

◆ Following is the provision for concrete strength for foundations.

	general	BNBC Part6 Chapter3		
3.6 Materials				
All materials for the construction of foundations shall conform to the requirements of Part 5 of this Code.				
3.6.1 Concrete				
All concrete materials and steel reinforcement used in foundations shall conform to the requirements specified in Chapter 5 unless otherwise specified in this Section. For different types of foundation the recommended concrete properties are shown in Table 6.3.5. However, special considerations should be given for hostile environment (salinity, acidic environment).				
Table 6.3.5: Properties of Concrete for Different Types of Foundations				
Foundation Type	Minimum cement content (kg/m ³)	Specified Min. 28 days Cylinder Strength (MPa)	Slump (mm)	Remarks
Footing/raft	350	20	25 to 125	Retarder and plasticizer
Drilled shaft/Cast-in-situ pile (tremie concrete)	400	18	125 to 200	recommended.
Driven pile	350	25	25 to 125	Slump test shall be performed as per ASTM C143.

◆ Following is the limits of reinforcement of compression members

	general	BNBC Part6 Chapter6
<p>6.3.9.1 For noncomposite compression members, the area of longitudinal reinforcement, A_{st}, shall be not less than $0.01A_g$ or more than $0.06A_g$. To avoid practical difficulties in placing and compacting of concrete as well as to deliver ductility to noncomposite compression members, area of longitudinal reinforcement, A_{st}, is preferred not to exceed $0.04A_g$ unless absolutely essential.</p> <p>6.3.9.2 Minimum number of longitudinal bars in compression members shall be 4 for bars within rectangular or circular ties, 3 for bars within triangular ties, and 6 for bars enclosed by spirals conforming to Sec 6.3.9.3.</p>		

Earthquake-Resistant Design (ERD)

For SDC B: OMF Sec. 8.3.9

- Mainly related to column ties and hooks

For SDC C: IMF Sec. 8.3.10

- provisions are related to beams, columns and flat slabs

◆ For OMF, BNBC2020 has the following provisions.

8.3.9 Ordinary Moment Frame Members not Proportioned to Resist Forces Induced by Earthquake Motion

8.3.9.1 Induced moments

Frame members assumed not to contribute to lateral resistance shall be detailed according to (a) or (b) below depending on the magnitude of moments induced in those members when subjected to twice the lateral displacement under the factored lateral forces.

- (a) Members with factored gravity axial forces not exceeding $0.1A_gf'_c$ shall satisfy Sections 8.3.4.2(a) and 8.3.8.1(a) and members with factored gravity axial forces exceeding $0.1A_gf'_c$ shall satisfy Sections 8.3.5.4, 8.3.7.2(a) and 8.3.8.1(b) when the induced moment exceeds the design moment strength of the frame member.
- (b) The member shall satisfy Sec 8.3.4.2(a) when the induced moment does not exceed the design moment strength of the frame members.

8.3.9.2 Tie requirements

All frame members with factored axial compressive forces exceeding $0.1A_gf'_c$ shall satisfy the following special requirements unless they comply with Sec 8.3.5.4.

- (a) Ties shall have hooks not less than 135° with extensions not less than 6 tie bar diameter or 60 mm. Cross ties as defined in Sec 8.3.2 are allowed.
- (b) The maximum tie spacing shall be s_0 over a length l_0 measured from the joint face. The spacing s_0 shall be not more than (i) eight diameters of the smallest longitudinal bar enclosed, (ii) 24 tie bar diameters, and (iii) one-half the least cross-sectional dimension of the column. The length l_0 shall not be less than (i) one-sixth of the clear height of the column, (ii) the maximum cross-sectional dimension of the column, and (iii) 450 mm.
- (c) The first tie shall be within a distance equal to $0.5s_0$ from the face of the joint.
- (d) The tie spacing shall not exceed $2s_0$ in any part of the column.

◆ Following is the general provision for concrete strength.

5.5.4 Minimum Concrete Strength	general	BNBC Part6 Chapter5
Minimum concrete strength for structural use of reinforced concrete shall be 20 N/mm ² . However, for buildings up to 4 storey, the minimum concrete strength may be relaxed to 17 N/mm ² .		

◆ Following is the general provision for values of fy and fyt

6.2.4 Design Strength for Reinforcement	general	BNBC Part6 Chapter6
The values of f_y and f_{yt} used in design calculations shall not exceed 550 MPa, except for transverse reinforcement in Sections 6.3.9.3 and 8.3.		

Reinforcement bars (f_y) and (f_{yt}) up to 550MPa can be used in IMF and OMF.
 f_{yt} の記述が正しいか、要確認

6.3.9.3 Volumetric spiral reinforcement ratio, ρ_s , shall be not less than the value given by	general	BNBC Part6 Chapter6
$\rho_s = 0.45 \left(\frac{A_g}{A_{ch}} - 1 \right) \frac{f'_c}{f_{yt}} \quad (6.6.12)$		
Where the value of f_{yt} used in Eq. 6.6.12 shall not exceed 700 MPa. For f_{yt} greater than 420 MPa, lap splices according to 8.1.9.3(e) shall not be used.		

Stipulation of spiral reinforcement

8.1.9.3 Spirals: Spiral reinforcement for columns shall conform to Sec 6.3.9.3 Chapter 6 and to the following:	general	BNBC Part6 Chapter8
(e) Splices in spiral reinforcement shall be lap splices of 48 spiral diameter for deformed uncoated bar or wire and 72 spiral diameter for other cases, but not less than 300 mm.		

BNBC Part6 Chapter8

Sec 8.3.10.4 (b)

IMF

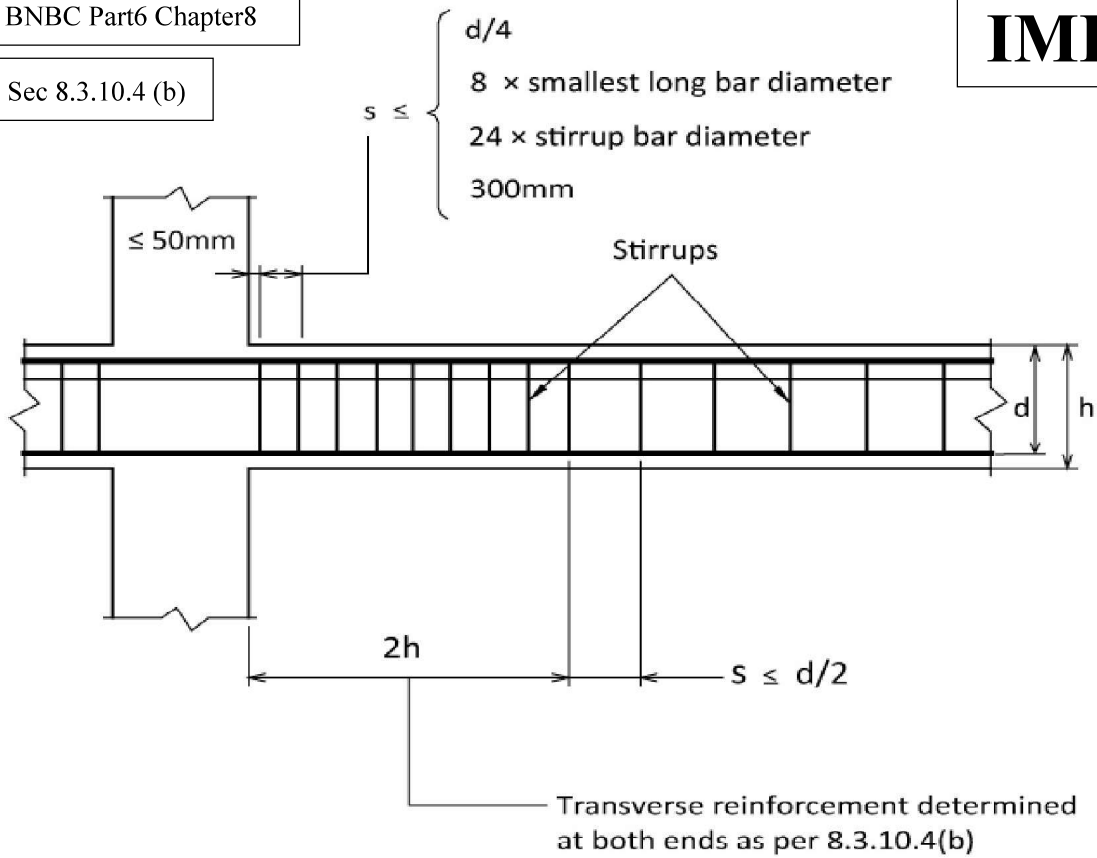
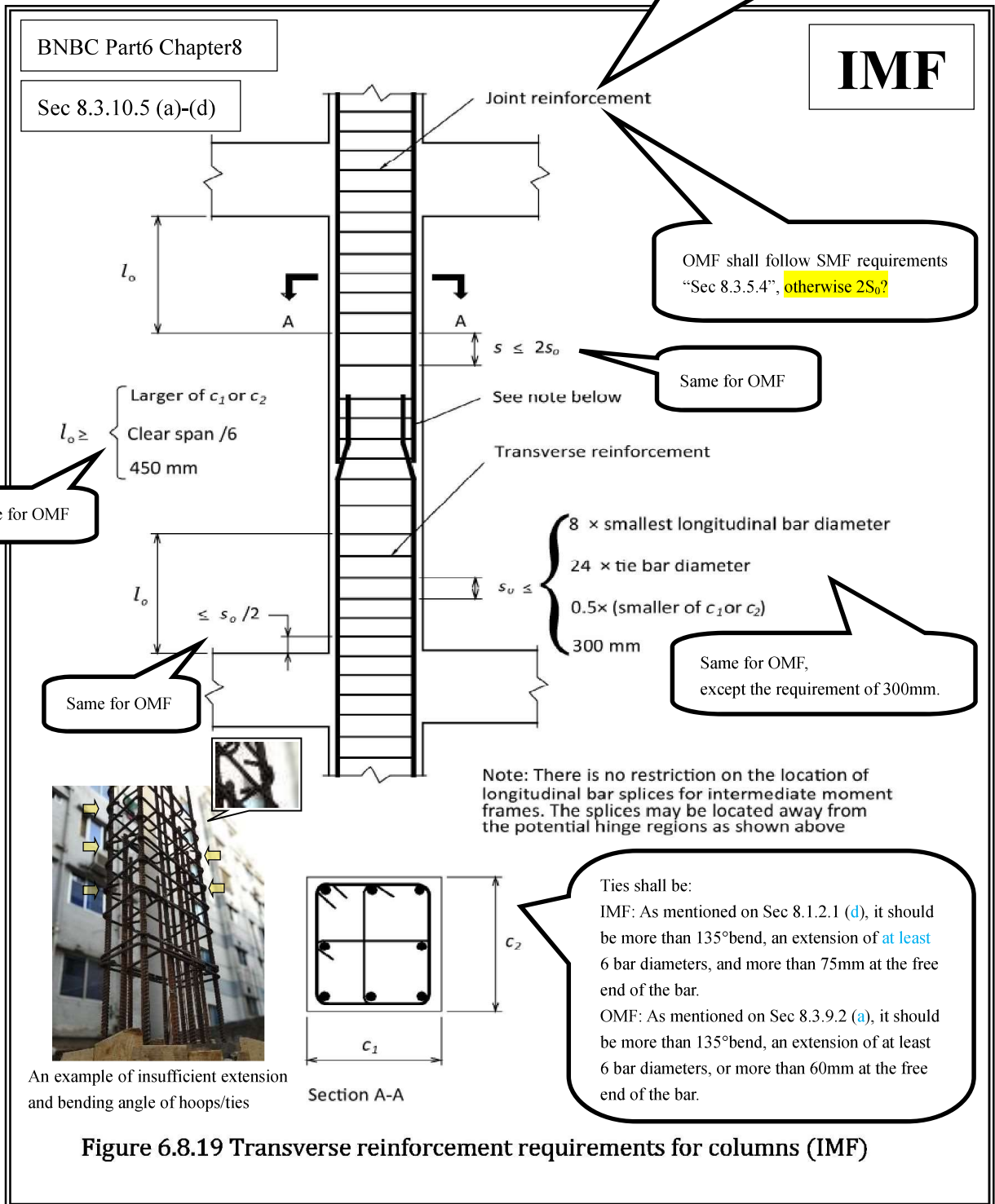


Figure 6.8.18 Transverse reinforcement requirements for beams (IMF)

■ By following the Sec 8.3.10.5 (c), reinforcement of column-beam joint shall follow 6.4.9. (See next page)

■ Comments on reinforcement in OMF are added below IMF.
 (All frame members with factored axial compressive forces exceeding $0.1Agfc'$ (unless they comply with Sec 8.3.5.4))

Since the requirement of shear reinforcement is very low as per equation 6.6.55 at beam-column joint for intermediate moment frame, so we provide support shear reinforcement to the joint which is the same as the hoop in the ℓ_0 area.



◆ By following the Sec 8.3.10.5 (c), joint reinforcement in IMF shall follow Sec 6.4.9.

<p>8.3.10.5 Columns</p> <p>(c) Joint reinforcement shall conform to Sec 6.4.9.</p>	<p>IMF</p>	<p>BNBC Part6 Chapter8</p>
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<p>6.4.9 Transfer of Moments to Columns</p> <p>6.4.9.1 When gravity load, wind, earthquake, or other lateral forces cause transfer of moment at connections of framing elements to columns, the shear resulting from moment transfer shall be considered in the design of lateral reinforcement in the columns.</p> <p>6.4.9.2 Except for connections not part of a primary seismic load-resisting system that are restrained on four sides by beams or slabs of approximately equal depth, connections shall have lateral reinforcement not less than that required by Eq. 6.6.55 within the column for a depth not less than that of the deepest connection of framing elements to the columns. See also Sec. 8.1.13 Chapter 8.</p>	<p>general</p>	<p>BNBC Part6 Chapter6</p>
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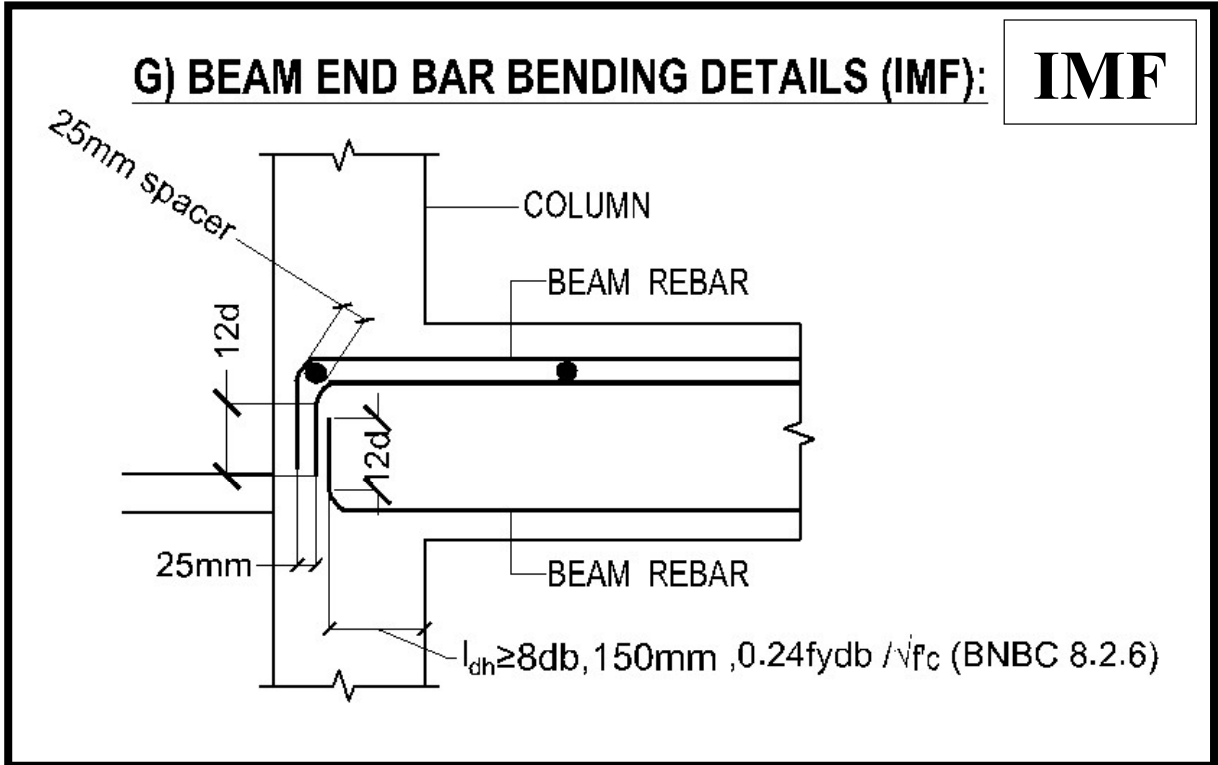
<p>6.4.3.5.3 Where shear reinforcement is required by Sec 6.4.3.5.1 or for strength and where Sec 6.4.4.1 allows torsion to be neglected, $A_{v,min}$ shall be computed by</p> $A_{v,min} = 0.062 \sqrt{f'_c} \frac{b_w s}{f_{yt}} \quad (6.6.55)$ <p>But, shall not be less than $(0.35b_w s)/f_{yt}$.</p>	<p>general</p>	<p>BNBC Part6 Chapter6</p>
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<p>8.1.13 Connections</p> <p>8.1.13.1 Enclosure shall be provided for splices of continuing reinforcement and for anchorage of terminating reinforcement at connections of principal framing elements (such as beams and columns),</p> <p>8.1.13.2 External concrete or internal closed ties, spirals, or stirrups shall be used as enclosures at connections.</p>	<p>general</p>	<p>BNBC Part6 Chapter8</p>
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<Reference> Development length and Extension of the t-shaped joint

Development length (l_{dh}) \geq { $8d_b$, 150 mm, $0.24f_y d_b / \sqrt{f'_c}$ } (BNBC 8.2.6)

Extension \geq 12d (BNBC 8.1.2.1(b))



Earthquake-Resistant Design (ERD)**For SDC D: SMF Sec. 8.3.3-8.3.8**

- No flat slab is allowed
- $f_c' \geq 21$ Mpa
- $f_u/f_y \geq 1.25$

◆ Concrete strength applied in the SMF.

SMF	BNBC Part6 Chapter8
<p>8.3.3.3 Concrete in special moment frames and special structural walls</p> <p>Compressive strength f'_c of the concrete shall be not less than 21 N/mm². Specified compressive strength of light-weight concrete, f'_c shall not exceed 35MPa unless demonstrated by experimental evidence. Modification factor λ for lightweight concrete in Sec 8.3 shall be in accordance with Sec 6.1.8 unless noted otherwise.</p>	

As for ordinary concrete, there is a restriction for a lower limit for f'_c , but no restriction for an upper limit.

◆ Yield strength applied in the SMF

SMF	BNBC Part6 Chapter8
<p>8.3.3.4 Reinforcement in special moment frames and special structural walls</p> <p>(a) Requirements of Sec 8.3.3.4 shall apply to special moment frames, special structural walls and all components of special structural walls including coupling beams and wall piers.</p> <p>(b) Deformed reinforcement resisting earthquake-induced flexural and axial force, or both, shall comply with ASTM A706 Grade 420. Alternatively only BDS ISO 6935-2 Grades 300, 350, 400 and 420 or ASTM A615 Grades 275 and 420 reinforcement shall be permitted if:</p> <p>(i) The actual yield strength based on mill tests does not exceed f_y by more than 125 N/mm² (retests shall not exceed this value by more than an additional 20 N/mm²); and</p> <p>(ii) The ratio of the actual tensile strength to the actual yield strength is not less than 1.25.</p> <p>(iii) Minimum elongation in 200 mm shall be at least 14 percent for bar dia. 10 mm to 20 mm, at least 12 percent for bar dia. 22 mm through 36 mm, and at least 10 percent for bar dia. 40 mm to 60 mm.</p> <p>(c) The value of f_{yt} used to compute the amount of confinement reinforcement shall not exceed 700 N/mm².</p> <p>(d) The value of f_y or f_{yt} used in design of shear reinforcement shall conform to Sec 6.4.3.2.</p>	

Reinforcement bars (f_y) up to 420MPa can be used in SMF.

According to Ash calculation, value of f_{yt} has an upper limit of 700 N/mm².

◆ Values of f_y and f_{yt} used in designing of shear reinforcement

general	BNBC Part6 Chapter6
<p>6.4.3.2 The values of f_y and f_{yt} used in design of shear reinforcement shall not exceed 420 MPa, except the value shall not exceed 550 MPa for welded deformed wire reinforcement.</p>	

Based on the shear strength calculation, value of f_{yt} has an upper limited of 420 N/mm².

◆ Calculation formula for Ash (required cross-sectional area of shear reinforcement) in the SMF

SMF	BNBC Part6 Chapter8
<p>8.3.5.4 Transverse reinforcement</p> <p>(a) Transverse reinforcement shall be provided as specified below and shown in Figures 6.8.8 and 6.8.9 unless a larger amount is required by Sec 8.3.8.</p> <p>(i) The volumetric ratio of spiral or circular hoop reinforcement, ρ_s shall not be less than that indicated by the following equation:</p> $\rho_s = \frac{0.12f'_c}{f_{yt}} \quad (6.8.6)$ <p>and shall not be less than that required by Eq. (6.6.12).</p> <p>(ii) The total cross-sectional area of rectangular hoop reinforcement shall not be less than that given by the following equations:</p> $A_{sh} = 0.3 \left(\frac{sh_c f'_c}{f_{yt}} \right) \left(\frac{A_g}{A_{ch}} - 1 \right) \quad (6.8.7)$ $A_{sh} = 0.09 \left(\frac{sh_c f'_c}{f_{yt}} \right) \quad (6.8.8)$	

Ordinary concrete used in SMF is defined as $fc' \geq 21\text{N/mm}^2$ (*1) but there is no restriction for an upper limit. 6.8.7 and 6.8.8 are equations in which a larger fc' results in a larger A_{sh} , making it more difficult to place reinforcement. In other words, these are the equations that restrict the excessive values of fc' .

This equation is to reduce the value of A_{sh} for ensuring reasonable spacing by using a rebar with an upper limit of 700N/mm^2 (*2) as f_{yt} . In this case, value of f_{yt} is allowed up to 700N/mm^2 .

On the other hand, value of f_{yt} is limited to 420 N/mm^2 (*3) for shear strength calculation. For instance, even you use a rebar with f_{yt} of 700 N/mm^2 , f_{yt} of 420N/mm^2 is adopted for the calculation. If you use the value more than 420 N/mm^2 , there will be more likely to have major shear cracks due to the lack of extra margin for shear stress.

*1 : 8.3.3.3, *2 : 8.3.3.4 (c), *3 : 6.4.3.2.

◆ Examples of rebar that can be used as main reinforcement in the SMF.

BDS ISO 6935-2-2016

Table 6 — Tensile properties

Ductility class	Steel grade	Specified characteristic value of upper yield strength R_{eH} MPa ^c		Ductility properties		
				Specified characteristic value of R_m/R_{eH}	Specified characteristic value of elongation ^a %	
		Minimum	Maximum		Minimum	A Minimum
A	B300A-R	300	—	1,02	16	2
	B400A-R B400AWR	400	—		14	
	B500A-R B500AWR	500	—		10	
	B600A-R	600	—		-	
	B450AWR	450	$1,25 \times R_{eH}(\text{min.})$	1,05	-	2,5
B	300B-R	300	—	1,08	16	5
	B400B-R B400BWR	400	—		14	
	B500B-R B500BWR	500	—		10	
	B600B-R	600	—		-	
C	B300C-R	300	—	1,15	16	7
	B400C-R B400CWR	400	—		14	
	B500C-R B500CWR	500	—		10	
	B600C-R	600	—		-	
	B450CWR	450	$1,25 \times R_{eH}(\text{min.})$		-	
D	B300D-R	300	—	1,25	17 ^b	8
	B300DWR		$1,3 \times R_{eH}(\text{min.})$			
	B350DWR	350				
	B400DWR	400				
	B420DWR	420				
B500DWR	500	—	13 ^b			

^a By agreement between the manufacturer and purchaser, the type of elongation shall be selected between A and A_{gt} . If the type of elongation is not specified by agreement, A_{gt} should be used.

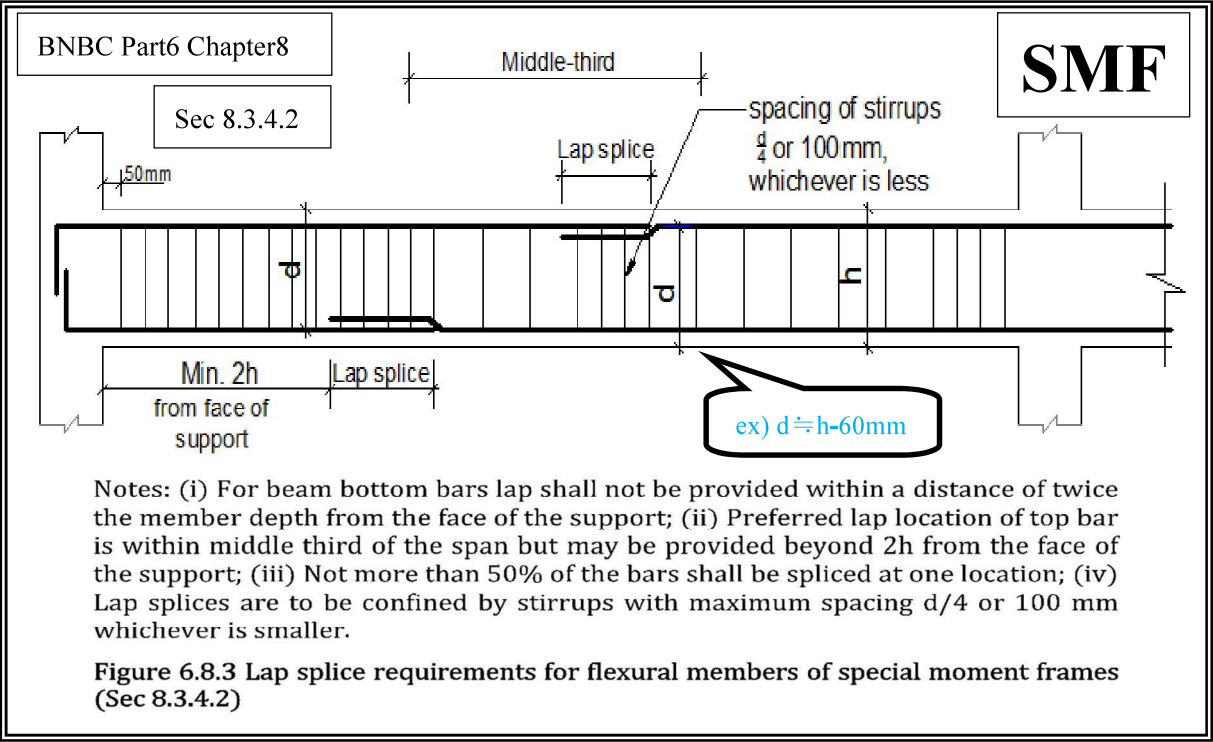
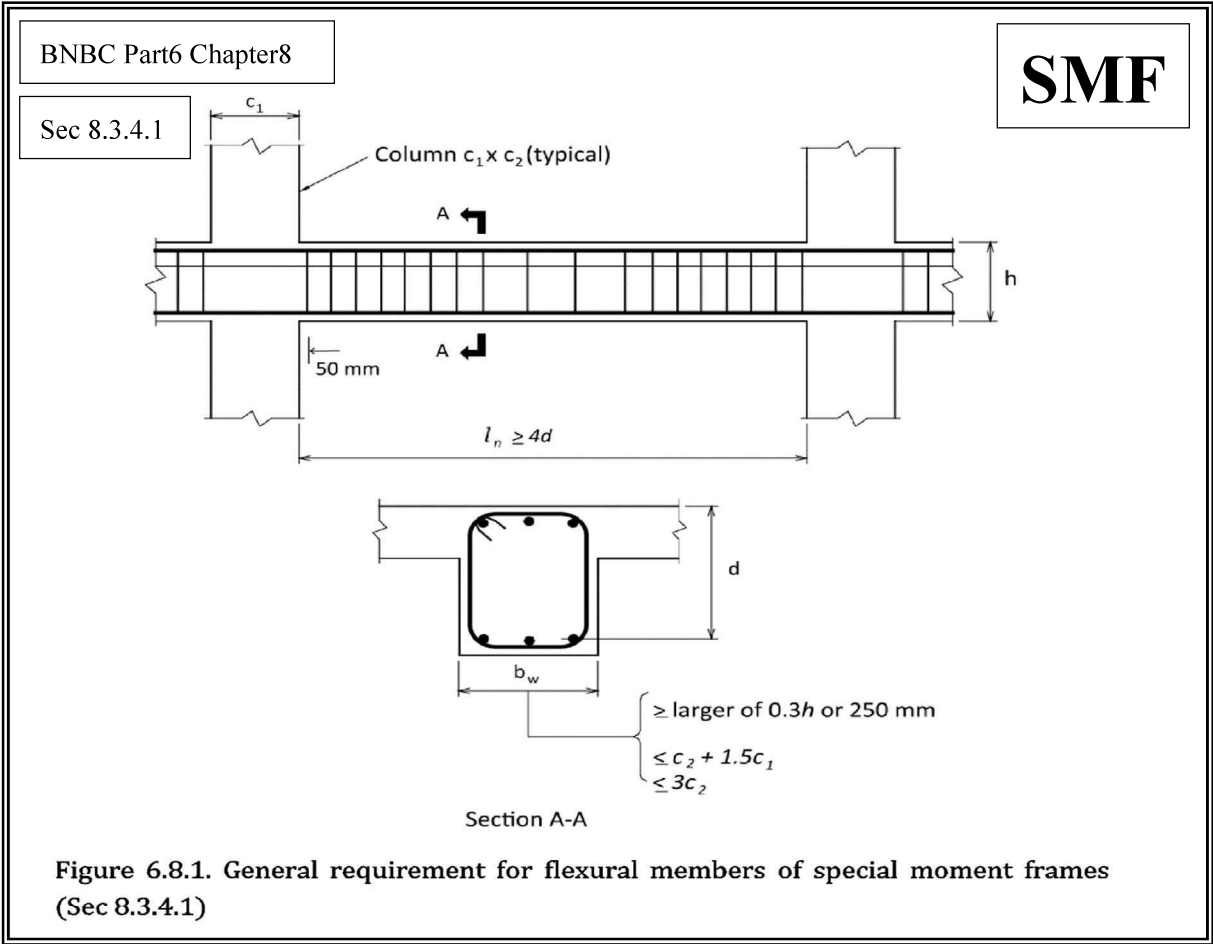
^b In the case of the bars with diameter 32 mm or more in ductility class D, the minimum specified characteristic value for A may be decreased by 2 % for each 3 mm increase in diameter. However, the maximum diminution from the minimum specified characteristic value stated in Table 6 is limited to 4 %.

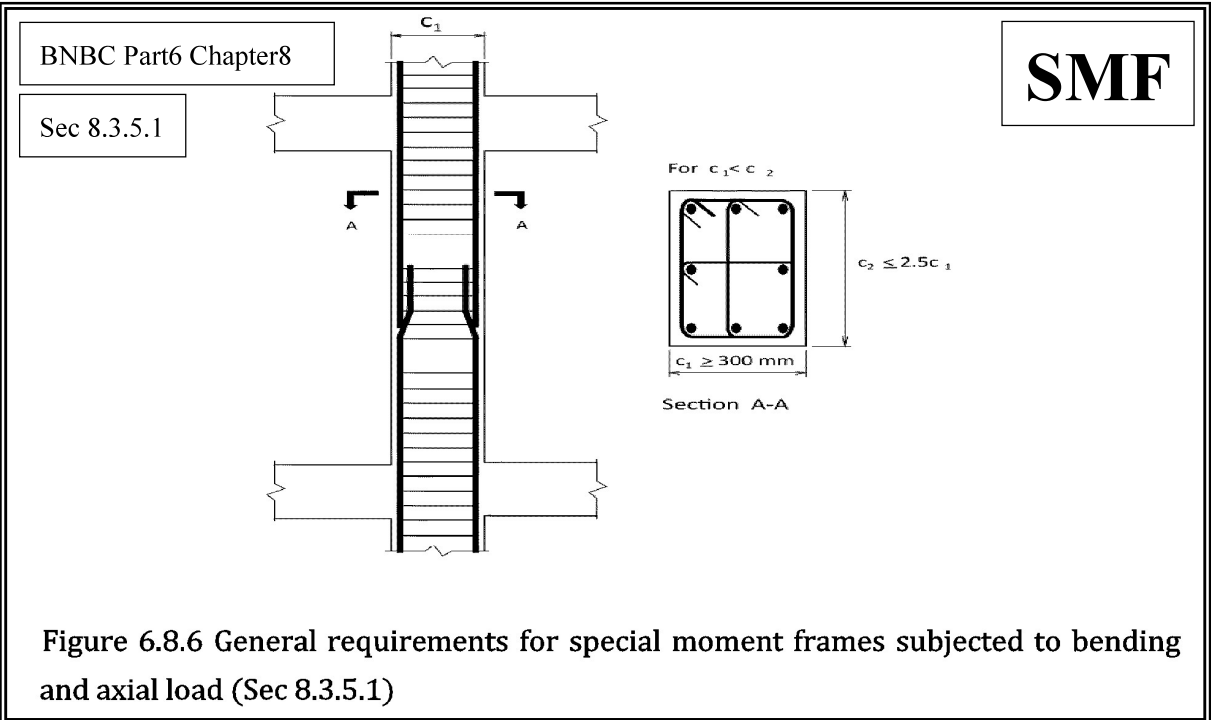
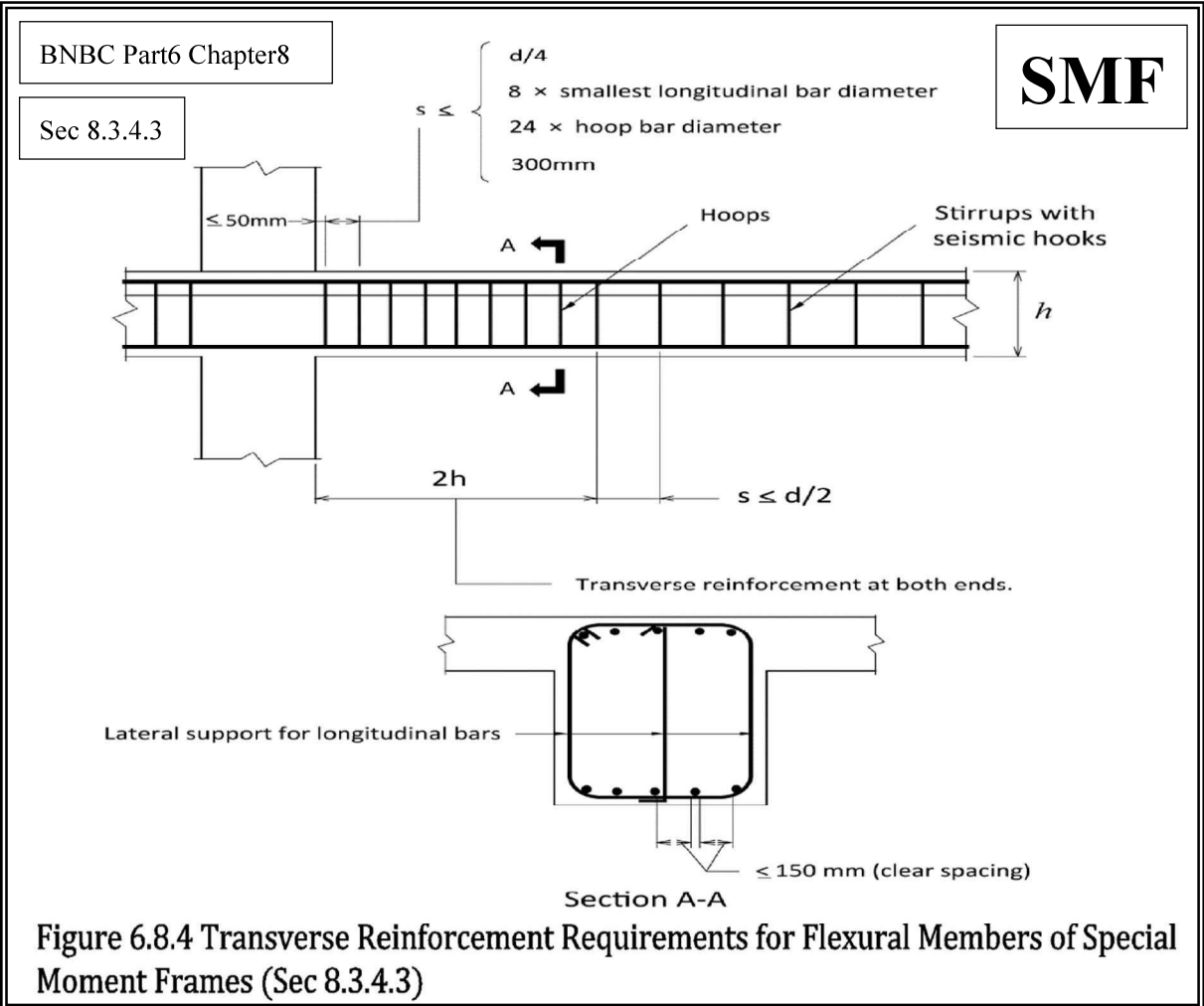
^c 1 MPa = 1 N/mm²

For the steel grade (main reinforcement), ASTM A 706 Grade 420, others highlighted in the red box above (Ductility class D and up to grade 420), ASTM A615 Grade 275 and 420 can be used (when 8.3.3.4 (b) is satisfied).

The use of steel grade higher than above is prohibited. The reason is that if a higher-grade steel is easily used as a main reinforcement, bending strength would be excessively increased and it would lead to shear failure.

Therefore, it should be noted that "More is not better."





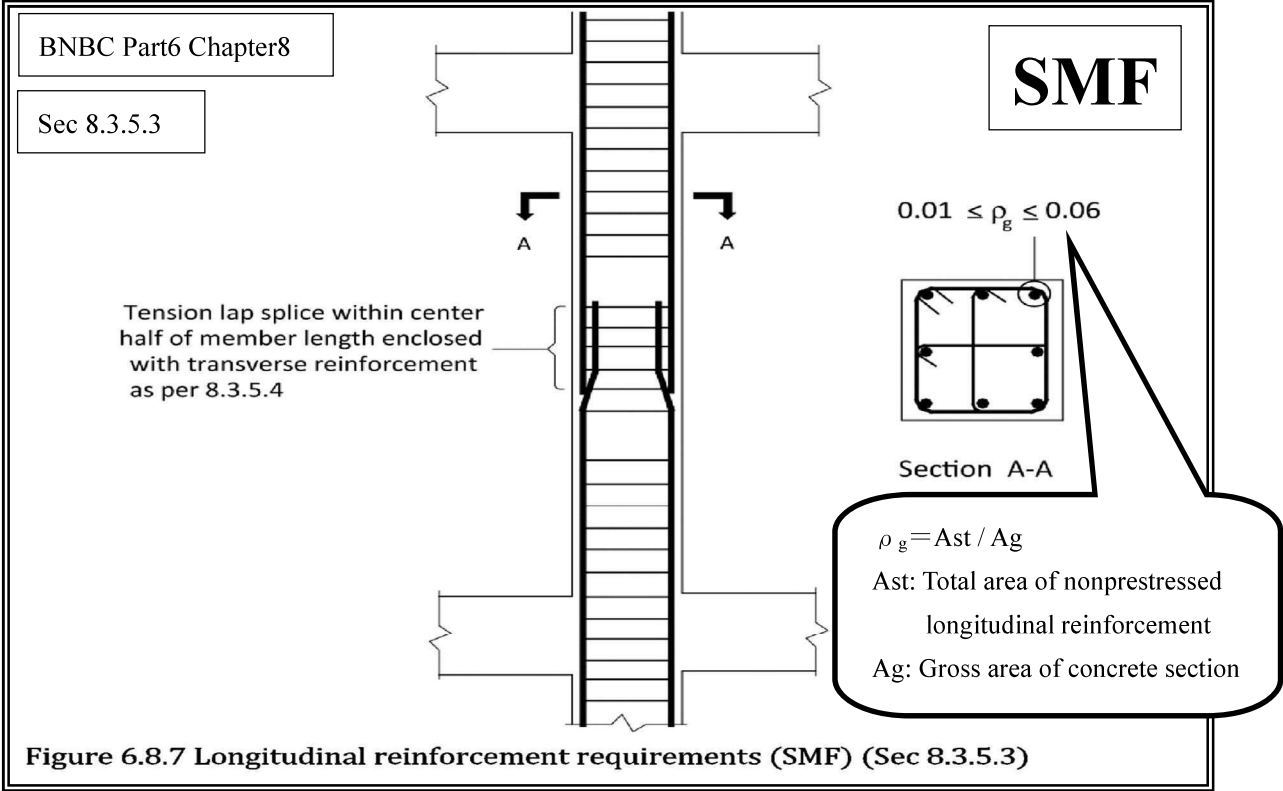


Figure 6.8.7 Longitudinal reinforcement requirements (SMF) (Sec 8.3.5.3)

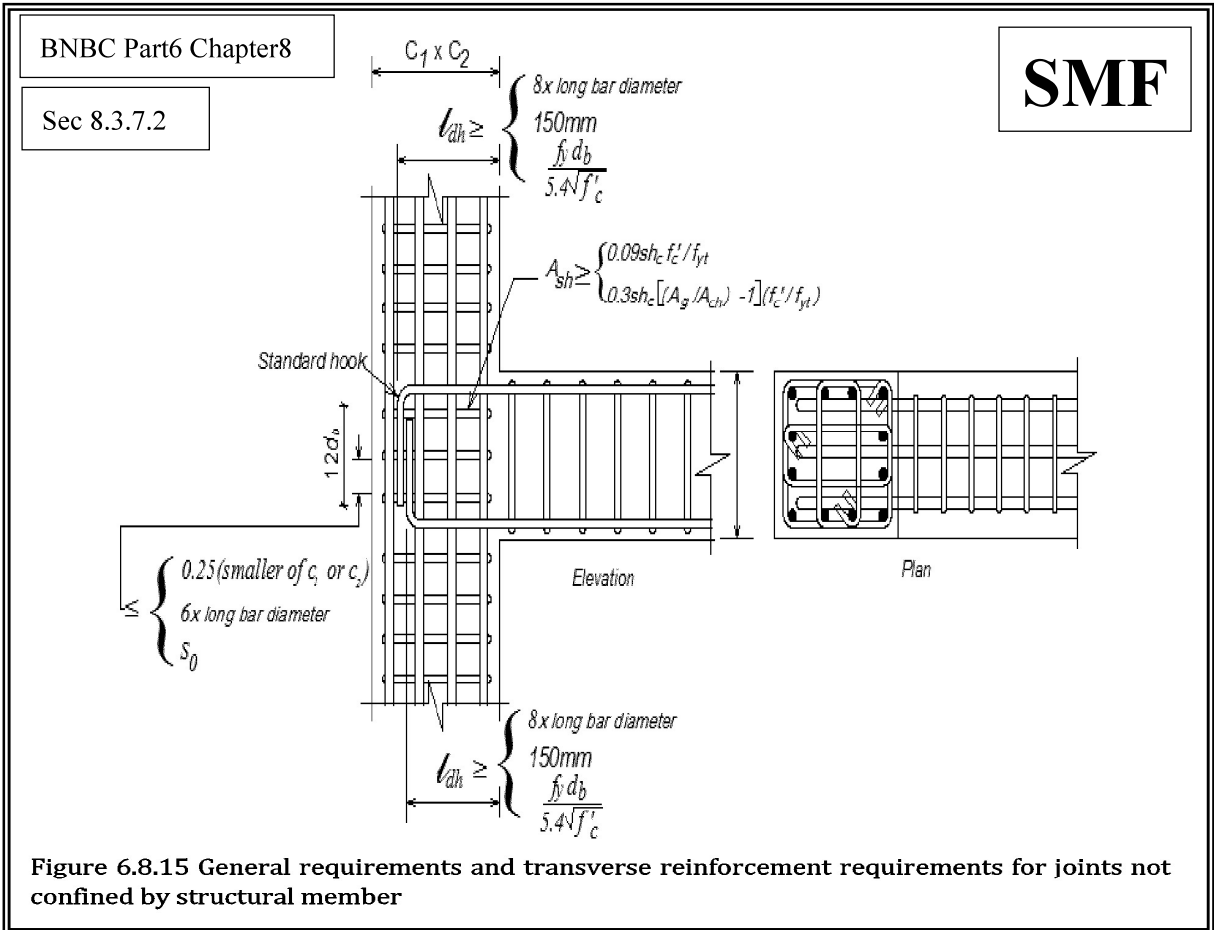
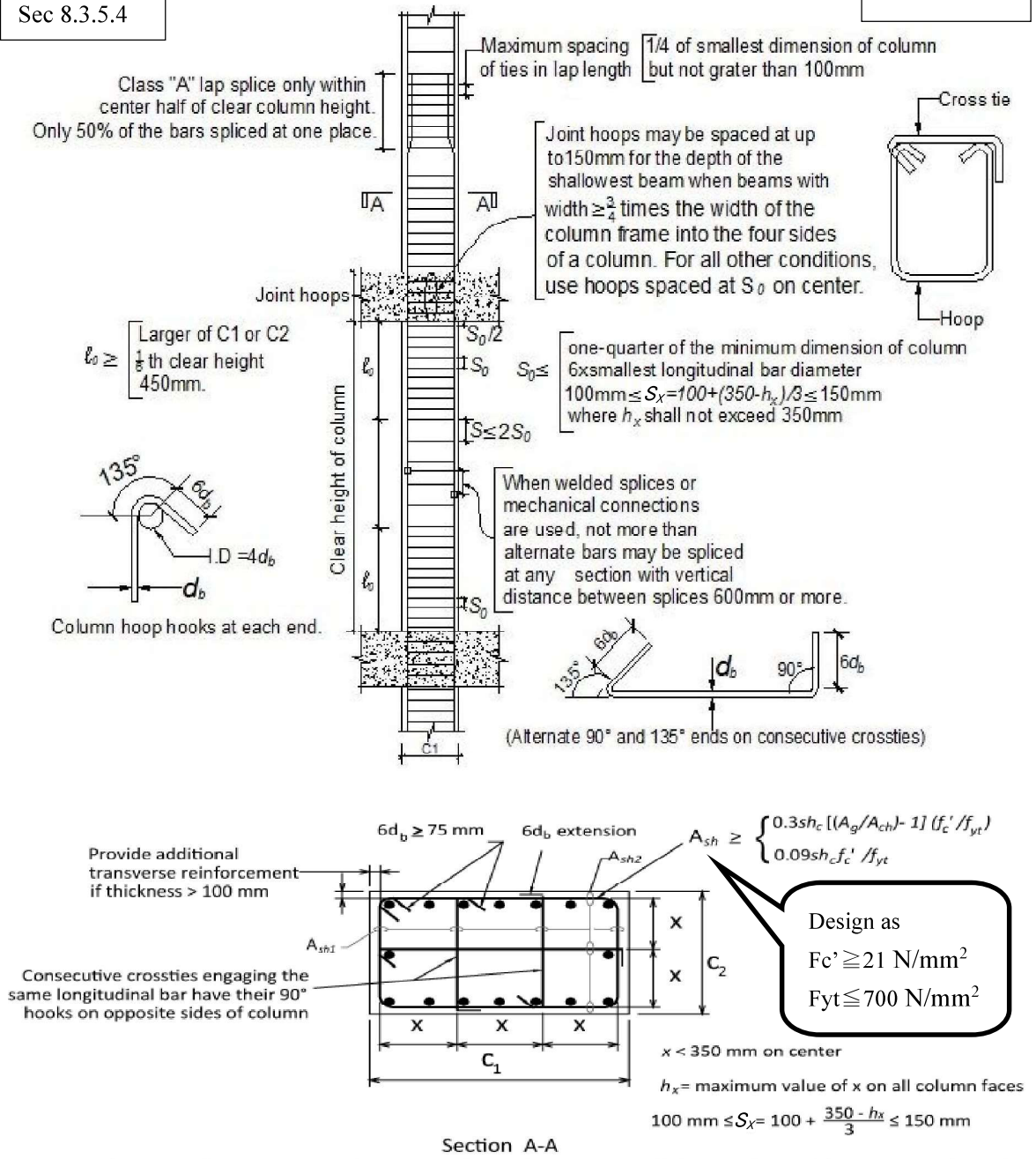


Figure 6.8.15 General requirements and transverse reinforcement requirements for joints not confined by structural member



Note: In beam column joints where members frame into all four sides of the joint and each member width is at least three-fourths the column width, the spacing of transverse reinforcement shall be 150 mm within the overall depth of the shallowest frame member. For all other conditions spacing shall be S_0 . Use hoops and cross ties in beam column joint.

Figure 6.8.8 Transverse reinforcement requirements- rectangular hoop for members subjected to bending and axial load rectangular hoop (SMF) (Sec 8.3.5.4)

< Others >

■ Answers for Questionnaire (conducted in Oct-Nov 2022)

◆ Legal documents

- What are the design documents required when constructing a new building?
Select all that apply from the following.

- Architectural drawings Structural drawings
- Mechanical drawings Electrical drawings Plumbing drawings
- Specifications Structural calculation sheets
- Soil report Design report

◆ Structural design

- Have you ever seen the structural drawings (not architectural drawings) ?
→ If yes, please answer to the following.

Select all that apply to the structural drawing from the following

- Floor plan elevation cross-section of building Lay-out plan
- schedule of column etc. detailed bar arrangement specifications

- The total of the dead load does not change even if the dimensions of the frame and the type of finish are changed. (correct / incorrect)

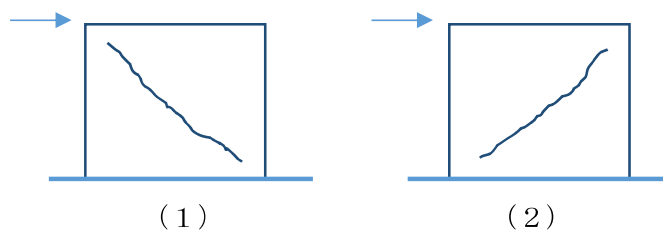
- The live load should be set to the same value regardless of the use of the room. (correct / incorrect)

- The photo on the right shows the situation of an X-shaped crack caused by the earthquake. Select the main causes of the cracks below.

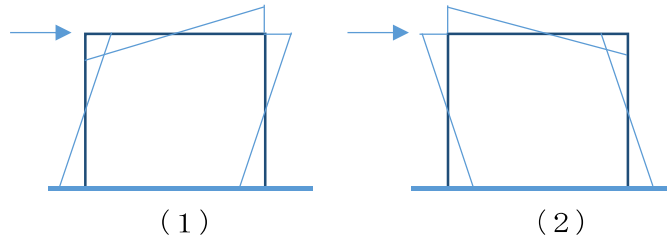


- By horizontal force.
- By vertical force.
- Because the length of “h” is small.
- Because the shear capacity of the wall is larger than flexural capacity.

- Which is the correct crack diagram that enters the wall?
((1) / (2) / (3) Not knowing) (force from left to right)



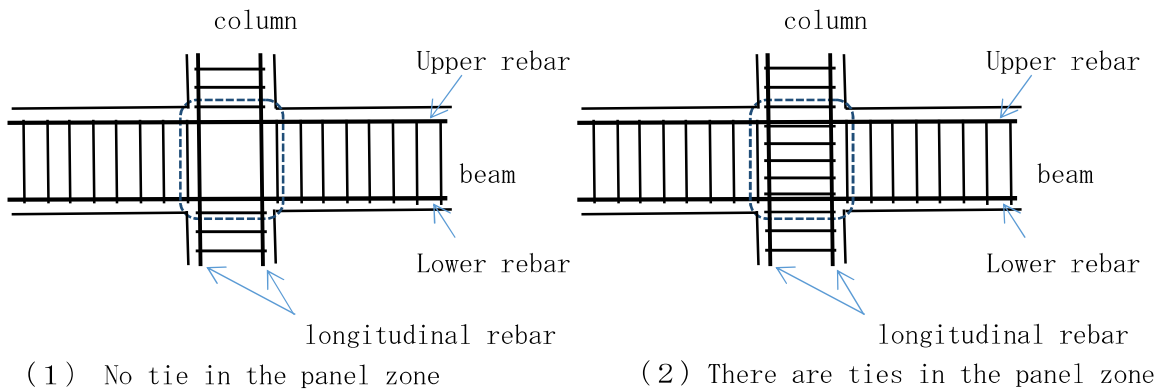
- Which is the correct BMD for the frame (no wall inside)?
 (1) / (2) / (3) Not knowing) (force from left to right)



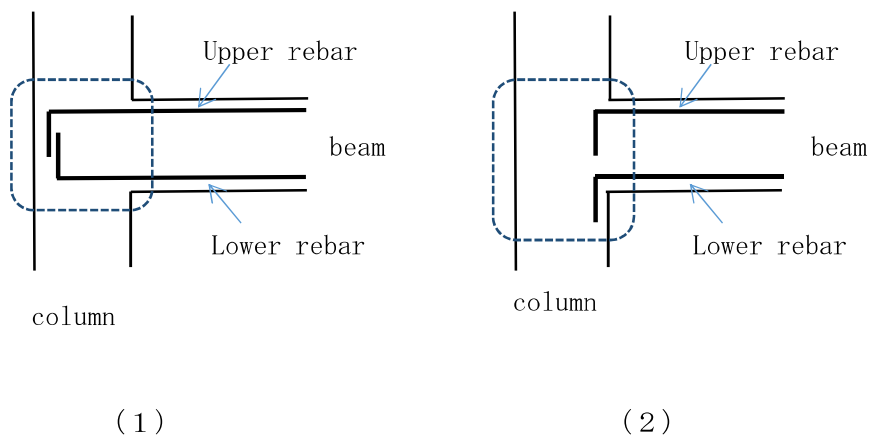
◆ Reinforcement

- At the ends of columns, the spacing between the tie of SMF is set to 200 mm.
 correct / incorrect).

- The correct reinforcement arrangement at the joint between the column and the beam (panel zone: the part surrounded by the dotted line) is (1) / (2).



- The correct shape of the beam main bar (upper rebar / lower rebar) fixed to the column is (1) / (2).



■ Answers for Questionnaire (conducted on 28 May 2024)

The duration of the test is 60 minutes.

Answer the questions using Manual and Design Documents.

The passing score is 60 points.

(You have to answer at least 12 out of 20 questions to pass and get certificate.)

Name

① Select all from the followings those should be included in the structural drawing.

- Floor plan
 Elevation
 Specifications
 Lay-out plan
 Schedule of column/beam/share wall/slab
 Detailed bar arrangement

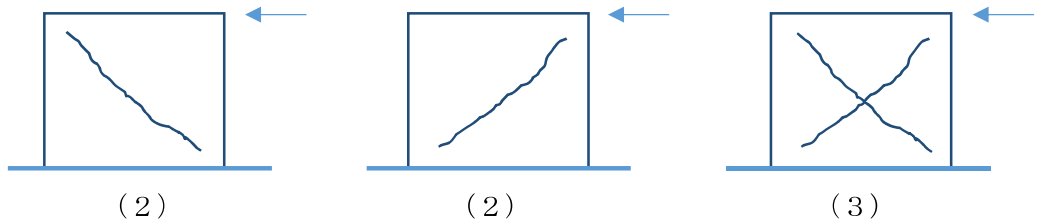
② The photo on the right shows the situation of an X-shaped crack caused by the earthquake. Select the main causes of the cracks below (multiple answers possible).



- By horizontal force.
 By vertical force.
 Because the length of “h” is small.
 Because the shear capacity of the wall is smaller than flexural capacity.

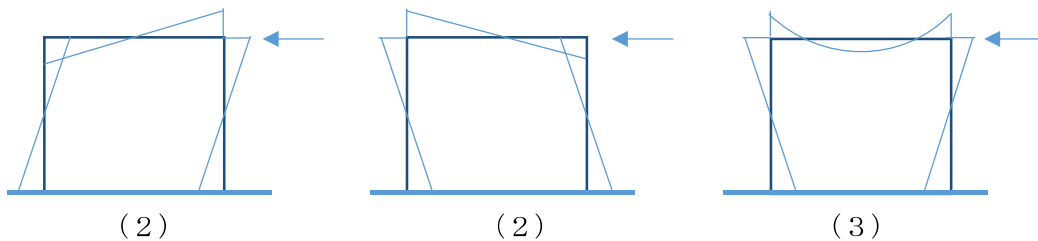
③ Which is the correct diagram of crack that would appear in the wall?
[lateral force from right to left]

(1) / (2) / (3)



④ Which is the correct BMD (bending moment diagram) for the moment frame (no wall inside)? [lateral force from right to left]

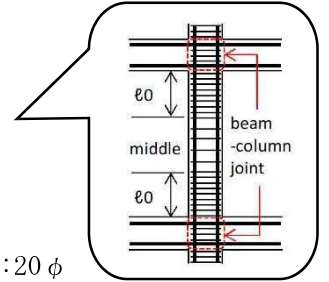
(1) / (2) / (3)



- ⑤ Select the correct reinforcement ratio of longitudinal rebar (ρ_g) of the 5th floor column C-1 by referencing structural drawings. ($\rho_g = A_{st}/A_g \times 100$ (%))
2.39% 3.06% 3.67%

- ⑥ In SMF buildings, select the minimum extension required for a 135 degree hook of hoop/tie (10ϕ).
30 mm 45 mm 60 mm 75 mm 150 mm)

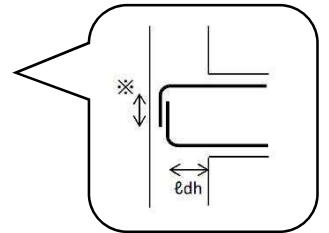
- ⑦ In SMF buildings, select the required spacing of the hoop/tie at the end part of the columns (ℓ_0 range), the middle part, and the beam-column joints (see the figure on the right).



Conditions: minimum dimension of column:300mm, longitudinal rebar:20 ϕ

- ◆ In the end part
 60 mm or less 75 mm or less 100 mm or less 120 mm or less)
- ◆ In the middle part
120 mm or less 150 mm or less 200 mm or less 240 mm or less)
- ◆ In the beam-column joints
 60 mm or less 75 mm or less 100 mm or less 120 mm or less)

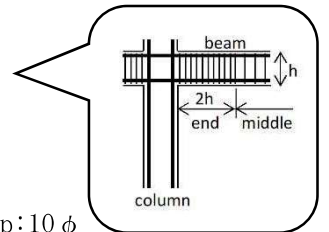
- ⑧ In SMF buildings, Select the minimum development length (ℓ_{dh}) and extension (※-marked part length) required for the longitudinal rebar of beam (see the figure on the right).



Conditions: $f_y=420$ N/mm², $\sqrt{f_c}=4.9$, longitudinal rebar: 20 ϕ

- ◆ development length (150 mm 160 mm 240 mm 300 mm 320 mm)
- ◆ extension (150 mm 160 mm 240 mm 300 mm 320 mm)

- ⑨ In SMF buildings, select the required spacing of the stirrup in the end part of the beams ($2h$ range) and the middle part (see the figure on the right).



Conditions: depth of beam:600 mm, longitudinal rebar:20 ϕ , stirrup:10 ϕ

- ◆ In the end part
100 mm or less 135 mm or less 150 mm or less 180 mm or less)
- ◆ In the middle part
200 mm or less 270 mm or less 300 mm or less 360 mm or less)

- ⑩ Select the appropriate SDC (seismic design category) from the following when OC=II, Z=0.2, and site class=SD.
 B C D)
- ⑪ In the case of “⑩” above, select all of the following Structural Systems that can be adopted.
 Building Frame Systems (Special RC shear walls)
 Building Frame Systems (Ordinary RC shear walls)
 Moment Resisting Frames (RC SMF)
 Moment Resisting Frames (RC IMF)
 Moment Resisting Frames (RC OMF)
 Dual Systems: SMF (Special RC shear walls)
 Dual Systems: SMF (Ordinary RC shear walls)
 Dual Systems: IMF (Special RC shear walls)
 Dual Systems: IMF (Ordinary RC shear walls)
- ⑫ Select the BNBC reference for each SDC.
SDC B (8.3.3 8.3.4 8.3.5 8.3.6 8.3.7 8.3.8 8.3.9 8.3.10)
SDC C (8.3.3 8.3.4 8.3.5 8.3.6 8.3.7 8.3.8 8.3.9 8.3.10)
SDC D (8.3.3 8.3.4 8.3.5 8.3.6 8.3.7 8.3.8 8.3.9 8.3.10)
- ⑬ For each type of moment resisting frame, choose all the concrete strengths that can be used for the columns of the 4th floor building, which is not in the corrosive environment or other severe exposure conditions.
OMF (17 N/mm² 18 N/mm² 20 N/mm² 21 N/mm²)
IMF (17 N/mm² 18 N/mm² 20 N/mm² 21 N/mm²)
SMF (17 N/mm² 18 N/mm² 20 N/mm² 21 N/mm²)
- ⑭ For each type of moment resisting frame, choose all the yield strength (f_y) that can be used for the longitudinal rebar of columns.
OMF (420 N/mm² 550 N/mm² 700 N/mm²)
IMF (420 N/mm² 550 N/mm² 700 N/mm²)
SMF (420 N/mm² 550 N/mm² 700 N/mm²)
- ⑮ For each type of moment resisting frame, choose all the yield strength (f_{yt}) that can be used for the transverse reinforcement of columns in the calculation of A_{sh} .
OMF (420 N/mm² 550 N/mm² 700 N/mm²)
IMF (420 N/mm² 550 N/mm² 700 N/mm²)
SMF (420 N/mm² 550 N/mm² 700 N/mm²)

Answer the appropriateness of the design policy ⑩ to ⑳.

- ⑩ In order to increase the bearing capacity of the column, the reinforcement ratio of longitudinal rebar of column was designed to be 8%.
(Appropriate Inappropriate)
- ⑪ The cover thickness of the column was designed as 150 mm.
(Appropriate Inappropriate)
- ⑫ The general concrete curing period was designed as 5 days.
(Appropriate Inappropriate)
- ⑬ The free fall height of concrete pouring was designed as 2.0 m.
(Appropriate Inappropriate)
- ⑭ Choose the right wind speed for Dhaka.
(47.8 m/s 56.7 m/s 65.7 m/s)
-

■ **Reference 01 (BNBC reference)**

Since BNBC2020 is based on ASCE 7-05 (partially ASCE 7-02) and ACI 318-08, it is preferable to check and follow the latest version of ASCE and ACI.

As of 2024 May, ASCE 7-22 and ACI 318-19 (22) are the latest versions.

■ Reference 02 (BNBC training video by URP)

BNBC Training Outline (General and Structural Instruction)

<https://www.skghoshassociates.com/bnbc-structural-recordings/>

Training and Capacity Building Initiative of Component S-09

(Implementation and Enforcement of BNBC-2020)

of the Urban Resilience Project (URP):RAJUK PART

24 March– 07 June 2021

- 1. Introduction to Building Codes and Overview of BNBC 2020**
- 2. Review of Structural Design, Loads, Construction Practices and Safety**
- 3. Bidhimala, BC Act, and TI Act**
- 4. Concrete Materials**
- 5. Earthquakes and Their Effects on Structures**
- 6. Experience in Past Earthquakes, Lessons Learned**
- 7. Overview of Inspection Requirements Proposed by Component S-09 of URP:
RAJUK Part**
- 8. Inspector Skills**
- 9. Gravity Loads on Buildings and Structures**
- 10. Wind Loads on Buildings and Structures**
- 11. Seismic Design Loads on Buildings and Structures Part 1**
- 12. Seismic Design Loads on Buildings and Structures Part 2**
- 13. Soils and Foundations Part 1**
- 14. Soils and Foundations Part 2**
- 15. Anchoring to Concrete**
- 16. Masonry Structures**
- 17. Seismic Detailing of Moment Frames**
- 18. Seismic Detailing of Shear Walls**
- 19. Steel Structures 1**
- 20. Steel Structures 2**
- 21. Structure and Environment**
- 22. Construction Safety, Construction Quality and Demolition**
- 23. Responsibilities of Professionals**

■ Reference 03 (Seismic design of reinforced concrete special moment frames)

August 2016 with references to ASCE 7-16 and ACI 318-14

NIST GCR 16-917-40



NEHRP Seismic Design Technical Brief No. 1



**Seismic Design of Reinforced
Concrete Special Moment Frames**
A Guide for Practicing Engineers
SECOND EDITION

**Jack P. Moehle
John D. Hooper**

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