PROBLEM

5 points
Time: 60 minutes

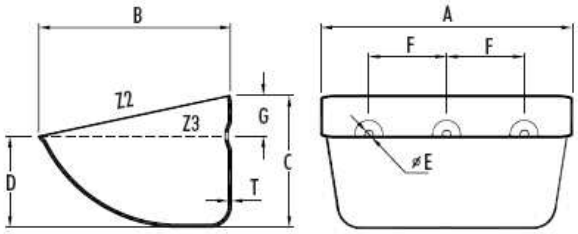
In a quarry a new transport system for stones made of little size limestone has to be designed. This stones have to be transported initially by a bucket elevator which will feed in a belt conveyor as shown in the image. The desired transported material flux is 95 t/h.

The features of the material to be transported is:

- Density 2.8 kg/dm^3.
- Maximum size grain is 200 mm.
- Classified material.
- Material with a moderate abrasive.

Features of the bucket elevator:

- Geometric features of the bucket.



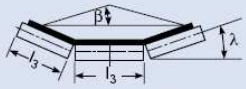
No.	A (mm)	B (mm)	C (mm)	D (mm)	T (mm)	kg	Capacity (Litres) Capacidad (Litros) Z2 (total)	Z3 (water)	Recessed Holes Agujeros Embutidos No.	E (Ø mm)	F (mm)	G (mm)	Max. Pcs/Mtr
SJ250-250/3	260	260	190	130	4.0	3.5	7.0	5.3	3	13	80	55	5
SJ250-250/4	260	260	190	130	4.0	4.6	7.0	5.3	3	13	80	55	5
SJ330-250/3	340	260	190	130	3.0	4.5	9.6	7.2	3	13	80	55	5
SJ370-250/3	380	260	190	130	3.0	5.1	10.8	8.3	4	13	80	55	5
SJ470-250/3	480	260	190	130	3.0	6.5	14.0	10.5	5	13	80	55	5
SJ330-250/4	340	260	190	130	4.0	6.0	9.6	7.2	3	13	80	55	5
SJ370-250/4	380	260	190	130	4.0	6.1	10.8	8.3	4	13	80	55	5
SJ470-250/4	480	260	190	130	4.0	8.6	14.0	10.5	5	13	80	55	5
SJ470-250/4.7	480	260	190	130	4.7	10.1	14.0	10.5	5	13	80	55	5

Features of the belt conveyor:

- Friction coefficient between the pulley and the belt is 0.2
- Theorical capacity $Q_t(m^3/h)$ of the belt for a speed of v=1 m/s:

THEORETICAL CAPACITY Q'$_t$ (m³/h) at v = 1 m/s

THREE-SECTIONED CARRYING IDLERS



B (mm)	l_3 (mm)	λ°	20		25		30		35		40		45	
		β°	10	15	10	15	10	15	10	15	10	15	10	15
400	160		36	43										
500	200		60	73	67	79								
650	250		110	132	123	145	134	155	145	164	153	171	160	176
800	315		172	207	193	226	211	243	227	257	240	268	250	276
1000	380		281	337	315	369	345	396	371	419	391	437	407	449
1200	465		412	493	461	540	505	581	543	614	573	640	597	658
1400	530		573	685	642	750	703	807	755	803	797	888	829	913
1600	600		758	907	851	993	932	1068	1000	1128	1056	1075	1097	1208
1800	670		970	1160	1088	1270	1196	1365	1279	1443	1350	1502	1402	1544
2000	750		1204	1435	1351	1577	1479	1695	1588	1791	1676	1865	1742	1917
2200	800		1476	1740	1656	1930	1813	2074	1946	2191	2052	2281	2131	2342

- Minimum belt width for the classified material and non classified material for a maximum grain size material

RECOMMENDED MIN. BELT WIDTH B (mm)

	Min. belt width (mm)										
Material	400	500	650	800	1000	1200	1400	1600	1800	2000	2200
Sorted, length of largest edge (mm)	50	75	125	175	250	350	400	450	550	600	600
Unsorted, length of largest edge (mm)	100	150	200	300	400	500	600	650	700	750	750

- Maximum speed recommended depending on the belt width B and the abrasive level of the material to be transported: low, moderate and abrasive:

RECOMMENDED MAX. BELT SPEED v max. (m/s)

	Belt width B (mm)										
Material	400	500	650	800	1000	1200	1400	1600	1800	2000	2200
Light, fine-grained	2,5	3,15	3,15	3,55	4,0	4,0	4,0	4,0	4,5	4,5	4,5
Moderate, abrasive	1,6	2,0	2,5	2,5	3,15	3,15	3,15	3,55	3,55	3,55	3,55
Heavy, very abrasive	1,25	1,6	1,8	1,8	2,24	2,24	2,24	2,5	2,5	2,5	2,5

QUESTIONS:

1. Select a bucket from those given in the list to guarantee a centrifugal discharge knowing that the distance between the centres of the bucket elevator is 15 m.
2. What would happen with the material discharge if the pulley diameter of the bucket elevator was 600 mm.
3. The bucket discharge is carried out over a horizontal belt conveyor with 3 idlers to increase the belt capacity and a length between ends of 200 m. Select from the table the three-sectioned carrying idlers to guarantee that transport over the belt is carried out in continuous way. Discuss the obtained the results.
4. Calculate the belt tension.