Code ☑ Check® Building Fourth Edition

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 ISBN-13: XXX-X-XXXXX-XXX-X

Based on the 2015 International Residential Code® Including major changes from the 2012 edition

For updates and information related to this book, visit www.codecheck.com

SCOPE OF THIS BOOK

Code Check Building is a field guide to commonly used provisions of chapters 1-10 of the 2015 editions of the International Residential Code (IRC). The scope of the IRC is 1- & 2-family dwellings and townhouses and their accessory structures (such as detached garages). A townhouse, in this sense, is a single family dwelling unit constructed in a group of 3 or more units with each unit extending from foundation to roof and open to a yard or public way on at least 2 sides. In all cases, the scope of the IRC and this book is limited to structures not more than 3 stories above grade plane in height. Other books in the Code Check series deal with the electrical, mechanical, and plumbing aspects of the IRC. Multi-family dwelling units are within the scope of the International Building Code (IBC).

The IRC contains prescriptive requirements. Within specified geologic & climatic conditions, it provides construction methods that do not require further engineering design. The methods and materials covered in the IRC are not the only ones allowed; rather, they are simply the ones for which there is a standard methodology. As an example, the IRC tells us how far we need to set back the foundation from a slope break (**p.12**). If you want to build it closer than allowed by the IRC, a design professional must apply the engineering requirements of the IBC.

The text lines in Code Check provide a brief summary of a code citation, followed by the code number. The amount of text in Code Check is not the complete code, and we encourage you to refer to the entire code text whenever possible. The full text of each code cited in Code Check is available on line on ICC's web site. For 2015 IRC references, go to http://codes.iccsafe.org/I-Codes.html. For 2012 and earlier IRC references, go to http://publicecodes.cyberregs.com/icod/irc/index.htm.

Always consult with the local building department before beginning a project. They will provide information on which model code editions are used in your area and on the state or local amendments that apply. The codes for some states and cities are also available on ICC's web site, at http://codes.iccsafe.org/

This book is primarily geared to wood frame buildings over concrete or CMU foundations. Other topics covered in the IRC, such as wood foundations, structural insulated panel (SIP) construction, insulated concrete forms (ICF), and steel framing cannot be included because of space limitations.

The actual code lines in the IRC begin with the letter R - we have omitted the R to save space.

KEY TO USING THIS BOOK

The line for each code rule starts with a checkbox and ends with a code reference from the 2015 IRC. Exceptions and lists start with a bullet, and exception lines also end with a code reference. Changes from the 2012 code are highlighted by having the reference in a different color and an endnote to the table on the inside back cover. In some cases, the change occurred in the 2012, as shown in the table.

Example from **p.12**:

☐ Footings supported on undisturbed soil or engineered fill **F18**_____ 403.1

This line is telling us that section 403.1 req's footings on previously undistirbed soil & that figure 18 is an example.

Exceptions to a code rule are noted by EXC at the end of a line, followed by a bulleted line with the exception, as in this example from **p.8**:

☐ Threshold at req'd egress door max 1½ in. above landing or floor EXC **F7** 311.3.1

• 7¾ in. below threshold OK if door not swinging over landing ____ 311.3.1X

These lines tell us that section 311.3.1 limits the req'd egress door threshold height to 1 1/2 in. except for a landing which can be 7 3/4 inches below if the door does not swing over it, and .1 req's footings on previously undistirbed soil & that figure 7 is an example.

Significant changes are given a different color code citation followed by a superscript number that is commented on in the inside back cover, as in this example from **p.4**:

☐ Min. 6 ft. 8 in. bathrooms, toilet rooms & laundry rooms _____ 305.1[10]

The rule for a min ceiling height has been lowered from 7 ft. to 6 ft. 8 in. for these rooms. It can be found in section 305.1 of the IRC. On the inside back cover, this line is explained as code change #10.

Special thanks to Skip Walker for his invaluable assistance in making this book, cheers!

ABBREVIATIONS

AMI	In accordance with Manufacturers' Instructions	**LL**	Lot Line
ASTM	American Society for Testing & Materials	**max**	maximum
BO	Building Official	**min**	minimum
BWL	Braced Wall Line	**mph**	miles per hour
BWP	Braced Wall Panel	**o.c.**	on center
cfm	cubic feet per minute	**PT**	Pressure Treated
CMU	Concrete Masonry Unit	**psf**	pounds per square foot
DFE	Design Flood Elevation	**psi**	pounds per square inch
exc	except	**req**	require
EXC	Exception (follows in next line)	**req'd**	req'd
FRT	Fire-Retardent Treated	**req's**	requires, requirements
FSD	Fire Separation Distance	**SDC**	Seismic Design Category
GB	Gypsum Board	**SDC D**	SDC D_0, D_1, & D_2
hr	hour	**UL**	Underwriters Laboratories
IBC	International Building Code	**w/**	with
L&L	Listed & Labeled	**w/o**	without
		WRB	Water Resistive Barrier
		WSP	Wood Structural Panel

ALTERNATIVE DESIGN DOCUMENTS

The American Forest and Paper Association publishes the *Wood Frame Construction Manual for One- and Two-Family Dwellings (WFCM)* which can be used as an alternate to IRC designs for wood framing and can be used for buildings where wind design is required.

The American Iron and Steel Institute (AISI) publishes the *Standard for Cold-Formed Steel Framing – Prescriptive Method for One- and Two-Family Dwellings (AISI S230)* which can be used as an alternative to the IRC. It can also be used for buildings where wind design is required.

The American Concrete Institute (ACI) publishes two documents that supplement the prescriptive rules of the IRC. These are *ACI 318 – Building Codes for Structural Concrete*, and *ACI 530 – Building Code Requirements for Masonry Structures.*

The Truss Plate Institute (TPI) publishes *TPI 1 - National Design Standard for Metal Plate Connected Wood Truss Construction*, which is mandatory for metal-plate-connected truss design. TPI also contributes to *BCSI 1-03 Guide to Good Practice for Handling, Installing & Bracing of Metal Plate Connected Wood Trusses.*

The American Society of Civil Engineers (ASCE) publishes *ASCE 24 –Flood-Resistant Design and Construction,* which can be used as an alternative to the prescriptive requirements of IRC R322. It is mandatory for construction in identified floodways.

The American Society of Civil Engineers (ASCE) publishes *ASCE 7 –Minimum Design Loads for Buildings and Other Structures*. It is the basis of the structural engineering provisions of the IBC. It can be used for buildings where wind design is required.

The International Code Council (ICC) publishes *ICC 600 – The Standard for Residential Construction in High-Wind Regions*. It can be used for buildings where wind design is required.

SEQUENCE OF THE BOOK

Pages 2–10 of this book cover topics that are relevant to planning, inspections, and non-structural issues.
Pages 11–23 deal with foundations & framing.
Pages 24–30 deal with ladding, coverings, and other items typically covered in the final inspection.
The inside back cover summarizes significant changes in the 2015 IRC.

GLOSSARY

The following glossary is an abbreviated version of the full glossary for this book, available on line at www.codecheck.com/CCB4/Glossary.pdf. Chapter 2 of each of the codes referenced above contains a more complete list of authoritative definitions.

Aspect ratio: The ratio of longest to shortest dimensions, or for wall sections, the ratio of height to length.

Attic: The unfinished space between the ceiling assembly of the top story and the roof assembly.

Attic, habitable: A finished or unfinished area meeting minimum room dimension and ceiling height requirements and enclosed by the roof assembly above, knee walls (if applicable) on the sides, and the floor–ceiling assembly below. Habitable attics are sometimes referred to as lofts.

Basement: A portion of a building that is partly or completely below grade.

Braced wall line (BWL): A straight line on the building plan indicating the location of the lateral resistance provided by wall bracing. It does not necessarily align with the exact location of the bracing.

Braced wall panel (BWP): A full-height section of wall constructed to resist shear forces by application of bracing materials.

Building thermal envelope: The basement walls, exterior walls, floor, roof, and other building elements that enclose conditioned space.

Connector: A device such as a joist hanger, post base, hold-down, mudsill anchor, or hurricane tie used to connect structural components–***also see Fastener.***

Cripple wall: Wood-framed wall extending from the foundation to joists below the first floor. Found in the underfloor area.

Dampproofing: A coating intended to protect against the passage of water vapor through walls or other building elements. It is a lesser degree of protection than waterproofing.

Dead load: The weight of all materials of the building and fixed equipment.

Diaphragm: A horizontal or nearly horizontal system, such as a floor, acting to transmit lateral forces to the vertical resisting elements.

Fastener: Generic category that includes nails, screws, bolts, or anchors***—also see Connector.***

Fire separation distance: The distance measured perpendicular from the building face to the closest interior lot line or to the centerline of a street, alley, or public way.

Grade: The finished ground level adjoining the building at all exterior walls.

Habitable space: Space in a building for living, sleeping, eating, or cooking. Bathrooms, bathroom closets, hallways, storage, or utility areas are not considered habitable space.

Live loads: Loads produced by use and occupancy of the building and not including wind, snow, rain, earthquake, flood, or dead loads.

Monolithic: Concrete cast in one continuous operation with no joints, such as a footing and floor slab or a footing and foundation stem wall.

Perm: The unit of measurement of water vapor transmission through a material, based on the number of grains of water vapor at a given pressure differential. Vapor retarders are rated in perms.

Plain concrete or masonry: Structural concrete or masonry with less reinforcement than the minimum amount specified for reinforced concrete or masonry.

Seismic Design Category (SDC): Classification assigned to buildings based on the occupancy category & severity of earthquake ground motion expected at the site.

Story: That portion of a building that is between the upper surface of one floor and below the upper surface of the next floor above or the roof.

Story above grade: The parts of the building that are entirely above grade, or basements that are more than 6 feet above grade for more than 50% of the total building perimeter or more than 12 feet above ground at any point.

Townhouse: Single-family dwelling unit constructed in groups of three or more attached units in which each unit extends from foundation to roof and with a yard or public way on at least two sides.

Waterproofing: Materials that protect walls or other building elements from the passage of moisture as either vapor or liquid under hydrostatic pressure.

Wood structural panel (WSP): A panel manufactured from veneers (plywood) or wood strands (OSB) and bonded with waterproof synthetic resins. Wood structural panels must bear a grade stamp and are used in floors, roof diaphragms, and shear walls.

PLANNING, PERMITS & INSPECTIONS

Prior to starting a project, approval is needed from the local planning and building departments; specific requirements vary from one jurisdiction to another. Local or state adoption of the codes may also include amendments that differ from the requirements shown in this book. Plans by a licensed design professional will bear a signature and stamp. In some cases, special inspections are required to be conducted either by 3rd party agencies or the engineer of record. The frame inspection is an important milestone. Bank draws are sometimes based upon passing that inspection.

Plans & Permits — 15 IRC

- ☐ Permits req'd for new work, additions, repairs & alterations _____ 105.1
- ☐ Permit application must identify proposed scope of work, address, intended use, & valuation & include construction documents _____ 105.3
- ☐ Site or plot plan req'd for new structures & additions _____ 106.2
- ☐ If in flood hazard area, plans to include DFE, elevation of lowest floor & bottom of lowest structural member_____ 106.1.4[1]
- ☐ Local statutes may req stamped plans_____ 106.1
- ☐ BO may req plans to include BWL locations & methods_____ 106.1.3[2]
- ☐ BO may approve alternative materials, design & methods_____ 104.11
- ☐ Approved permit card req'd to be on site _____ 105.7
- ☐ Approved plans req'd to be on site _____ 106.3.1

Work Exempt from Permits — 15 IRC 105.2

- 1-story detached accessory structures ≤ 200 sq. ft. floor area
- Fences ≤ 7 ft. high*
- Retaining walls ≤ 4 ft. from bottom of footing to top of wall & no surcharge
- Water tanks on grade ≤ 5,000 gallons & ≤ 2:1 height/width ratio
- Sidewalks & driveways
- Painting, papering, tiling, carpeting, cabinets, countertops, similar finish work
- Pre-fab pools < 24 in. deep (check local – may req electric permit)
- Swings & playground equipment
- Window awnings projecting ≤ 54 in. & requiring only exterior wall support
- Decks ≤ 200 sq. ft. & ≤ 30 in. above grade & not attached to dwelling & not serving req'd exit door

** The intent of this 2012 code change was to consider that fence posts might be taller than the 6 ft. fence between them. Be sure to check with the local jurisdiction for their interpretation and any local regulations.*

Required Inspections — 15 IRC

- ☐ Inspection & approval req'd prior to concealing any work _____ 109.4
- ☐ In flood hazard areas, registered design professional req'd to document lowest floor elevation before construction above it_____ 109.1.3
- ☐ Foundation forms & reinforcement prior to placing concrete_____ 109.1.1
- ☐ MEP (mechanical, electrical, plumbing) roughs prior to frame _____ 109.1.2
- ☐ Frame after roof, masonry, bracing, fire & draftstop, & MEP approved 109.1.4
- ☐ BO may req 3rd party inspection of specified items _____104.4 & 109.2
- ☐ Fire-resistance rated drywall req's inspection before tape & plaster 109.1.5.1
- ☐ If in flood hazard area, documentation of elevations must be submitted to BO prior to final inspection_____109.1.6.1
- ☐ Final inspection req'd prior to occupancy _____ 109.1.6

TABLE 1 — ALLOWABLE DEFLECTION OF STRUCTURAL MEMBERS [T301.7]

Structural Member	Deflection
Rafters ≤ 3:12 slope & no finished ceiling attached to rafters	*L*/180
Interior walls and partitions	*H*/180
Floors	*L*/360
Ceilings w/ brittle finishes – including plaster & stucco	*L*/360
Ceilings w/ flexible finishes – including gypsum board	**L/240[3]**
All other structural members	*L*/240[1]
Exterior walls – wind loads w/ plaster or stucco finishes	*H*/360
Exterior walls – wind loads w/ other brittle finishes	*H*/240
Exterior walls – wind loads w/ flexible finishes & GB interior	*H*/180
Exterior walls – wind loads w/ flexible finishes & no GB	*H*/120
Lintels supporting masonry veneer walls	*L*/600

1. For cantilevers *L* shall be considered twice the length of the cantilever

T1 is a performance standard that serves as the design basis for T3 & the span tables for joists, rafters, & studs.

TABLE 2	CLIMATIC & GEOGRAPHIC DESIGN CRITERIA (FILL-IN TABLE) T301.2(1)												
Ground Snow Load[1]	Wind Design				Seismic Design Category[2]	Subject to Damage From			Winter Design Temp[2]	Ice Barrier Req'd[2,3]	Flood Hazards[2]	Air Freezing Index[2]	Mean Annual Temp[2]
	Speed (mph)[2]	Topo-graphic Effects[2,3]	Special Wind Region[2,3]	Wind-borne debris zone[2,3]		Weathering (concrete)[4]	Frost line depth[2]	Termites[2]					

1. From IRC figure 301.2(5) or local information
2. To be filled in by the building jurisdiction
3. These questions can be answered yes or no.
4. From IRC figure 301.2(3)

DESIGN

The first design considerations are geographic. Determine whether the property in a flood hazard area based on FEMA maps or other sources. Determine the design wind speed and the seismic design category from the maps in the IRC. Where these indicate that wind design is required, ASCE-7 or other design standards must be used. Site specific wind maps are available at www.atcouncil.org/windspeed. The IRC assigns a Seismic Design Category (SDC) from A to E, with A the least likely to experience seismic activity, and E the most vulnerable. Category D is further broken down into 3 subparts, D_0, D_1, and D_2. Buildings in SDC E must be designed to the IBC. However, the BO can allow an E to be designated as D_2 (and therefore within the prescriptive scope of the IRC) if the building has no "irregular" portions and has wall bracing continuous in one plane from the foundation to the uppermost story with no cantilevers.

General Design Criteria — 15 IRC

- ☐ Determine climatic & geographic design criteria _____ 301.2
- ☐ Complete **T2** from IRC maps & information from building department __ 301.2
- ☐ Non-conventional building elements req design in accordance w/ accepted engineering practice _____ 301.1.3
- ☐ Engineered design per IBC permitted for all structures _____ 301.1.3

Flood Hazard Areas — 15 IRC

- ☐ Establish design flood elevation _____ 322.1.4
- ☐ Buildings in flood hazard areas req design per IRC R322 or ASCE 24 301.2.4
- ☐ Buildings w/substantial damage of any origin w/ repair costs > 50% of value require 100% compliance w/flood-resistant design EXC __ 105.3.1.1
  - • Health and safety improvements req'd by BO or alterations of historic buildings that do not change its designation _____ 105.3.1.1[4]

Wind Design — 15 IRC

- ☐ Determine ultimate wind speed from maps _____ 301.2.1[5]
- ☐ If history of damage due to wind speed-up at hills, modify map values to consider topographic effects _____ 301.2.1.5
- ☐ Cladding, covering, fenestration, etc., req design for specified pressure loads or per IRC T301.2(2&3) & IRC F301.2(7) _____ 301.2.1
- ☐ When wind design req'd per maps, design per ICC-600, ASCE-7, WFCM, AISI S230, or the IBC _____ 301.2.1.1
- ☐ Glazed openings in wind-borne debris regions must meet ASTM 1886 & 1996 as modified in IRC 301.2.1.2.1 EXC _____ 301.2.1.2[6]
  - • Buildings to 45 ft. high protected w/ pre-cut pre-drilled structural panels to fit on permanently installed anchors on building _____ 301.2.1.2X[7]

STRUCTURAL PLANNING

For wood or steel studs, the height of individual stories is limited to 11 ft. 7 in., provided the laterally unsupported stud heights do not exceed the amounts in **T15** on **p.19**. The 2015 IRC resolved conflicts between the story height restrictions, bracing requirements, and floor framing height.

Story Height — 15 IRC

- ☐ Stud walls 11 ft. 7in. CMU walls 13 ft. 7 in. EXC _____ 301.3[8]
  - • CMU additional 8 ft. bearing height gable end walls _____ 301.3X
- ☐ Engineered design per IBC req'd when exceeding above _____ 301.3

WALL FRAMING

Sections 301.3 and 602.3 were each modified for consistency in the 2015 IRC. An engineered design must be provided for walls that exceed the design limits of T15. If the story height limits are exceeded, follow a design in accordance with the International Building Code.

Stud Walls — 15 IRC

- ☐ Studs req full bearing on plate at least equal to stud width _____ 602.3.4
- ☐ Studs continuous from sole plate to top plate EXC _____ 602.3
  - • Jack studs, trimmer studs & cripple studs _____ 602.3X
- ☐ Lumber req's grade mark or certification by lumber grading agency _ 602.1.1
- ☐ End-jointed lumber OK if identified by grade mark _____ 602.1.2
- ☐ End-jointed lumber in fire rated assemblies req's "HRA" mark _____ 602.1.2[41]
- ☐ Utility grad studs max 16 in. o.c. & not to support > roof & ceiling _ 602.3.1X1
- ☐ Max story height of wood-frame 11 ft. 7 in., masonry 13 ft. 7 in._____ 301.3[8]
- ☐ Max bearing wall stud height 10 ft. between lateral support (floor or roof-ceiling assembly perpendicular to plane of wall EXC__T602.3(5)
  - • 2×6 studs supporting roof load with ≤ 6 ft. tributary length OK to 18 ft. height or to 20 ft. if studs spaced 12 in. o.c._____ 603.3.1X2
- ☐ Stud size & spacing per T15_____ 602.3.1

TABLE 15 STUD SIZE AND SPACING [602.3(5)]

Bearing walls to 10 ft. laterally unsupported height[A]

Load Supported	Stud size & maximum o.c. spacing (in.)			
	2×4	3×4	2×5	2×6
Roof + ceiling or habitable attic	24	24	24	24
1 floor	24	24	24	24
1 floor & roof+ceiling or habitable attic	16	24	24	24
2 floors & roof+ceiling or habitable attic	-	16	-	16
Nonbearing walls				
Stud size	2×3[B]	2×4	2×5	2×6
Max laterally unsupported height[A]	10	14	16	18

A. Lateral support refers to walls or roof/ceiling assemblies
B. Not allowed in exterior walls

Top Plates — 15 IRC

- ☐ Double top plates req'd EXC _____ 602.3.2
  - • Single plate OK w/ metal ties at joints per T16 & joists/rafters centered over studs within 1 in. tolerance_____ 602.3.2X
- ☐ Single top plate connections per T16 _____ 602.3.2X[42]
- ☐ Plates min 2 in. nominal thickness & at least same width as studs___ 602.3.2
- ☐ End joints offset min 24 in., need not occur over studs F33 _____ 602.3.2
- ☐ Nailing per T16_____ 602.3.2
- ☐ Studs to have full bearing on nominal 2× bottom plates ≥ stud width 602.3.4

TABLE 16 SINGLE TOP PLATE SPLICES

Condition	Corners & intersecting walls		Butt joints in straight walls	
	Plate size	Nails each side	Plate size	Nails each side
SDC A-C & D if BWL spacing < 25 ft.	3 in. × 6 in. × 0.036 steel	6 – 8d box	3 in. × 12 in. × 0.036 steel	12 – 8d box
SDC D if BWL spacing ≥ 25 ft.	3 in. × 8 in. × 0.036 steel	9 – 8d box	3 in. × 16 in. × 0.036 steel	18 – 8d box

Notching & Boring of Studs & Plates — 12 & 15 IRC

- ☐ Notching 25% max in bearing wall, 40% nonbearing F32 _____602.6#1
- ☐ Bored holes min 5/8 in. from face of stud_____602.6#2
- ☐ OK to exceed above limits with approved stud shoes installed AMI __602.6X
- ☐ Holes not OK in same area as notch _____602.6#2
- ☐ Boring 40% max in bearing wall, 60% nonbearing EXC F32 _____ 602.6
  - • 2 successive doubled bearing studs 60% OK F32_____ 602.6
- ☐ Top plate notches or bored holes > 50% of plate width req min 1½ in. strap min 6 in. past notch or hole _____ 602.6.1
- ☐ Plate strap min 16 ga., min 8 10d nails each side of notch or hole EXC_____ 602.6.1
  - • Not req'd if entire side of wall w/ notch/hole covered with WSP __ 602.6.1X

FIG. 32

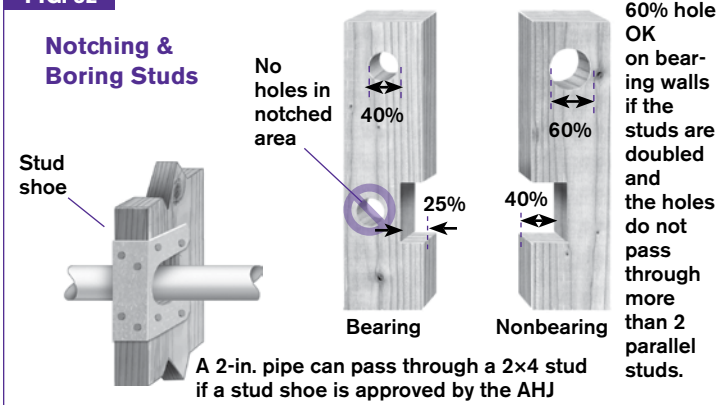
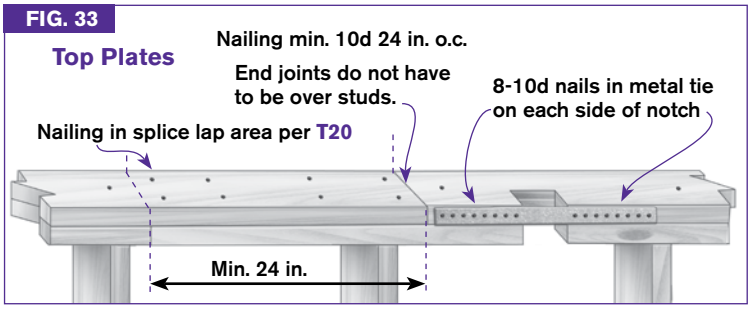


TABLE 17 MAXIMUM SIZE STUD NOTCHES & BORED HOLES [602.6]

Wall type	Exterior or Bearing Wall			Nonbearing Walls		
	2×4	3×4	2×6	2×3	2×4	2×6
Notches	7/8 in.	7/8 in.	1 3/8 in.	1 in.	1 3/8 in.	2 3/16 in.
Holes[A]	1 3/8 in.	1 3/8 in.	2 3/16 in.	1 ½ in.	2 1/8 in.	3 1/4 in.

A. Holes min 5/8 in. from edge of stud

FIG. 33



Headers — 15 IRC

Due to space limitations this book does not have the tables for built-up girders and headers. These can be downloaded from www.codecheck.com/cc/CCBuilding4th.html.

- ☐ Header spans per download _____ 602.7
- ☐ Nonbearing walls do not req headers at openings_____602.7.4
- ☐ Single-member headers F34 face nail 12 in. o.c. top & bottom _____602.7.1[43]