

A shape grammar for teaching the architectural style of the *Yingzao fashi*

Volume 2, Figures

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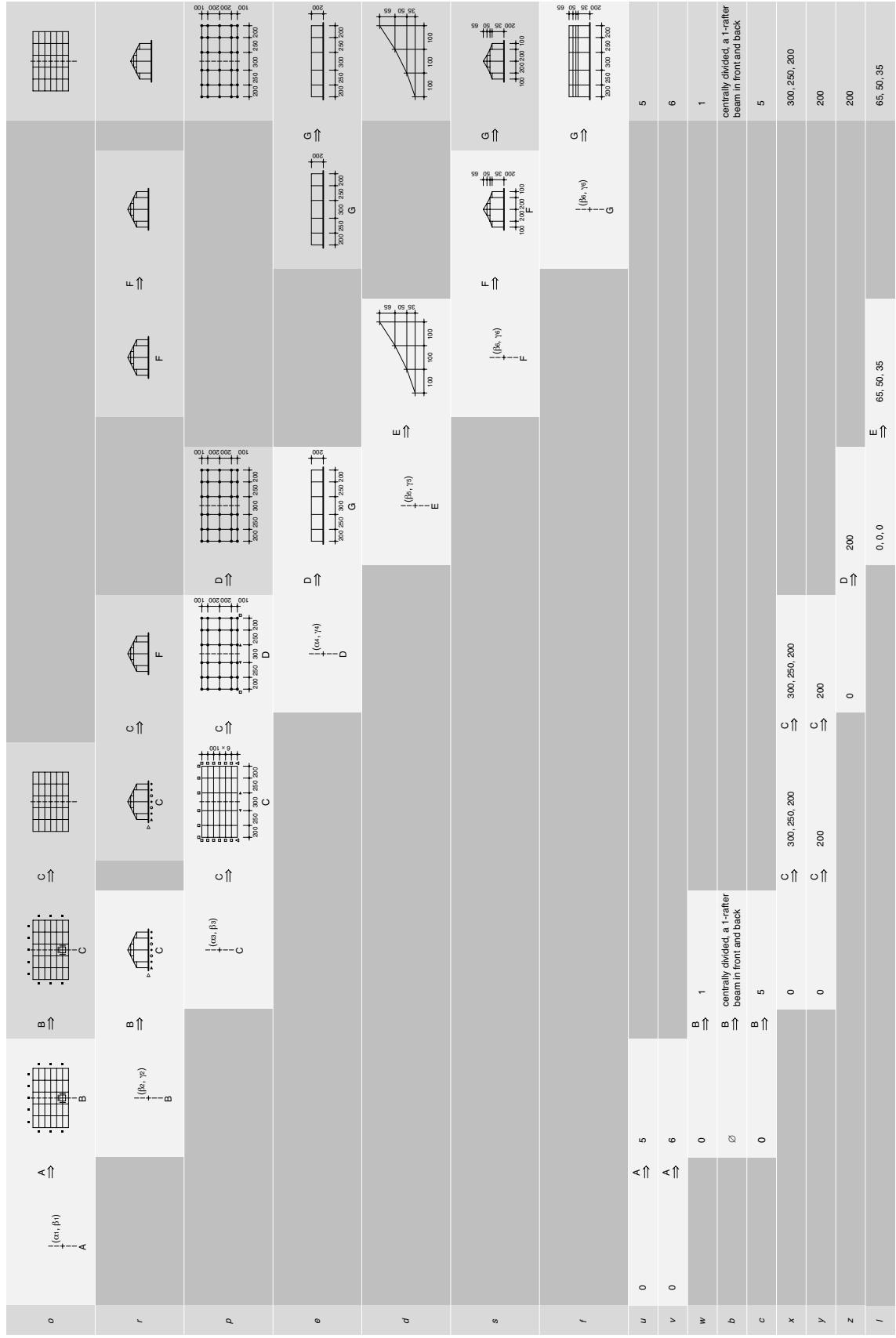


Figure 1a. The derivation of the sample design. The design consists of 16 elements (separated vertically): 7 drawings and 9 descriptions. These are grouped in 7 subdesigns. The computation has 7 stages (separated horizontally). Each stage involves a different combination of elements. The principal elements are shown in light grey; the secondary elements in medium grey.

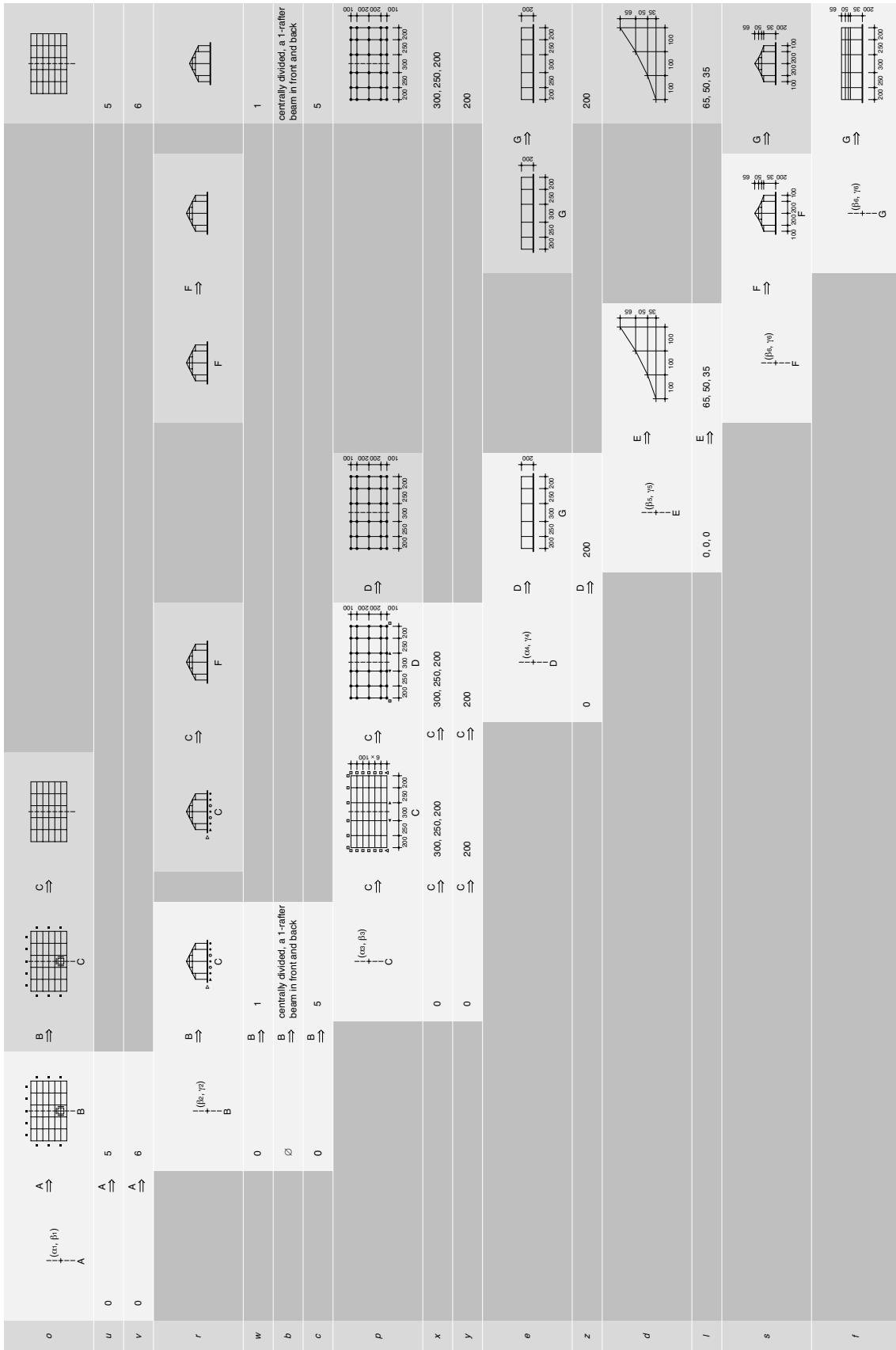


Figure 1b. The derivation of the sample design, reorganized by subdesign.

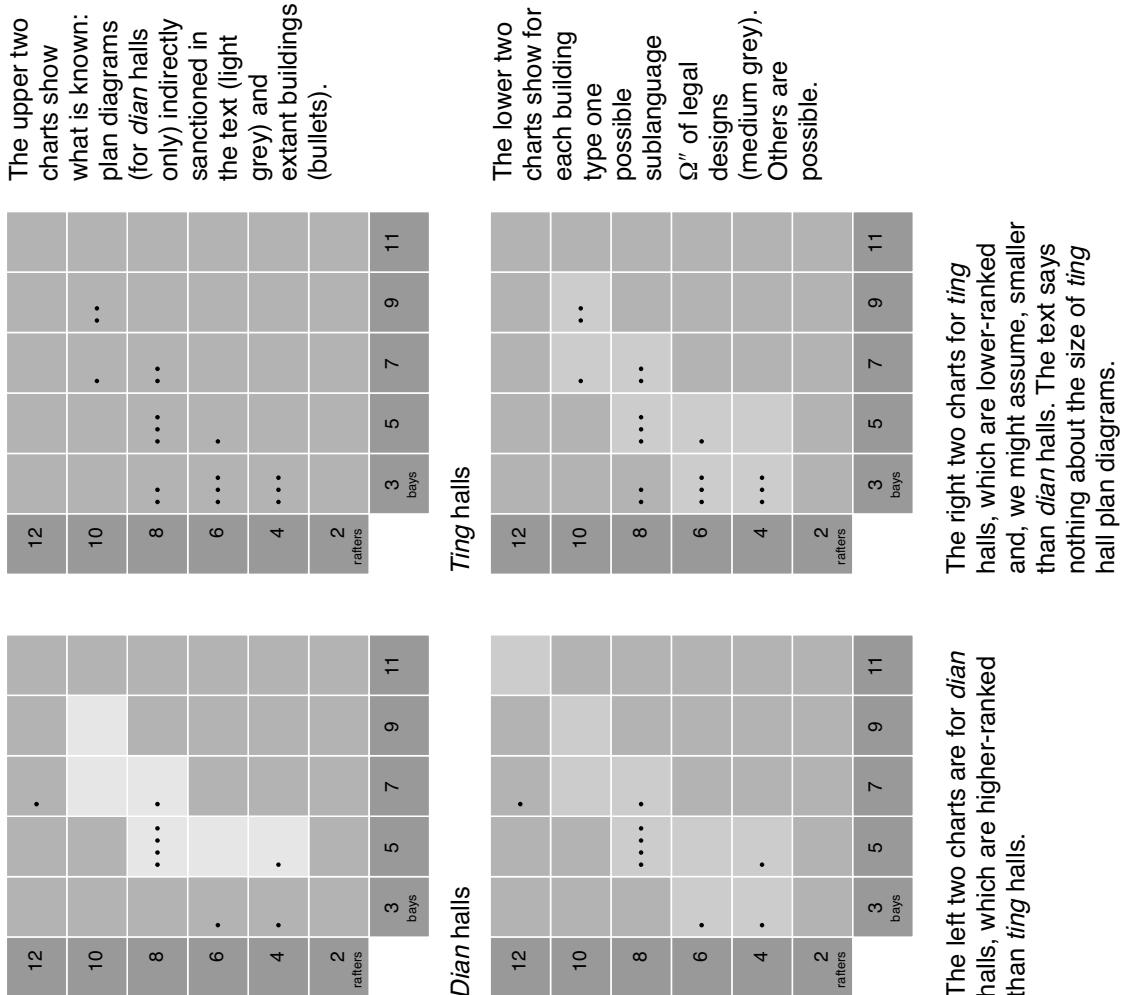


Figure 2.
Sublanguages
of plan diagram
subdesigns.
Source: Chen
(1992; 1993)

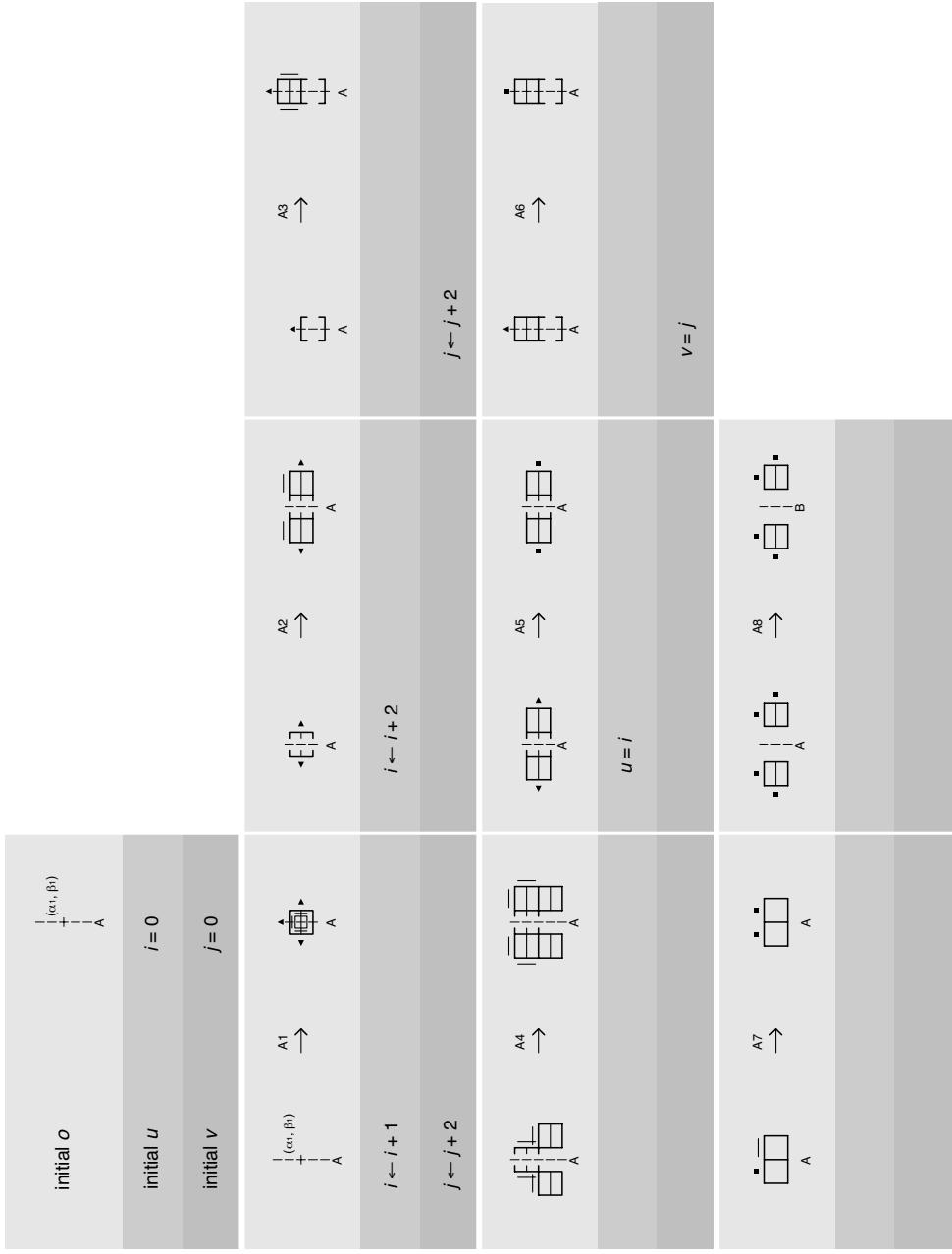


Figure 3. Rules for generating plan diagrams (stage A).

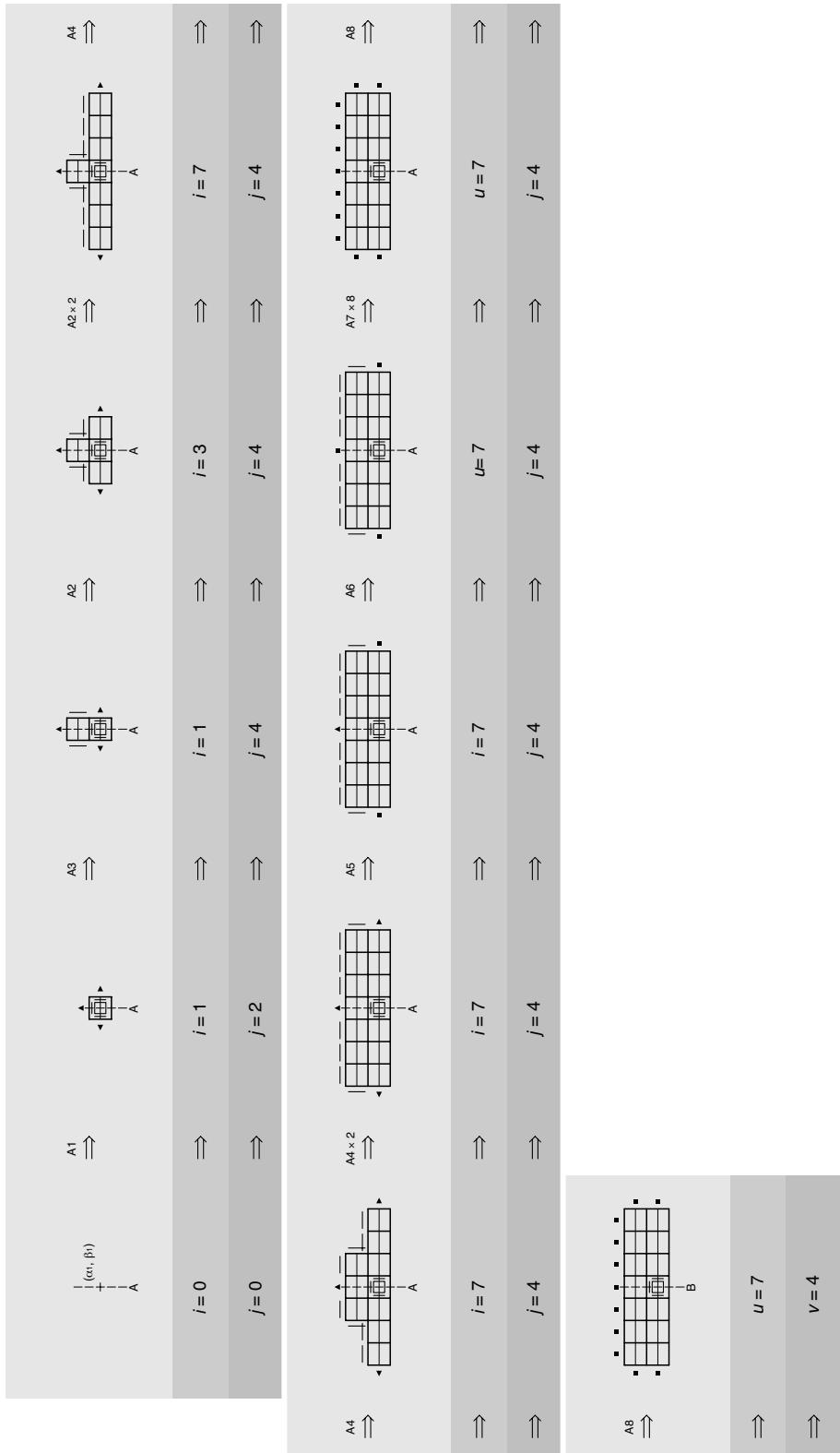


Figure 4. Derivation of a 7×4 plan diagram (stage A).

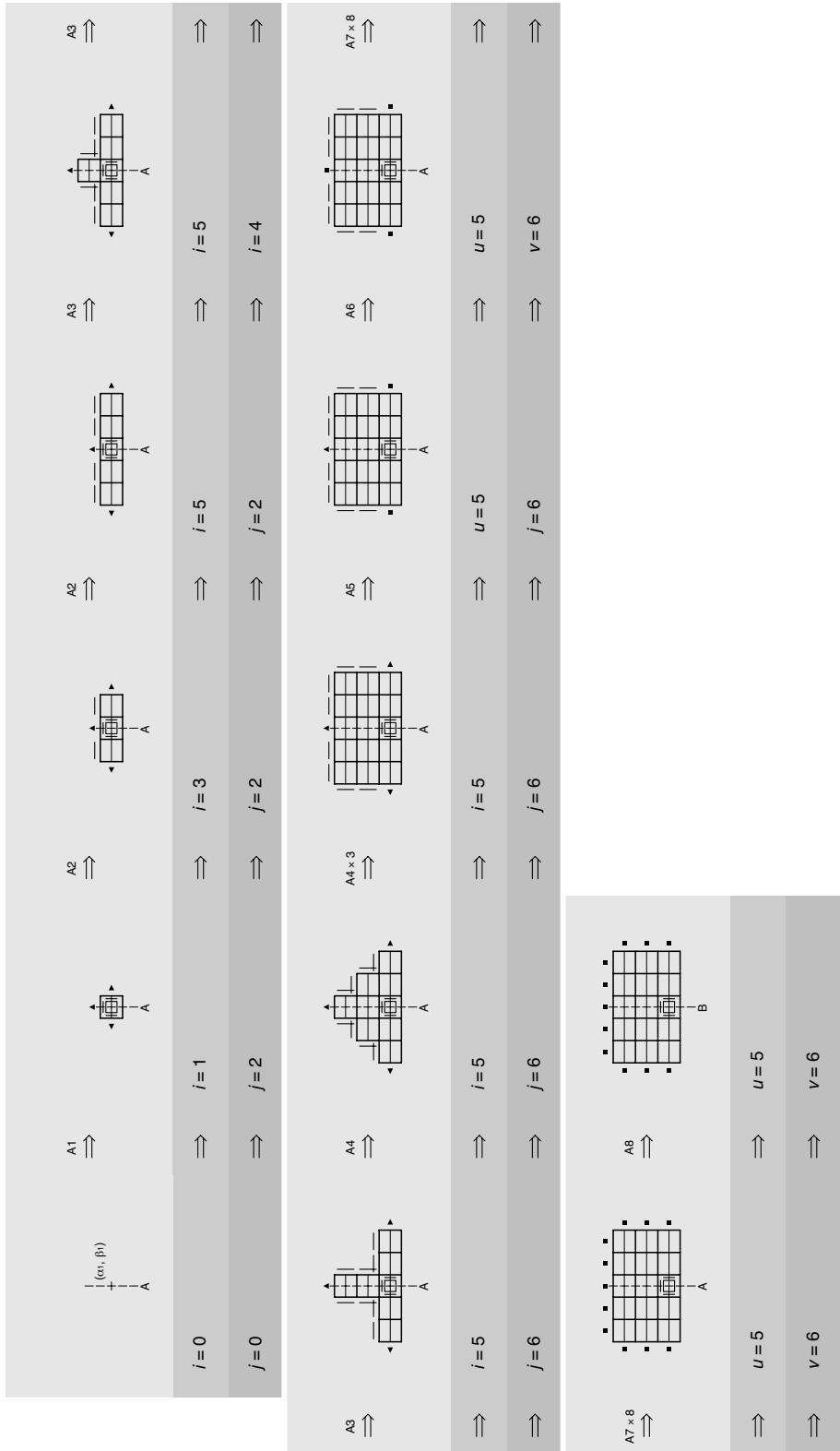
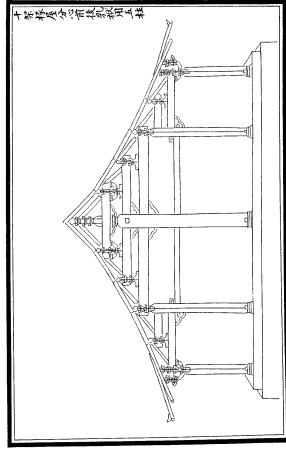
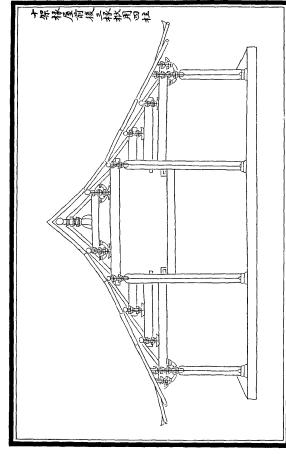


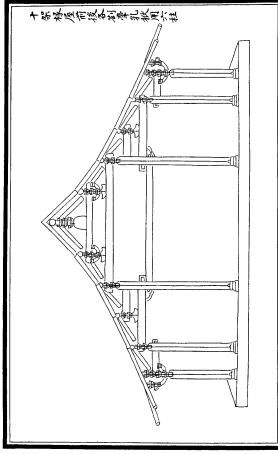
Figure 5. Derivation of a 5×6 plan diagram (stage A).



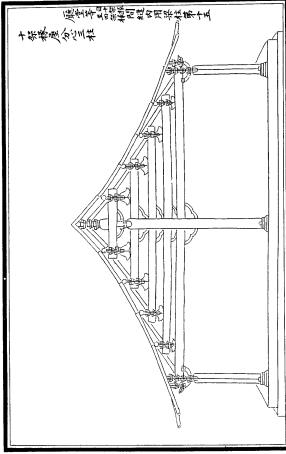
A 10-rafter building, centrally divided, 2-rafter beam in front and back, with 5 columns. 10-*jia chuan* wu, *fen* *xin*, *qian hou rufu*, *yong* 5 *zhu*.



A 10-rafter building, 3-rafter beam in front and back, with 4 columns. 10-*jia chuan* fu, *yong* 4 *zhu*.



A 10-rafter building, a 1-rafter beam and a 2-rafter beam in front and back, with 4 columns. 10-*jia chuan* wu, *qian hou zhaqian rufu*, *yong* 6 *zhu*.



A 10-rafter building, double 2-rafter beams in front and back, with 6 columns. 10-*jia chuan* wu, *qian hou bing rufu*, *yong* 6 *zhu*.

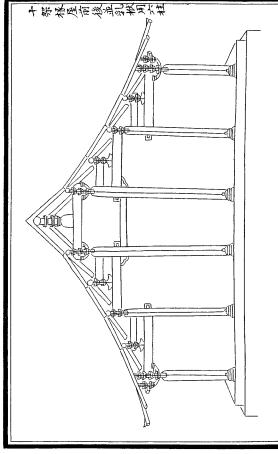
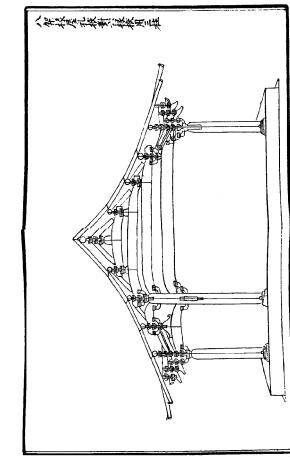
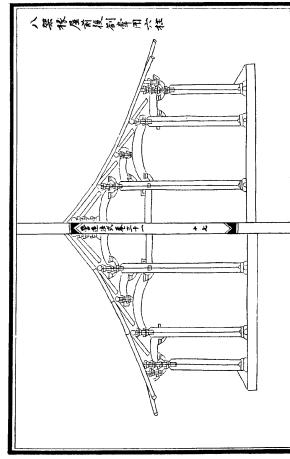


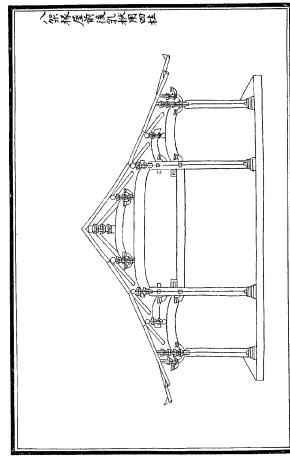
Figure 6a. The corpus of section diagrams consists of drawings with descriptions, of 18 *ting* halls from 4 to 10 rafters deep. Of the 18, five are of 10-rafter buildings. These are shown here. The drawings are at least 200 years more recent than the text proper, but they are still useful for our purpose. From Liang (1983, 313–315).



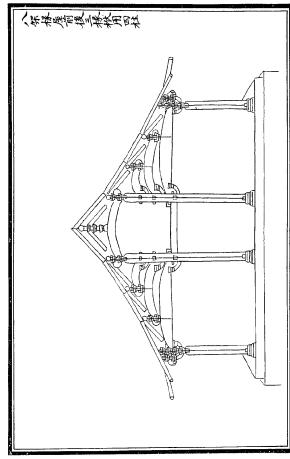
An 8-rafter building, 2-rafter beam in front, 6-rafter beam in back, with 3 columns. 8-jia chuan wu, rufu dui 6-chuan fu, yong 3 zhu.



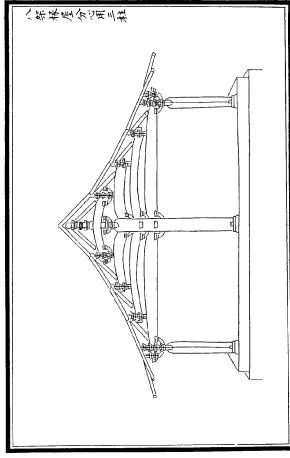
An 8-rafter building, 1-rafter beam [and 2-rafter beam] in front and back, with 6 columns. 8-jia chuan wu, qian hou zhaqian [rufu], yong 6 zhu.



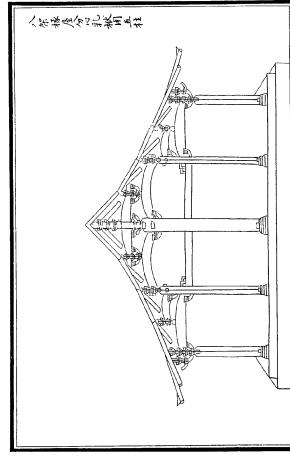
An 8-rafter building, 2-rafter beam in front and back, with 4 columns. 8-jia chuan wu, qian hou rufu, yong 4 zhu.



An 8-rafter building, a 3-rafter beam in front and back, with 4 columns. 8-jia chuan wu, qian hou 3-chuan fu, yong 4 zhu.

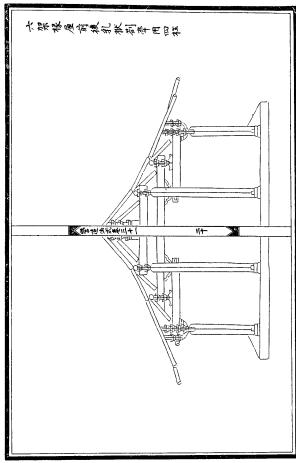


An 8-rafter building, centrally divided, with 3 columns. 8-jia chuan wu, fen xin, yong 3 zhu.

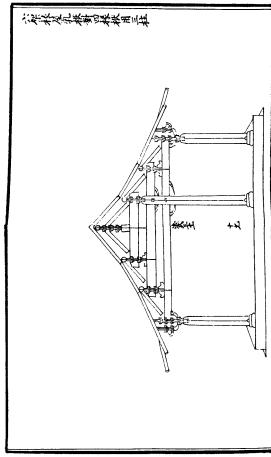


An 8-rafter building, centrally divided, a 2-rafter beam in front and back, with 5 columns. 8-jia chuan wu, fen xin, qian hou rufu, yong 5 zhu.

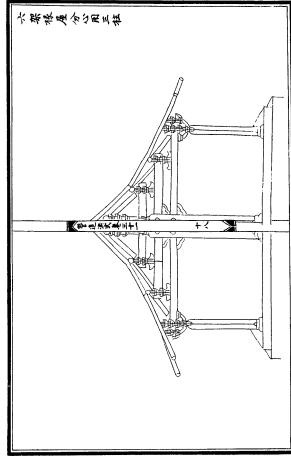
Figure 6b. The corpus of section diagrams consists of drawings with descriptions of 18 *ting* halls from 4 to 10 rafters deep. Of the 18, six are of 8-rafter buildings. From Liang (1983, 316–318).



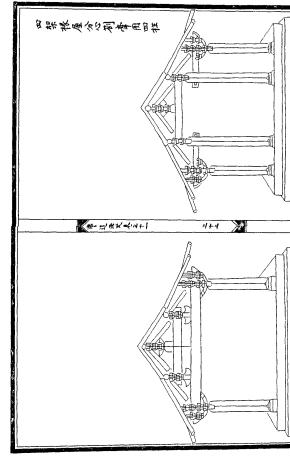
A 6-rafter building, a 2-rafter beam in front and back, with 4 columns. 6-jiā chuān wú, qian hou rufu, yong 4 zhu.



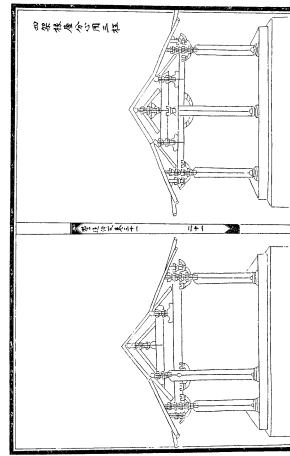
A 10-rafter building, a 2-rafter beam abutting a 4-rafter beam, with 3 columns. 6-jiā chuān wú, rufu duī 4-chuān fú, yong 4 zhu.



A 6-rafter building, centrally divided, with 3 columns. 6-jiā chuān wú, fen xīn, yong 3 zhu.



Left [description assumed]. A 4-rafter building, clear span, with 2 columns. 4-jiā chuān wú, tongyān, yong 2 zhu.
Right. A 4-rafter building, centrally divided, a 1-rafter beam, with 4 columns. 4-jiā chuān wú, fen xīn, zhāiqiān, yong 4 zhu. [The description is wrong. For centrally divided, fen xīn, read in front and back, qian hou.]



Left [description assumed]. A 4-rafter building, a 1-rafter beam abutting a 3-rafter beam, with 3 columns. 4-jiā chuān wú, zhāiqiān duī 3-chuān fú, yong 3 zhu.
Right. A 4-rafter building, centrally divided, with 3 columns. 4-jiā chuān wú, fen xīn, yong 3 zhu.

Figure 6c. The corpus of section diagrams consists of drawings with descriptions, of 18 *ting* halls from 4 to 10 rafters deep. Of the 18, three are of 6-rafter buildings, and four are of 4-rafter buildings. These are shown here. From Liang (1983, 319–321).

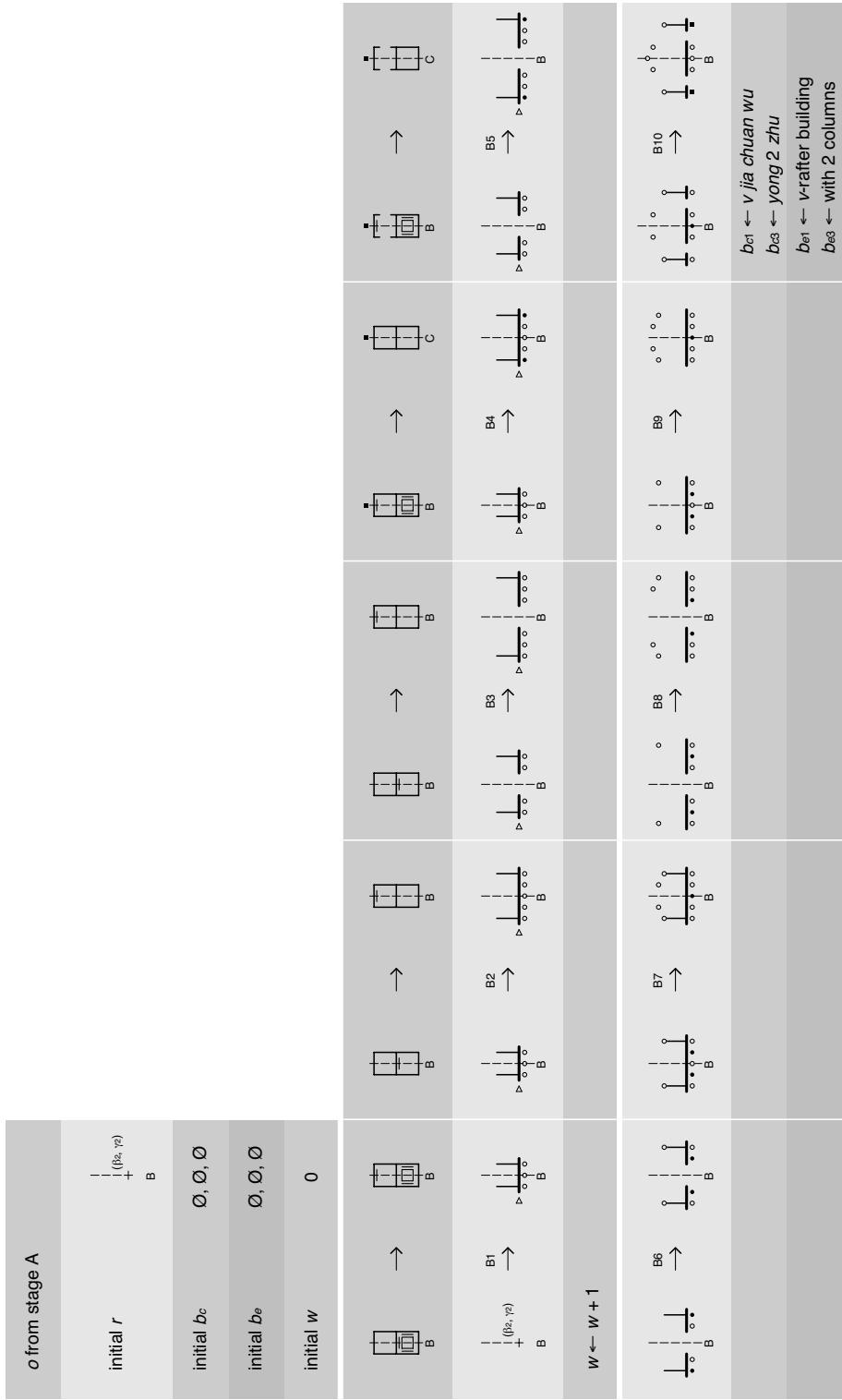


Figure 7. Schemata for preparing section diagrams (stage B).

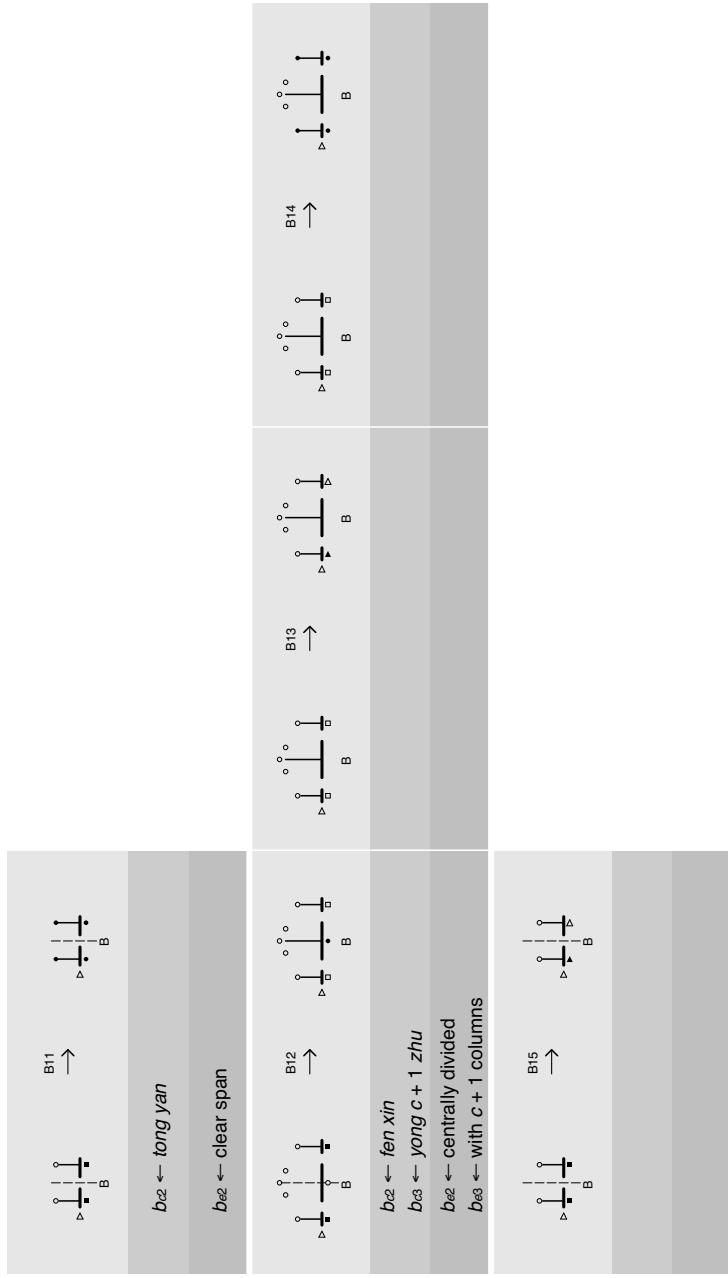


Figure 8a. Schemata for instantiating beams in section diagrams (stage B).

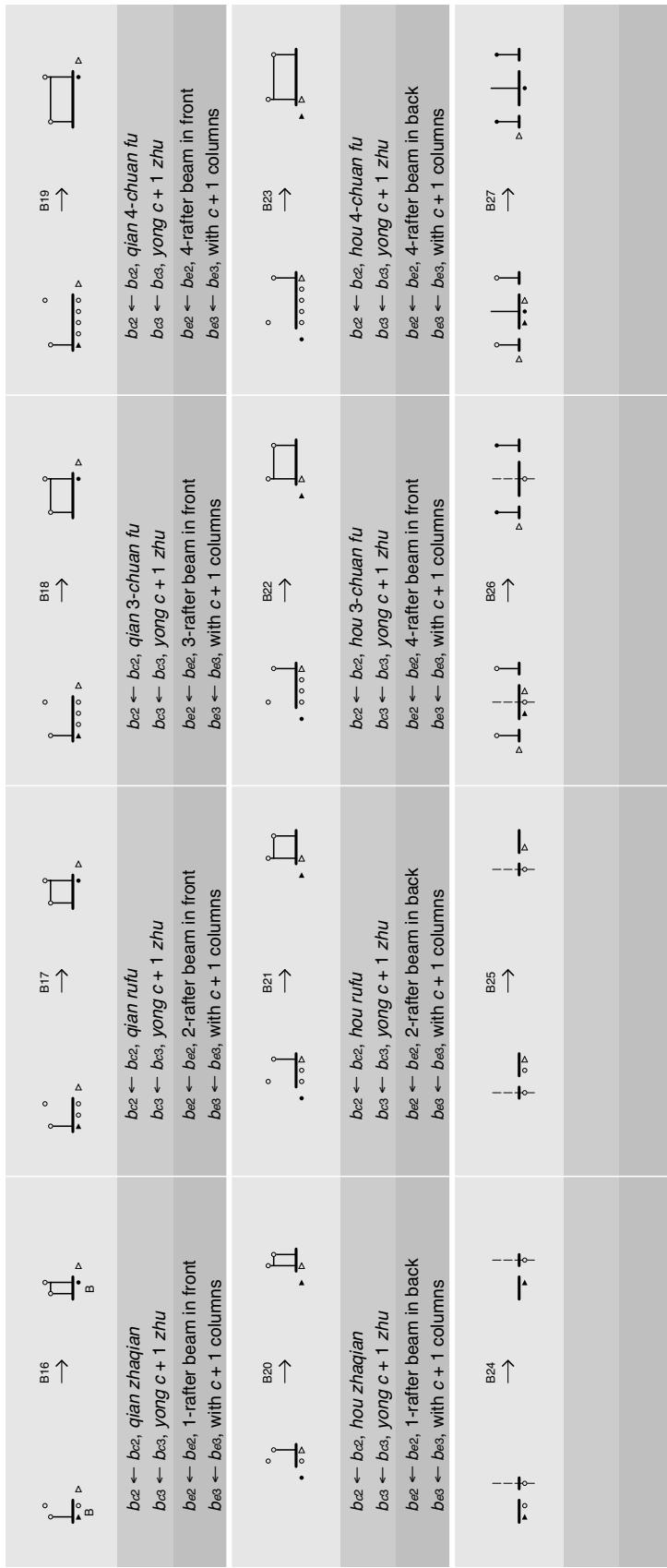


Figure 8b. Schemata for instantiating beams in section diagrams (stage B).

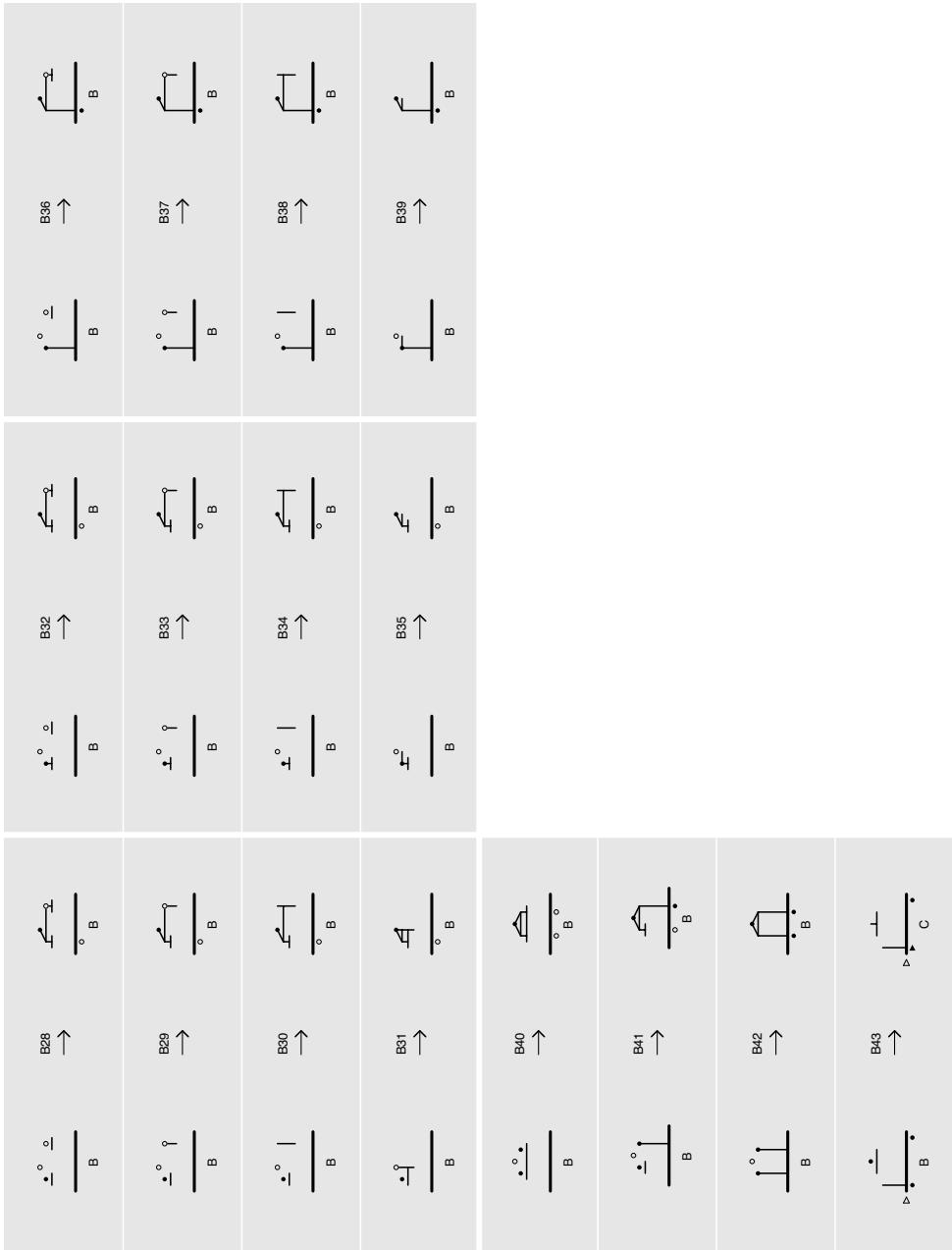


Figure 9a. Schemata for completing section diagrams (stage B).

B44 $\leftarrow qian\ a1\ hou\ a2\ qian\ a3\ hou\ a2a4$	B45 $\leftarrow qian\ a1\ hou\ a2$ $qian\ a1\ hou\ a1$	B46 For $a1 + a2 = c$. $qian\ a1\ hou\ a2 \leftarrow a1\ dui\ a2$ $b_{\leq 3} \leftarrow$ with $c - 1$ columns
$a1$ in front, $a2$ in back, $a3$ in front, $a4$ in back $\leftarrow a1\ a3$ in front, $a2a4$ in back	$a1$ in front, $a1$ in back $\leftarrow a1$ in front and back	For $a1 + a2 = c$. $a1$ in front, $a2$ in back $\leftarrow a1$ abutting $a2$ $b_{\leq 3} \leftarrow$ with $c - 1$ columns
B47 $\leftarrow qian\ hou\ bing\ a1$ $a1a1$ in front and back \leftarrow double $a1$ in front and back	B48 $\leftarrow qian\ hou\ a1a2$ $a1a2$ in front and back $\leftarrow a1a2$ in both front and back	

Figure 9b. Functions for reducing descriptions of section diagrams (stage B).

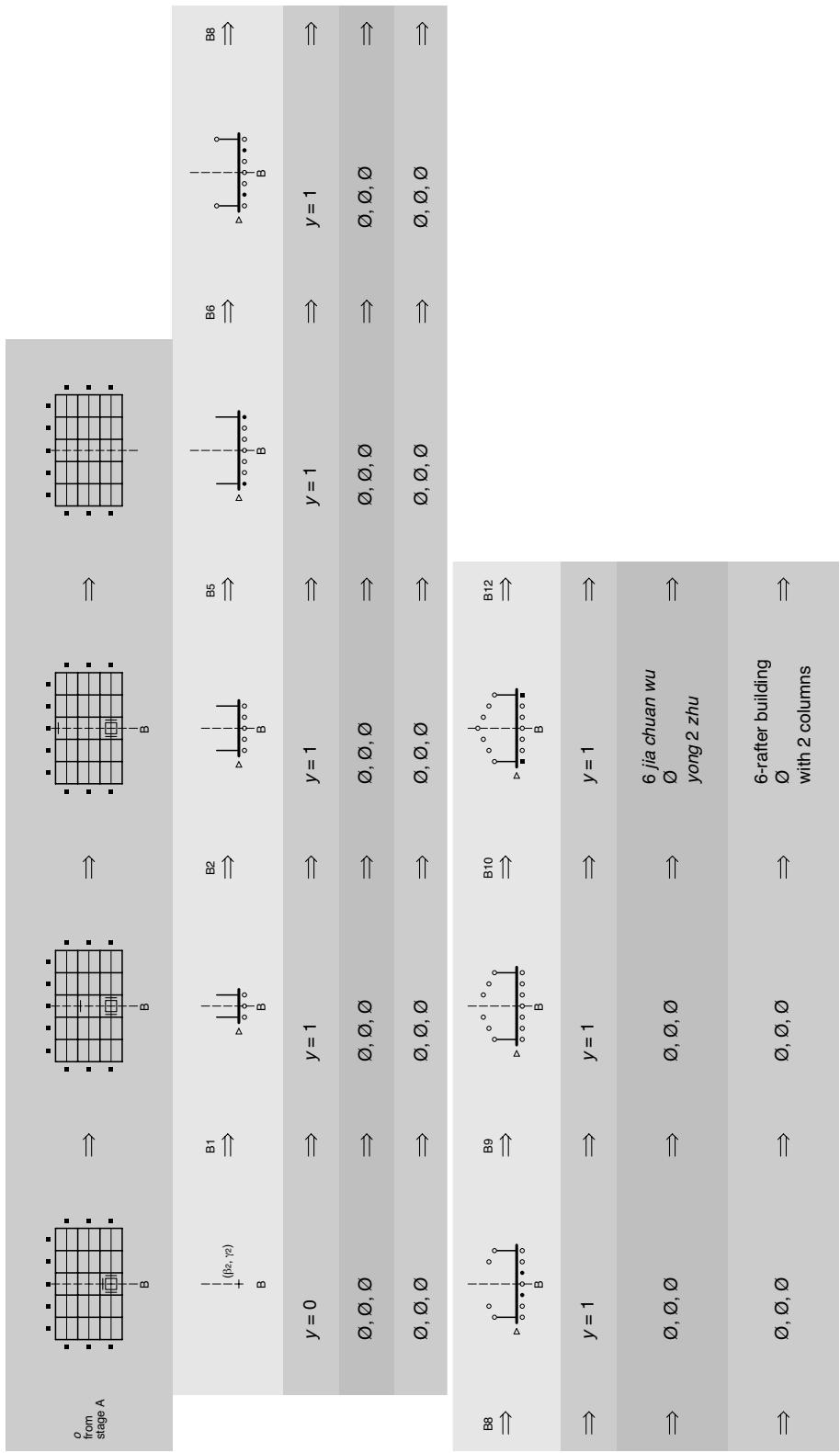


Figure 10. Preparation of a 6-rafter section diagram (stage B).

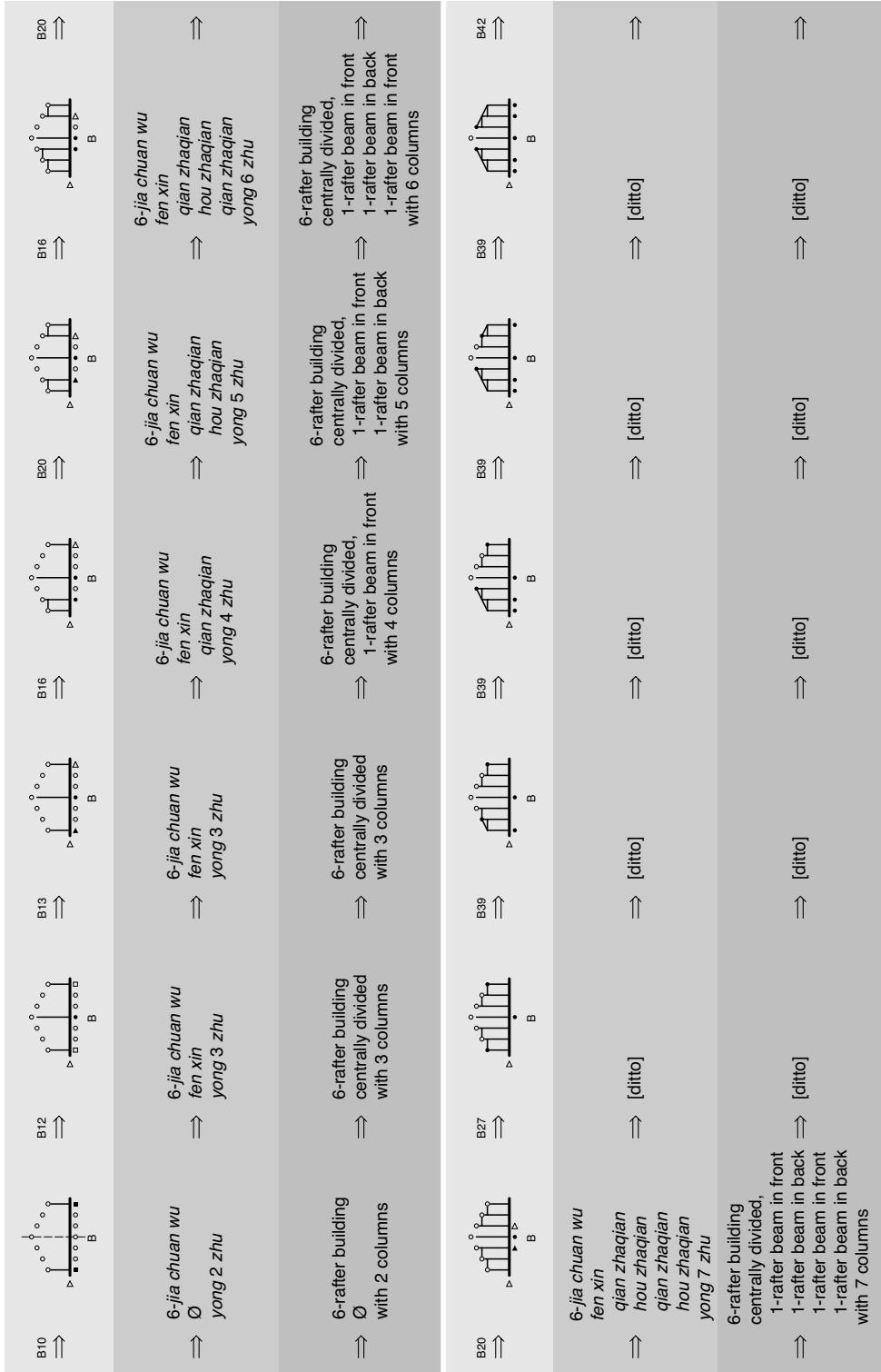


Figure 11a. Derivation of a 6-rafter building, centrally divided, with a double 1-rafter beam in front and back (stage B). This section diagram is probably illegal.

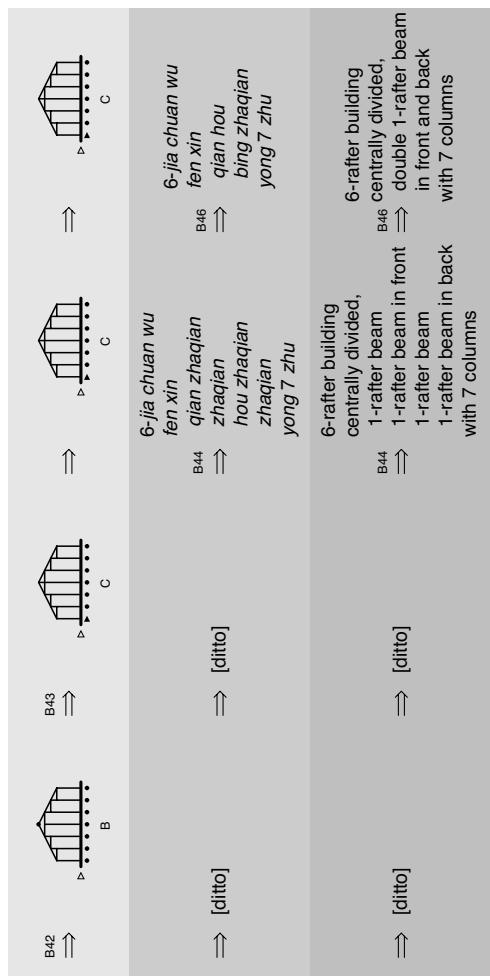


Figure 11b. Derivation of a 6-rafter building, centrally divided, with a double 1-rafter beam in front and back (stage B), continued. This section diagram is probably illegal.

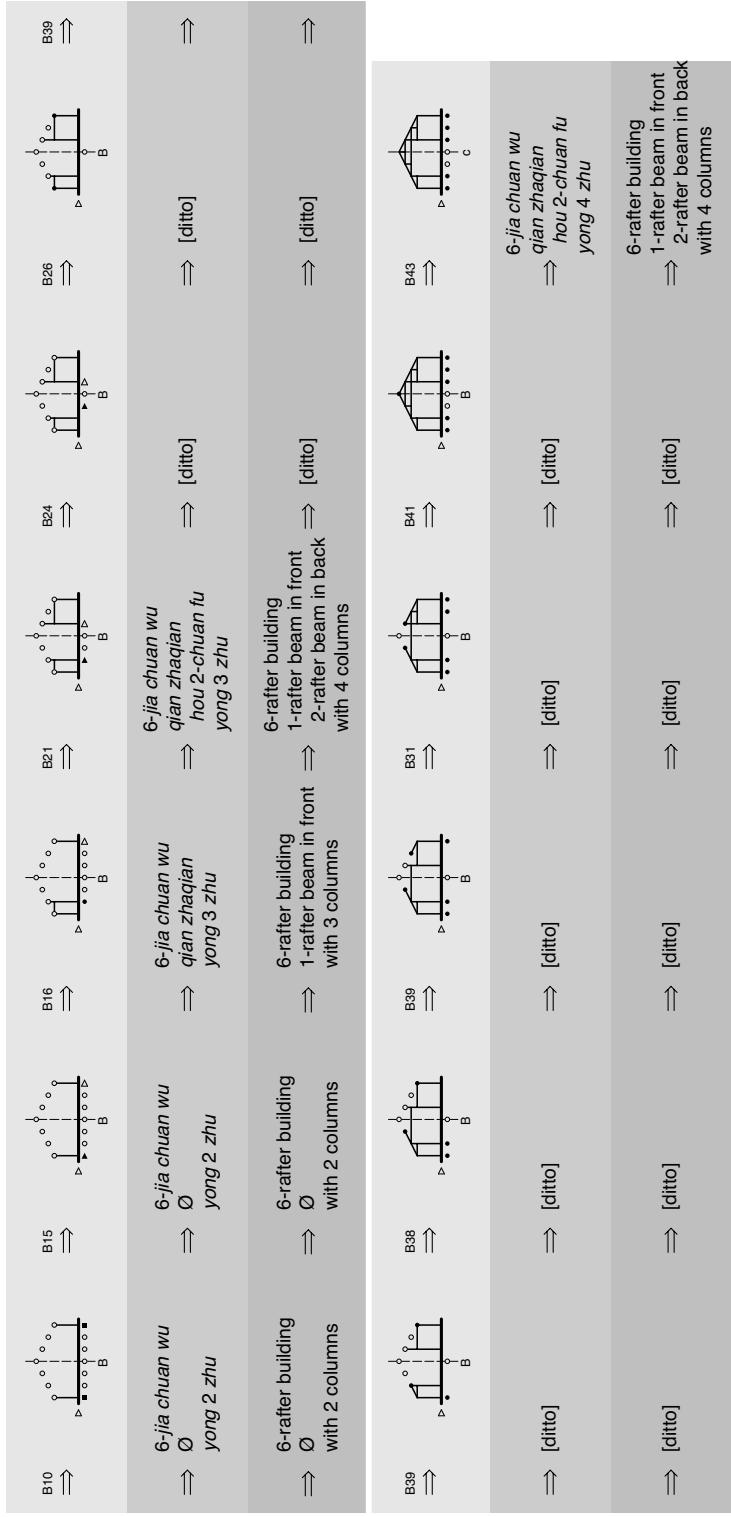


Figure 12. Derivation of a 6-rafter building, 1-rafter beam in front, 2-rafter beam in back, with 4 columns (stage B).

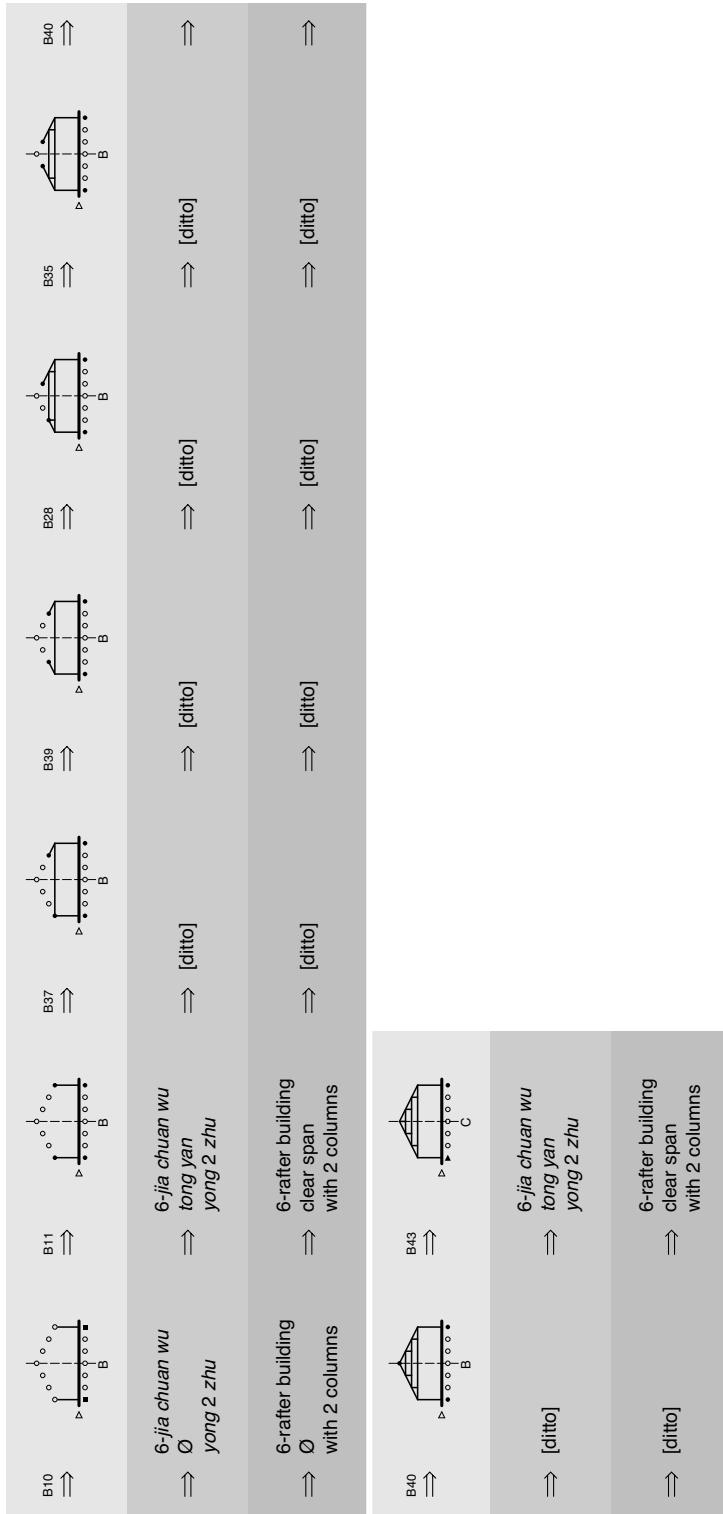


Figure 13. Derivation of a 6-rafter building, clear span, with 2 columns (stage B).

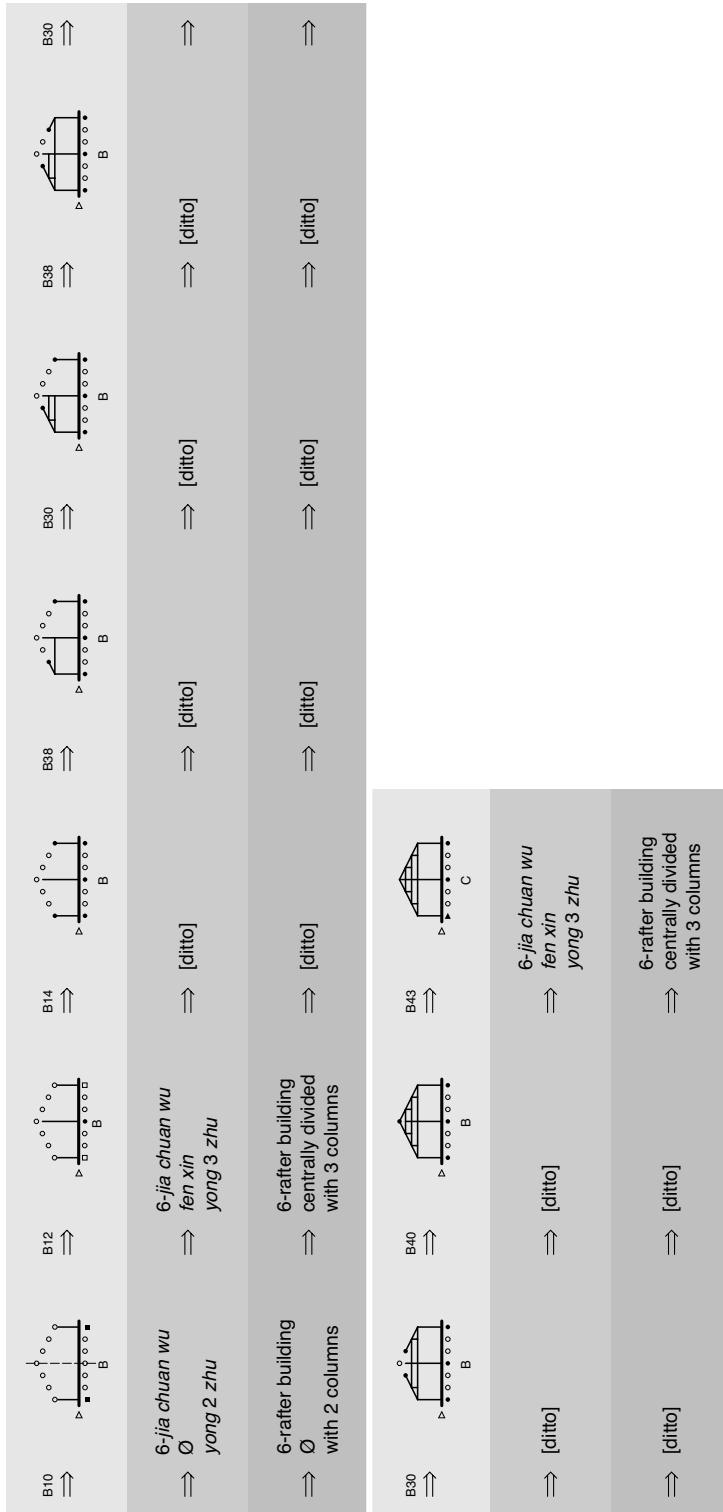


Figure 14. Derivation of a 6-rafter building, centrally divided, with 3 columns (stage B).

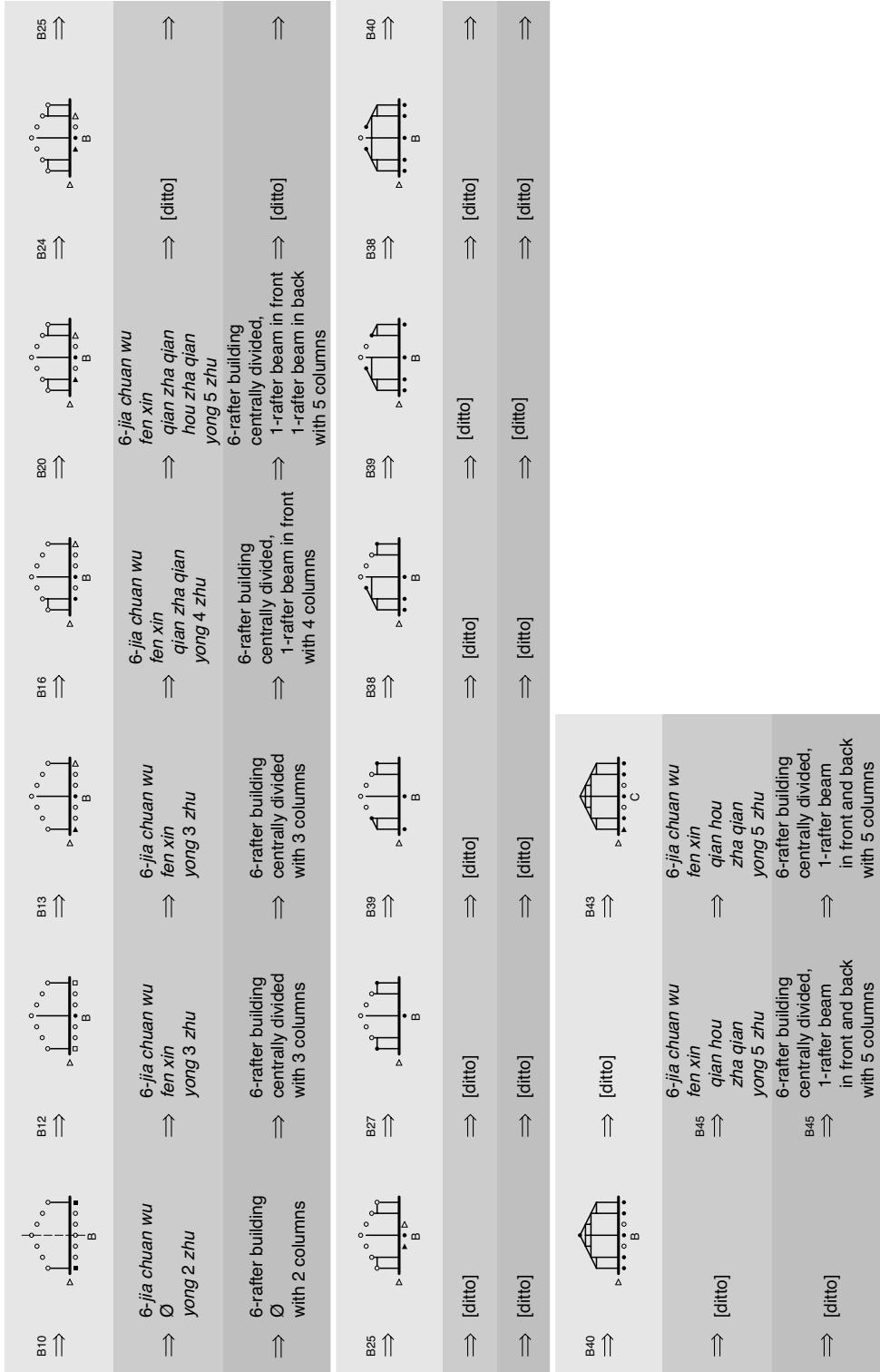
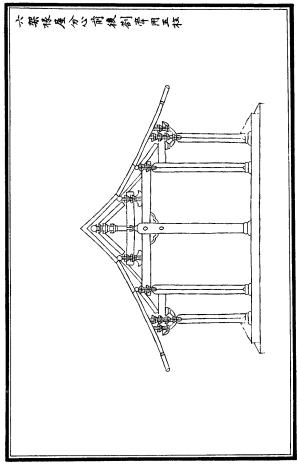
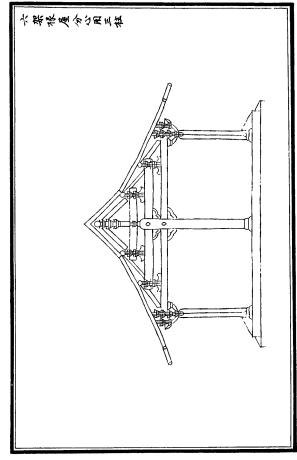


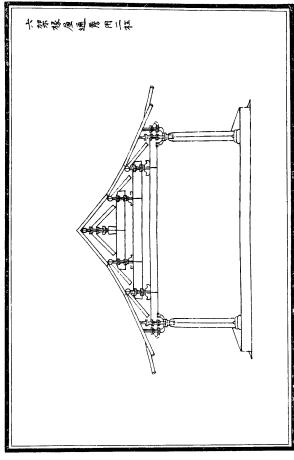
Figure 15. Derivation of a 6-rafter building, centrally divided, 1-rafter beam in front and back, with 5 columns (stage B).



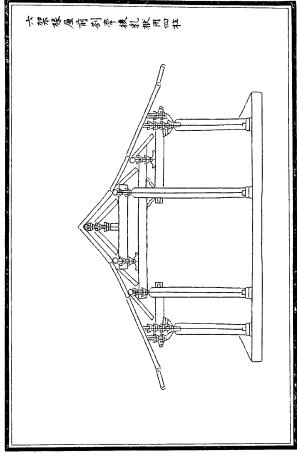
A 6-rafter building, centrally divided, a 1-rafter beam in front and in back, with 5 columns. 6-jia chuan wu, fen xin, qian hou zhaqian, yong 5 zhu.



A 6-rafter building, a 1-rafter beam in front, a 2-rafter beam in back, with 4 columns. 6-jia chuan wu, qian zhaqian, hou rufu, yong 4 zhu.



A 6-rafter building, clear span, with 2 columns. 6-jia chuan wu, fen xin, yong 2 zhu.



A 6-rafter building, centrally divided, a double 2-rafter beam in front and back, with 7 columns. 6-jia chuan wu, fen xin, qian hou bing zhaqian, yong 7 zhu.

Figure 16. New 6-rafter section diagrams with descriptions (stage B). Whether or not they are legal is for the user to determine.

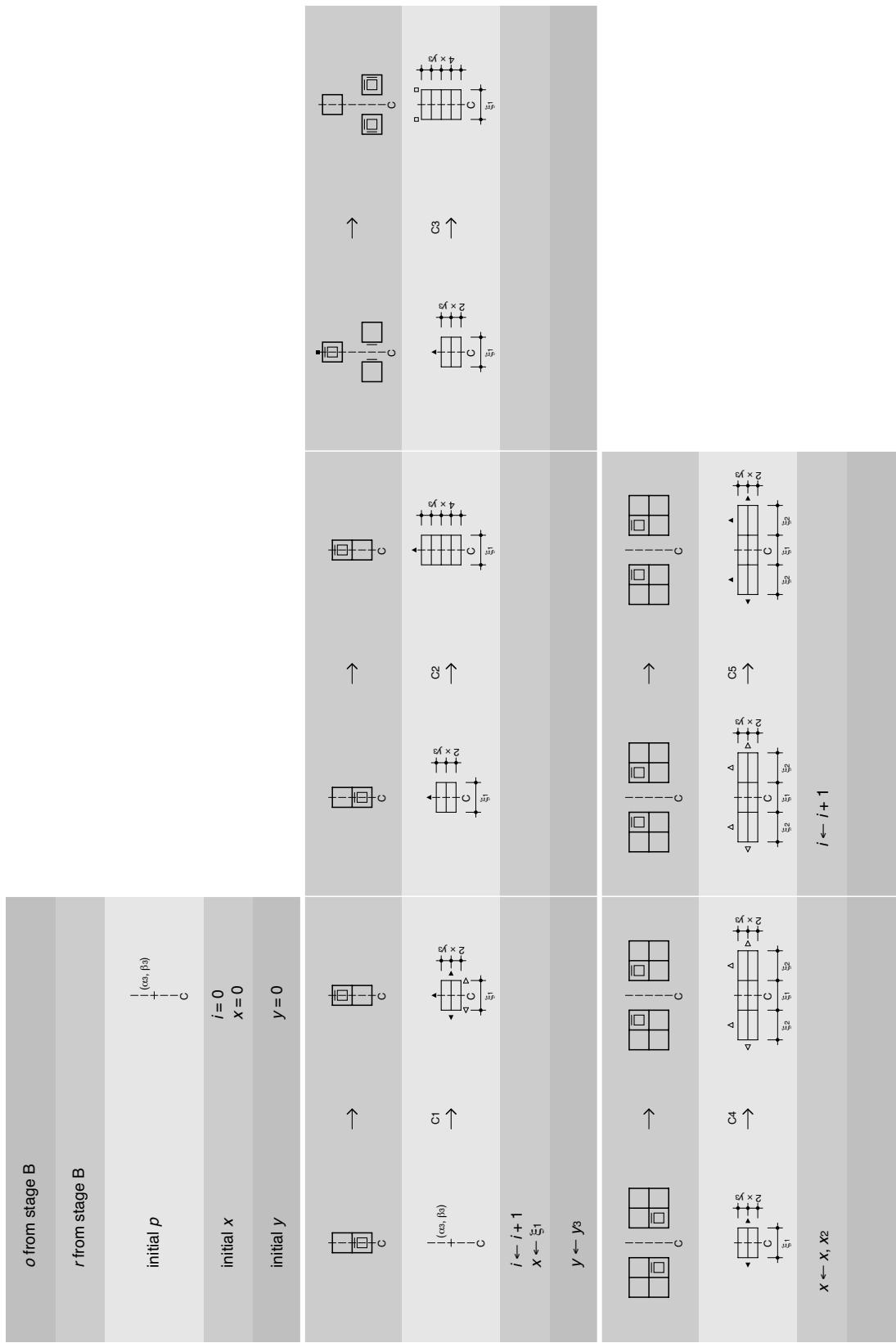


Figure 17a. Schemata for generating plans (stage C).

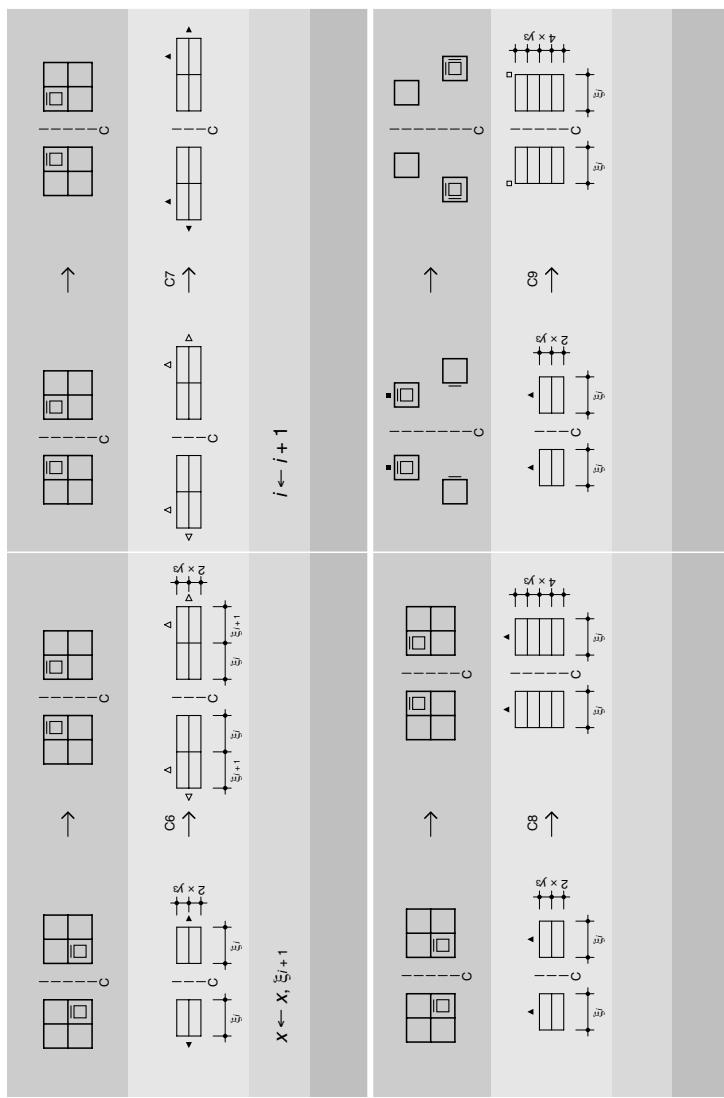


Figure 17b. Schemata for generating plans (stage C).

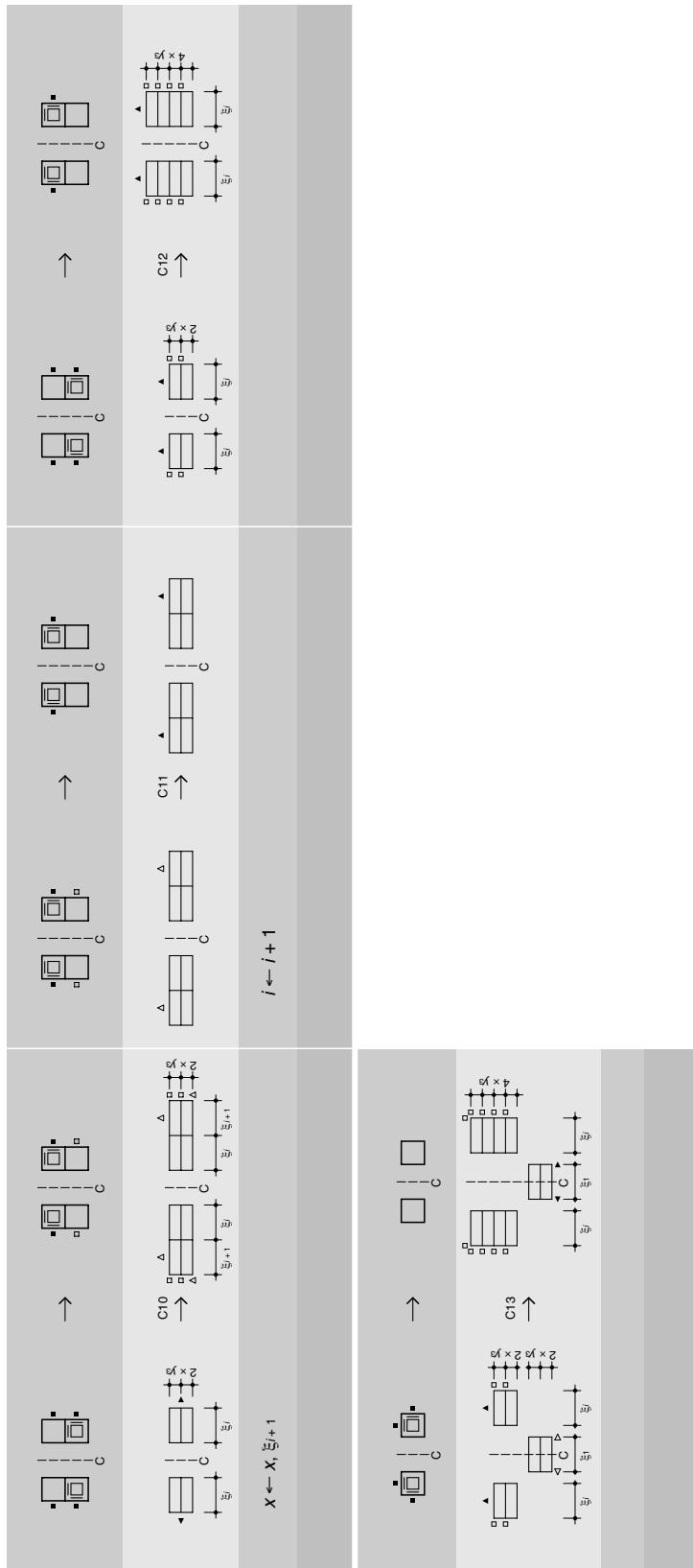


Figure 17c. Schemata for generating plans (stage C).

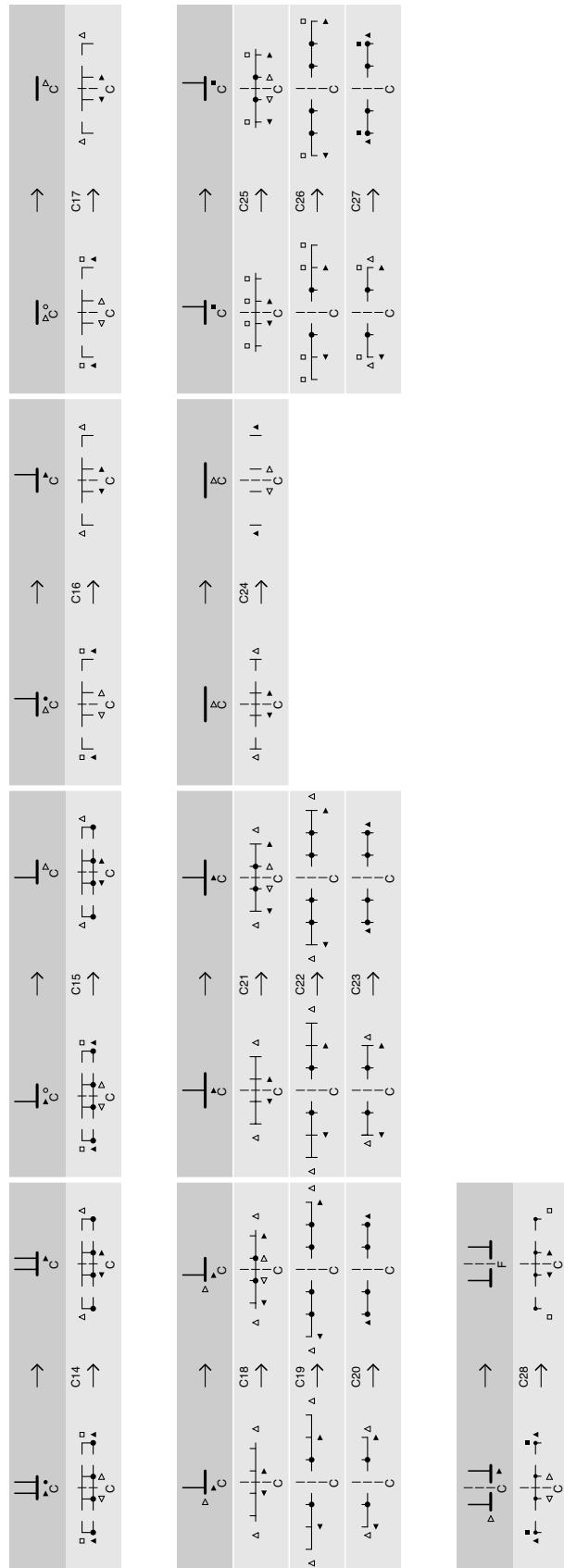


Figure 18. Schemata for instantiating the disposition of beams in plans (stage C).

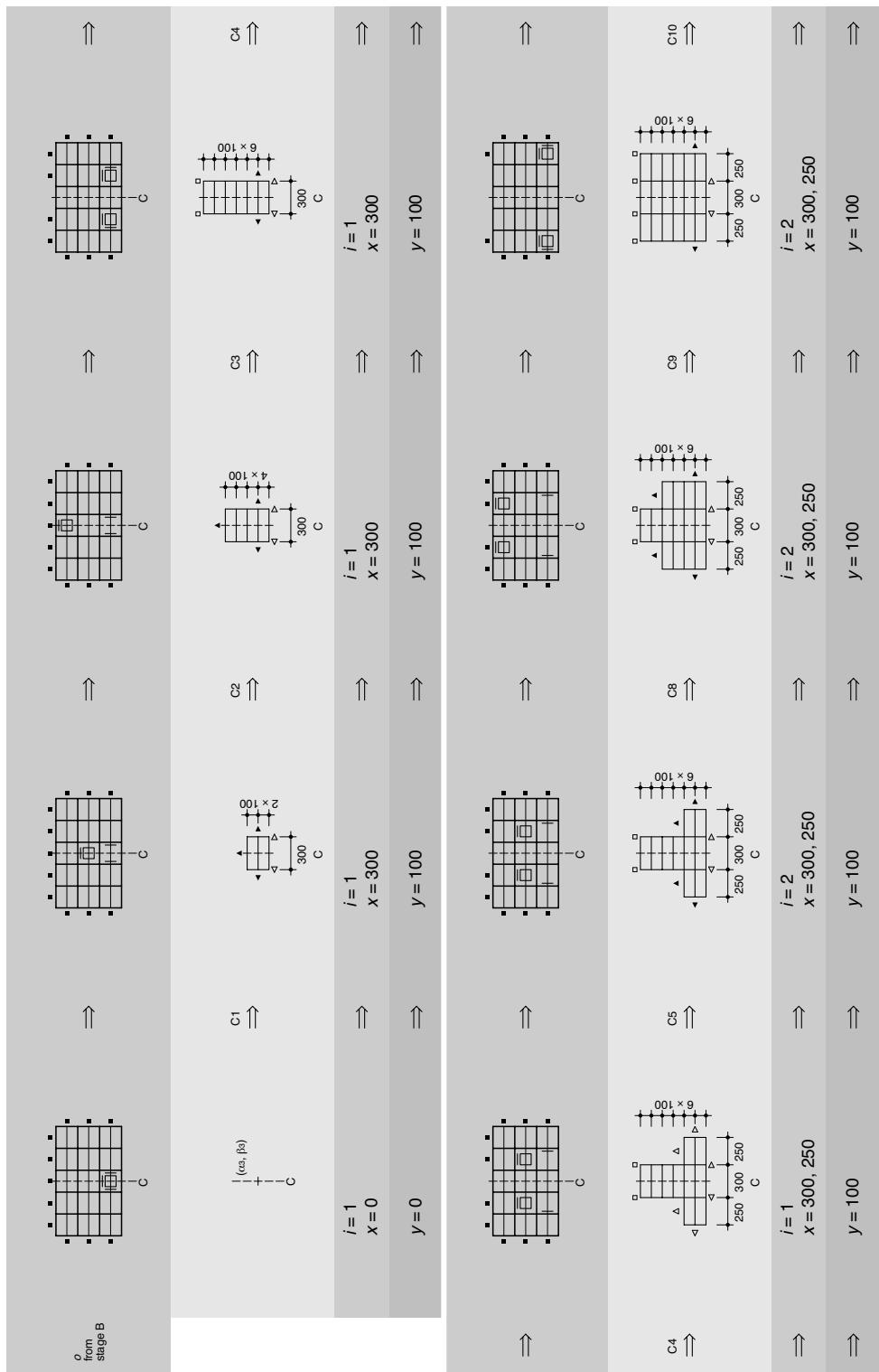


Figure 19a. Derivation of a plan with $x = (300, 250, 200)$ and $y = 100$ (stage C).

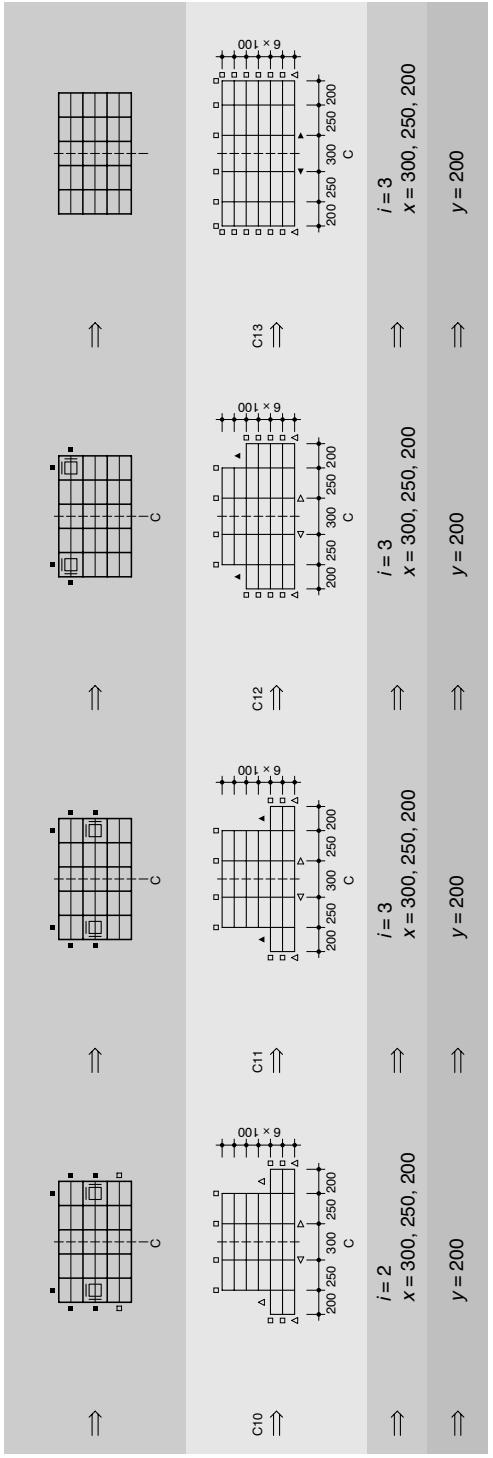


Figure 19b. Derivation of a plan with $x = (300, 250, 200)$ and $y = 100$ (stage C), continued.

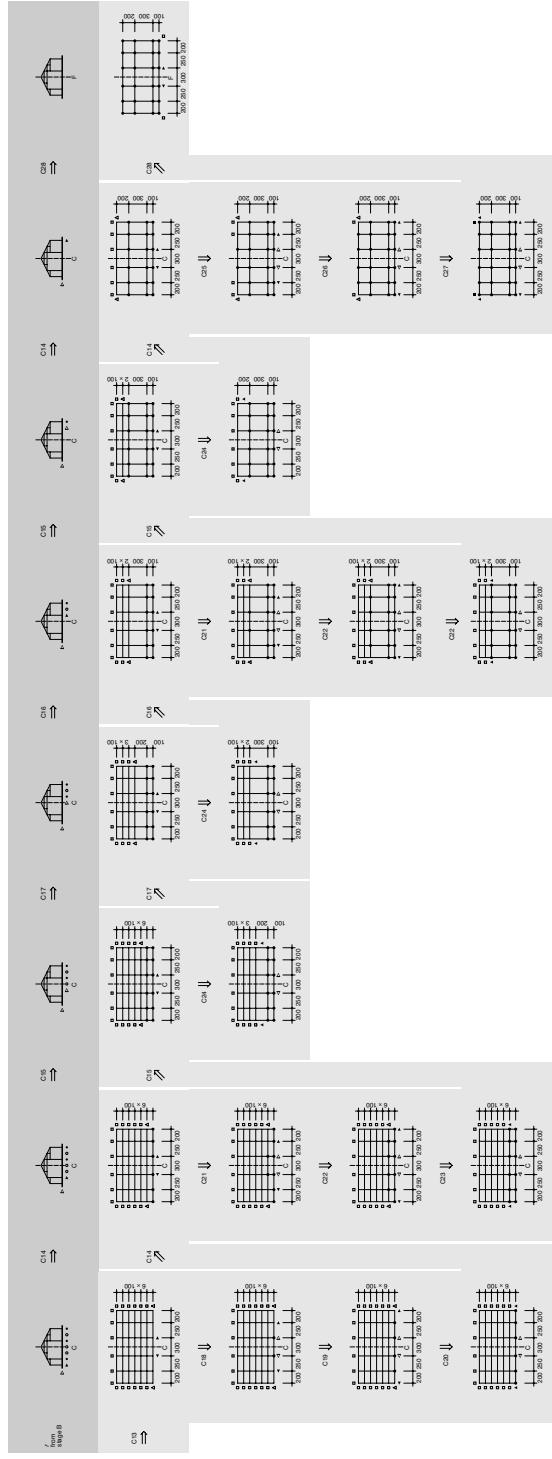


Figure 20a. Derivation of the plan of a 6-rafter building, 1-rafter beam in front, 2-rafter beam in back, with 4 columns (stage C). Reduced version of figures 20b–c.

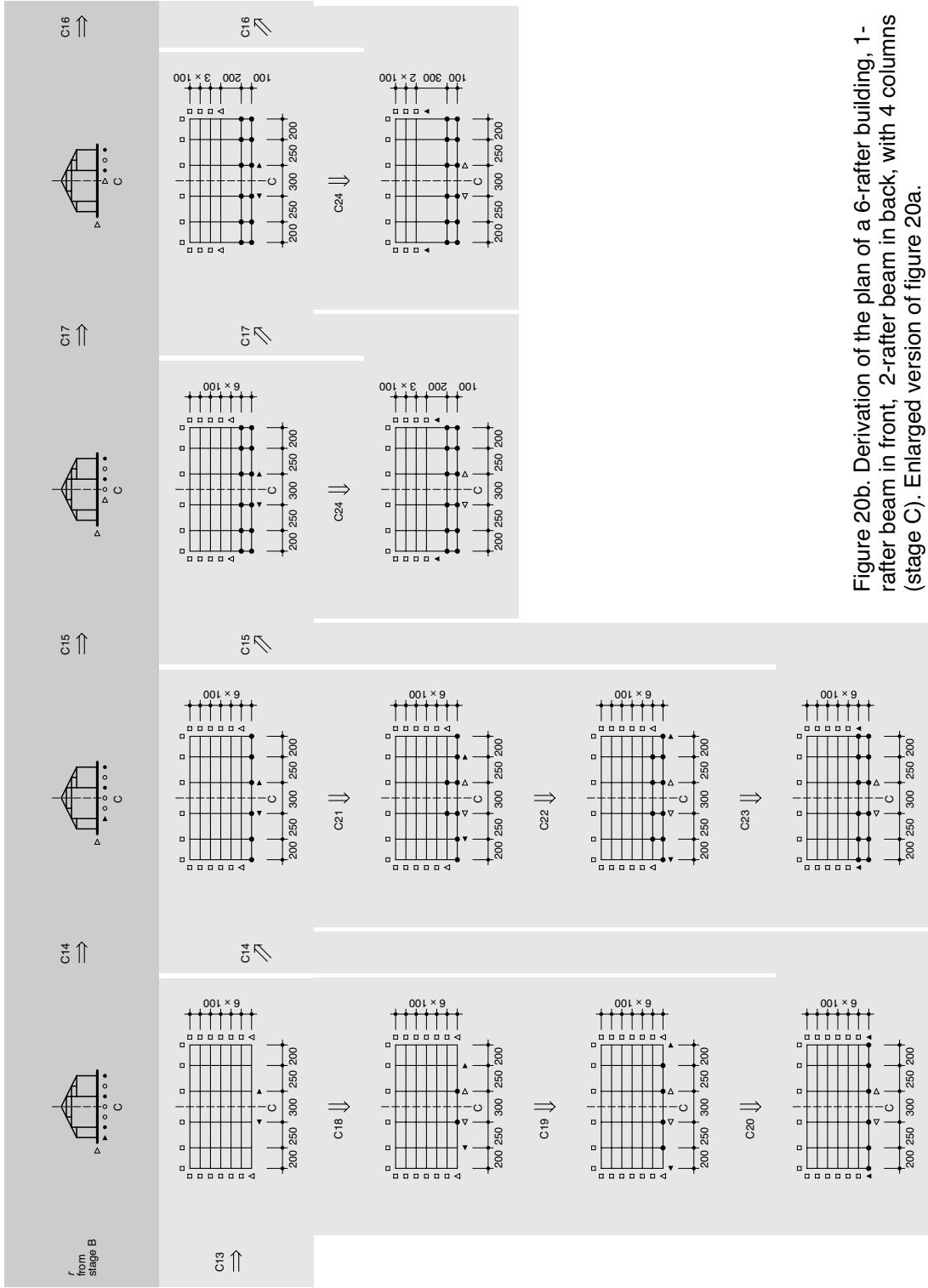


Figure 20b. Derivation of the plan of a 6-rafter building, 1-rafter beam in front, 2-rafter beam in back, with 4 columns (stage C). Enlarged version of figure 20a.

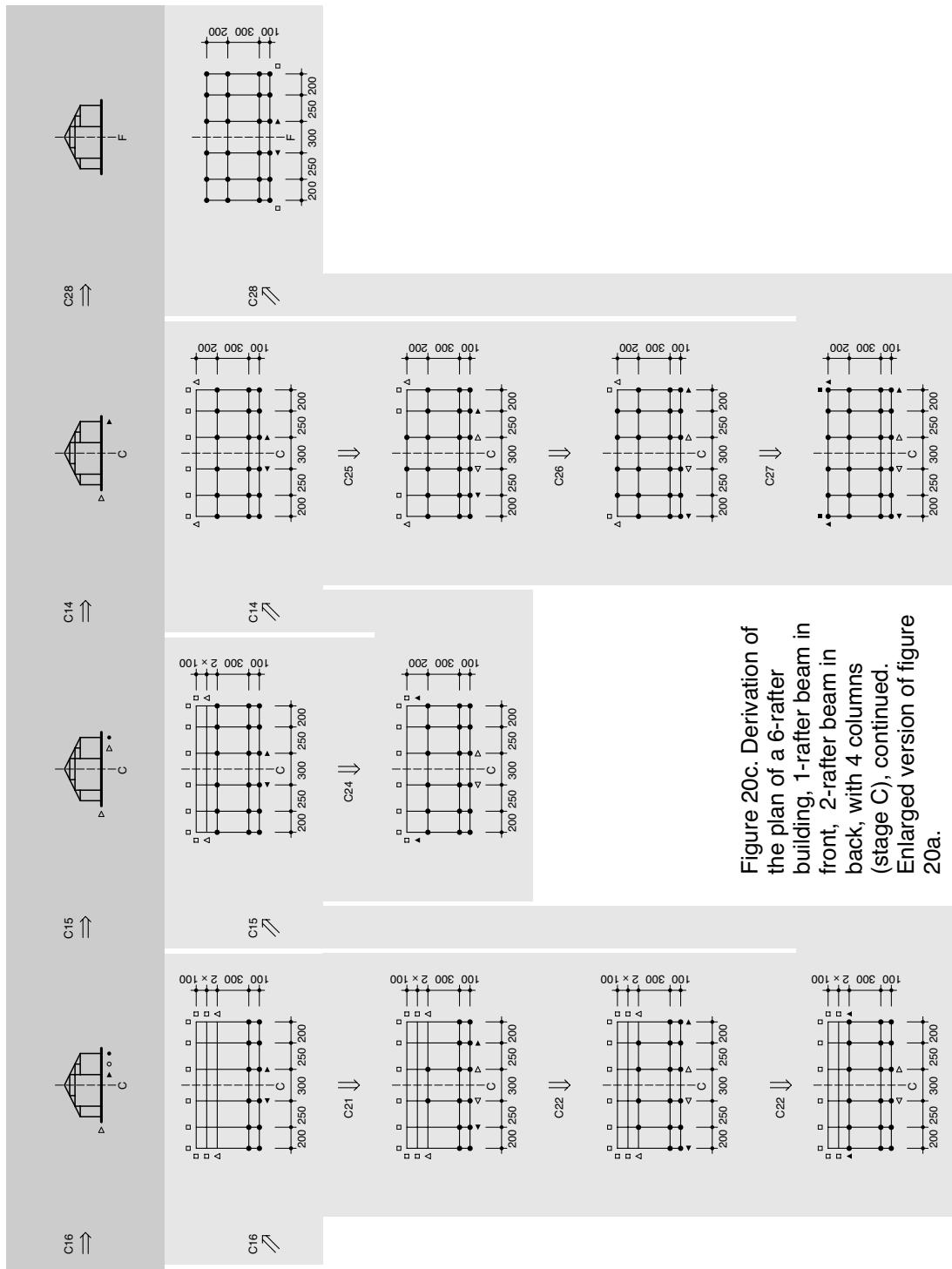


Figure 20c. Derivation of the plan of a 6-rafter building, 1-rafter beam in front, 2-rafter beam in back, with 4 columns (stage C), continued. Enlarged version of figure 20a.

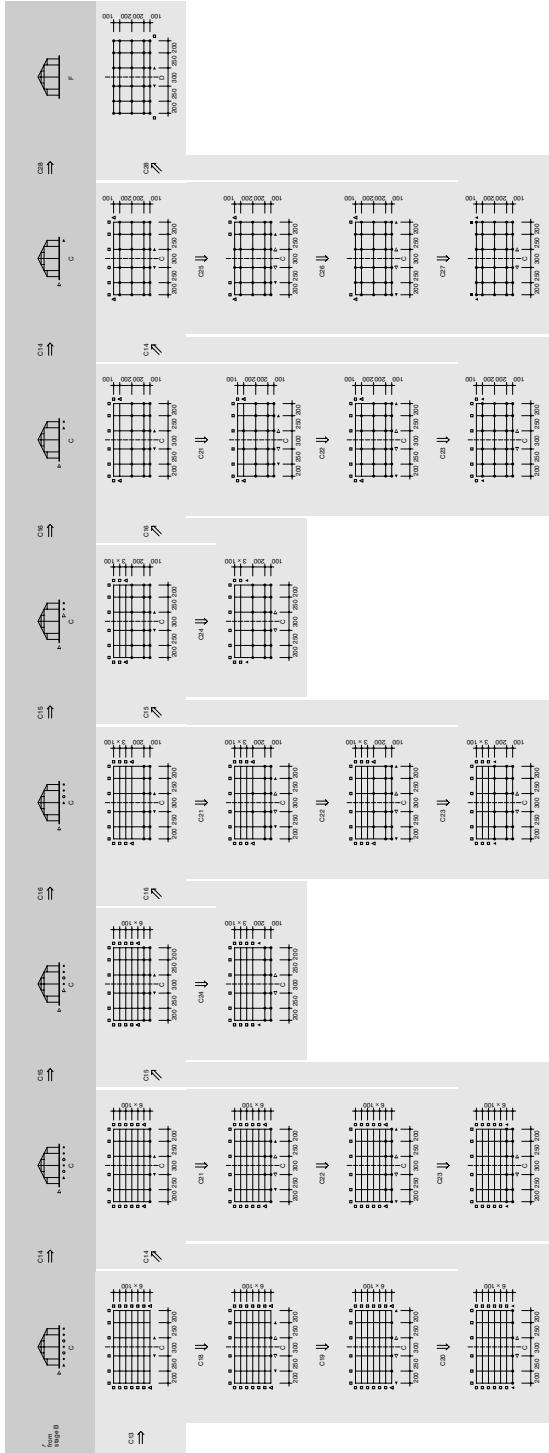


Figure 21a. Derivation of the plan of a 6-rafter building, centrally divided, a 1-rafter beam in front and back, with 3 columns (stage C). Reduced version of figures 21b–c.

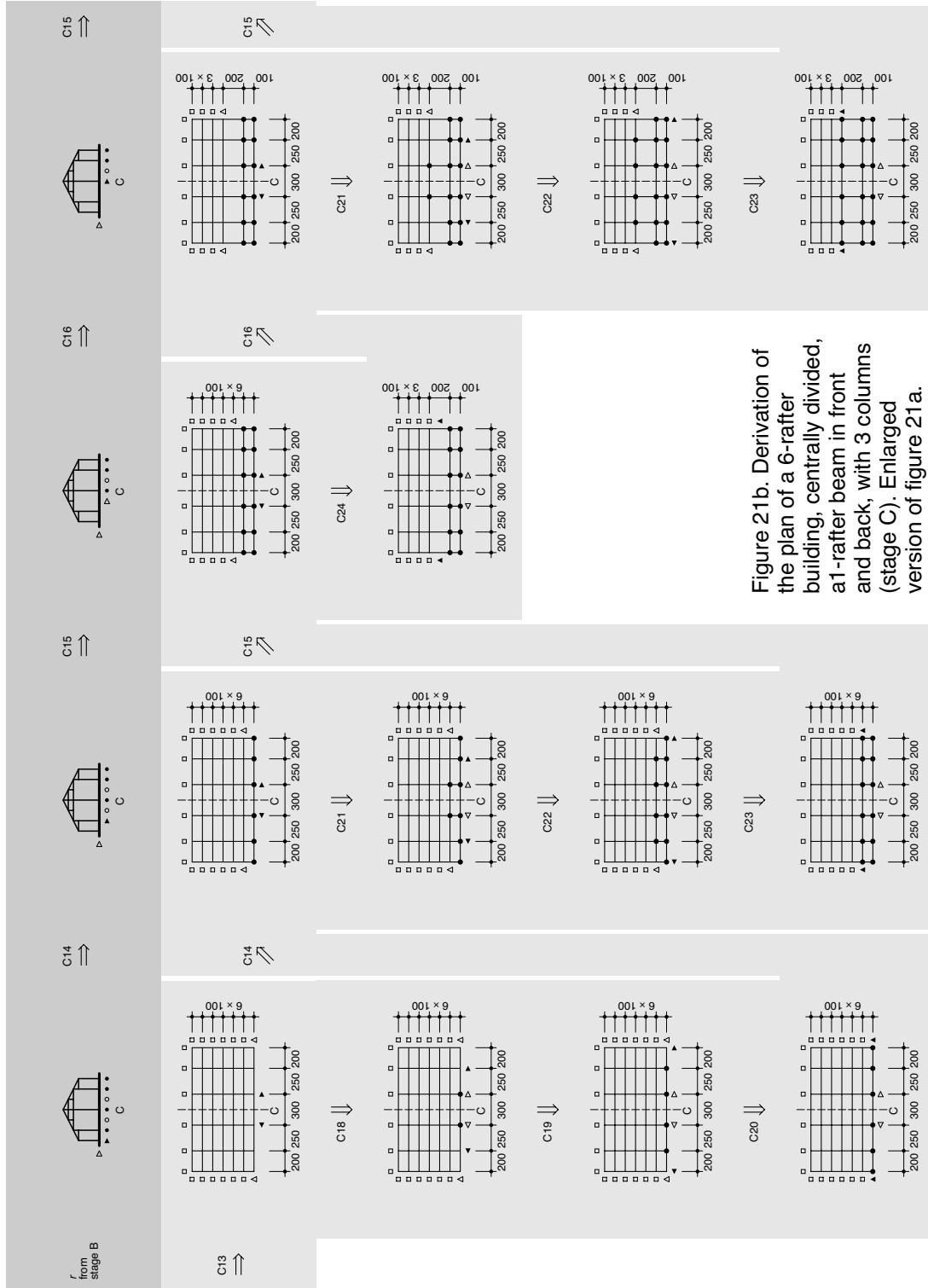


Figure 21b. Derivation of the plan of a 6-rafter building, centrally divided, a1-rafter beam in front and back, with 3 columns (stage C). Enlarged version of figure 21a.

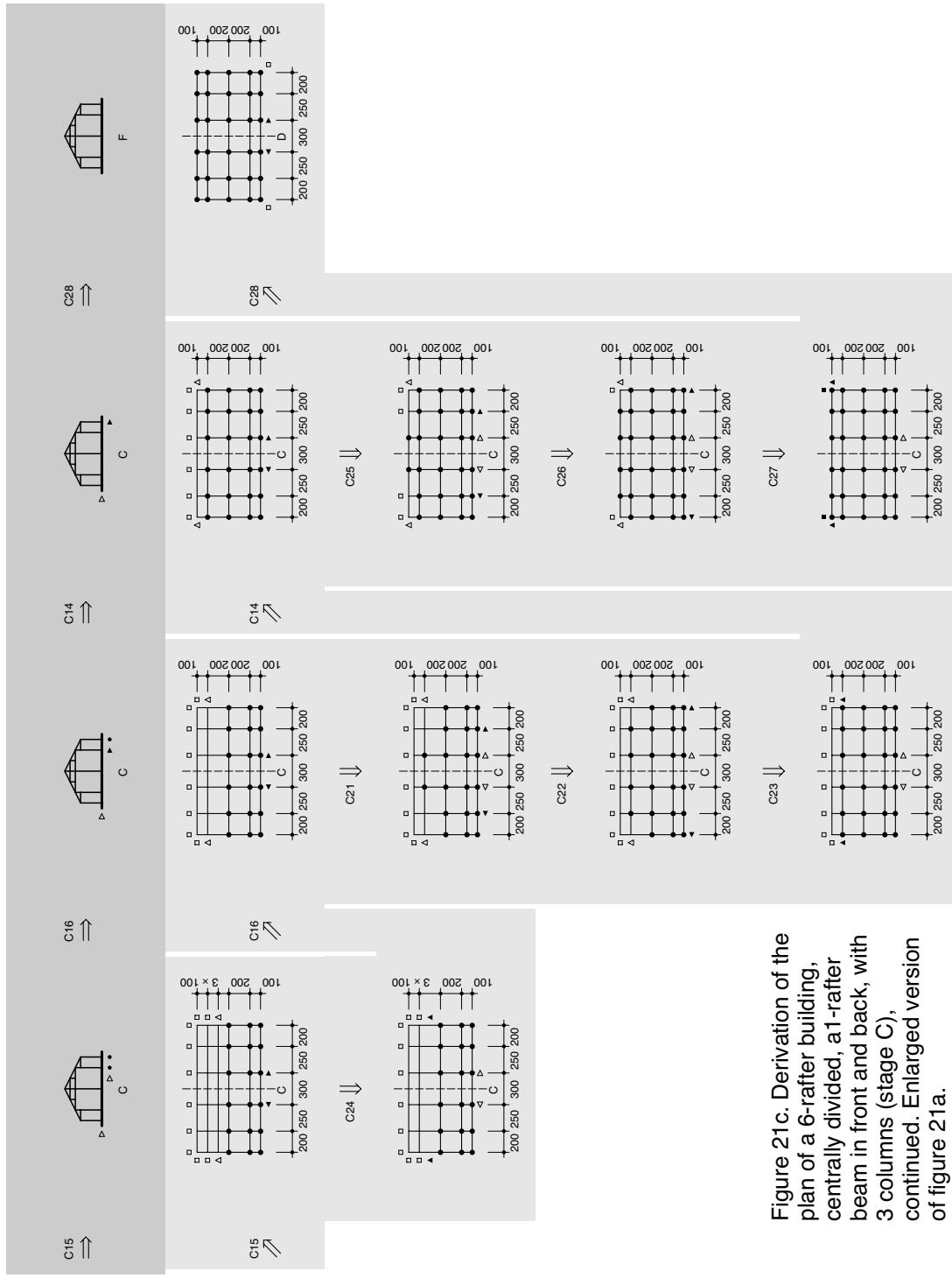


Figure 21c. Derivation of the plan of a 6-rafter building, centrally divided, a1-rafter beam in front and back, with 3 columns (stage C), continued. Enlarged version of figure 21a.

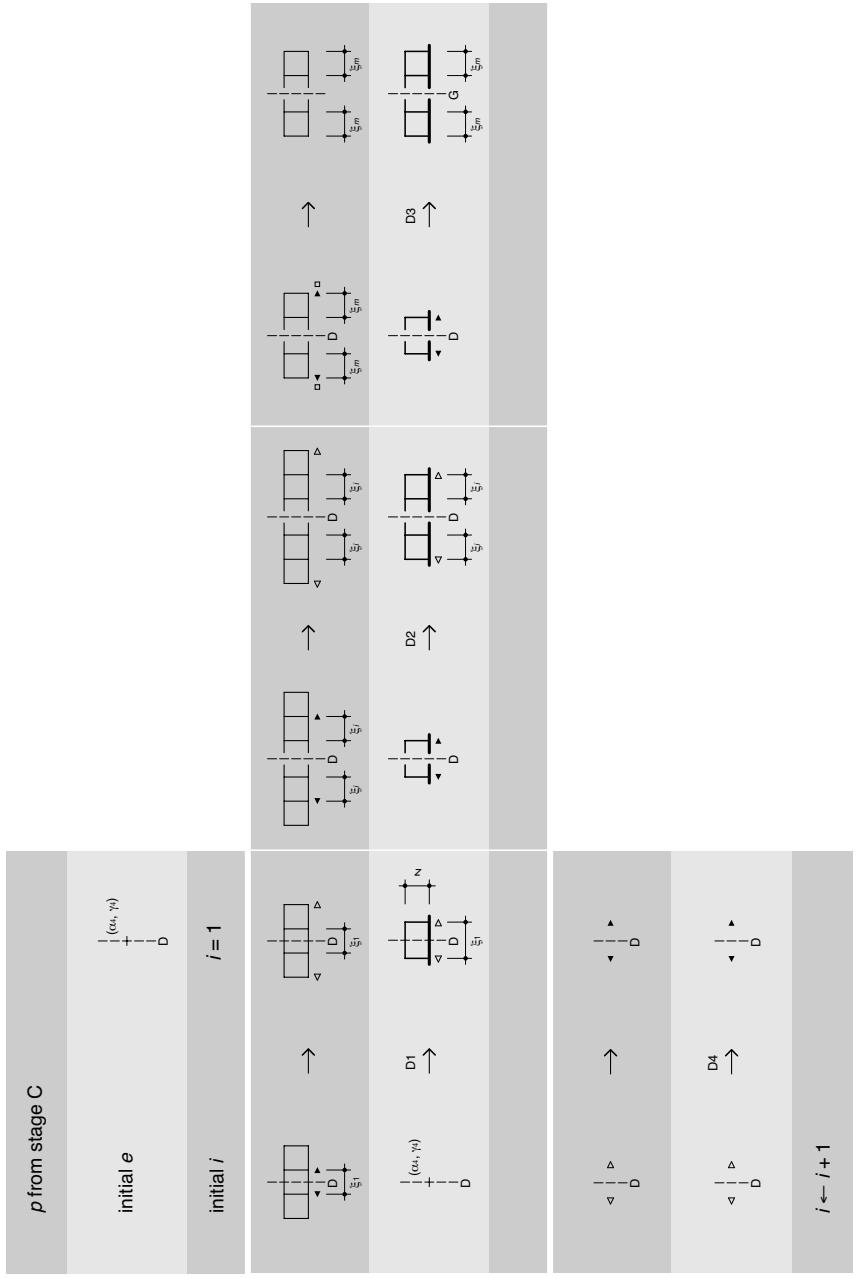


Figure 22. Schemata for generating partial scale elevations (stage D).

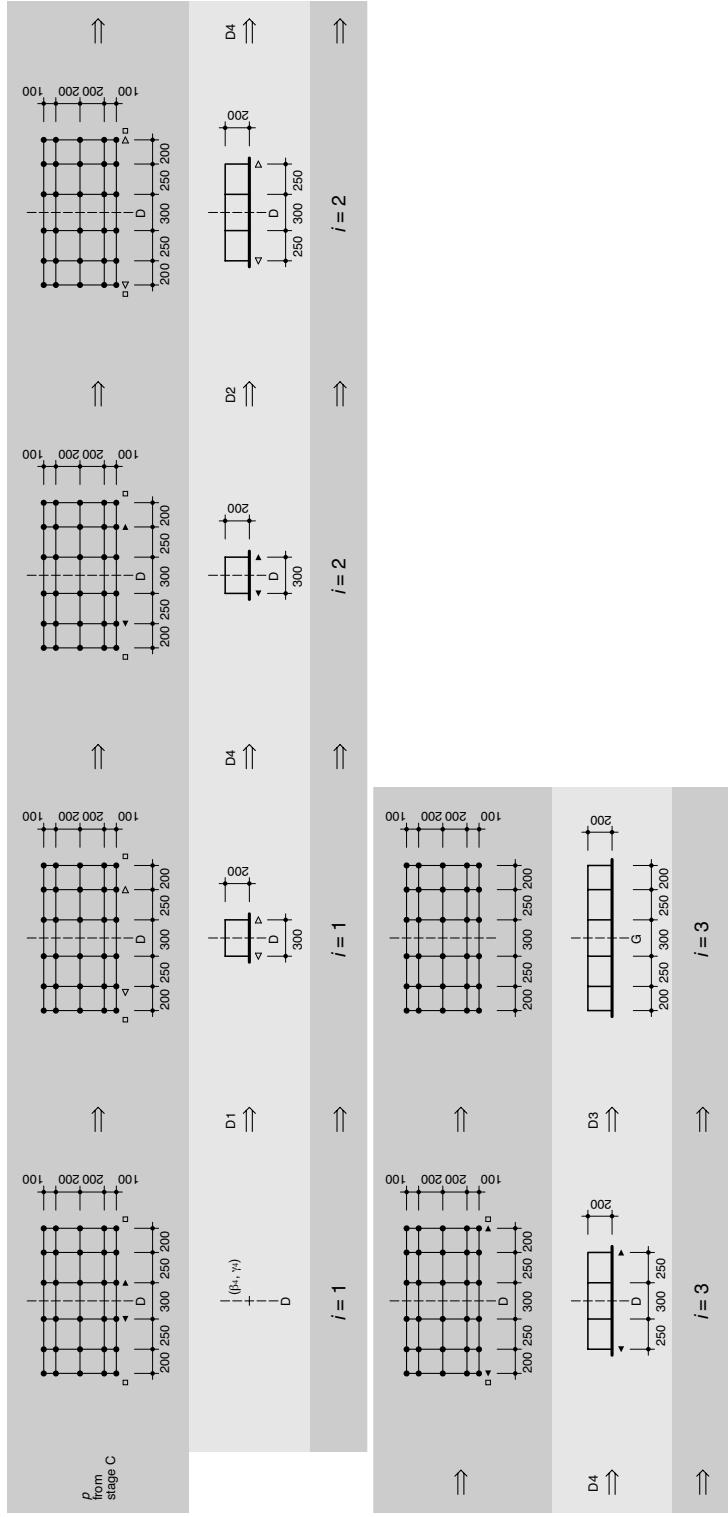


Figure 23. Derivation of a partial elevation with $x = (300, 250, 200)$ and $z = 200$ (stage D).

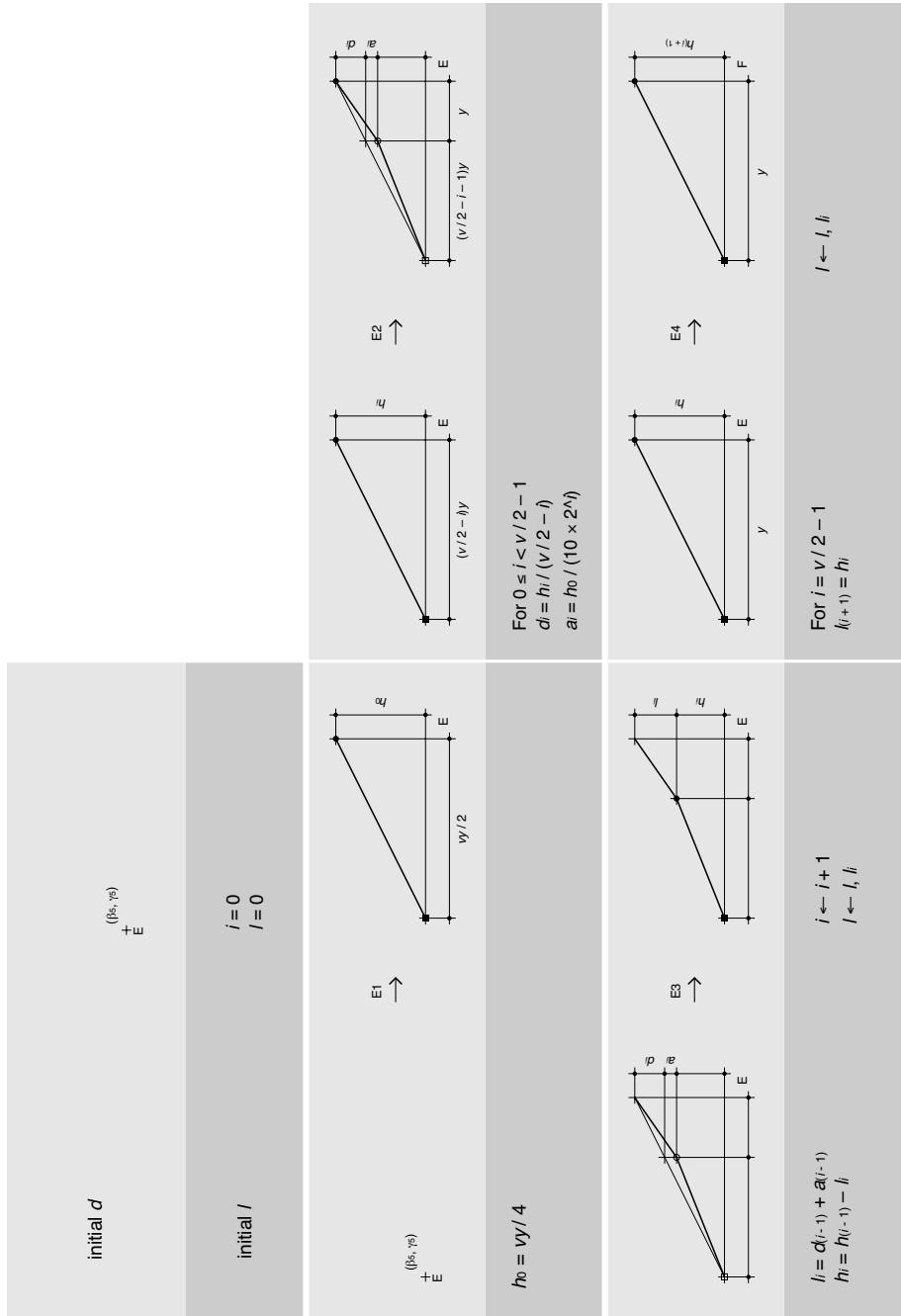


Figure 24. Schemata for generating the roof section, *juzhe* (stage E).

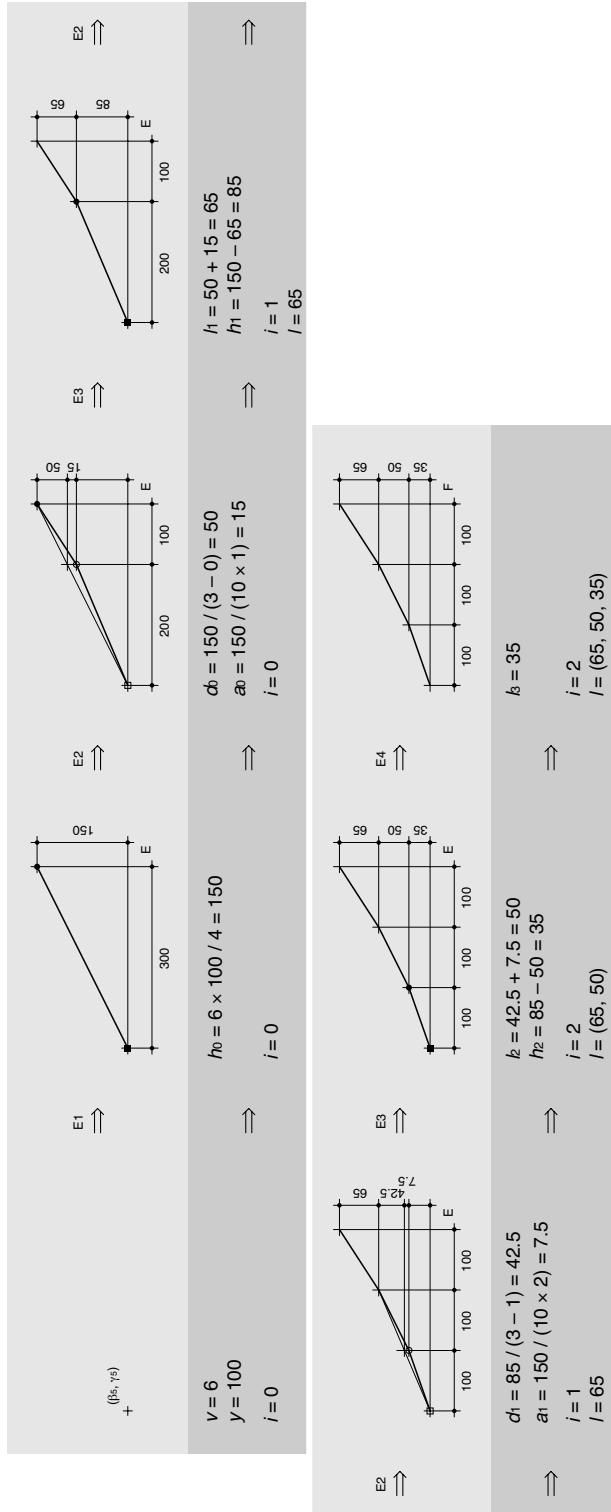


Figure 25. Derivation of a roof section with $v = 6$ and $y = 100$ (stage E).