



20 build safe | live safe
21 **DIGITAL** CONSTRUCTION
SAFETY CONFERENCE

CRANES & DERRICKS SAFETY ISSUES

P R E S E N T E D B Y

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PRESENTATION OVERVIEW

This presentation will provide an overview of various types of Cranes, how the cranes are designed, set up, inspected and utilized on the job site. Attendees will learn safety requirements for installing, using, operating and removing cranes to avoid potential safety hazards. This presentation also reviews crane rules to develop the necessary strategies in order to mitigate risk and prevent accidents.

WHERE ARE WE NOW?

■ DOB NOW: *Build*

- DOB NOW: *Build* for Cranes (April 27, 2020 & July 7, 2020)
- DOB NOW BIS CNs Service Notice (May 3, 2021)

■ 1 RCNY 3319-01

- **Phase 1:** Prototype – went into effect on January 1, 2016
- **Phase 2:** Onsite Inspection – went into effect 5/24/2017
- Technical Cleanup Amendments to Rules 3319-01 (went into effect 7/23/20)
- **Phase 3 & 4:** CD Inspection & Crane Operations (TBD)

WHERE ARE WE NOW?

(continued)

- **CD8 FORMS** introduced 3/1/2019
- **1 RCNY 3319-02: Lift Director Rule**
 - Went into effect on 5/24/2017 for tower cranes and derricks and 7/1/17 for mobile cranes
- **Local Laws**
 - Crane Modernization (LL 3/2018), Event Loggers (LL79/2017), and Wind Measurements (LL13/2018)

WHERE ARE WE NOW?

- **Chapter 3316-3320:** The Code revision bill has been introduced to the City Council as [Intro 2261](#)
 - Expanding crane regulations to account for knuckle booms, telehandlers, and similar new technology that may come down the pike
 - Changing terminology around C-2, C-3 license to **limited HMO license** and creating new limited license for knuckle booms, mini cranes, with authority to also create other limited licenses via rule (esp. telehandlers)

WHERE ARE WE NOW?

- Authorizing the Department to, through rulemaking, tie the CD for tower cranes, crawler cranes, and large mobile cranes to the duration of the job
- Removing terminology from code that implies a learner needs to be employed by the supervising HMO

DOB NOW: *Build* KEY STAKEHOLDERS



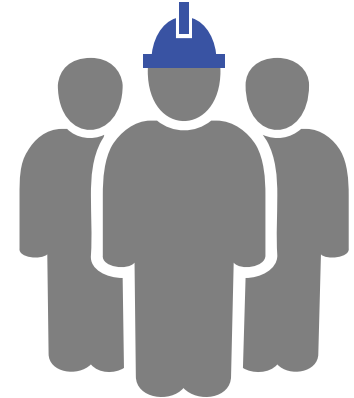
APPLICANT OF RECORD

- Manufacturers
- Engineers
- Device Owners
- Professional Engineers



OTHER STAKEHOLDERS

- Filing Representatives
- Hoist Machine Operators
- Master Riggers
- Tower/Climber Crane Riggers
- Lift Directors
- Equipment Users
- Licensees



INSPECTORS

- Special Inspectors
- Progress Inspectors

DOB NOW ACCESS

PUBLIC PORTAL

Address

House Number

Enter House Number

Street Name

Enter Street Name

Borough

Select Borough

Search

Building Identification Number (BIN)

Borough, Block, Lot

Device Search

Open to the Public

INDUSTRY PORTAL

DOB NOW BUILD

Submit Filings, Payments, and Requests to the NYC Department of Buildings:

Submit Jobs for:

- Antenna
- Curb Cuts
- Electrical
- Elevators
- Fences
- Plumbing

Submit Compliance Filing for:

- Signs
- Sidewalk Sheds
- Sprinklers
- Standpipes
- Supported Scaffolds

DOB NOW SAFETY

Submit Compliance Filing for:

- Facades
- Boilers

Search the Public Portal for Filings and Permits Submitted in:

Address

House Number

Enter House Number

Street Name

Enter Street Name

Borough

Select Borough

Search

Building Identification Number (BIN)

Borough, Block, Lot

Device Search

Log in to:

DOB NOW

to Submit and Filings:

Enter your e-filing account information

Email

Search

Password

Password

Login

To register for an account or reset your password, go to the e-filing website.

Need more help? Contact us.

DOB NOW

Public Portal FAQ and User Manual

DOB NOW

FAQ and Resources

Registered eFiling Users



CRANES

Types of Devices

TYPE OF DEVICES

- Tower Cranes
- Mobile Cranes
- Crawler Cranes
- Pile Drivers
- Derricks

TYPES OF DEVICES: TOWER CRANES

Luffing Jib

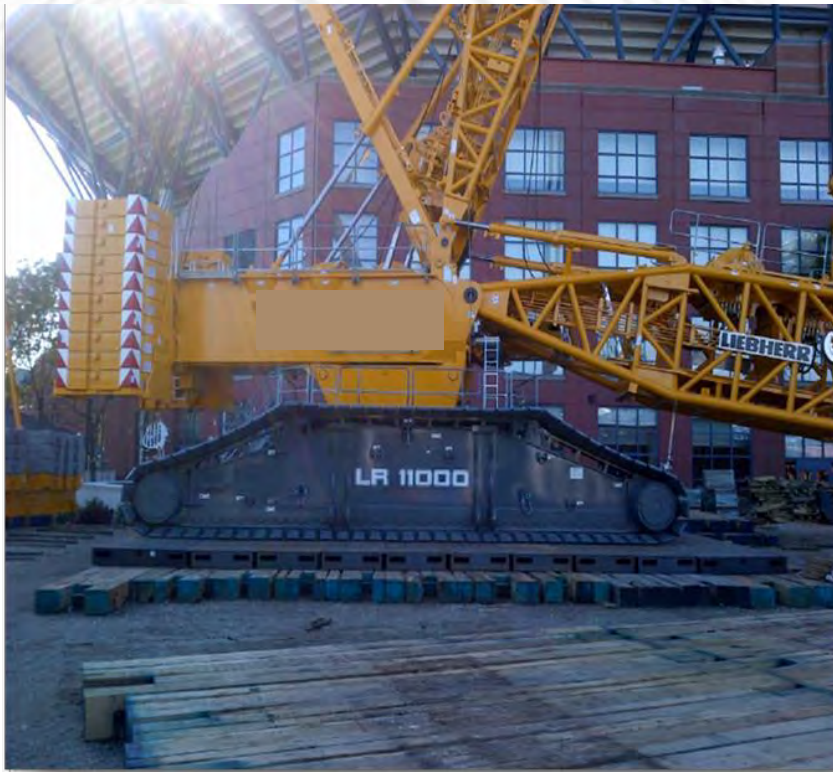


Hammerhead



TYPES OF DEVICES: MOBILE CRANES

Crawler Crane



Hydraulic Crane



TYPES OF DEVICES: CRAWLER CRANES



TYPES OF DEVICES: DERRICKS & PILE DRIVERS

Derrick



Pile Driver





CRANES

Safety Hazards

UNSAFE OPERATION



- 1 RCNY §3319-01(q)(6),
Hoisting Personnel
 - Written notification
three (3) business
days prior to use
 - Applicant must comply
with pertinent OSHA
requirements

OVERLOADING: BOOM FAILURE

- 1 RCNY §3319-01(g)(2)(vi)(B) 1
 - Loads, surcharges, and values noted on crane or derrick notice application account for all loading conditions, including wind.



UNSAFE OPERATIONS



- **1 RCNY §3319-01(g)(2)(i)(B) Site conditions.**
Elevations and sections detailing all pertinent site conditions, dimensions indicated, include, as applicable:
 - North arrow
 - Buildings and structures at and adjacent to the site, with projections, setbacks, equipment and structures on roof or setback indicated
 - Temporary construction, such as platforms, runback structures, scaffolds, mast climbers, hoists, horizontal netting, cocoon systems, climbing formwork, sidewalk sheds, fences, and barricades
 - Pedestrian and traffic control to be provided per requirements of the Department of Transportation
 - Other cranes or derricks at the site, swing radii indicated

INSUFFICIENT CLEARANCE



- **1 RCNY §3319-01(g)(2)(i)(C) 6**
 - Minimum clearances for the boom/jibs/attachments and counterweights
 - Operation restrictions necessary to prevent contact must be clearly shown

IMPROPER SETUP



■ 1 RCNY §3319-01(g)(8)(i)(A) Engineer's Inspection:

- Prior to and following the **setup**, assembly, erection, jumping, or climbing of a crane or derrick, the crane or derrick notice engineer, or a qualified person employed and supervised by such engineer, must perform an inspection and verify compliance with the approved crane or derrick notice plans, including but not limited to:

LOOSE BOLT



■ 1 RCNY §3319-01(k)(3)

Periodic inspection.

- Mandatory at one to twelve month intervals, or as recommended by the manufacturer, based on activity, severity of service, and environment
- Select items require frequent inspection

■ 1 RCNY §3319-01(k)(3)(i)

Inspection items.

- In addition to paragraph (1) above, check for the following:
1 RCNY §3319-01(k)(3)(i)(B):
 - LOOSE BOLTS or rivets.

BENT BOOM LACING



- 1 RCNY §3319-01(p)(2)(iii)
 - The **operator** shall be responsible for the operation of the crane or derrick hoist.

UNSAFE OPERATION

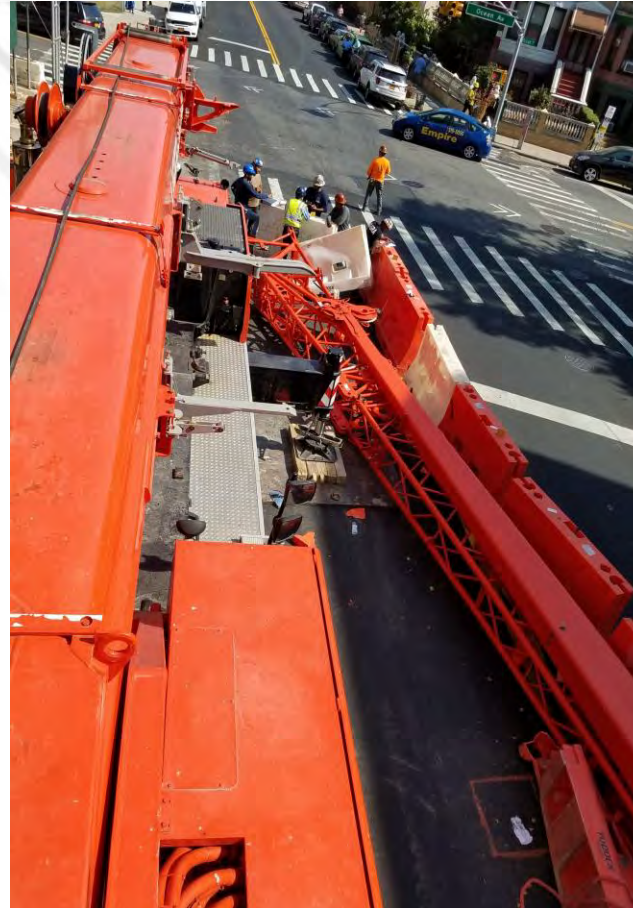


■ 3319-01

§6. Subdivision (d) of section 3316-01 of chapter 3300 of Title 1 of the Rules of the City of New York

- (7) Load suspended beneath another load (“Christmas treeing”) prohibited. No load may be suspended directly beneath an existing load.

UNSAFE OPERATION



■ 3319-01

§6. Subdivision (d) of section 3316-01 of chapter 3300 of Title 1 of the Rules of the City of New York

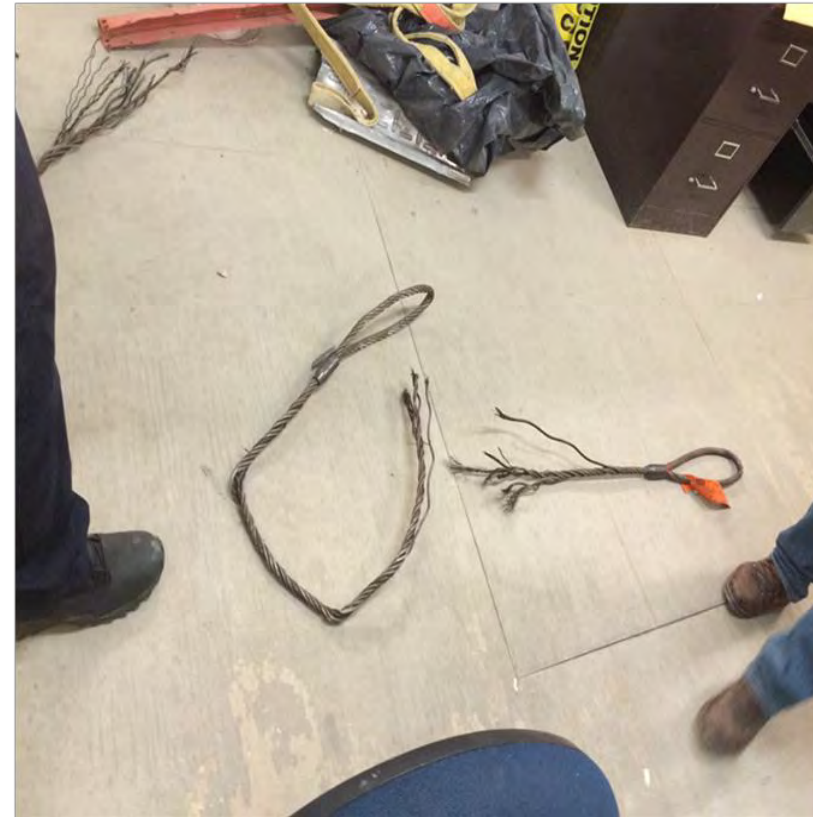
- **Unfolding and pinning of a boom or swing-away jib.**

WIRE ROPE

Broken Wires



Torn Rope



WIRE ROPE

■ 1 RCNY §3319-01(m)(2)(ii)(A)

Broken Wires

- Running ropes – six randomly distributed **broken wires** in one lay or three broken wires in one strand in one lay.
- In rotation-resistant ropes, two randomly distributed **broken wires** in six diameters or four randomly distributed broken wires in 30 rope diameters.
- One outer wire **broken** at the point of contact with the core rope that has worked its way out of the rope structure and protrudes or loops out from the rope structure. Additional inspection of this section is required.
- Kinking, crushing, birdcaging, or any other damage resulting in distortion of the rope structure.
- Evidence of heat damage from any cause.

WIRE ROPE

■ 1 RCNY §3319-01(m)(2)(ii)(A)

Broken Wires *(continued)*

- Reductions from nominal diameter of more than the following:
 - 6.A 1/64 in. for diameters up to and including 5/16 in.
 - 6.B 1/32 in. for diameters up to and including 1/2 in.
 - 6.C 3/64 in. for diameters up to and including 3/4 in.
 - 6.D 1/16 in. for diameters up to and including 1 1/8 in.
 - 6.E 3/32 in. for diameters up to and including 1 1/2 in.
- In standing ropes, more than two **broken wires** in one lay in sections beyond end connections or more than one broken wire at an end connection.

UNSAFE OPERATIONS: KNUCKLE BOOM CRANE

Is this legal?



UNSAFE OPERATIONS



Is this legal?

CRANE: ARTICULATING BOOM

Permitting & Licensing Requirements

■ NYC Building Code 3319.3

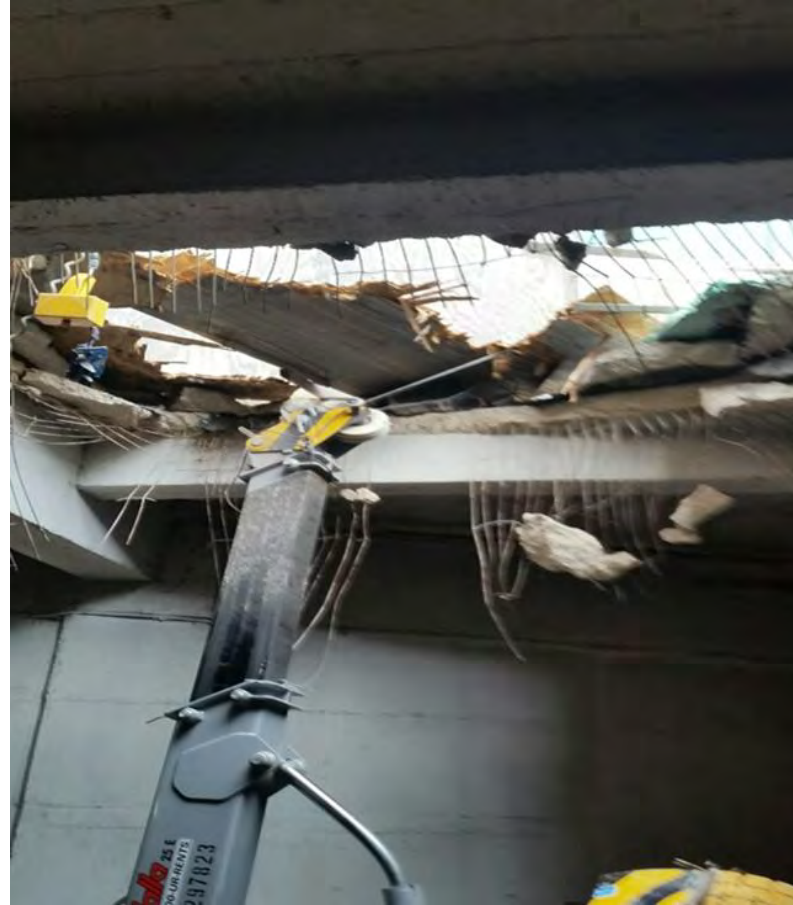
- Does not require prior approval of the Department of Buildings to use an articulating boom crane at a jobsite, provided all of the following conditions are met:
 - The articulating boom crane is used exclusively to load or unload a truck or trailer;
 - The length of the boom does not exceed 135 feet; and
 - The material is not raised vertically more than 100 feet during the unloading process.

CRANE: ARTICULATING BOOM

Permitting & Licensing Requirements

- A prototype, CN, CD, and HMO licensee are required if an articulating boom crane is used for any other type of work at a job site including but not limited to:
 - Deliveries at a jobsite beyond the maximums specified in BC 3319.3.
 - **Holding steel, HVAC equipment, hoist towers, scaffolding, or any other loads in place while they are bolted or otherwise affixed.**
 - Assisting in the demolition of a building.

IMPROPER TIEBACK





CRANES

Mini-cranes

WHAT IS A MINI-CRANE?

■ Mobile Crane

- Wheel or tread-mounted
- Boom length not exceeding 50 feet
- Manufacturer's rated capacity of 3 tons or less



MINI-CRANES

- An **ALT2** permit must be obtained prior to the use of a mini-crane.
- The EQ-Construction Equipment work type must be selected
- Plans must be filed with the permit and developed by a NYS registered PE

MINI-CRANES

Plans must include:

- Machine make and model
- Capacity
- Site conditions/location/configuration
- Maximum and minimum swing radii
- Minimum boom clearance
- Picking/landing zones
- **Securing tiebacks**
- Wind thresholds

MINI-CRANES

Operator Qualifications

- Licensed New York City Hoisting Machine Operator (HMO)
- Valid certificate acceptable to the Department
 - Issued by manufacturer
 - Specific to make/model of mini-crane to use on site

MINI-CRANES

- **Steel Erection Work and Critical Picks**
MUST have Licensed New York City Hoisting Machine Operator (HMO)
- **Mini-crane capacity in excess of 1 ton**
Rigging crew and rigging supervisor **must** be trained or certified in accordance with Section BC 3316.9.2 of the NYC Building Code
- A **Lift Director** is not required for the use of a mini crane.



CRANES

Risk Mitigation

CERTIFICATE OF ON-SITE INSPECTION

1 RCNY §3319-01 (went into effect 5/24/17)

Application for Certificate of On-Site Inspection

- **Cranes and Derricks Notice Plan**
- Assembly/Disassembly Plan
- Pre-operational Test Procedures
- **Load Imposed**
- **Wind Action Plan**
- Certifications
- Calculations

RISK MITIGATION: CODES & RULES

- On-site Inspection
 - A/D Director
 - **Updated CD8 Forms**
 - Lift Director
 - Frequent Inspections
 - Log Requirements
- Local Laws
 - LL 79/2017: Event Recorders
 - LL 3/2018: Crane Age Bill
 - LL 13/2018: Anemometer



CRANES

On-Site Inspection/CN

CRANE NOTICE APPLICATION

Cranes and derricks notice plan (filed by a licensed NYS Professional Engineer) with the following information:

- Ground and Subsurface Elements
- Site Condition
- Location and Configuration
- Foundation, Tie-ins, and Supporting Elements
- Bolted Connections
- Anchors
- Welded Connections
- Structural Steel
- Counterweights
- Aviation Hazards
- Electrical Information
- Special Inspection
- Range of Tolerance

CRANE NOTICE APPLICATION

A. Ground & Subsurface Elements

- Elevations and sections with ground and subsurface elements
- Slopes, bearing values
- Load imposed and surcharge

B. Site Conditions

- Elevations and sections including but not limited to:
 - Surrounding structures
 - Temporary structures
 - Pedestrian and traffic control
 - Other cranes
 - Above ground utilities

CRANE NOTICE APPLICATION

C. Location & Configuration

- Elevations and sections for location and configuration
- Outriggers location and configuration
- Maximum and minimum swing radius

D. Footing, foundation, tie-ins and supporting elements

- Elevations and sections of footing or founding of the crane or derrick
- Ties-in or other structures supporting the crane or derrick
- Bearing values
- Load imposed
- Concrete strength to be obtained prior to installation

CRANE NOTICE APPLICATION

E. Bolted Connections

For a bolted connection utilized in a platform or dunnage that supports a crane or derrick, or utilized in the footing, foundation, tie-ins, or supporting elements of a derrick or a tower crane:

- Bolts sizes
- Grades and specifications
- Torque values
- Re-torqueing schedule and procedures
- Plates, rods and pre-tensioning information
- Dowels, clamping forces, and grout specifications

CRANE NOTICE APPLICATION

F. Anchors

Elevations and sections detailing anchored connections to a structure, including, as applicable:

- Type and size of anchors
- Epoxy or grout specifications
- Installation instructions, and pull testing criteria

G. Welded Connections

For a welded connection:

- Material information
- Welding specifications
- Welding procedures

CRANE NOTICE APPLICATION

H. Structural Steel

- Shape, size, and grade of the steel must be specified on the plans

I. Counterweight

- Weight
- Acceptable material
- Dimensions
- As per manufacturer requirements

J. Aviation Hazards

- Aircraft warning lights

CRANE NOTICE APPLICATION

K. Electrical Information

- Electrical requirements of Cranes **must** be indicated on the plans, such as voltage, amperage, phasing, grounding, and other electrical information specific to tower crane Voltage, amperage, phasing, grounding, and any other electrical information specific to the tower crane

L. Special Inspection

- Special Inspection **must** be identified on the plans as per of 3319-01

M. Range of Tolerances

- Specific values indicating the numerical range of tolerance must be indicated

LOAD IMPOSED

Where the crane or derrick imparts a load on a building or structure, the application **must** be accompanied by either:

- A. Sealed and stamped **reviewed for load** imposed by EOR of the project.
- B. Signed and sealed letter from the EOR attesting to the adequacy of the building structure to support loads imposed.
- C. For a project for which there is no EOR, as signed and sealed letter from the crane EOR attesting the adequacy of the building structure to support imposed loads.

WIND ACTION PLAN

- The application **must** be accompanied by a wind action plan containing:
 - Load reductions, if any, due to wind
 - The maximum in-service wind threshold
 - Wind thresholds, configurations, and procedures, including angles and sequencing, for parking and securing the crane in each applicable out-of-service position (e.g. retracted, parked, jackknifed, laid down, and/or other special protective measures for wind)
 - The communication protocol for safeguarding the crane in the event of changes in weather forecasts over weekends or longer stoppage periods

WIND ACTION PLAN

(continued)

- Self-contained document
- Maximum in-service threshold (30 mph or per manufacturer whichever more stringent)
- Specific to configuration
- Able to be implemented based upon site conditions
- Emergency action plan

WIND ACTION PLAN

In-service/During Operation

Out-of-service

Sample Wind Action Plan for a specific configuration, make and model of crawler crane

WIND REQUIREMENTS	
WIND SPEED (mph)	LUFFING JIB
	REDUCTION BY %
15	0
20	10
25	20
30	40
35	70
Above 35	<i>OPERATION PROHIBITED</i>

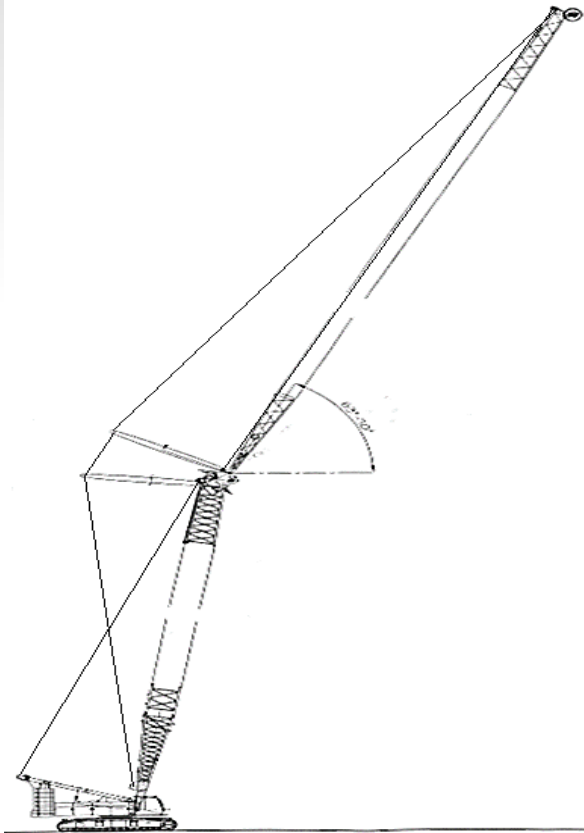
UP TO 49 MPH: PARK CRANE (UPPER IN LINE WITH CRAWLERS) WITH LOAD BLOCKS AND WEIGHT BALLS ON GROUND OR SECURED. POSITION BOOM AT 80° AND LUFFING JIB AT 66°-70°.

UP TO 80 MPH: JACK KNIFE BOOM AND LUFFING JIB.

ABOVE 80 MPH: LAY BOOM AND JIB DOWN.

NOTE: The table above is from the Manufacturer's manual. The New York City Department of Buildings does not allow the operation of cranes above 30 mph

WIND ACTION PLAN



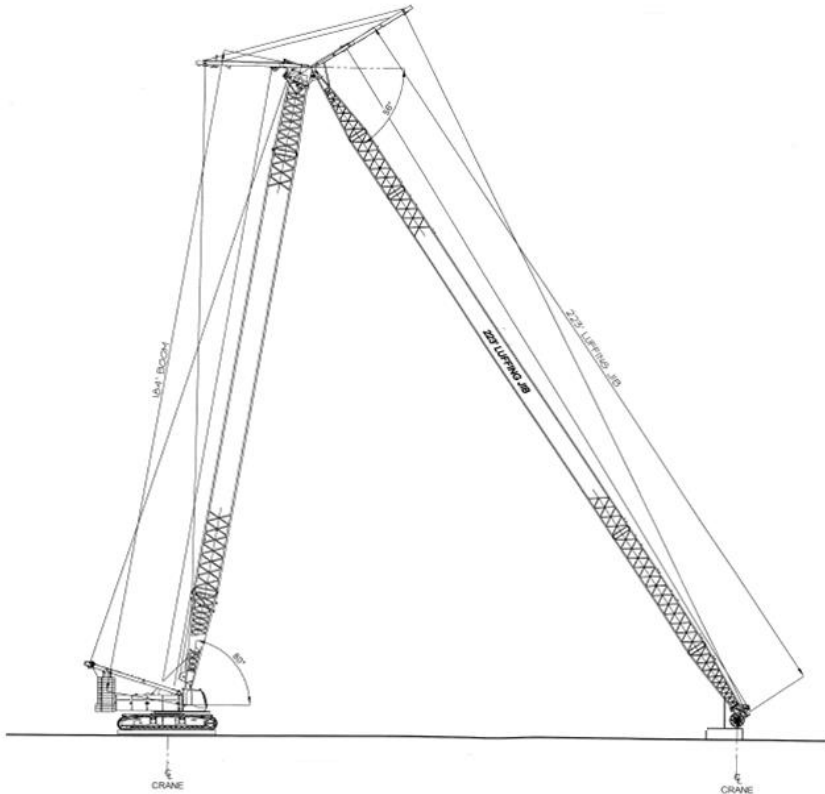
Out-of-service Parked Position

Winds < 45 Mph (Park)

- Park Boom at 80°
- Park Luffing Jib at 63° To 70°
- Do Not Place Weight Balls on Ground
- At higher wind speeds, the boom and jib must be placed on the ground or jack-knifed.

NOTE: Developed for specific crane make, model and configuration

WIND ACTION PLAN



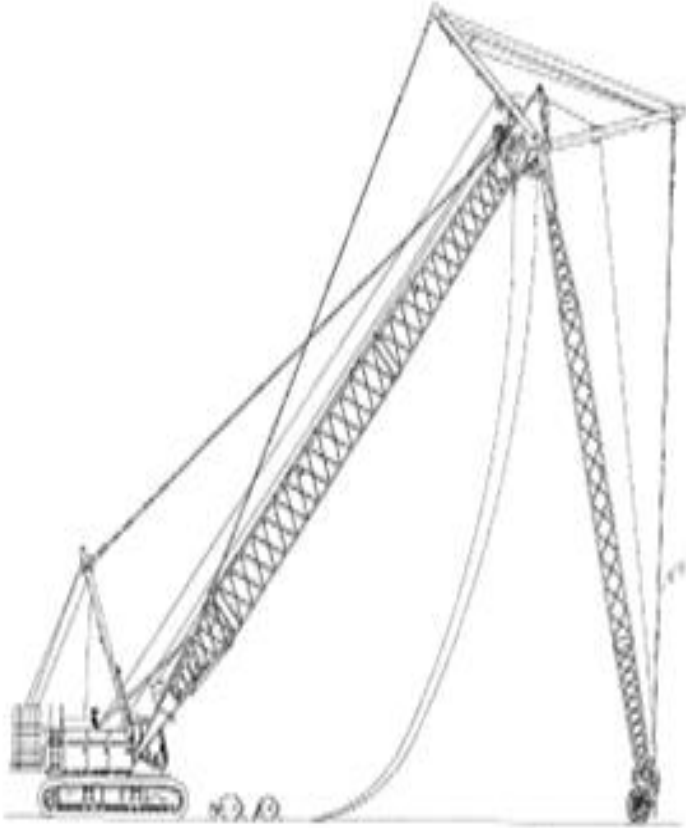
Out-of-service Jack-knifing

(Sample) Jack-knife Procedure

- Park boom at 80° ,
- Set luffing jib at $\pm 56^\circ$
- Max wind speed 53 mph
- Place all blocks on ground (at higher wind speeds, the Boom & jib must be placed on the ground)

NOTE: Developed for specific crane make, model and configuration

WIND ACTION PLAN



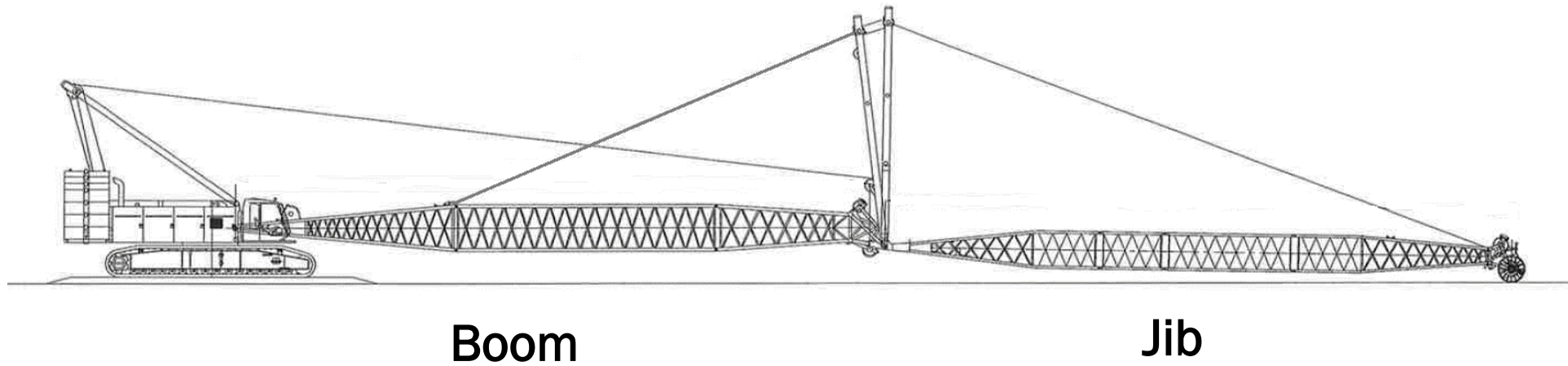
Sequence of Laying Down

The HMO must:

- Perform a parking/securing inspection at any time the crane is taken out of service and parked or secured
- Record in the crane log the laid down configuration
- Reference to the wind action plan or manufacturer's manual page
- Maximum wind speed allowed for such configuration

WIND ACTION PLAN

Out of Service Laydown



BUILDING CODE: TOWER CRANES

Site Specific Wind Analysis

NYC Building Code 1618 (Loads on Temporary Installations)

- Installations governed by this code shall be defined as temporary when such installations are intended to be taken apart or removed after a limited period following their installation including but not limited to **CRANES**.

Loads on Temporary Structures

- Shall be designed and constructed to resist loads as per NYC BC Chapter 16.
- All temporary installations reducing the design environmental loads shall include action plan. (Basic wind speed can be reduced by applying a factor of 0.8)
- Action plan shall be reliably implemented with one day's notice or less.

BUILDING CODE: TOWER CRANES

Site Specific Wind Analysis: 1 RCNY §3319-01

- Cover each configuration for which approval is sought.
- Crane EOR to provide the manufacturer the following:
 - Project address
 - Crane make and model
 - Maximum lifting capacity
 - Distance of crane from building

BUILDING CODE: TOWER CRANES

Site Specific Wind Analysis: 1 RCNY §3319-01 (*continued*)

- Required information from manufacturer:
 - Wind load base shear
 - Wind load overturning moment at base
 - Vertical loads at base
 - Overturning moment at base center due to vertical loads
 - The slewing moment
- Certification from the manufacturer that analysis is based on information provided by the crane EOR
- Certification from the manufacturer that all components can sustain wind load as specified above

BUILDING CODE: TOWER CRANES

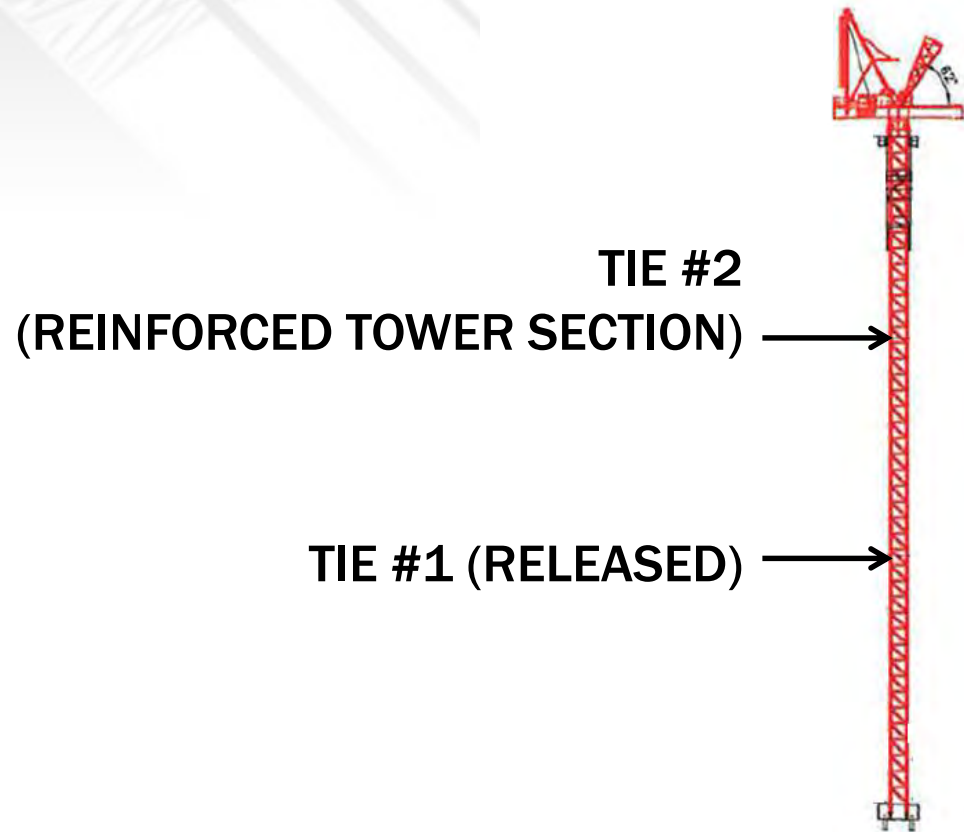
Site Specific Wind Analysis: RCNY §3319-01

(continued)

- Note any special condition in which the crane may not be used or installed
- Proposed tie-in spacing
- Elevations and sections
- Action plan in case reduction factor is applied
- Wind load conditions, exposure category, wind distribution:
 - In-service of at least 45 mph
 - Out-of-service in accordance with NYCBC Chapter 16

TOWER CRANE WIND ACTION PLAN

Action Plan Elevation



Specify

- Boom configuration
- Boom angle and radius for weathervaning
- Phase including mast height



CRANES ON-SITE INSPECTION

On-site Inspection Forms (CD8)

ON-SITE INSPECTION FORMS

When do I use each new CD8?

CD8

- Any job requiring an on-site inspection – ALWAYS FILED

CD8-TR

- Any job requiring on-site special inspections

CD8-AD

- Any job requiring an assembled or disassembled inspection or assembly/disassembly director

CD8: ON-SITE INSPECTION FORM

- Inspections performed exclusively by Design Applicant
- On-site Inspection Checklist added
- Rule references added

CD8-TR: ID OF SPECIAL INSPECTIONS

- Replaces TR forms for crane filings
- Requires multiple filings for each applicable phase
 - Identification of requirement
 - Identification of inspection agency
 - Certification of Completion

CD8-TR: ID OF SPECIAL INSPECTIONS

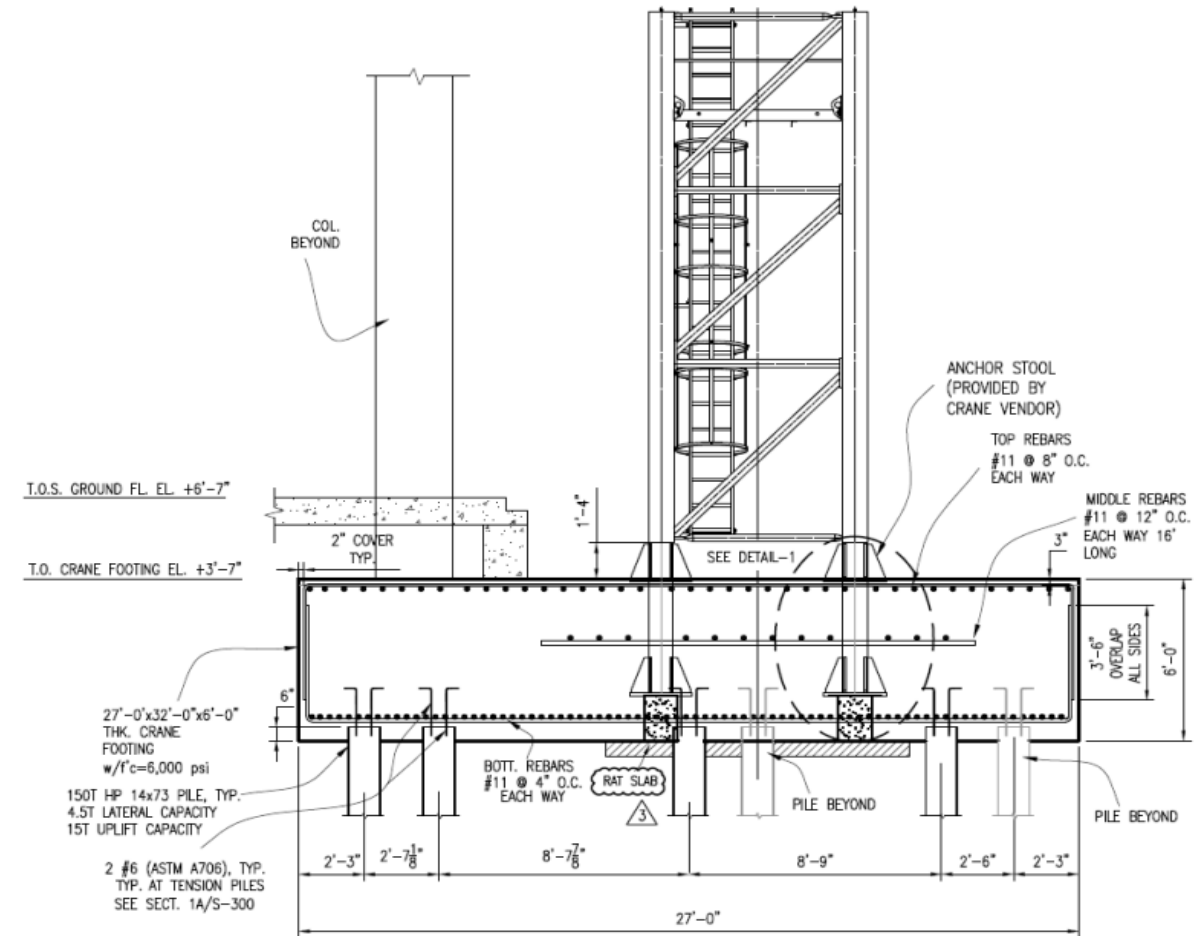
CD8-TR

Special Inspections

- Subgrade
- Deep Foundations
- Reinforcement
- Concrete

CD8

Design Applicant also inspects setup for conformance to design requirements, such as location, embedded components, stools, pile type/count, SIA reports



CD8-AD: ON-SITE INSPECTION FORM

Crane Pre-operation Inspections

- Unassembled Inspection Checklist
- Assembled Inspection Checklist
- Surveyor's statement
- Rigger or A/D Director's statement
- Pre-operational Test Witness Section

WHO INSPECTS THESE?





THANK YOU

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