart questions. Candidates are allowed 60 minutes to complete the exam. Candidates

# Tower Crane Operator Training Resources:



Start a New career in Tower or Mobile Crane Operating

**er Crane School OF PHOENIX.COM**

- Home
- Classes/Schedule
- Photos/Slideshow
- Classes / Pricing
- Contact

Visit our other website at: [CraneExam.com](http://CraneExam.com) **Crane Operator Resumes**

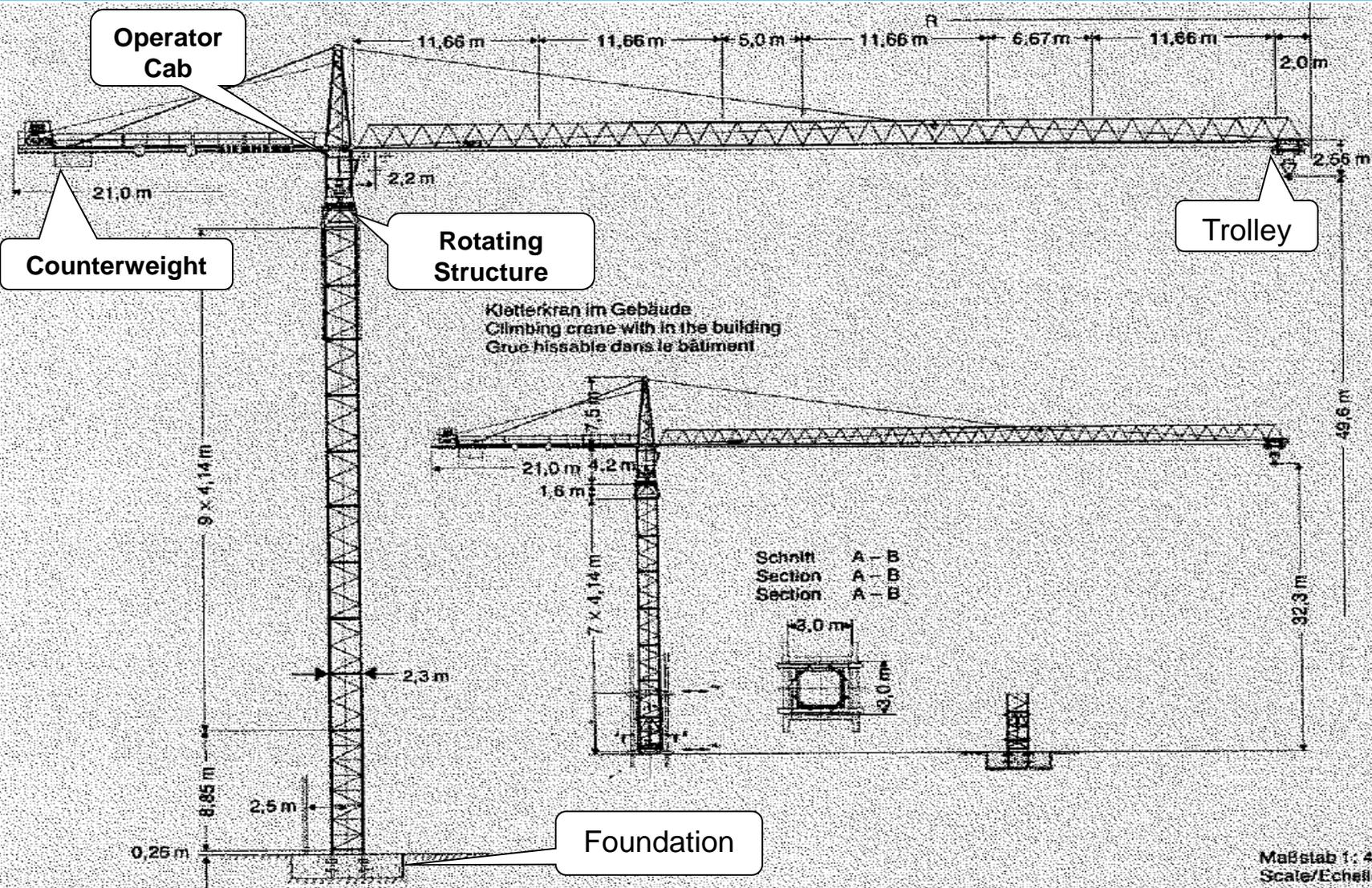
The banner features a man in a white hard hat and a white t-shirt with the school's logo. In the background, a tower crane is visible against a dark sky.



Tower Crane Simulation Training



# Test your knowledge and understanding - review some basic components:



**A sampling of some common rules to be aware of established by one manufacturer based on crane design parameters include:**



- If winds exceed 45 MPH, the crane must be shut down and allowed to weathervane 360 °.
- Must have air rights to weathervane over existing buildings, roads, power lines, etc.
- Crane must be secured via Tie-Ins or lowered if wind speeds exceed 94 MPH.
- Tower Crane must be grounded.
- Foundation concrete must have a specific weight of 150 pcf and a compressive strength of 4,000 PSI prior to erection of the crane.
- Foundation reinforcing steel shall be ASTM A615 Grade 60 deformed bars.
- Foundation design is based on adequate soil bearing. The bottom of the foundation must be above the water table.

**Some crane types or manufacturers require piling installation**

## Tower Cranes Greatest Enemy



# Lightening hazard (ground structure)



# Tower Crane Installation Documentary: NAVFAC NORTHWEST



- A safe tower crane installation begins with advanced pre planning assured by a professional government and contractor team (a good idea to include a representative from the manufacturer as well – most require it):



# Tower crane foundations (key) - are carefully designed by a professional:



- Tower crane foundation work and quality assurance/control serves as the basis for your tower crane installation success:



# Installing the vertical tower sections:

- The tower sections similar to the one pictured below will arrive by truck:



- Remember two cranes if required = critical lift:



# Installing tower vertical sections:

- **Tower cranes requires and erection plan: Don't forget employees must be positioned in a manner such that no part of their body is directly under the load.**



# 100 % fall protection (no exceptions)



- **100% fall protection considerations during erection is essential and should be carefully planned out ahead of time:**



# Rotating structure

- All steps are critical but probably the most critical is placing the rotating structure. It is very heavy and unbalanced so the lifting crane capacity should be validated (remember 80% or more requires a critical lift plan and never more than 90% in any configuration per guide specification).



# Horizontal members (one at a time):



- Installing the remaining horizontal counter weight and jib sections is a balance that must follow the manufacturers installation requirements closely.



# Electrical installation:

- Don't forget to assure a safe grounded electrical installation and lock out tag out considerations:



# Days done:



- Once erected all operations and load tests can begin in accordance with the manufacturers instructions:



**Special thanks to those of the NAVFAC Northwest team responsible for documenting the tower crane erection.**

# Sample Mishaps



- **Tower crane mishaps**

**Sample mishaps to review what can go wrong.**

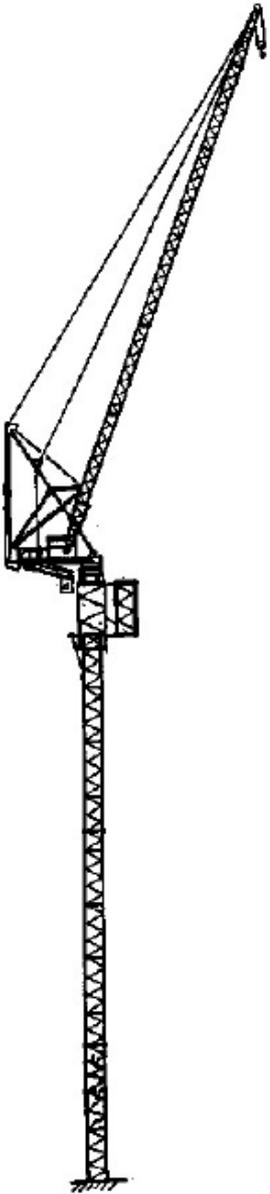
## TOWER CRANE COLLAPSE

A 300-ft tower crane collapsed onto the intersection of two major streets in downtown San Francisco during the morning rush hour. The accident fatally injured four crew members on the crane and a bus driven on the street below. Twenty-two pedestrians were also injured by falling crane pieces or flying debris.

A team of safety, mechanical, and metallurgical engineers was assembled to investigate the accident. Since all of the crew members involved in the operation of the crane at the time of the accident were killed, all of the circumstances of the failure had to be reconstructed from the physical evidence and the testimony of casual witnesses on the streets and in buildings around the site.

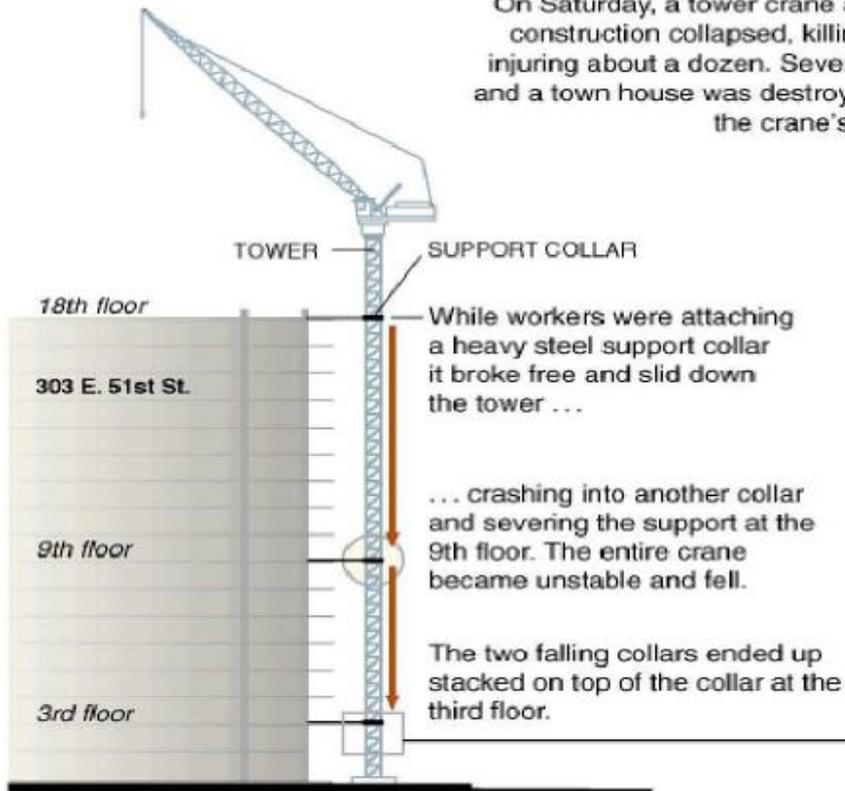
Reconstruction of the accident was hampered by the considerable damage to the crane cab and tower sections sustained upon impact with the street after falling 300 feet. Some of the components were embedded into the ground up to 15 ft below the pavement. Fractures, twists, bends, and scrapes on the components, however, were eventually decipher sufficiently to reconstruct the chain of events during the accident.

The crane collapsed during a climbing maneuver where the crane crew installs a new 20-ft section into the tower. To accomplish the climb, the cab of the crane is raised above the fixed tower by a hydraulic cylinder on a climbing frame to allow the next tower section to be inserted. Each climb required the hydraulic cylinder to be extended and reset several times to obtain the necessary clearance to insert a tower section. The operation at the time of the accident was for the final climb to the crane's full height of approximately 320 ft.

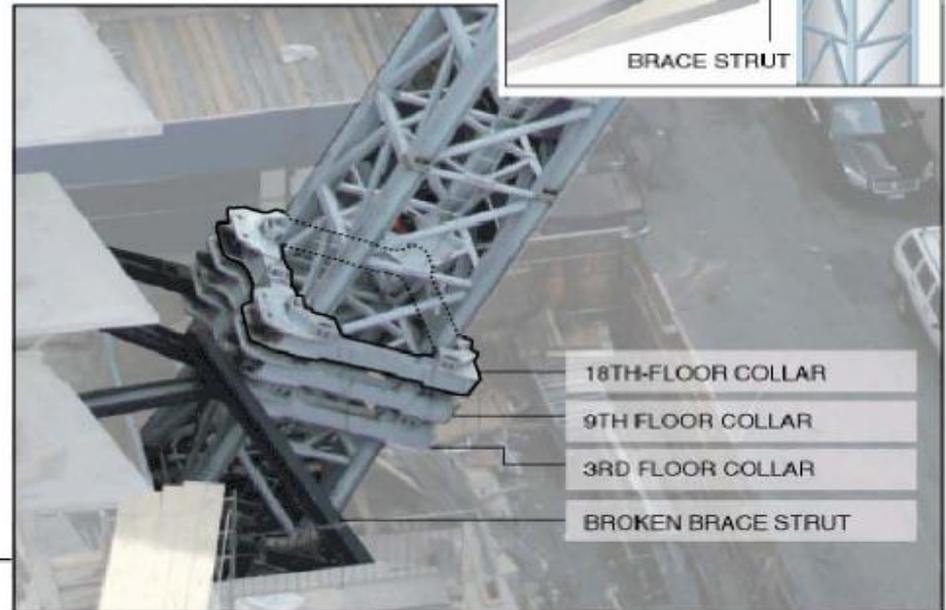
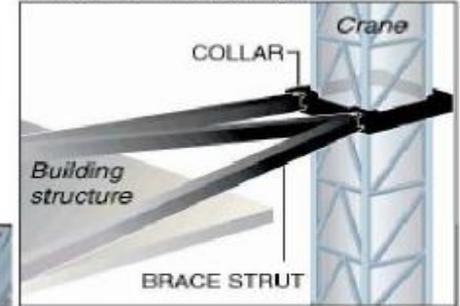


## How the Crane Fell

On Saturday, a tower crane attached to a building under construction collapsed, killing at least four people and injuring about a dozen. Several buildings were damaged, and a town house was destroyed. The details of what led to the crane's collapse:



TYPICAL CRANE SUPPORT



ILLUSTRATIONS BY MIKA GRÖNDAHL/THE NEW YORK TIMES; PHOTOGRAPH BY YASMIN NAMINI/THE NEW YORK TIMES







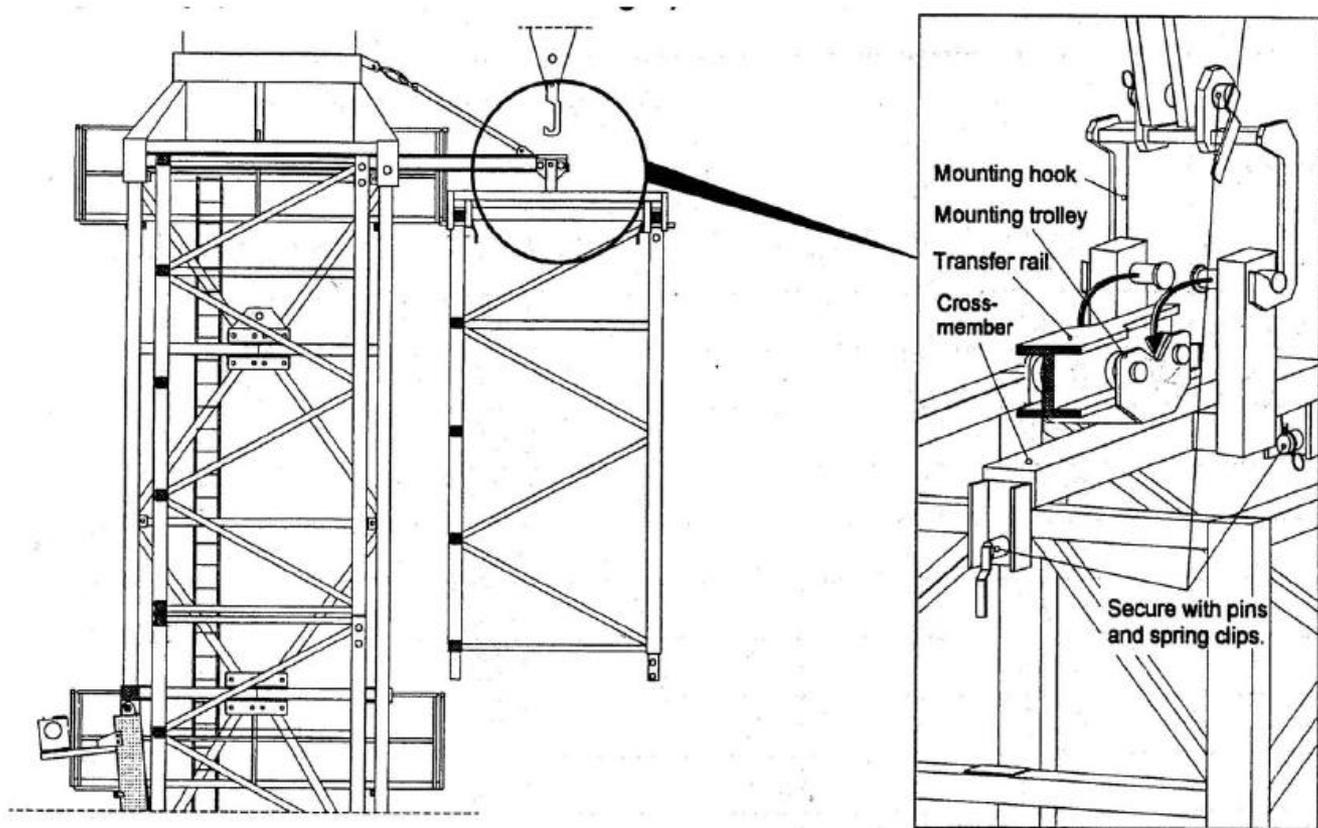
Christopher Badowski











## Conclusion:

These incidents involved tower cranes but were not related to the design, construction or use of these cranes.

The tower crane is the safest crane to have on your job site.

Consider this, 90 % of all crane accidents are caused by operator error! The tower crane eliminates the possibility of the operator:

- Bypassing the computer to go to rigging and travel mode.
- Changing the length of the boom.
- Setting up improperly.

The incident involving the Favco crane in New York was caused by poor rigging practices. Once again, nylon straps around sharp edges.

The Miami, FL incident was caused by improper handling or procedures used when climbing the crane.

Would you have even heard about the accident if no one had been in the office below?

## How to Eliminate Tower Crane Incidents

- Insist on engineered designs.
- Insist on qualified, trained erection crews.
- Insist on Lift Plans and erection sequences prior to starting the job.
- Give the assembly crew room to work.
- Have the erection crew inspect rigging every day. Nylon straps should only be used with shackles or softeners.
- Designate no work areas at least a 50' radius around the work area of the tower crane when assembling, climbing or dismantling a crane. Keep people clear of these areas or we will shut down the job for you.
- Insist on proper signaling for the whole job. Designated radio channels for tower crane operators. If two cranes are working in each other's swing path, a second dedicated radio between the two tower crane operators is essential.
- Take precautions in inclement weather. Follow all manufacturer's recommendations.
- Have your crew inspect rigging every day. Have competent signal persons.