

Dimensionamento de lajes maciças

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Exemplo

Determine a armadura das lajes a seguir, sabendo que:

$f_{ck}=30$ MPa

Classe de agressividade 3

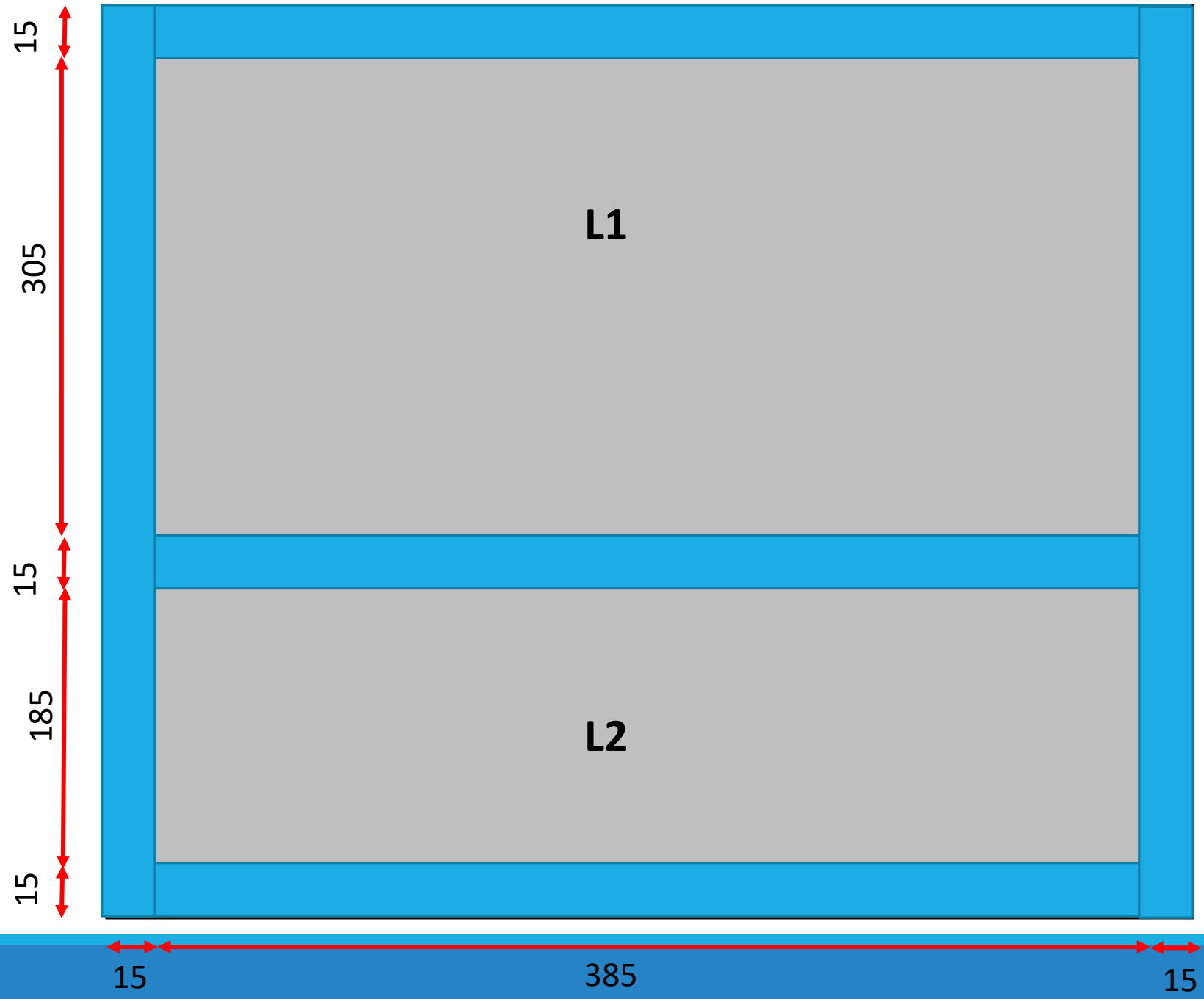
As lajes serão utilizadas para uma edificação residencial (quarto, sala)

na laje 1: Revestimento cerâmico de espessura de 5 cm

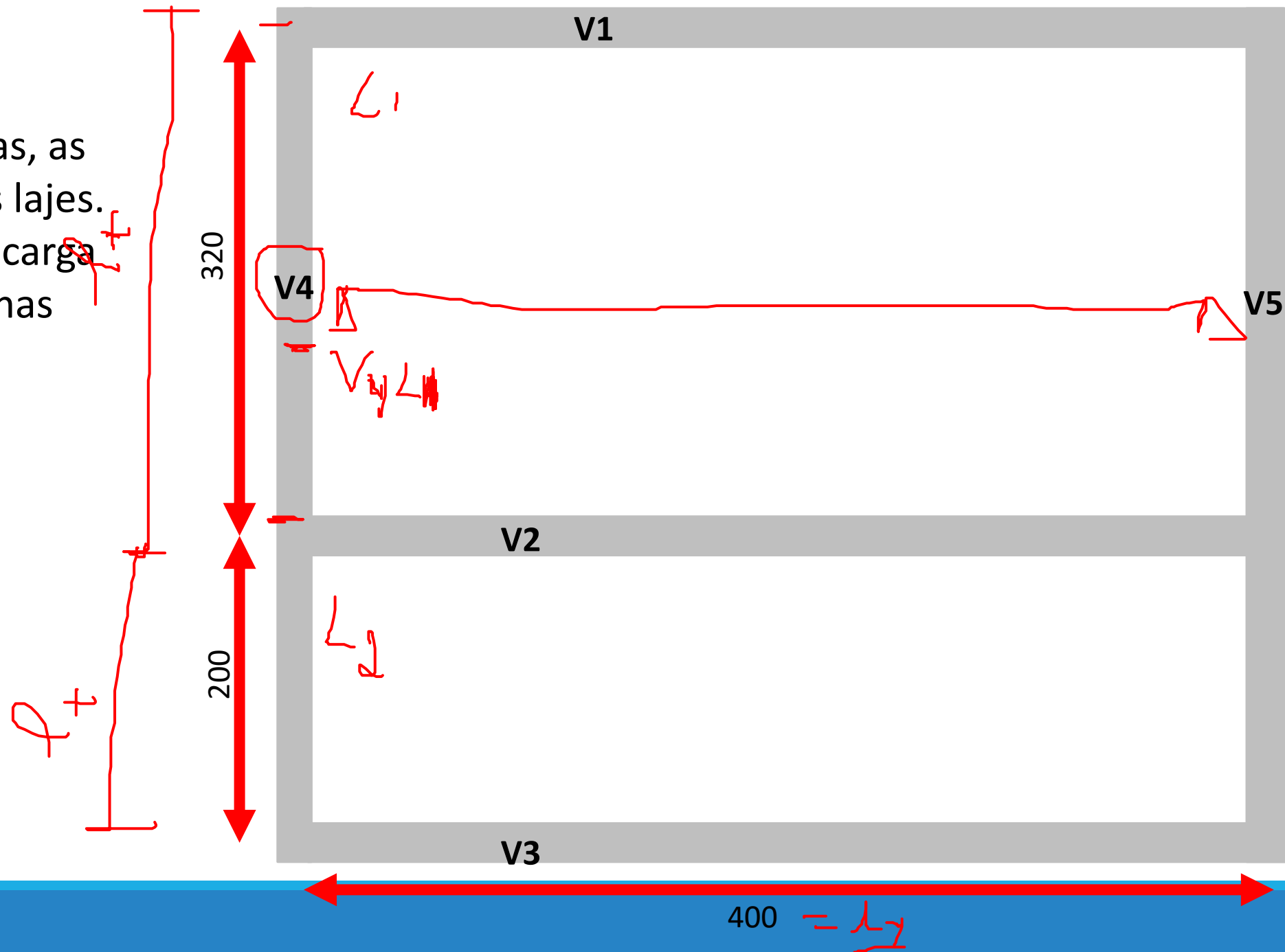
na laje 2: Revestimento cerâmico de espessura de 7 cm

Lajes maciças

Considere pilares embutidos nas paredes



No sistema com vigas, as vigas são apoios das lajes. Como determinar a carga de reação das lajes nas vigas?

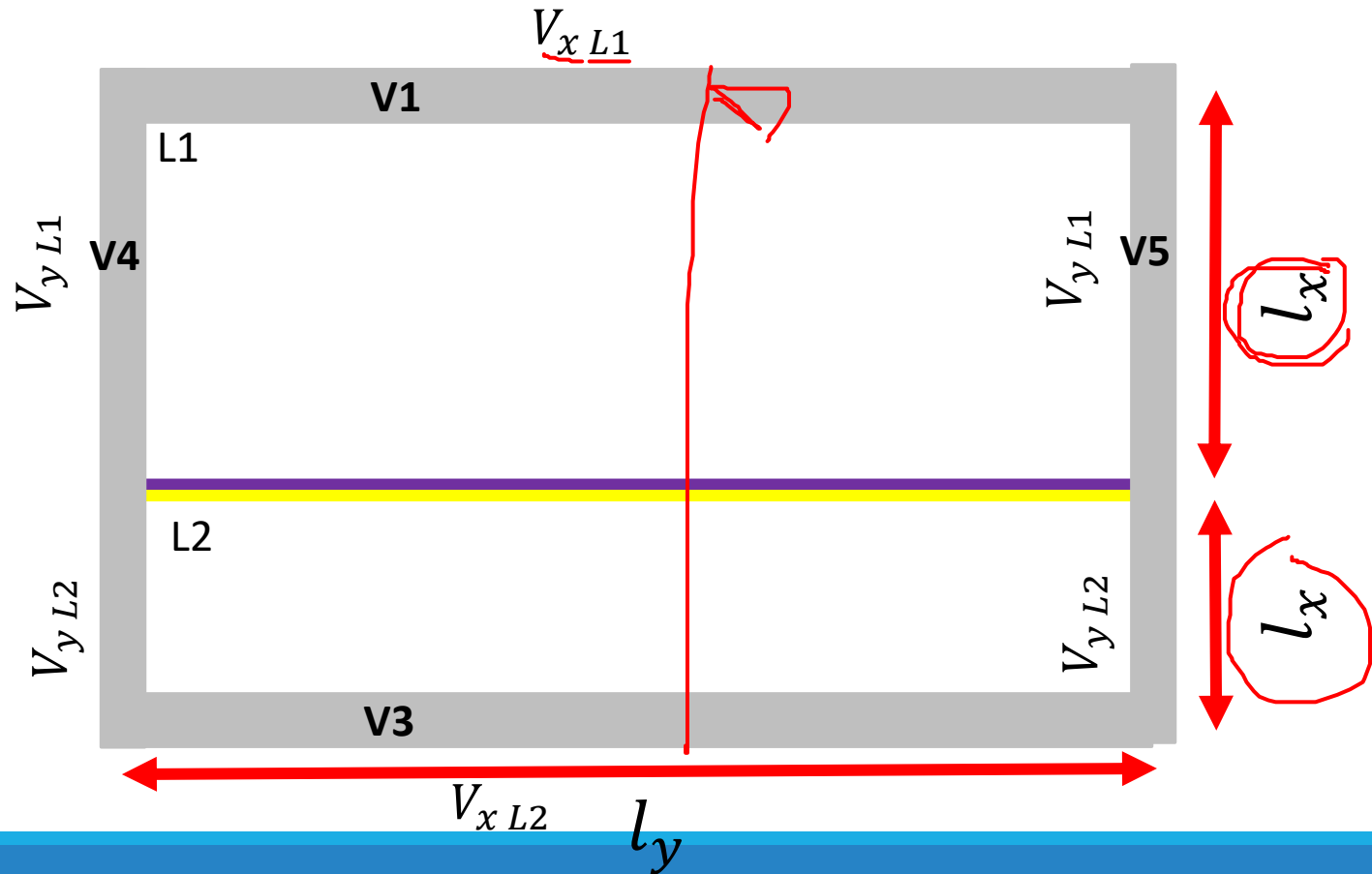


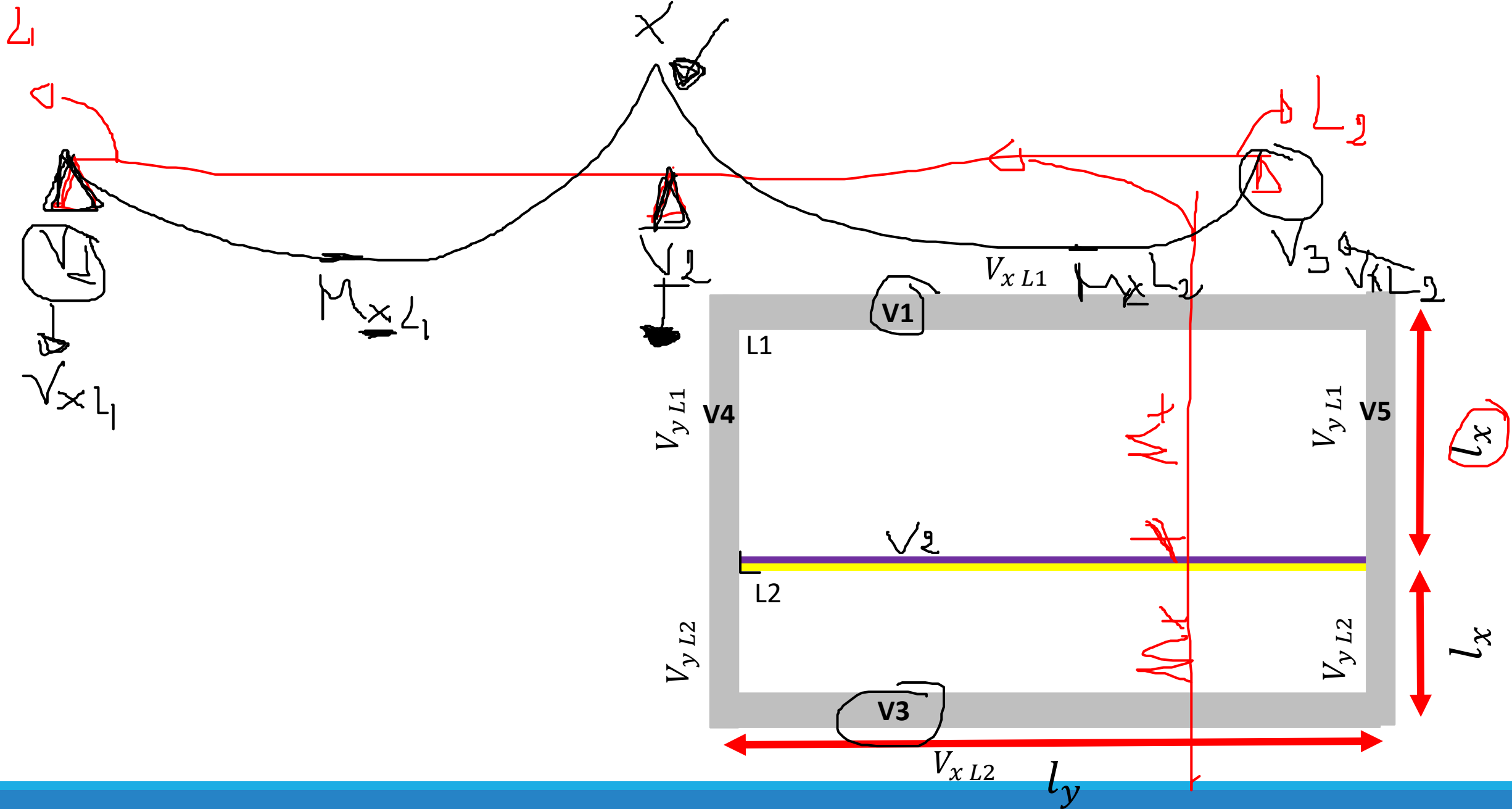
4. Reações de apoio nas vigas de borda

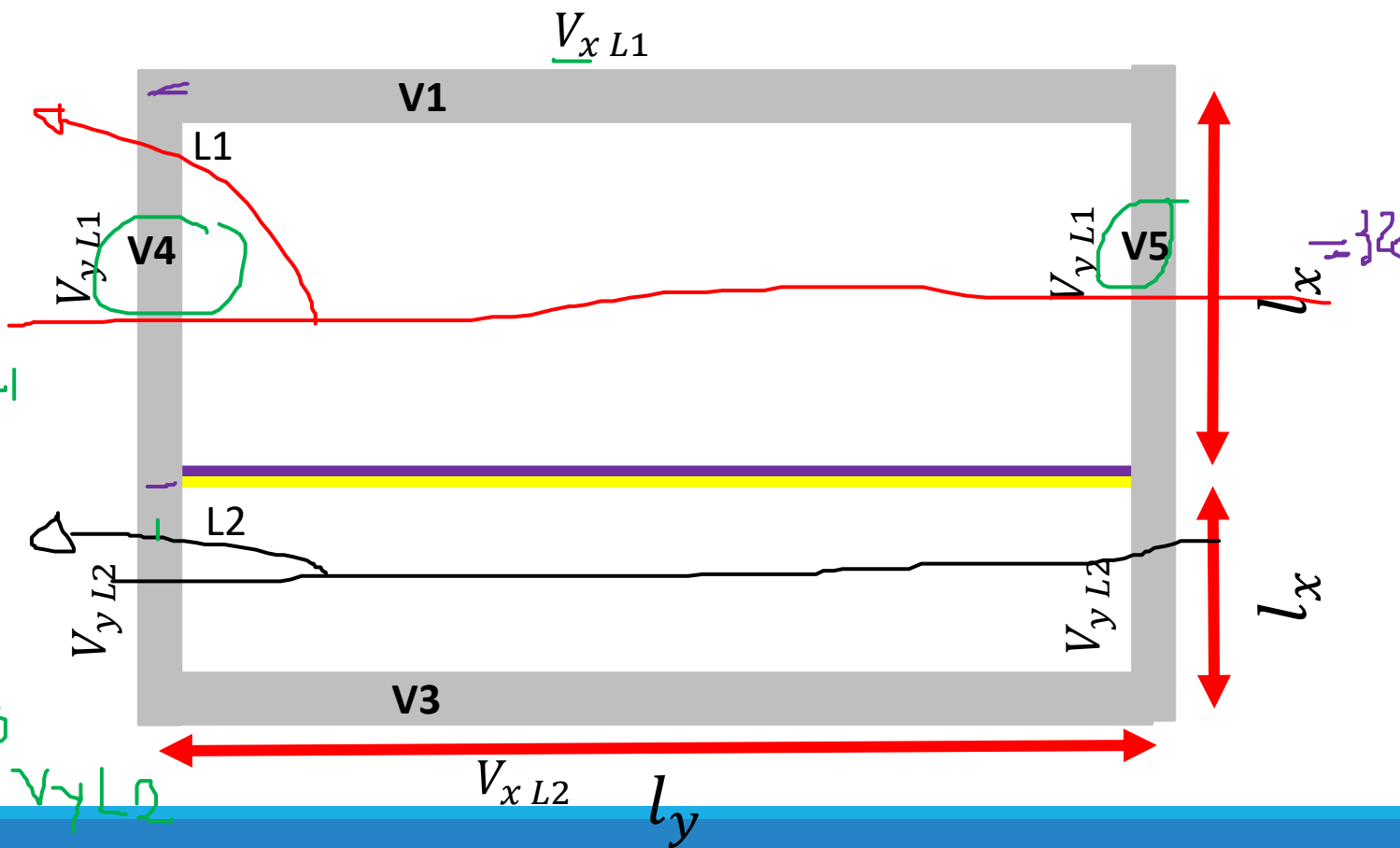
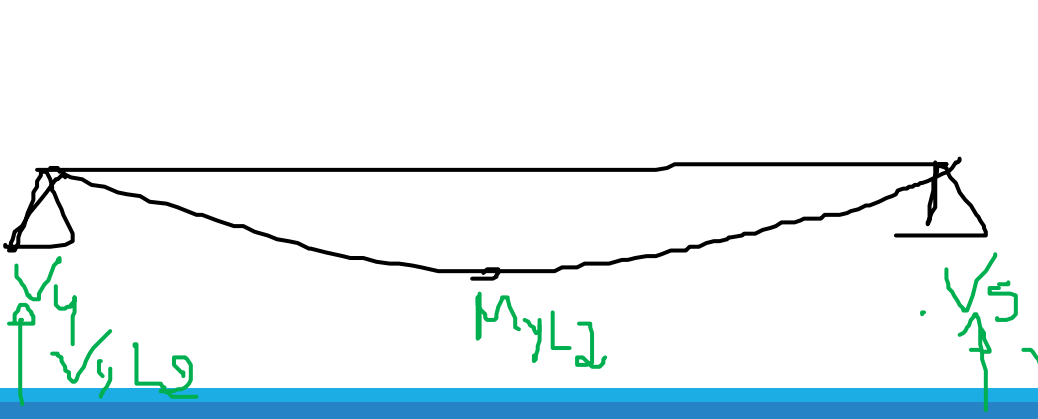
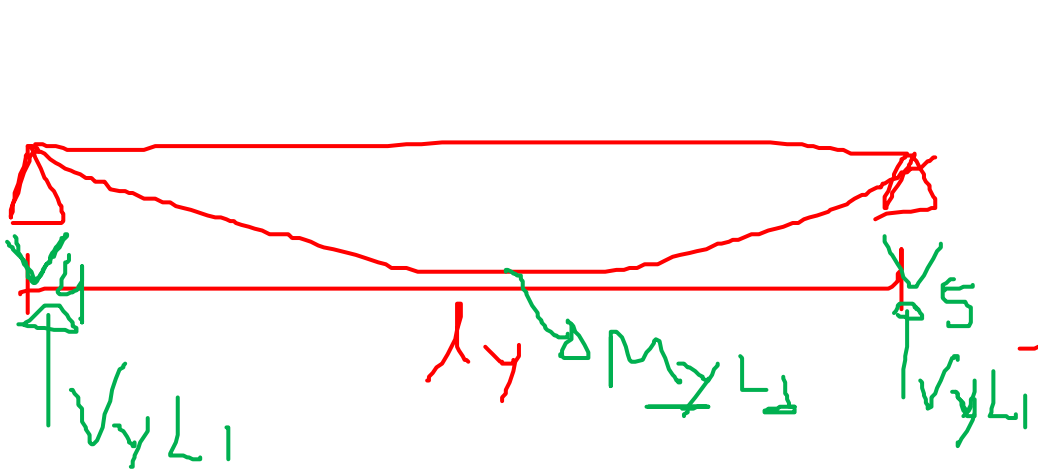
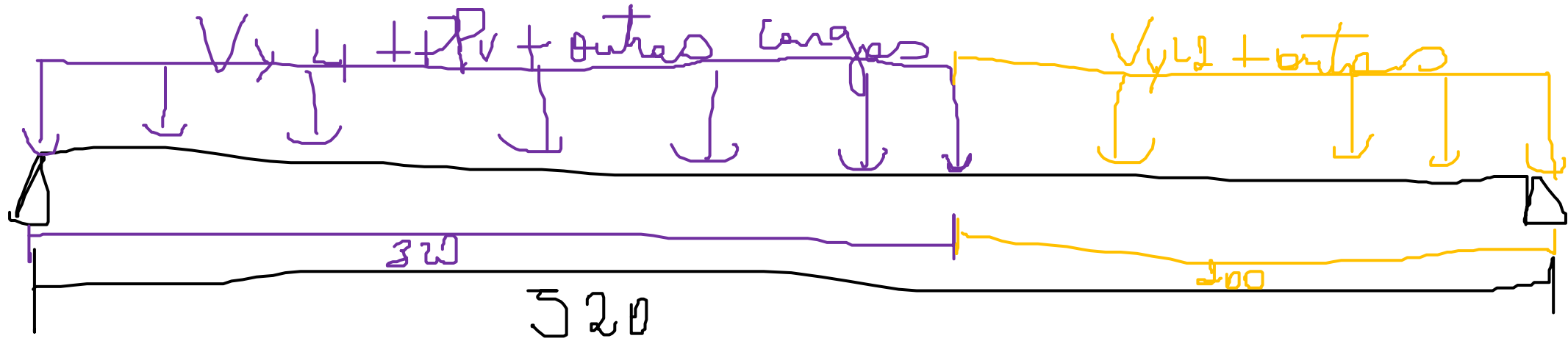
$$\lambda = \frac{l_y}{l_x}$$

$$V_{x4} = u_x * p * \frac{l_x^2}{10}$$
$$V_y = v_y * p * \frac{l_x^2}{10}$$

Bordos simplesmente apoiados







4. Reações de apoio nas vigas de borda

$$\lambda = \frac{l_y}{l_x}$$

$$V'_x = v'_x * p * \frac{l_x^2}{10}$$
$$V'_y = v'_y * p * \frac{l_x^2}{10}$$

Bordos engastados

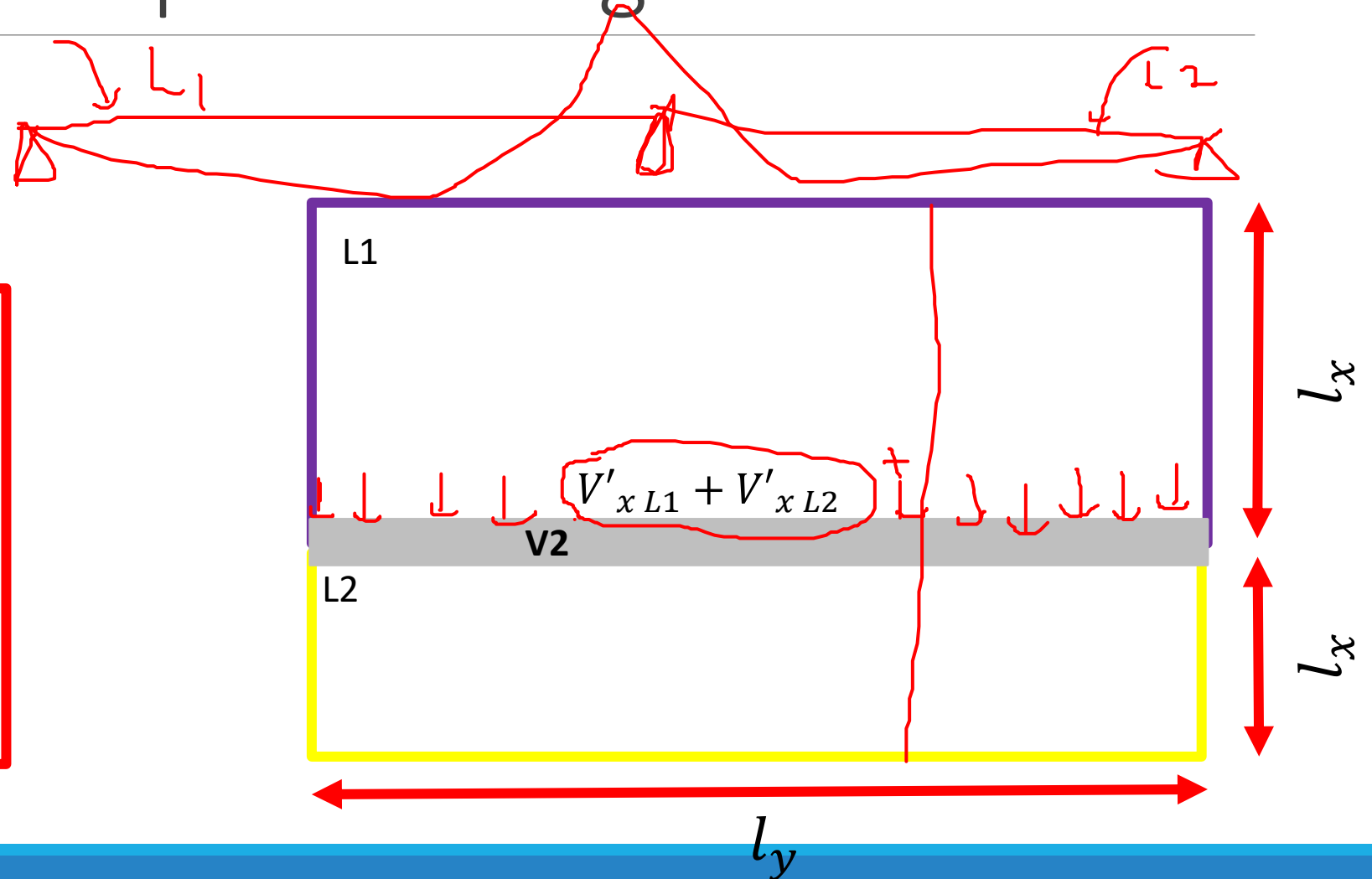


Tabela 2.2a

REAÇÕES DE APOIO EM LAJES COM CARGA UNIFORME

$\lambda = \frac{l_y}{l_x}$	Tipo								$\lambda = \frac{l_y}{l_x}$
	1		2A			2B			
	v_x	v_y	v_x	v_y	v'_y	v_x	v'_x	v_y	
1,00	2,50	2,50	1,83	2,75	4,02	2,75	4,02	1,83	1,00
1,05	2,62	2,50	1,92	2,80	4,10	2,82	4,13	1,83	1,05
1,10	2,73	2,50	2,01	2,85	4,17	2,89	4,23	1,83	1,10
1,15	2,83	2,50	2,10	2,88	4,22	2,95	4,32	1,83	1,15
1,20	2,92	2,50	2,20	2,91	4,27	3,01	4,41	1,83	1,20
1,25	3,00	2,50	2,29	2,94	4,30	3,06	4,48	1,83	1,25
1,30	3,08	2,50	2,38	2,95	4,32	3,11	4,55	1,83	1,30
1,35	3,15	2,50	2,47	2,96	4,33	3,16	4,62	1,83	1,35
1,40	3,21	2,50	2,56	2,96	4,33	3,20	4,68	1,83	1,40
1,45	3,28	2,50	2,64	2,96	4,33	3,24	4,74	1,83	1,45
1,50	3,33	2,50	2,72	2,96	4,33	3,27	4,79	1,83	1,50
1,55	3,39	2,50	2,80	2,96	4,33	3,31	4,84	1,83	1,55
1,60	3,44	2,50	2,87	2,96	4,33	3,34	4,89	1,83	1,60
1,65	3,48	2,50	2,93	2,96	4,33	3,37	4,93	1,83	1,65

Resolução

Viga 1 – determinação da reação da laje 1

$$V_{x L1} = v_x * p * \frac{l_x^2}{10}$$

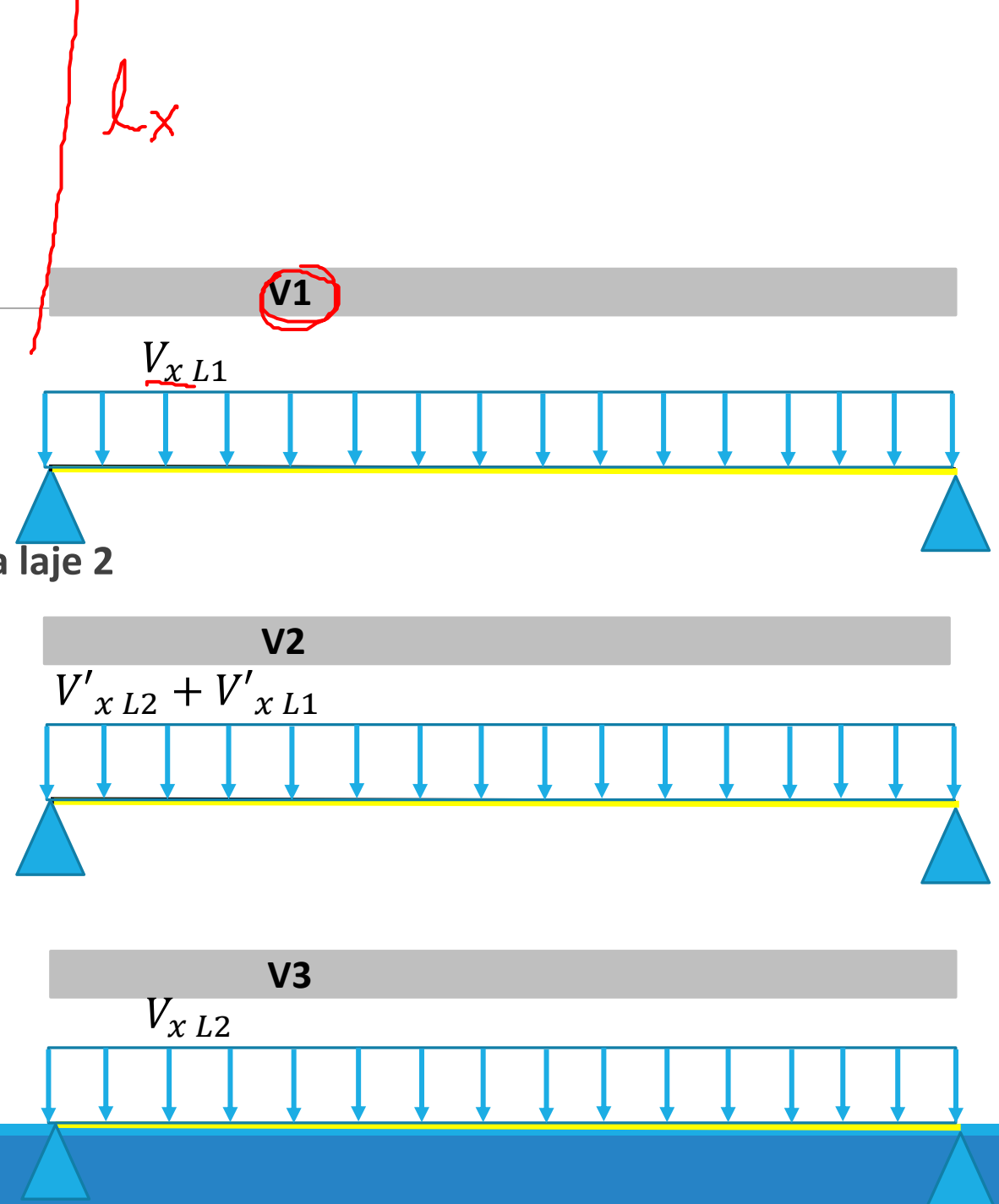
Viga 2 – determinação da reação da laje 1 e da laje 2

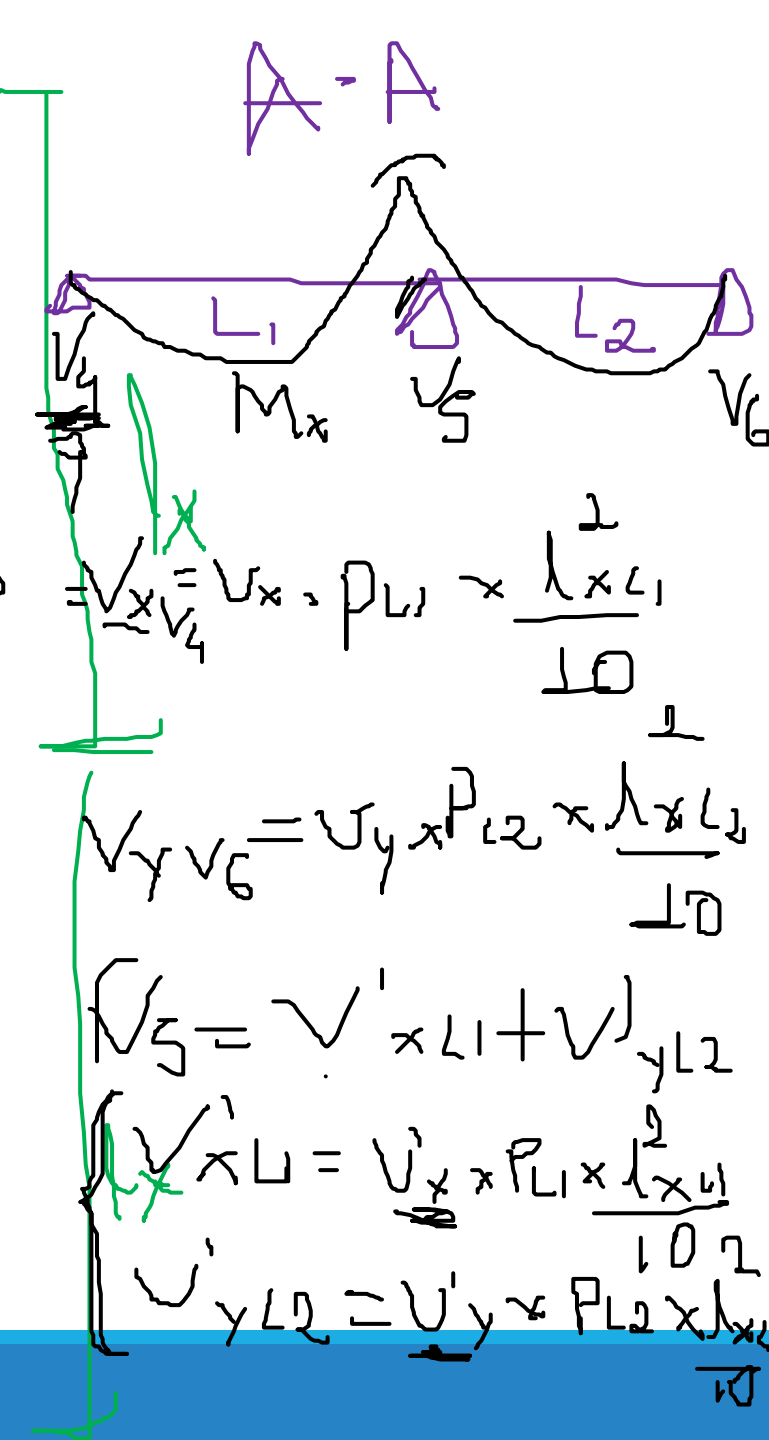
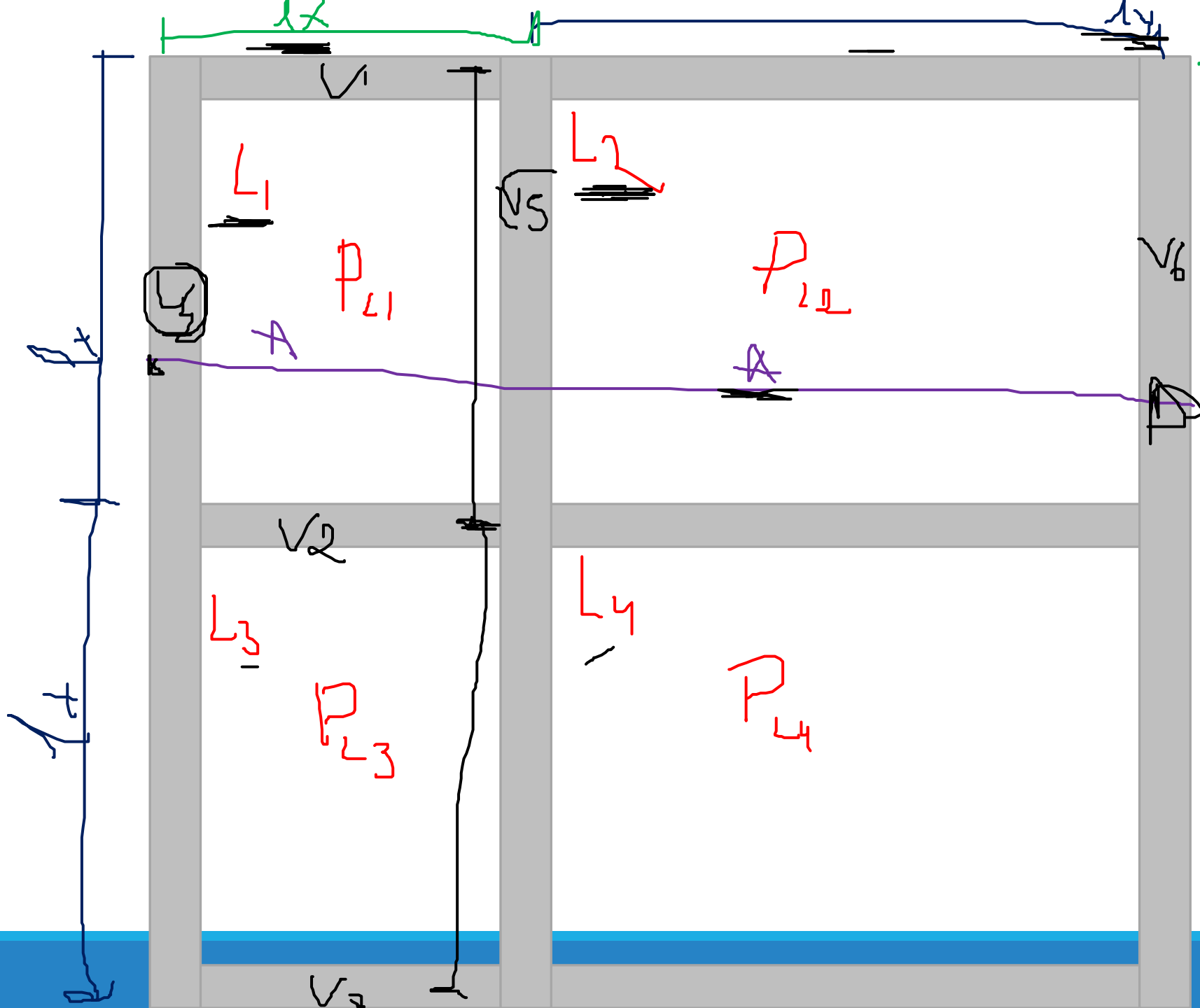
$$V'_{x L1} = v'_x * p * \frac{l_x^2}{10}$$

$$V'_{x L2} = v'_x * p * \frac{l_x^2}{10}$$

Viga 3 – determinação da reação da laje 2

$$V_{x L2} = v_x * p * \frac{l_x^2}{10}$$





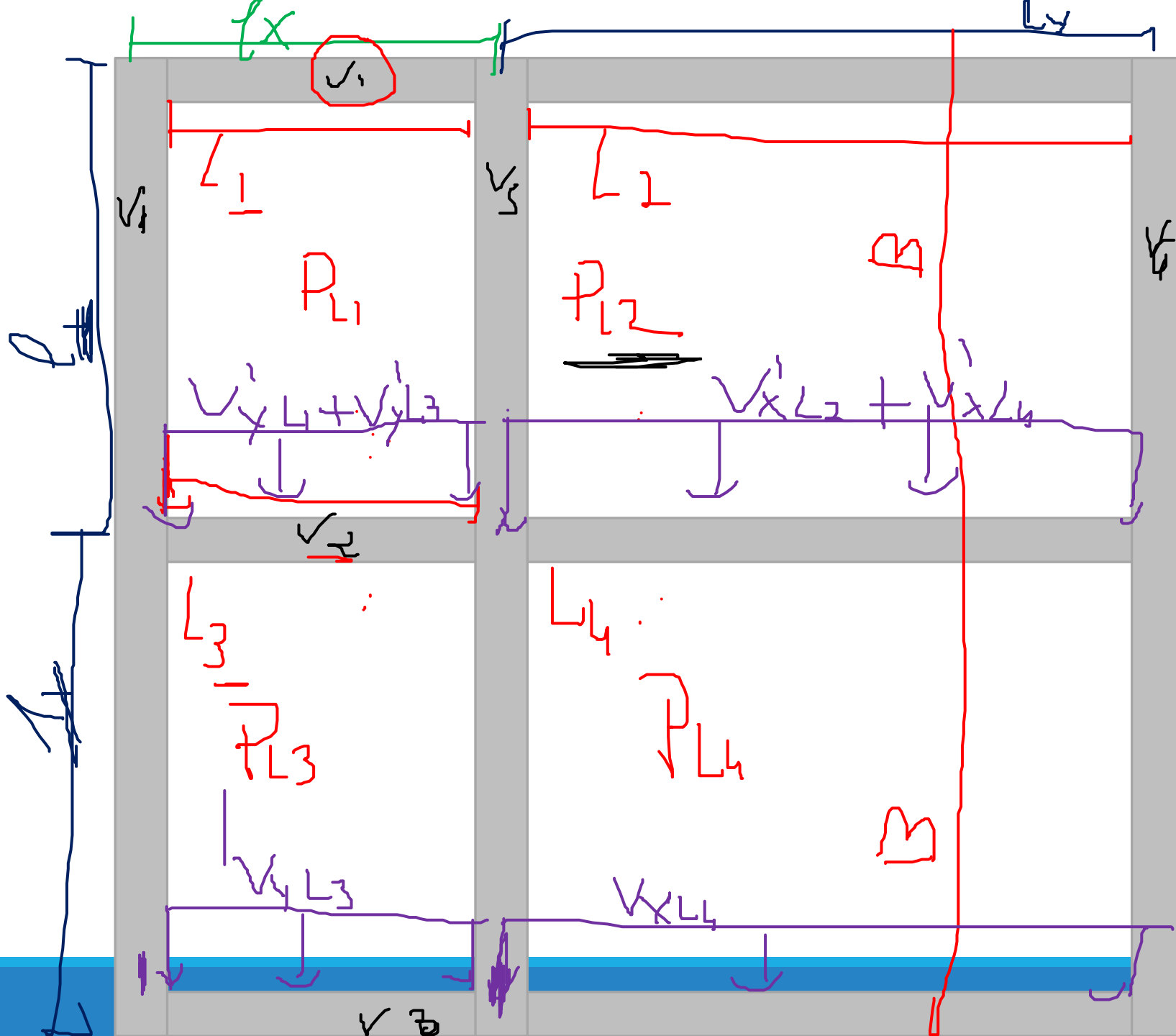
$$V_{xV_4} = V_x \times P_{L1} \times \frac{l_x \times l_1}{10}$$

$$V_{yV_6} = V_y \times P_{L2} \times \frac{l_x \times l_2}{10}$$

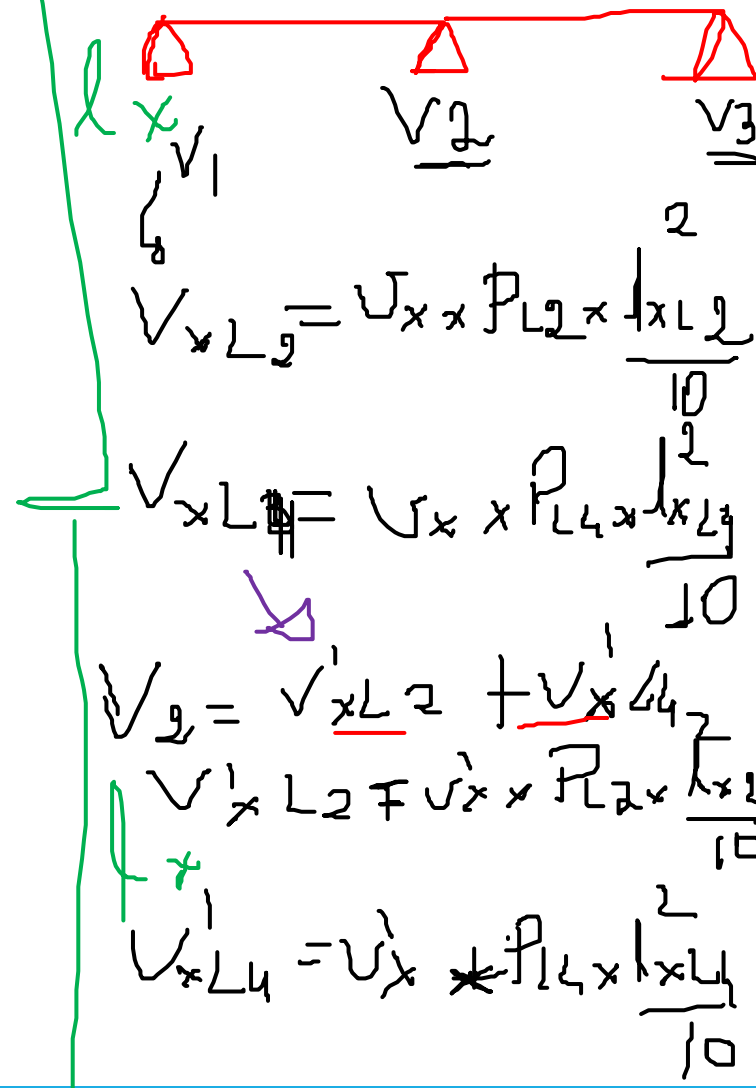
$$V_5 = V' \times l_1 + V'' \times l_2$$

$$V' \times l_1 = V'_x \times P_{L1} \times \frac{l_x \times l_1}{10}$$

$$V'' \times l_2 = V''_y \times P_{L2} \times \frac{l_x \times l_2}{10}$$



B-B



$$V_{xL_2} = V_x \times P_{L_2} \times \frac{L_x L_2^2}{10}$$

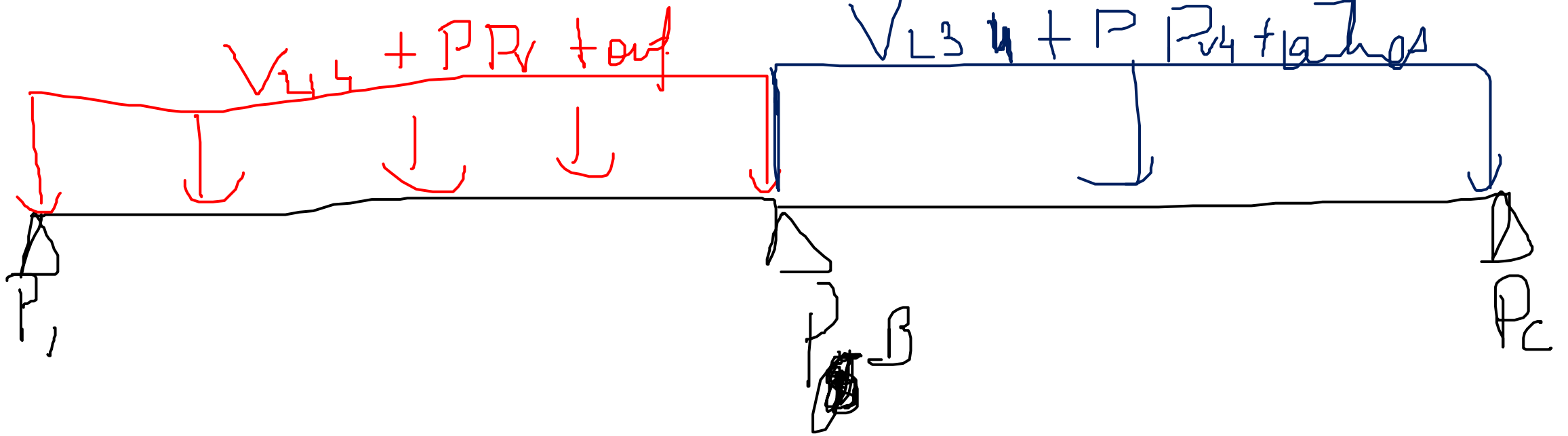
$$V_{xL_4} = V_x \times P_{L_4} \times \frac{L_x L_4^2}{10}$$

$$V_2 = V_{xL_2} + V_{xL_4}$$

$$V_1 \times L_2 + V_x \times P_{L_2} \times \frac{L_x L_2^2}{10}$$

$$V_{xL_4} = V_x \times P_{L_4} \times \frac{L_x L_4^2}{10}$$

V₄



Resolução

Viga 4 – determinação da reação da laje 1 e da laje 2

$$V_{yL1} = v_y * p * \frac{l_x^2}{10}$$

$$V_{yL1} = 1,83 * 7 * \frac{3,2^2}{10}$$

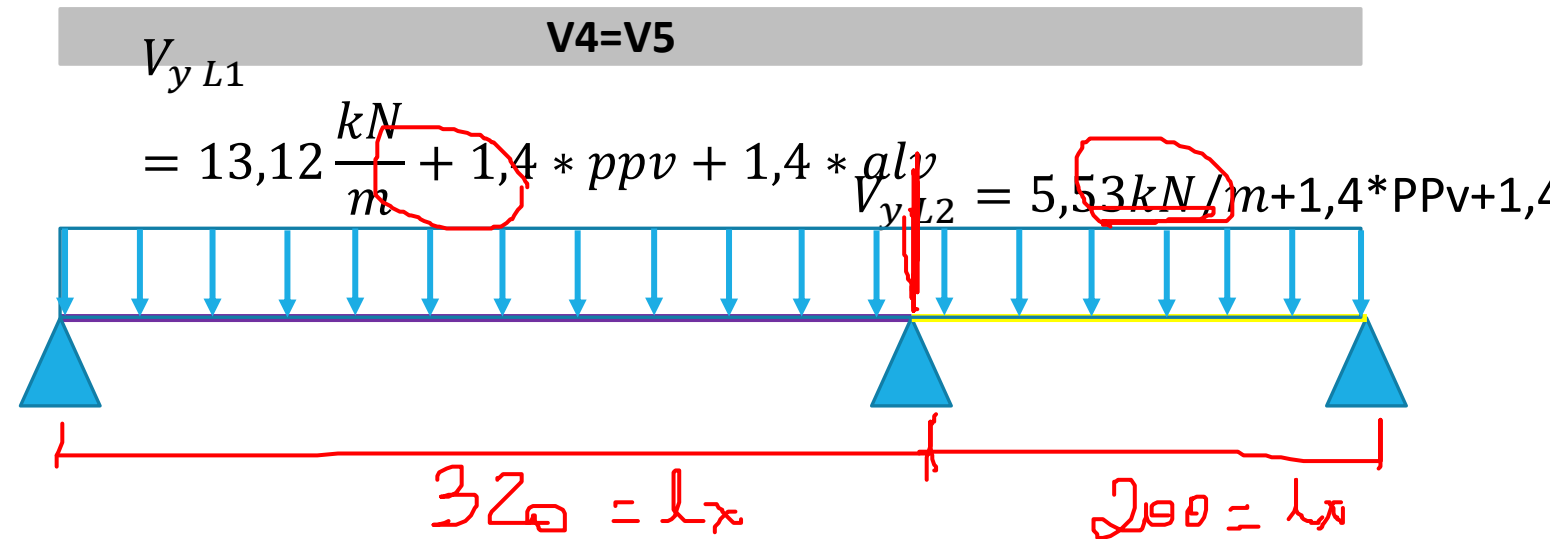
$$V_{yL1} = 13,12 \text{ kN/m}$$

$$V_{yL2} = v_y * p * \frac{l_x^2}{10}$$

$$V_{yL2} = 1,83 * 7,56 * \frac{2^2}{10}$$

$$V_{yL2} = 5,53 \text{ kN/m}$$

*Carga total = reações + 1,4 * ppv + 1,4 * alv*



$$\lambda_{L1} = 1,25$$

$$\lambda_{L2} = 2$$

Tabela 2.2a									
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$\lambda = \frac{l_y}{l_x}$	Tipo								$\lambda = \frac{l_y}{l_x}$
	1		2A			2B			
	v_x	v_y	v_x	v_y	v'_y	v_x	v'_x	v_y	
1,00	2,50	2,50	1,83	2,75	4,02	2,75	4,02	1,83	1,00
1,05	2,62	2,50	1,92	2,80	4,10	2,82	4,13	1,83	1,05
1,10	2,73	2,50	2,01	2,85	4,17	2,89	4,23	1,83	1,10
1,15	2,83	2,50	2,10	2,88	4,22	2,95	4,32	1,83	1,15
1,20	2,92	2,50	2,20	2,91	4,27	3,01	4,41	1,83	1,20
1,25	3,00	2,50	2,29	2,94	4,30	3,06	4,48	1,83	1,25
1,30	3,08	2,50	2,38	2,95	4,32	3,11	4,55	1,83	1,30
1,35	3,15	2,50	2,47	2,96	4,33	3,16	4,62	1,83	1,35
1,40	3,21	2,50	2,56	2,96	4,33	3,20	4,68	1,83	1,40
1,45	3,28	2,50	2,64	2,96	4,33	3,24	4,74	1,83	1,45
1,50	3,33	2,50	2,72	2,96	4,33	3,27	4,79	1,83	1,50
1,55	3,39	2,50	2,80	2,96	4,33	3,31	4,84	1,83	1,55
1,60	3,44	2,50	2,87	2,96	4,33	3,34	4,89	1,83	1,60
1,65	3,48	2,50	2,93	2,96	4,33	3,37	4,93	1,83	1,65

$$\lambda_{L1} = 1,25$$

$$\lambda_{L2} = 2$$

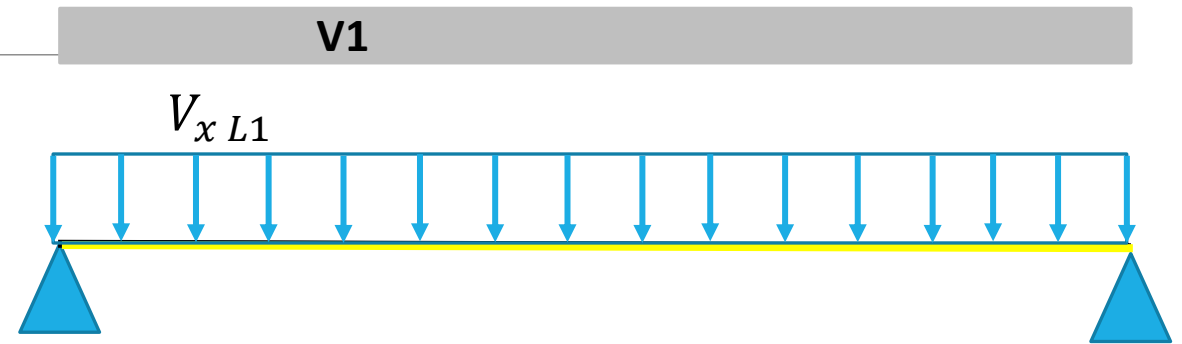
Tabela 2.2a
REAÇÕES DE APOIO EM LAJES COM CARGA UNIFORME

$\lambda = \frac{l_y}{l_x}$	Tipo								$\lambda = \frac{l_y}{l_x}$
	1		2A			2B			
	v_x	v_y	v_x	v_y	v'_y	v_x	v'_x	v_y	
1,65	3,48	2,50	2,93	2,96	4,33	3,37	4,93	1,83	1,65
1,70	3,53	2,50	2,99	2,96	4,33	3,40	4,97	1,83	1,70
1,75	3,57	2,50	3,05	2,96	4,33	3,42	5,01	1,83	1,75
1,80	3,61	2,50	3,10	2,96	4,33	3,45	5,05	1,83	1,80
1,85	3,65	2,50	3,15	2,96	4,33	3,47	5,09	1,83	1,85
1,90	3,68	2,50	3,20	2,96	4,33	3,50	5,12	1,83	1,90
1,95	3,72	2,50	3,25	2,96	4,33	3,52	5,15	1,83	1,95
2,00	3,75	2,50	3,29	2,96	4,33	3,54	5,18	1,83	2,00

Resolução

Viga 1 – determinação da reação da laje 1

$$V_{x L1} = v_x * p * \frac{l_x^2}{10}$$



Resolução

Viga 2 – determinação da reação da laje 1 e da laje 2

$$V'_{x L1} = v'_x * p * \frac{l_x^2}{10}$$

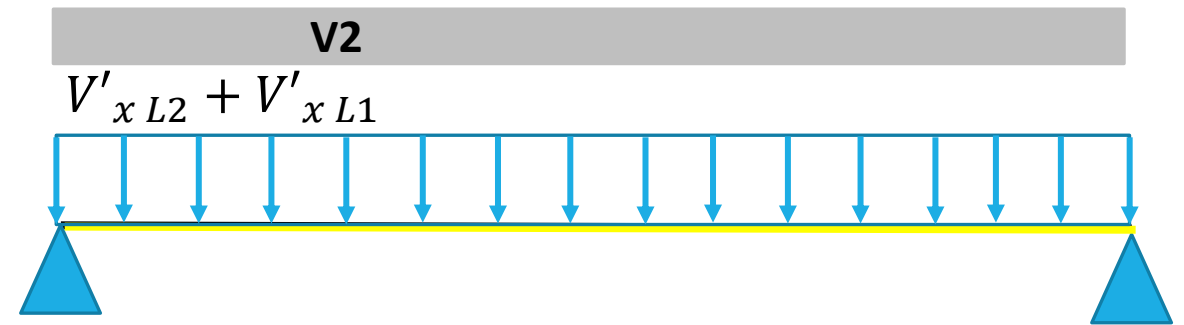
$$V'_{x L1} = 4,48 * 7 * \frac{3,20^2}{10}$$

$$V'_{x L1} = 32,11 \text{ kN/m}$$

$$V'_{x L2} = v'_x * p * \frac{l_x^2}{10}$$

$$V'_{x L2} = 5,18 * 7,56 * \frac{2^2}{10}$$

$$V'_{x L2} = 15,66 \text{ kN/m}$$

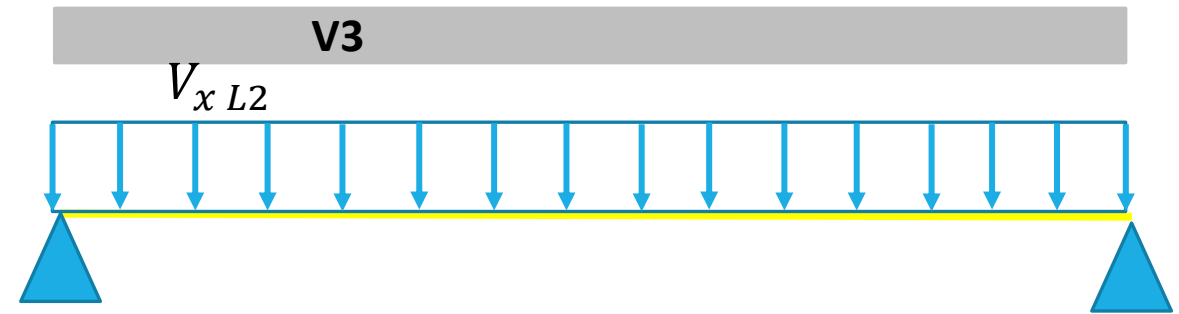


$$\rightarrow V'_{x L2} + V'_{x L1} = 47,77 \text{ kN/m}$$

Resolução

Viga 3 – determinação da reação da laje 2

$$V_{x L2} = v_x * p * \frac{l_x^2}{10}$$



Resolução

Viga 4 – determinação da reação da laje 1 e da laje 2

$$V_{y L1} = v_y * p * \frac{l_x^2}{10}$$

$$V_{y L1} = 1,83 * 7 * \frac{3,2^2}{10}$$

$$V_{y L1} = 13,2 \text{ kN/m}$$

$$V_{y L2} = v_y * p * \frac{l_x^2}{10}$$

$$V_{y L2} = 1,83 * 7,56 * \frac{2^2}{10}$$

$$V_{y L2} = 5,12 \text{ kN/m}$$

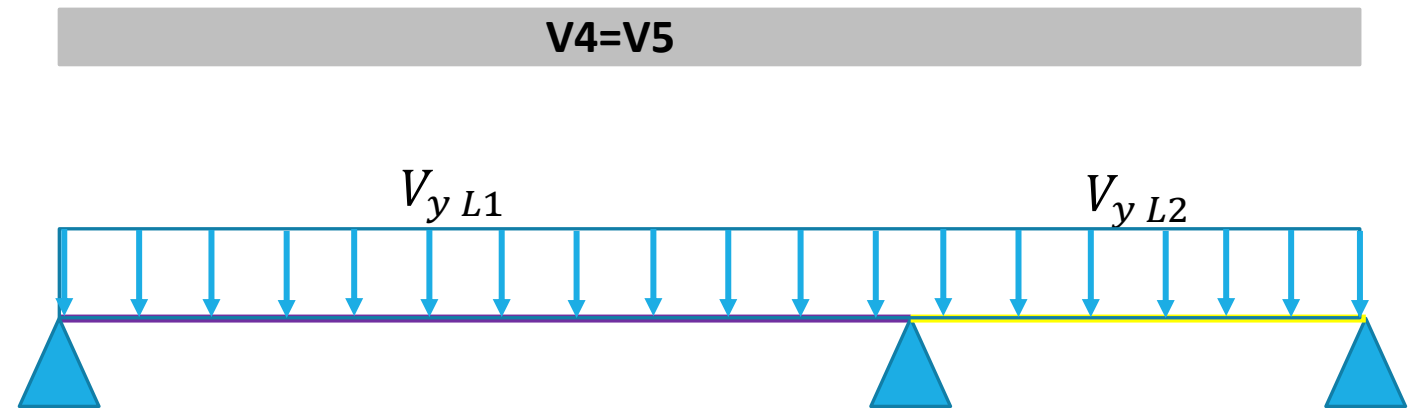


TABELA 6. reações nas vigas de bordo das lajes

LAJE	CASO	Lx (m)	λ	P (kN/m ²)	v_x	V_x	v_y	V_y	v'_x	V'_x	v'_y	V'_y
1	2B	320	1,25								-	-
2	2B	200	2								-	-

