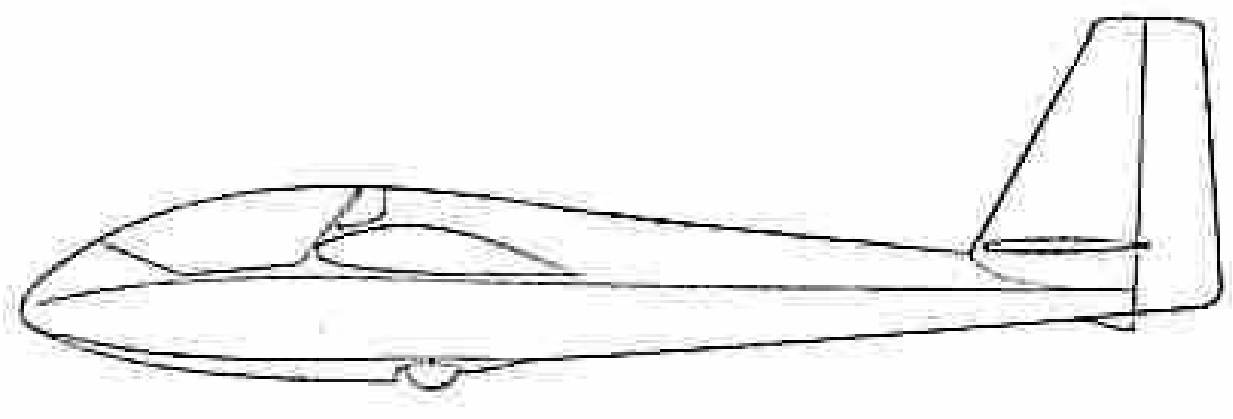


Aliante Eventuale - EC40/62

Documenti di progetto

(scansioni da originali di E.Ciani)

EC 40 Carta BCARE (1)

Tabella dati fondamentali

885 - Derivato da EC/38/56 Urendo: completo rifacimento.

17,70. - Biposto in tandem con ambedue i posti avanti all'ala.

- Ala trapezoidale con lieve freccia negativa perchè il 2° posto

1713 coincida con il baricentro. Fusoliera ovoidale. ~~Piani~~ Impennaggi

670 classici. Organi di atterraggio classici, monoruota.

2383 Costruzione in legno. Per scuola, attività sportiva, acrobazia limitata. ~~Categ~~ Secondo BCAR-E, categ multi.

20,2 apert.	mt	17,70	corda max	1.713
1.08 superficie (esta fusel) mq		20,2	" media	1.191
" (con tratto centr. rettang)		21.28		
allung		15,6/14,7	" min	0.669
8.75 sup 1 alett	mq	1.22	sup. tot diruttori	0.78 mq
5 / 8.8 Freccia al 45%		2,5°	diedro frontale (mis al ventre)	3° per ala

31 / 8.49 profilo da radice ~~a alett~~ 65$_3$620 a 4° ~~(cent... da radice)~~ ~~sino a~~ cent 21: 65$_3$617 a 4°

" estremità 4415 a 0°

- piano verticale — p. orizzontale

	piano verticale	p. orizzontale
apertura ~~tot~~ (parte con b. attacco).	1.64	ap. 3.98
1627+ superficie " " " "	1.89	sup ~~3.34~~ 3.34
700 / 2327 corda max	1.627	1.125 c media: ~~0.94~~ 0,9
1097+ " min	0.7	0.675
40 / 1037 sup. fisso	1.14	2,21
360 / 1397 sup. mobile	0.75	1.13 s. flettner: 9,8 dmq

profilo NACA 65 009 modificato

144 / 8 / 12 / 1.64

- Pesi previsti: a vuoto 280 Kg (Qa = 165 Kg) (Fus con piani 115 Kg)

C.U. max 200 " C U min 55 Kg 80

1.8 Q+ max 480 " 160 medio min 335 " 360

11 / 8 / 199 Q/S. Kg/mq 24 max 440 22 16,7 18

- lungh fusel 7,78 sez maestra 0.61 mq.

largh " 0.62 max - sup. bagnata

Definizione carichi BEAR — EC 40 Carta BCAR/E

(2)

5 7368 / 3 7554 / 1 7740 - 33.7 = 740,3 — 186

Categoria aeromobili - $\frac{Q}{S}$ =

Dati di centraggio.

C.M.A. lunghezza mt 1,191

b. attacco a m 1,91 da T.V.N

" " a 70 cm avanti ord 7

" " carrelli con b.att alla

772

C.M.P.O. ~~0.9~~ : b. a. a 4.46 da b.a CMA. Fuoco = 25% a 4,685 da b.a CMA

704,6 / 33.7 / 738 3 — Ai fini del calcolo dell'escursione si rappresentano i seguenti centraggi:

2650 - 740.3 = 1910,7

carico minimo: Kg 55

Q+ " 335

baricentro al 45% CMA = 535 mm da b.att.

1125 + 675 = 1800

carico max: Kg 200

Q+ " 480

bar. c. al 20% CMA = 238 mm da b. att.

Velocità di progetto

Posto V_S = 60 Km/h

$V_A = \sqrt{n_1} \cdot V_S$ = 134 Km/h

$\frac{Q}{S}$ max = 24 Kg/mq = 4.9 lbs/sq ft

V_D = 9.49 + 78 = 44 + 78 = 122 nodi = 226 Km/h

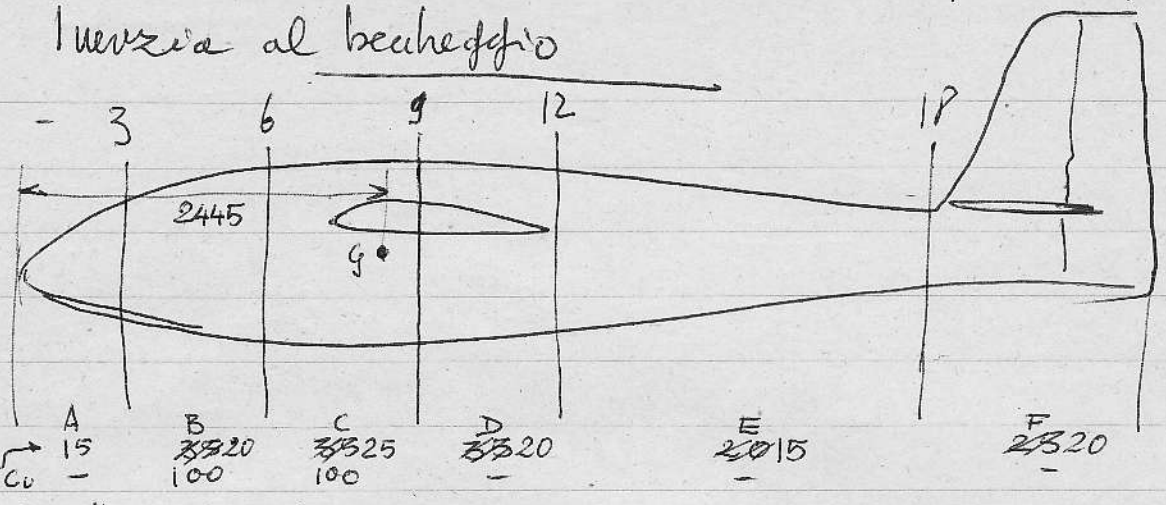
$V_T \geq$ 60 nodi = 112 Km/h. e non oltre 161 Km/h

sì, OK — provvisoriamente 134 Km/h (OK) (vedi $V_D \geq 1.4\, V_T$)

$V_W \geq$ 60 nodi = 112 Km/h → fissato 115 K/h

Inerzia al baricentro

535
1910
2445



200 Kg. G a 20% = 535 mm = 2445 da PVN

Zona	~~Kg~~	~~M~~ Q Kg	D': ½ zona da PVN	D: ½ zona a Cg.	D^2	Massa Kg massa	$J = M \cdot D^2$
A	~~15~~	15	,32	2,125	4.5	1.53	6.9
B	~~135~~	120	1,145	1,300	1.69	12.2	20.6
C	~~135~~	125	2,145	0,300	0.09	12.7	1.14
D	~~35~~	20	3,22	0,775	0.6	2.04	1.22
E	~~20~~	15	4,98	2,535	6.4	1.53	9.8
F	~~25~~	20	6,93	4,485	23.5	2.04	48
		~~335~~				32,04	8766

480
185

$V = \frac{m}{sec}$

$a = \frac{m}{sec^2}$

$M \left[\frac{Kg \cdot sec^2}{m}\right] \times m^2 =$

$= \left[Kg\ m\ sec^2\right] = J$

$F = M \cdot a$

$M = J \cdot \omega$

Acceleraz: $\omega = \frac{81,5}{V} \cdot (n_1 - 1)^2 = \frac{1300}{V}$

Cas	V	K/h	ω r/sec	CU	J	$M = \frac{\omega}{J\omega}$	D da G a F.	Pc
A, A_1	V_A	134	9,72	200	87,7	850	4.447	191
B, B_1	V_D	226	5,75	200	"	505	4,447	113,5

A_1, B_1 calcolare

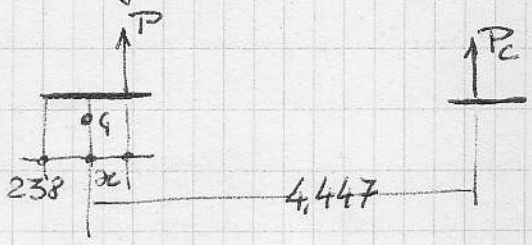
A, B richiamo

$\frac{Kg \cdot sec^2}{m} \cdot m^2 = Kg\ m \cdot sec^2$

Carichi manovra $V_A = 134$ Kt/h $= 37.2$ m/sec $(V^2 = 1380)$

$n_1 = 5$

car max: $Q = 20\%$: $480 \text{ Kg} \times 5 = 2400$ Kg



1) $P + P_c = 2400$

2) $P_c \cdot 4{,}447 = -P \cdot x$

3) $x = \dfrac{\frac{P}{K} \cdot 0.26 + 0{,}09}{\frac{P}{K}} \cdot 1.191 - 0{,}238 =$

$= 1.191 \cdot 0.26 + \frac{K}{P} \cdot 0{,}09 \cdot 1.191 - 0{,}238 = 0.31 + \frac{K}{P} \cdot 0{,}107 - 0{,}238 =$

$= \frac{K}{P} \cdot 0.107 + 0.072$

$K = \frac{\rho}{2} \cdot S \cdot V^2 = \frac{1}{16} \cdot 20{,}2 \cdot V^2 = 1.26 \cdot V^2 = 1.26 \cdot 1380 = 1742$

$x = \frac{1742}{P} \cdot 0.107 + 0.072 = \frac{186}{P} + 0{,}072$

- x in 2): $4{,}447 \cdot P_c = -P\left(\frac{186}{P} + 0{,}072\right) = -0{,}072P - 186$

$P_c = -0{,}0161P - 41{,}7$

- P_c in 1) $P - 0{,}0161P - 47 = 2400$

$0{,}9839P = 2447$

$P = 2480$ Kg

$P_c = -80$ Kg (in giù)

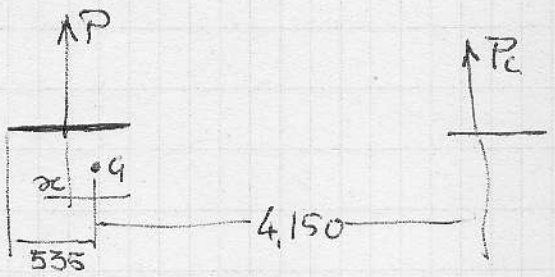
Agg. carico beccheggio: 191 Kg a picchiare (in su)

$P_c = +191 - 80 = +111$ Kg (in su)

A V_A C40 BCARE (3bj

$n_1 = 5$

car min: $335 \times 5 = 1680$; G a 45%



$P + P_c = 1680$

$P_c \cdot 4{,}15 = -P \cdot x$

$x = \dfrac{\frac{P}{K} \cdot 0.26 + 0{,}09}{\frac{P}{K}} \cdot 1.191 - 0.535 =$

$= 0.31 + \frac{K}{P} \cdot 0.107 - 0.535 = \frac{K}{P} \cdot 0.107 - 0{,}225$

$K = 1742$

$x = \frac{186}{P} - 0{,}225$

- x in 2) $4{,}15 \cdot P_c = -P\left(\frac{186}{P} - 0{,}225\right) = -186 + 0{,}225\,P$

$P_c = 0{,}0541\,P - 45$

- P_c in 1) $P + 0.0541\,P - 45 = 1680$

$1{,}0541\,P = 1725$

$P = 1640$ Kg

$P_c = 85$ " (in su

Agg. car hem 191 a pieh (in su)

$P_c = 191 + 85 = 276$ Kg (in su)

A

EC 40 BEAR

CMA 1,191

Carichi di manovra: A $V_A = 134$ m/s = 37,2 m/s $\left(\frac{2}{1.1380}\right)$

$n_1 = 5$ [ult. = 7.5].

A cer max: 480 Kg · x 5 = 2400 Kg.

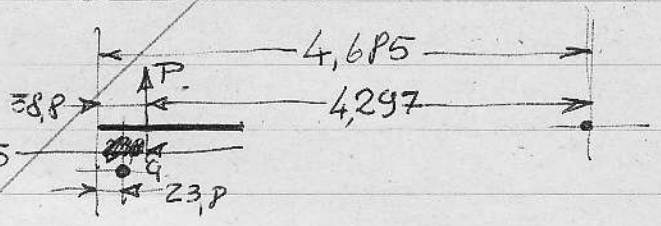
Si suppone di arrivare a stallo con $C_e = 1.38$.

$C_{e\,max} = 1.3$

$1.3 \cdot \frac{1}{16} \cdot 37,2^2 \cdot 20,2 = 2260$ Kg

1.38 — 2400

(3)



G a 20% = 23.8

Q = 480

sost 3'

$C_e = 1.38$: $C_m = 0.09 + 0.36 = 0.45$ CP a $\frac{0.45}{1.38}$ = 32,6% = 388 mm

Eql intorno a P.

$P_c = \frac{2400 \cdot 0.15}{4,297} = +84$ Kg (in giù

Carico manf su ala 2400 + 84 = 2484. $-Q_a \times 5 = -825 = 1659$

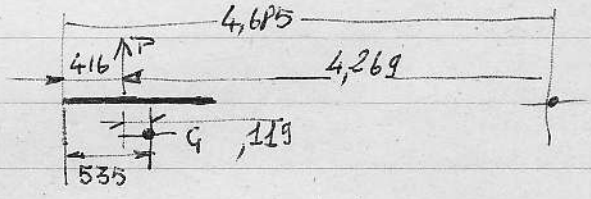
" ultimate : $1659 \times 1.5 = 2470$ Kg ≡ 1240 Kg per semiala

4,685 — 535 — 4,150

Mmanf - 45% = 535 m: 2400 / 1659 · 147 = 354 / 240 Kg mt calmanti manf.

G a 45% $Q_+ = 335$ Kg × 5 = 1680 Kg

$C_e = \frac{1680 \cdot 16}{1 \cdot 1380 \cdot 20.2} = 0.97$; $C_m = 0.09 + 25 - 0.34$: CP = 35% ≡ 416



Eql int a P

$P_c = \frac{1680 \cdot 0,119}{4,269} = -47$ (in su)

Carico manf su ala meno di prima

G = 20%: aggiunta carico bacheggio: 191 Kg a picchiare (in su)

− 84

Pc tot 107 Kg manf:

G a 45%: agg. bacheggio 191 (in su

+ 47

238 in su manf.

$0{,}09 + 0.26\,C_L$ $\quad q = \frac{2P}{\rho \cdot V^2 \cdot S}$

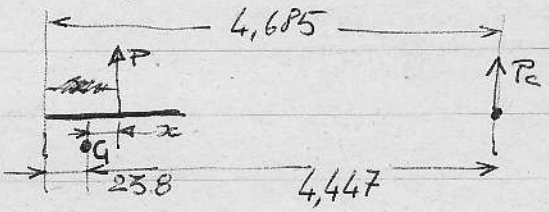
B

EC 40 - BCAR

Carichi di manovra: B. $V_D = 226$ Km/h $= 63$ m/sec (4)

$n_2 = 4$.

$q = 20\%$: $Q_+ = 480$: $\times 4 = 1920$ Kg



Somma vert: 1) $P + P_c = 1920$.

Eql m/f. G: 2) $P_c \cdot 4{,}447 = -P \cdot x$

$x = f(P)$ 3) $x = \dfrac{\frac{P}{K} \cdot 0.26 + 0{,}09}{\frac{P}{K}} \cdot 1.191 - 0.238$

$K = \frac{1}{2} \cdot S \cdot V^2 = \frac{1}{16} \cdot 20{,}2 \cdot 63^2 = 5000$

3): $x = \dfrac{\frac{P}{5000} \cdot 0.26 + 0.09}{\frac{P}{5000}} \cdot 1.191 - 0.238 = \dfrac{\frac{P}{5000}}{\frac{P}{5000}} \cdot 0.31 + \dfrac{\frac{1}{P}}{5000} \cdot 0{,}107 - 0{,}238 =$

$= 0.31 + \dfrac{535}{P} - 0{,}238 = \dfrac{535}{P} + 0{,}072$

2070
1920
150

x in 2): $P_c \cdot 4{,}447 = -P \cdot \left(\frac{535}{P} + 0.072\right) = -0.072P - 535$

$\therefore P_c = -\dfrac{0.072P + 535}{4{,}447} = -0{,}0161 \cdot P - 120$

Conta: $x = \frac{535}{2070} + 0{,}072 = 0{,}258 + 0{,}072 = 0{,}330$

2): $150 \cdot 4{,}447 = 2070 \cdot 0{,}0186 \; 0{,}330$

$670 = 670$

Aggiunta bacheggio: 113,5 in su

150

P_c tot 36,5 in giù.

P_c in 1): $P - 0{,}0161 \cdot P - 120 = 1920$

$,9839 \cdot P = 2040$;

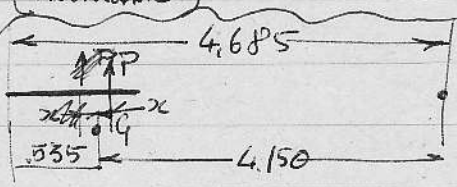
535
31
225

$P = 2070$

$\therefore P_c = +150$ Kg in giù

CP a $238 + 330 = 568$ mm $= 47{,}8\%$

M m/f. a 45%: 2070×3.35 cm $= 6400$ Kgmt. (Picchiata)



G a 45%: $Q_+ = 335$ Kg $\times 4 = 1420$ Kg.

$x = \dfrac{535}{P} - 0{,}225$;

$P_c = -\dfrac{-0.225P + 535}{4{,}150} = +0.054P - 129$

$P + 0{,}054P = 1420 + 129 = 1549$

$P = 1470$ $\quad P_c = +50$ Kg (in giù)

Aggiunta bacheggio:

113.5 in su

50 in giù

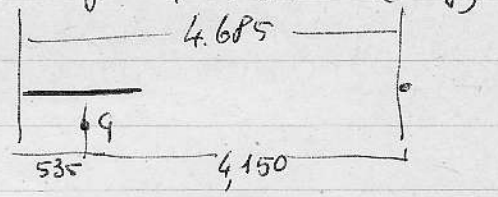
63,5 in su totale

C

Manovra: C . V_D = 226 Km/h = 63 m/sec (5)

$n = 0$ $C_{m_0} = 0.09$

$M_t = 0.09 \cdot \frac{1}{16} \cdot 20,2 \cdot 63^2 = 455$ Kgmt picchiante (max)



Q_a 45% = 535 kg

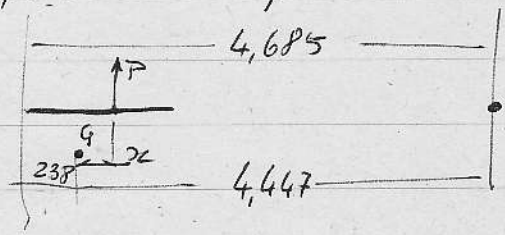
$P_c = \frac{455 \text{ Kgmt}}{4,15} = 110$ kg

$M_t = 0.09 \cdot \frac{1}{16} \cdot 20.2 \cdot 63^2 \cdot 1.191 = 535$

D

Manovra: D (inverso) V_A = 134 Km/h = 37.2 m/sec

n_3 = 2.5 Q_a = 165 kg



G a 20% = 238 mm

Q = 480 : x n_3 = 1200 Kg

1) $P + P_c = 1200$

2) $P_c \cdot 4.447 = -P \cdot x$

3) $x = \frac{187}{P} + 0.072$

$P_c = -0.0161\,P - 42,1$

1) $P - 0.0161\,P = 1200 + 120 = 1340$

$0.9839\,P = 1242,1$

P = 1265 Kg (inverso, flessione in giù)

P_c = 65 Kg (inverso, " " su)

Carico mof su ala: $1265 - Q_a \times 2,5 = -410$ = Kg 950 : 855

" ultimate " " 950 (855) × 1.5 = 1420 (1280) = 710 (640) per semiala

---

G a 45% = 535 mm Q = 335 × 2.5 = 840 Kg

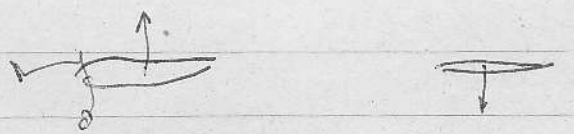
$x = \frac{535}{P} - 0.225$

$P_c = 0.054\,P - 129$

$P + 0.054\,P = 840 + 129 = 969$

P = 920 P

P_c = +49

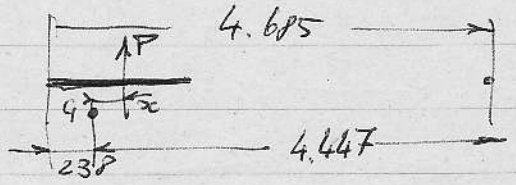


A_1

Manovra. $V_A = 134$ Km/h $= 37.2$ m/sec

$n = 1$ $\quad Q = 480$

Q a 20% $= 238$ mm



1) $P + P_c = 480$

2) $P_c \cdot 4{,}447 = -P \cdot x$

3) $x = \dfrac{\frac{P}{K} \cdot 0.26 + 0.09}{\frac{P}{K}} \cdot 1{,}191 - 0.238 = \dfrac{535}{P} + 0.072$ ~~$(K = 5000)$~~

x in 2): $P_c = -0.0161\,P - 120$

P_c in 1): $P - 0.0161 - 120 = 480$

$0{,}9839\,P = 600$

$P = 610$ Kg

$P_c = 610 - 480 = 130$ Kg

$K = \frac{1}{8} \cdot S \cdot V^2 = \frac{1}{16} \cdot 20{,}2 \cdot 37{,}2^2 = 1750$

$x = \dfrac{\frac{P}{1750} \cdot 0.26 + 0.09}{\frac{P}{1750}} \cdot 1.191 - 0.238 = 0.31 + \frac{1750}{P} \cdot 0{,}107 - 0.238 =$

$= \dfrac{187}{P} + 0.072$

Po $S = 3{,}34$:

x in 2): $4.447 \cdot P_c = -P\left(\frac{187}{P} + 0.072\right) = -0.072\,P - 187$

$P_c = -0.0161\,P - 42{,}1$

P_c in 1): $0{,}9839\,P = 522{,}1$ $\quad P = 530$ Kg: $\quad P_c = 50$ Kg (in giù)

Aggiunta carico baricentro: 191 kg a cabrare = in giù

$+ \underline{50}$

P_c totale 241 " prod $= 72$ "

362 ultimate $= 108$ Kg/mq

B_1

Manovra. $n=1$ $Q=480$ $V_D = 226\ K/h = 63\ m/sec$

$n=1$ $Q=480$ kg.

f a 20% = 238 mm

1) $P + P_c = 480$

2) $P_c \cdot 4{,}447 = -P \cdot x$

~~3) $x = \frac{535}{P} + 0.072$~~ $x = \frac{535}{P} + 0.072$

x in 2): $P_c = -0.0161\,P - 120$

P_c in 1) $0.9839\,P = 600$ $P = 610$ Kg (su) $P_c = 130$ Kg (giù)

Aggiunta carico di bilanciamento:

~~19~~ 113,5 Kg a cabrare (in giù):

→ $\frac{130}{243{,}5}$

P_c totale ~~321~~ " mens = Kg/mq ~~96~~ 73

~~482~~ " ult = " ~~144~~ 109

$\frac{}{365}$

Se $P = 610$ Kg: $Ce = \frac{16 \cdot 610}{20{,}2 \cdot 63^2} = \frac{}{3960} = 0{,}122$

$Cm = Ce \cdot 0.26 + 0.09 = 0.032 + 0.09 = 0.122$ $CP = 100\% \cdot 1.141$

~~Ce~~ $M_{45\%} = 610 \cdot 0{,}655 =$

Baric a 45%

(1) $P + P_c = 480$ $x = \frac{535}{P} + 0{,}072$

(2) $P_c + 415 = -P \cdot x$

x in 2): $P_c = -0{,}0174\,P - 129$

P_c in 1): $0{,}9826\,P = 609$ $P = 615$

$P_c = -6$

Raffica +

~~Riassunto Manovra e Raffica Simmetriche~~

V = +66 ft/sec = 20 m/sec a VA = 134 K/h = 37.2 m/sec

+

$\frac{Q}{S} = \frac{335}{20.2} = 16.7$ Kg/mq $= 3.42$ lb/sq ft

$\frac{480}{20,2} = 24$ " $= 4.92$

$F = 0.3 \left(\frac{Q}{S}\right)^{\frac{1}{4}} = 0.3 \cdot 3.42^{\frac{1}{4}} = 0.3 \cdot 1.36 = 0.408$ a carico minimo

$\cdot 1.49 = 0.447$ a " max

$\Delta\alpha = \text{arctg} \frac{F \cdot V}{V} = \text{at} \frac{0.447 \cdot 20}{37,2} = \text{atg } 0,24 = 13,5°$

Alla VA si ha per 480 kg: $Cl = \frac{480 \cdot 16}{20,2 \cdot \underset{1380}{37,2^2}} = 0,276 \simeq -0,2°$

Si va quindi a ~ 13.5° = quasi stallo = quasi 1.3 Cl

Ala:

$P = 1,3 \cdot \frac{1}{8} \cdot S \cdot V^2 = 1.3 \cdot \frac{1}{16} \cdot 20,2 \cdot \underset{1380}{37,2^2} = 2260$ kg

---

Piano:

$\Delta\alpha = 6,75° = 0.118$ rad $\quad \frac{d\,Cl}{d\,\alpha} = 5$ | $S = 3.34$ mq

$\Delta Cl = 5 \cdot 0.118 = 0.59$

$\Delta Pc = \frac{1}{16} \cdot 3,34 \cdot V^2 \cdot 0,59 = 170$ (in su)

Pc A (45%) = 47 in su

217 in su

$C_{M_{ac}} = 0,09 + 0.26 \underset{1.3}{Cl} = 0.09 + 0.034 = 0,124$

$M = 0.124 \cdot \frac{1}{16}$.

CP a 32,6% = 388 mm

M rif. 45% = $\frac{2400}{}$ = 354 Kgmt cabranti

Raffica —

$V = -66$ ft/sec $= -20$ m/sec a $V_A = 134$ K/h $= 37{,}2$ m/sec

$F = 0.447$. $\frac{dCe}{d\alpha} = 4.2$

Ala

$\Delta\alpha = 13{,}5° = 0.237_{rad}$ $\Delta Ce = 1$

a V_A si ha $Ce = 0.276 : -1 = -0{,}724 = Ce$

$P_{negativa} = \frac{1}{16} \cdot 20.2 \cdot 37{,}2^2 \cdot 0.724 = 1260$ Kg

---

Piano

170 Kg in giù

P_{CA} (Ga 20%) 84 " "

254 " mag = Kg/mq 76

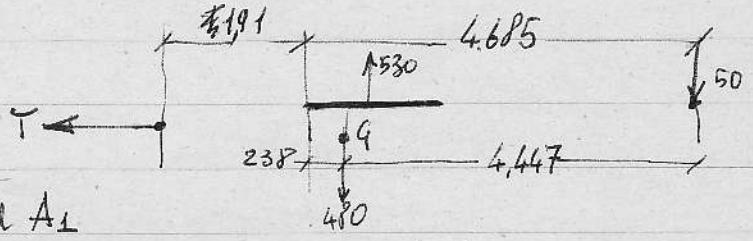
381 " ult = " 114

Riassunto Manovra e Raffica

Caso	A		B		C	D		A_1		B_1	Raff + 20	Raff - 20
V Km/h	134		226		226	134		134		226	134	134
Q_t	480	335	480	335		480	335	480	335	480	480	480
G	20%	45%	20%	45%		20%	45%	20%	45%	20%		
n	$n_1 = 5$		$n_2 = 4$		$n = 0$	$n_3 = 2,5$		$n = 1$		$n = 1$		
Ce	1.38											
CP												
PROOF: Statico P_c	+84	-47	+150	+50	+110	+65	-49	+50		+130	-47 (A)	+84 (A)
PROOF: P_c + bacheggio	-107	-238	+36,5	-63,5				+241		+243,5	-217	+254
PROOF: Pala = senza detraz.	2484	1680	2070	1470		-1265	-920	530		610	2260	-1260
PROOF: $M_{45\%}$ Kgmt	345		69		535					400		
PROOF: Pala - $Q_a \times n$	1659					-855						
ULT: Pala	2470					-1280						+380
ULT: P_c	-357											
ULT: M_t					683							

Lancio: Aerotraino: E3-3

$V_T = 134$ Km/h $= V_A = 37.2$ m/sec. $V^2 = 1380$

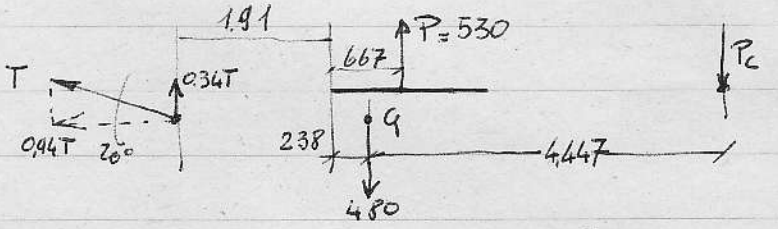


→ a) caso orizz. in avanti = cond A_1

→ G a 20% - 238 ≅ Q = 480 Kg : P = 530 Kg Pc = + 50 Kg

$C_l = \frac{16 \cdot 530}{20,2 \cdot V^2} = 0,304$ $(\cong -0,5°)$ E = 18,5 $T_{caro} = \frac{530}{E} = \frac{28,6}{28,6}$ Kg

$C_m = 0.17$: $CP = \frac{0.17}{0.304} = 56\% = 667$

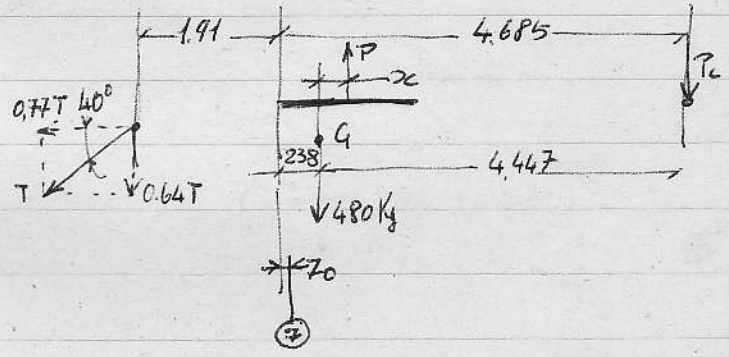


→ b) 20° in alto

posto P invariato; E invar:

$T = \frac{28,6}{0.94} = 30,4$ Kg

$T_v = 10.3$ Kg Pc diminuisce: $\Delta P_c = \frac{10.3 \cdot 2,148}{4,447} = 5,0$; $P_c = 45$



→ c) 40° in basso

E invariata: $T = \frac{28.6}{0,77} = 37.2$ Kg

$T_v = 23,8 \rightarrow 24$

1) $P + P_c = 504$

2) $P_c \cdot 4.447 = -P \cdot x - 24 \cdot 2,148$ (46)(51,5)

3) $x = \frac{187}{P} + 0.072$

x in 2): $P_c \cdot 4,447 = -P\left(\frac{187}{P} + 0.072\right) - 46$ 51,5

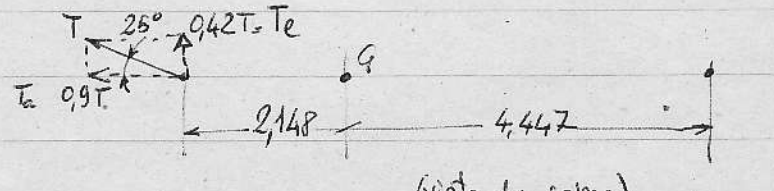
$P_c = -0.0161\,P - 42,1 - 10,5 = -0.0161\,P - 52,4$ 53,6

P_c in 1): $0,984\,P = 557.6$: → P = 567 Kg $P_c = -63$ Kg

→ d) 25° a lato

= a condiz a): $T_a = 28,6$

T = 31,8 $T_e = 13,3$



Carico laterale su verticale: $13,3 \cdot \frac{2,148}{4,447} = 6,5$ Kg

Aerotraino: Raffica di ± 12,2 m/sec a $V_A = 37,2$ m/sec (1380)

$F = 0,447$ a car max

$\Delta\alpha = \text{atg}\frac{F \cdot U}{V} = \text{atg}\frac{0.447 \cdot 12,2}{37,2} = \text{atg } 0,146$: $\Delta\alpha = 8,3° = 0,145$ rad

→ Raff +:

ALA: $\frac{d\,Ce}{d\,\alpha} = 4,2$ $\quad \Delta Ce_{\Delta\alpha=0.145} = 0,61$

$\Delta P = 061 \cdot \frac{1}{16} \cdot 20,2 \cdot V^2 = 1060$ Kg

PIANO:

$\Delta\alpha = 0.072$ rad ; $\Delta Ce = 5 \cdot 0.072 = 0.36$

$\Delta Pc = 0.36 \cdot \frac{1}{16} \cdot 3.34 \cdot V^2 = 104$ Kg

Raff −:
valori uguali ma negativi.

Riassunto P, Pc con le varie posiz carro e raffica:

Caso / Caso		a orizz	b +20°	c −40	d 25° Cato	
n=1 V=134	P	530	530	565		
	Pc	+50 (già)	+45	+61	?	
	T	28,6	30,4	37,2		
Raff +12,2 m/sec V=134	P	1590	1590	1615		
	Pc	+54	+59	+43		
Raff −12,2 V=134	P	530	530	495		
	Pc	+154	+149	+165		

Aerotraino: strappo del cavo

T aumenta fino a valore rottura = 1000 Kg ; $M_a = \frac{480}{g} = 49 ; \frac{355}{g} = 36$

a) cavo orizz in avanti

$a = \frac{F}{M} = \frac{1000}{49 \div 36} = 20,4 \div 27,8 \text{ m/sec} \equiv 2,19 \div 2,85\ g$

Fusol esaberante.

Car ne ala ul p.o: Qa x 2.85 = 470 Kg + R

b) 20° in alto

Componente orizz meno di prima

" vert = 340 Kg $M_{ordg} = 340 \cdot 2.65 = 900$ Kgmt (amiss.

W = 820 σ = 110 Kg/cm²

x1,5 = 165

c) 40° in basso

Comp. orizz meno di prima

" vert = 640 Kg : $M_{ordg} = 640 \cdot 2.65 = 1700$ Kgmt (amiss)

W = 820 σ = 208

x1,5 310

d) 25° a Cato

Comp. orizz meno di prima

" Cater = 420 Kg $M_{ordg} = 420 \cdot 2.65 = 1120$ Kgmt

Ordg W = 560 σ = 200 Kg/cm²

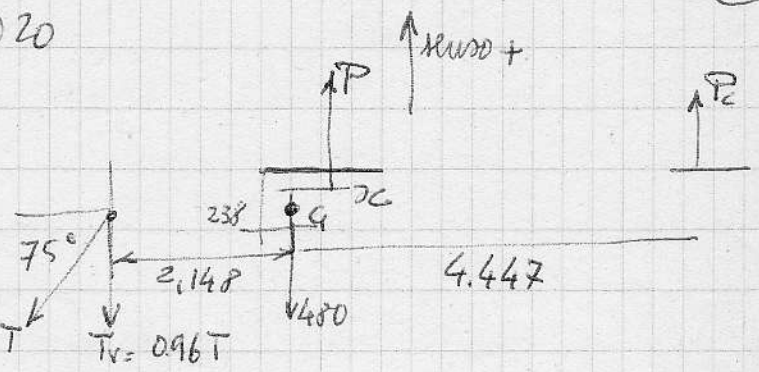
x1,5 = 300

Ricarto sopra senza considerare scarichi di inerzia

L. verric: Gancio ant

$V_w = 115\ K/h = 32\ m/sec.$ $V^2 = 1020$

Ga 20% $Q_+ = 480\ Kg$



$Pc_{max} = 13.334 \cdot \frac{1}{16} \cdot V^2 = 274\ Kg$ (−274)

$Tv + P + Pc = 480\ Kg$

$Pc = -274\ Kg$

$2,148\ Tv = -Px - 4,447\ Pc$

$\rightarrow\ Tv + P = +754$

(1) $P = Tv + 480 + 274(Pc) = Tv + 754$ $\quad Tv = P - 754$

(2) $2.148\ Tv + P \cdot x = Pc \cdot 4.447 = 1220$

$$x = 1.191\ \frac{P/K \cdot 0.26 + 0,09}{P/K} - 0.238 = K/P \cdot 0.107 + 0.072$$

$K = S/2 \cdot S \cdot V^2 = \frac{1}{16} \cdot 20,2 \cdot 1020 = 1275$; $x = 135/P + 0,072$

x in (2): $2.148\ Tv + 135 + 0.072\ P = 1220$; $= -0,072P + 1085$

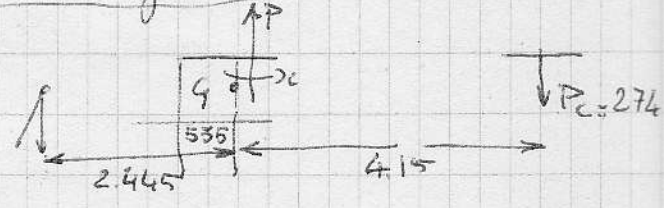
$Tv = -0,0335\ P + 447$

Tv in (1): $P = -0.0335\ P + 447 + 754$:

$0,9665\ P = 1201$

$P = 1242\ Kg$ $\quad Tv = 488\ Kg$ $\quad T = 510\ Kg$

Idem: $G = 45\%$: $Q = 335$



(1) $P = Tv + 335 + 274(P2) = 509$

(2) $2.445 \cdot Tv + P \cdot x = Pc \cdot 4,15 = 1140$

$x = 135/P + 0.072$ ‖

x in (2): $2.445 \cdot Tv + 135 + 0.072 \cdot P = 1220$. $\quad Tv = -0,0294 \cdot P + 444$

Tv in (1) $\quad P = -0,0294\ P + 444 + 509$;

$0,9706\ P = 953$

$P = 975$ $\quad Tv = 466$

L. veniello: gancio ant.

Raffica + 12.2 m/sec

G 20%: Qt = 4080 Kg

Se P = 1242 Kg $Cl = \frac{1242}{K} = 0.96$

Con V = +12,2 : F = 0.447

$\Delta\alpha = \text{arctg} \frac{F \cdot V}{V} = \text{arctg} \frac{0.447 \cdot 12.2}{32} = 0.17$ rad

$\frac{\delta Cl}{d\alpha} = 4,2$: $\Delta Cl = 0.71$; Cl tot 1.67 Quindi caso A: P = 2480 max pari stallo

Pc = 274 = Cl max ; con raffica stallo. $\Delta\alpha$ piani = 0.085 rad

Raff - 12.2:

Cl passa da 0.96 a 0,25 P diminuisce

Pc cala per Cl = 1.3: $\frac{\Delta Cl}{\Delta\alpha} = 5$: $\Delta\alpha = 0.085$

$\Delta Cl = 0.425$: Cl = 0.875 : Pc diminuisce

L ruote gancio ant
V=115 32 1020

Strappo cavo:
si suppr che ci sia pto debole con R = ~~650 kg~~ ~~700~~ kg

con che ci resti si ha T = 840 kg

e Tv max = 805 kg.

Lancio verticale: fianco ant

$V = 115 = 32\ m/s = V^2 = 1020$

Strappo del cavo: mach? cavo che va a 1,2 TR

Nelle cavo di raff +22 +, di valore tale da portare a stallo l'ala (supponendo cont $P_c = 274$ (kg)) si ha

caso 480 kg pag pilec: (senza raffica). cavo 488 kg

il cavo va a → ~~1000~~ 1000 × 1.2 = 1200 kg.

~~cavo Mg = 1200 · 2.148 = 2560 Kgmt~~ $J_{long} = 87,6$

carico lib per ω = 712

ecco $M_g = 712 \cdot 2.148 = 1520$ Kgmt

$\omega = \frac{1520}{87,6} = 17,5$ rad sec^2

Scarichi inerzia parte ant:

			M	ω	D	a	Scarico
Zone v. pag 7	zona	A	~~415~~ g	17,5	2.152	37,5	57
	"	B	~~126~~ g	"	1.3	22,8	278

Ord 6: M_{cavo} 1200 · 1.645 = 1980 Kgmt

$-M_{scar}$ 57 · 0.82 = 45

1935 $\quad \sigma = \frac{1935}{532} = 362$

Ord 7: M_{cavo} 1200 · 1980 = 2380

M_{scar} 57 · 1.16 = 66

2314 $\quad \sigma = 470$ ($T_{max} \simeq 920$

$T_{max} \simeq 740$

Ord 8

$T_{max} \simeq 850$

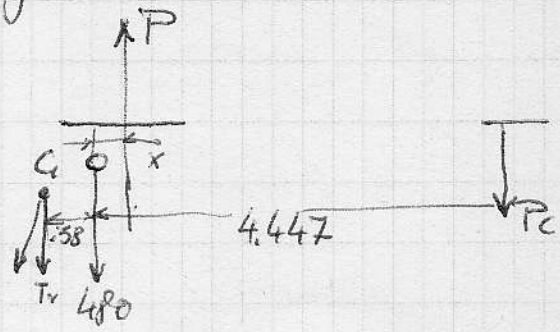
Ord 9

L. verricello gancio baricentrale

$V_w = 115$ K/h $= 32$ m/s $(1020 = V^2)$

Stab. il valore $P_c = 274$ kg (ray

G_a 20% : $G_t = 480$



(1) $P = T_v + 480 + P_c = T_v + 754$

(2) $T_v \cdot 0{,}38 = -Px + 4.447\,P_c$

$= -Px + 1220$

$x = 135/P + 0{,}072$

sc in 2): $0.38\,T_v = -135 - 0.072\,P + 1220 = -0072\,P + 1085$

$T_v = -0{,}019P + 286 - 0{,}19P + 2860$

T_v in 1: $P = -0.19P + 2860 + 754 =$

$0{,}81\,P = 3614$ $\quad P = 4460$: $T_v = -850 + 2860 = 2010$ kg

Impossibile: altre stallo

Posto $P = P_{max} = 2480$ kg:

1) $P = 2480 = T_v + 480 + P_c$

2) $T_v \cdot 0.38 + \underset{312}{\cancel{Px}} = 4.447\,P_c$

$T_v = 1{,}17\,P_c - 820$

T_v in 1.) $2480 = 11.7\,P_c + 480 + P_c$

$2000 = 12.7\,P_c$: $\quad P_c = 157{,}5$

$T_v = 1840 - 820 = 1020$ kg

$x = \frac{135}{\underset{2480}{P}} + 0.072 = 0.0545 + 0.072 = 0{,}1265$

$P \cdot x = 312$

Raffica +: stallo per ala

" o $P_c = 274$ per coda

" −: meno Pala

∴ T_{cada}.

$R = k\,c = 500\,c_{(cm)} = 250'000\,c_{(mt)}$

$2500 = k\,5$; $0{,}01 \quad 50'000$

$c = \frac{R}{50000}$

$E = \frac{1}{2} \cdot \frac{R}{50000} \cdot R$

$= \frac{R^2}{100000}$

Atterraggio: si considera tipo 1 perdi ruota. | $G = 20\%$ | $Q = 480$

Rigidezza prima: $R_{kg} = 500\ c_{(cm)}$

Assetto A: linea Cl = 0 a +4° : mezz final − 3°,5 con tenerno

" B : E Max : " " parallela al "

" C : Sparciato: (ala a ∿ 14÷15 ≅ Vs) " " + 7° " " ; coda montata :

" D : idem ruota " "

Definizioni: ($G = 20\%$)

- K = raggio d'inerzia ; $K = \sqrt{\frac{J}{M}} = \sqrt{\frac{87{,}6}{32}} = \sqrt{2{,}73} = 1{,}66$ mt
- l_N = dist ha maiez G sul suolo e pt cont pattino prima (A) ≅ zero
- $F_N \cong 1$
- l_t = dist Pg su tenerno e pt cont p coda (C,D) = 5 mt
- $F_t = \frac{1.66^2}{1.66^2 + 5^2} = \frac{2.75}{2{,}75 + 25} = \frac{2.75}{27{,}75} \cong 0.1$

$E = \frac{1}{2} c \cdot R$

$R = \frac{2E}{c}$

$c = \frac{2E}{R}$

$E = \frac{1}{2} M V^2$

$\frac{2E}{0.05} =$

$2 \cdot 20 \cdot E =$

$40 \cdot E$

Localizz	M	Vy m/sec	E Kgmt	C cm	R mooj	R = V ult	Resist (0,5·V)	Laterale (0,3·V)
1 an B(1B)	49	1.3	41,5	4,1	2050	3075	1540	920
2 " B	49	1.6	62	5	2500	=		
1): C	"	1.3	41.5	4,1	2050	3075	"	
2 : C	"	1.6	62	5	2500	=		
3 A	"	0.53	7	1,68	840	1260	630	140 380
4 A	"	0.64	10	2	1000	=		
5 D	4,9	1,1	2,7	3,3	164	246	123	74
6 D	4,9	1,3	3,2	3,6	180	=		

$c = 0{,}05$

$R = 500 \cdot c$

$c = \frac{R}{500}$

$E = \frac{1}{2} \cdot \frac{R}{500} \cdot R$

$= \frac{R^2}{1000}$

$R = \sqrt{1000 \cdot E}$ kg

$= \sqrt{1000\,E_{kgmt}}$ kgcm

$= 316 \sqrt{E_{kgmt}}$

$R' = 50\,c'$ kg cm

$c' = \frac{R'}{50}$

$E = \frac{R'^2}{100}$

$R' = \sqrt{100\,E_{kgcm}} =$

$= \sqrt{10000\,E_{kgmt}} =$

$= 100 \sqrt{E_{kgmt}}$

$\frac{1}{2} m v^2 = \frac{1}{2} \cdot 49 \cdot 2.55$

$125 \cdot 2.5 \cdot 480 = 1550$

$\frac{R \cdot c}{2} = E$

$c = \frac{2E}{R}$

Alettoni

$V_A = V_T = 37{,}2$ m/sec

$V^2 = 1380$

Movimento: $-35° \; +20°$

Posto $C_m = 0.04$ per grado: $0.04 \cdot 35 = 1.4$.

a $V_A = V_T = 37{,}2$ m/sec.

$$F_{spec} = \frac{1}{16} \cdot 1{,}4 \cdot 1 \cdot 1380 = 120 \text{ Kg/mq} \; \text{max} = 180 \text{ ult}$$

ρ C_M S V^2

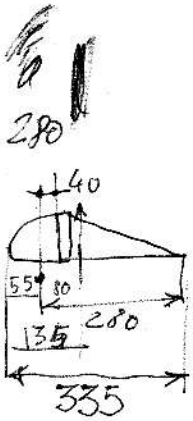
Deriva e timone.

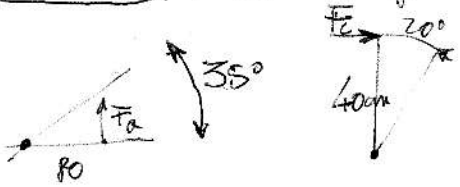
punto stallo: $Cl_{max} = 1.3$: $V_A = V_T = 37{,}2$: 172 Kg/mq max; 168 ult.

Alettoni : condiz: sforzo max

$S = 1.22$ a battuta

$$F_{a_{1°}} = \frac{1}{16} \cdot 0.04 \cdot V^2 \cdot 1{,}22 = 4{,}2 \text{ Kg}$$





alett alzato $F_c = F_{aa} \dfrac{8 \cdot \text{sen } 35°}{40 \cdot \text{sen } 20°} = F_a \dfrac{8 \cdot 0.574}{40 \cdot 0.342} = F_a \dfrac{4.6}{13{,}7} = 0{,}334 \cdot F_{aa}$

alett abbass: $F_c = F_{ab} \dfrac{8 \text{ sen } 20}{40 \text{ sen } 20} =$

$= 0{,}2 \; F_{ab}$

$$F_{ab} = \frac{20}{35} \cdot F_{aa} = 0.57 \; F_{aa}$$

$$F_{calc} = 0{,}334 \; F_{aa} + 0{,}2 \; F_{ab} = 0.334 \; F_{aa} + 0.2 \cdot 0.57 \; F_{aa} =$$

$$= 0.334 \; F_{aa} + 0{,}114 \; F_{aa} = 0{,}448 \; F_{aa} \; ; \quad F_{cl.} \leq 2 \times 34 \text{ Kg}$$

$$F_{aa} \leq \frac{68}{0{,}448} = 151 \text{ Kg} = 124 \text{ Kg/mq}$$

Quindi vale condiz. sopra

1125
675
1800
185

Carico asimmetrico sul gruppo di coda

~~→ Su p. orizz: carico di bilanciam. max~~

→ E3-5: 3.1 ≡ carichi a $V_A = V_T$: inviluppo manovra

P. orizz: carico max = + 244 − 238 (raffica esclusa) S=3.34.

considerando il ~~244~~ 276 Kg: ~~163~~ 184 un lato = ~~98~~ Kg/mq maaf.
~~81~~ 92 altro lato

M libero = torsione su fusol:

carico non equilibrato x braccio = ~~82~~ 92 x 0,94 = ~~77~~ 86 Kgmt maaf

P. vert: 112 Kg/mq x 1,89 = 212 Kg x b = 0.89 = 189 " "

2~~7~~75 " "

→ 4~~15~~ ultimate

Ord 18: A = 1120 s=0.15

$\frac{40{,}000}{2 \cdot 1{,}120 \cdot 0{,}15} = 120$ Kg/cm²

E3-3. 5,5: strappo cavo - gancio ant.

P. orizz: max Pc = 375 Kg: { 250 un lato / 125 altro "

libero: 125 Kg x b = 0.94 = 118 Kgmt maaf.

P. vert: c. sopra 189 "

307 " maaf

→ 460 " ultimate

Ord 18:

$\frac{460}{2 \cdot 1120 \cdot 0.15} = 137$ Kg/cm²

Ala

I carichi massimi sull'ala (già dettato Qa × n), ultimate, sono:

a) carico ~~normale~~ annuale al p.a. (diritto : 2470 Kg BCAR

b) " " " " rovescio : 1280 " " 3400 "

c) " sul piano alare : $\frac{2470}{8}$ = 310 Kg : (?) "

d) " " " " con diruttori aperti:

Vmax 200 K/h: R = Q+ = 480 Kg:

$R = R_a + R_{diruttori} = C_x \cdot \rho \cdot S \cdot V^2 + R_{diz} : = \frac{0,006}{16} \cdot 20,2 \cdot 56^2 + R_{diz} :$

$= 23,5 + R_{diz} :$ $R_{diz} = 480 - 23,5 = 466,5$ Kg

Quindi: 466 Kg su diruttori (magg) → 700 Kg ult.

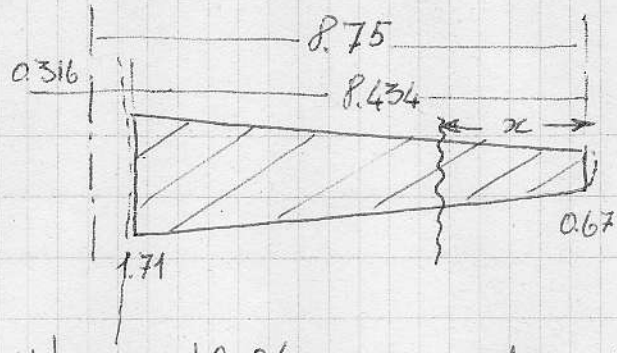
24 " " ala " → 36 " "

c) Mt: contemporaneo a d): ~~680~~ 700 Kgmt ultimate.

C40 BCAR

Vers Fruttì:

ALA



Carico vam al p.d: ~~1275~~ 1235 Kg

eqz c: $y = 0.123x + 0.67$

" $S = 0.0615x^2 + 0.67x$

S esterna a fus: (parte tratteggi) = 10,04 mq · car spec = ~~121~~ 123 Kg/mq

quindi:

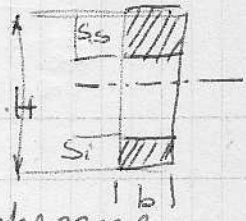
$T = 7.55x^2 + 8.25x$
$Mf = 2,516x^3 + 4.125x^2$
} tratto $0 \le x \le 8,434$

$T = 1235$; $Mf = +1235(x - 8.434)$: $8,434 < x < 8.75$

Cent	X	x^2	x^3	$7.55x^2$	$8.25x$	T	$2,516x^3$	M. $4.125x^2$	Mf	Rarezza
		$x - 8,434$				1232	(4450)			
E	8.75	0,316				1232	(4450)	390	4840	2305
1	8.434	71.2	600	537	695	1232	1510	2940	4450	
3	8.167	66.8	545	505	674	1179	1370	2760	4130	2140
5	7,834	61.2	480	462	646	1108	1210	2520	3730	1930
7	7.5	56.2	420	424	618	1042	1055	2320	3375	1745
11	6.834	46.6	319	352	564	916	800	1910	2710	1405
17	5.834	34	198	256	482	738	497	1400	1897	970
23	4.834	23.4	113	177	399	576	284	965	1249	648
29	3.834	14.7	56	111	316	427	141	606	747	386
35	2.834	8	22,8	60,5	234	294,5	57,4	330	387,4	200
41	1.834	3.37	6.2	25,4	151	176,4	15,6	139	154,6	80
Spina	8.51	0,076				1237	(4450)	94	4544	

Carico ammale al p. alare, rarezza: Kg 640 Kg

Diffr. c.s, tallec = a 51.8%



Dimensioni longherone e fallcatar. specifiche

Il longh ha è asimmetrico

NB: Si considerano le H di tav 5107 perché lo spessore del fasciame ~~compensa~~ (che è in più) compensa l'ondeggiamento a mafalo. Si trascura il contributo del fasciame resistente

Sez	H	S_s	S_i	W_{max}	W_{min}	Carico diretto σ_c	Carico diretto σ_t	Carico rovescio σ_c	Carico rovescio σ_t	b
				1160	920	~~384~~	~~484~~		~~399~~	
1	~~347~~	83	57	~~1215~~	~~960~~	~~368~~	~~494~~	250	~~491~~	6.74
3	336	80	55	1100	870	376	472	246	195	6.74
5	326	~~76~~	54	~~975~~	~~790~~	~~382~~	~~483~~	~~245~~	~~198~~	64.8
7	315	72	53	890	703	~~379~~	480	248	~~196~~	62.2
11	294	69	4.85	714	558	386	~~485~~	252	~~199~~	57
17	263	62	43	492	388	~~386~~	~~488~~	~~250~~	~~197~~	49.4
23	231	55	38	320	254	390	492	~~255~~	~~204~~	41.7
29	200	42	30	185	145	~~408~~	~~515~~	~~266~~	~~208~~	34
35	172	31	23	97	77	408	~~508~~	~~268~~	~~206~~	26.2
41	145	21	16	~~55~~	~~36.4~~	~~346~~	588	~~255~~	~~151~~	1.9
						290	490			

Dimensioni anime e sollecitaz spec. a taglio

Cent	s	H	A cm q	τ
1	2	347	13,9	89
3	2	336	13,4	88
5	2	326	13	86
7	1.5	315	9.45	110
11	1.5	294	8.7	106
17	1.5	263	7.9	94
23	1.5	231	6.9	84
29	1	200	4	108
35	0.8	172	2.75	98
41	0.8	145	2.32	77

Torsione

La Tmax si ha in C e vale ~~800~~ 805 Kgmt (ultimo)

= ~~364,8~~ 395 ~~400~~ 402,5 Kgmt per semiala.

Trattandosi di ala interamente coperta in compensato le sollecitaz. specif sono assai basse.

P. es. alla cent 1 (area 3774 cm²: sp = 2 mm) si ha:

$$\tau = \frac{Mt}{2A \cdot s} = \frac{\cancel{34,150}\ 40,250}{2 \cdot 3774 \cdot 0.2} = \frac{\cancel{2,3}\ \cancel{2,67}\ 2,7}{1} \text{ Kg/cm}^2$$

Non si ~~ripeta~~ esegue il calcolo della rigidità torsionale ritenendo più attendibile la prova di rigidità torsionale che verrà eseguita sull'ala finita

[7] 2 $W = 2 \cdot \frac{7^2}{6} = 16{,}4$

515 × 80 = 4400 kg/cm

$\sigma_f = 250$

$A = 14$

$T = 1600$

$\sigma_t = 115$

---

[7] 3 $W = 24{,}5$ ~~32,8~~ $A = 21$

$\sigma_f = 168$ ~~185~~

$\sigma_t = 780$

Longherone posteriore (a 0,77 mt da asse)

La sollecitazione max si ha con:

a) Torsione max = 805 kg mt: ~~805/0,784~~ = 402,5 per semiala

b) carico sul piano alare con direttrici:

supponendo che a VD sui dischi il carico medio sia di 480 kg = 720 kg VLT = 360 kg per ala:

si ha: (nello spiccato attacco post):

carico vert: $402{,}5/0{,}77 = 525$ kg

" carico: $360 \cdot 3{,}51/0{,}77 = $ ~~1~~ 1640 kg

Quindi nella sez = cent 1 si ha:

$M_f = 525 \cdot 8 = 4200$ kg/cm

$T = 1640$ kg.

Per cent:

[7] 3 $W = 24{,}5$ $A = 21$

$\sigma_f = 162$

$\sigma_t = 78$

Tot: 230

Diruttori.

Definizione dei carichi.

Si suppone che l'aliante a $C_{z\,min}$ (candela) stabilizzi a 220 K/h.

Si ha: $Q = R_{Hz} + R_{aliante}$

$R_{Hz} = Q - R_{aliante} =$

$= 480 - 0{,}0.160 \cdot \frac{1}{16} \cdot 20{,}2 \cdot \frac{61^2}{3720} =$

$= 480 - 75 = 405$ Kg

1333
75
75
1483

Come carico sui diruttori si considerano 610 Kg ultimate, distribuiti uniform. sulle pale.

Pale (ter pag 115)

Lungh complessiva pale: 7.4 mt;

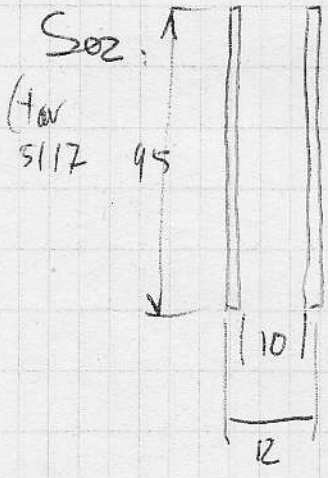
Car p mt: $\frac{610}{7.4} = 83$ Kg/mt

$S_{tot} = 0{,}78\ m^2$

190
180
370
740

$M_{max} = \frac{p\,\ell^2}{8} = \frac{83 \cdot 1.483^2}{8} = 23$ Kg mt

Sez.



(ter pag 117)

$J = \frac{9{,}5}{12} \cdot (12^3 - 1^3) = 0.56\ cm^4$

0.72

$W = \frac{2 \cdot 0.56}{1{,}2} = 0.95\ cm^3$

$\sigma = \frac{2300}{0.95} = 24{,}2$ Kg/mmq (dural

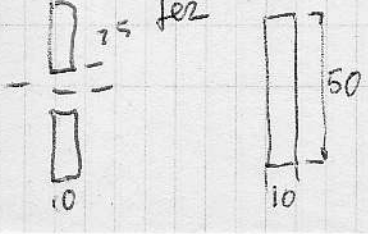
Leve · dural $s = 10$ mm

Verifica in mezzeria:

Carico ~~M~~ Pala maggiore: $1.9 \times 83 = 158$ Kg = 80 Kg per leva

Mf leva: $80 \times 20{,}5 = 1640$ Kgcm

leva



$W = b\frac{h^2}{6} = \cancel{1 \cdot \frac{5^2}{6} = 4{,}2}$

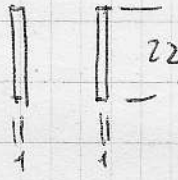
$= 5 \cdot \frac{1^2}{6} = 0{,}84$

$\sigma = \frac{1640}{\cancel{4{,}2}\ 0{,}84} = \cancel{390}$ 19,5 Kg/mmq

Comando alettoni

1 alettone = 1.22 mq : × 180 Kg/mq = 220 Kg :
C.P a 40% corda = 0.25 × 335 = 84 mm
dist C.P - asse cerniera = 3 cm.
M cerniera = 220 · 3 = 660 Kg mt.
braccio comando = 8,2 cm : $P = \frac{660}{8,2} = 81,0$ Kg compr.

Leva: $M_{max} = 81p \times 7 = 5670$ Kg cm :

leva: 

$W = 0.2 \cdot \frac{2,2^2}{6} = 0,16\ cm^3$ $\sigma = \frac{5670}{0.16} = 35'090\ Kg/cm^2$

biella lunga: $P = 81 \cdot \frac{8.5}{9} = 76$ Kg

C alett = 335

Alettoni

P = 180 Kg/mq ultimate

- Verifica del longherone alettone a flessione

Si considerano separate una dall'altra le zone da una cerniera all'altra.

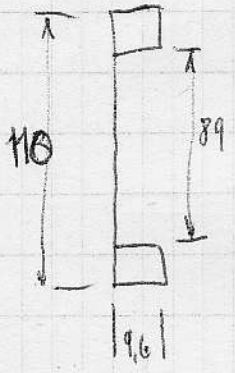
La zona più lunga ha apertura 1.32 mt; sup. = 0.44 mq:

carico 180 × 0.44 = 79 Kg:

Poichè il carico è unif. distrib si ha:

$$M_{max} = \frac{P \cdot l}{8} = 79 \cdot \frac{1.32}{8} = 13 \text{ Kgmt} \quad \text{e cmt } 45.$$

Sez resist:



113
24
89

$$J = \frac{9,6}{12} \cdot \left(11^3 - 8,9^3\right) = \frac{9,6}{12} \cdot \frac{1330}{\frac{705}{625}} = 500$$

$$W = \frac{500}{11,0} = 9,1$$

$$\sigma = \frac{1300}{9,1} = 14,3 \text{ Kg/cm}^2$$

- Carico sulle cerniere.

Su tutto alettone: 180 × 1.22 = 220 Kg

N° 4 cerniere: $\frac{220}{4} = 54$ Kg cadauna

1.67
1.62
3.24

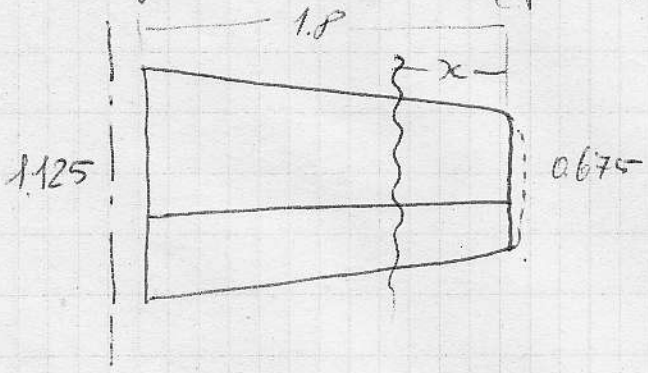
C40 / BCAR

Piano orizzontale

Car max: 276 kg : ipotesi $\frac{1}{3}$ e $\frac{2}{3}$: $\frac{2}{3} \cdot 276 = 185$ kg : x1.5 : 278 kg

1.125 - 675 / 450

Sup. da cent 1 a cent 11 (af. 1.8 mt) = 1.62 x 2 : Ppiec = 172 Kg/mq



corde: $y = 0.25\,x + 0.675$

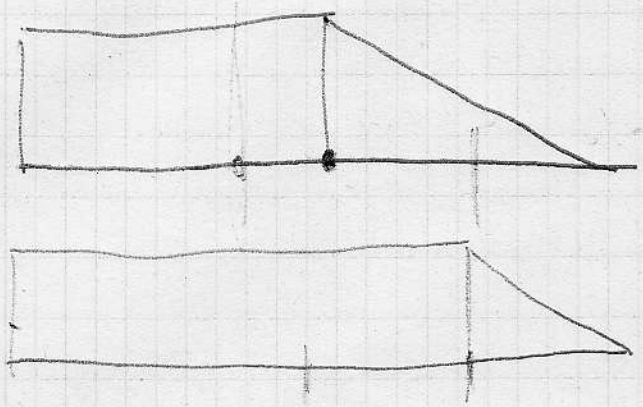
$S = 0.125\,x^2 + 0.675\,x$

$T = 21.5\,x^2 + 116 \cdot x$

$Mf = 7.17\,x^3 + 58 \cdot x^2$

Cent	x	x^2	x^3	$21,5\,x^2$		T			Mf
1	1.8	3.24	5.28	70	208	278	38	188	226
2	1.62	2.62	4.25	56	188	244	30.5	152	182,5
3	1.44	2.07	3	44,5	167	211,5	21.5	120	141,5
5	1.08	1.17	1.28	25,2	126	151,2	9,2	68	77,2
7	0.72	0.52	0.37	11.2	83	94,2	2.6	30	32,6

Longherone fino



276 185 278
267 178 261

1,125
675
1,800

P. Orizz

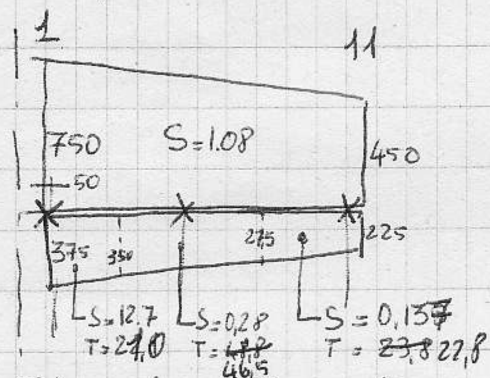
→ ipotesi $\frac{1}{3}$ e $\frac{2}{3}$: $\frac{2}{3}$ · 375 = 250 · 1.5 = 375 ult. su un lato
= 234 kg/mq ult
166

Car max + 268 375 276 kg (carico ven + strappo)
− 238 "

$\frac{278 \cdot 2}{3.23}$ = 166 kg/mq ult.

ripartito cent da 1 a 11 = $\frac{375}{3,23}$ = 116 112 kg/mq = 174 168 ult ← carteggiare tutto

S = ,81



Parte fisso: eqz. corde = 0.167 x + 0,45
S = 0083 x² + 0.45 x
× 166 174 = T = 13.8 14.4 x² + 75 78.3 x
Mf = 4,6 x³ + 37,5 x²

Parte mob: S = 0.54

Sollecitaz per carico distribuito su fisso

Cent	x	x²	x³			T			Mf	Mf.
1	1.8	3.24	5.82	44,7	135	179,7	26,7	121,0	152 (209)	147,7
2	1.62	2.62	4.25	36,0	122	158,0	19.5	98	122,4	117,5
3	1.44	2.07	3	28,5	108	136,5	13,8	51,7.5	85,4 (130)	91,3
5	1.08	1.17	1.28	16,2	82,0	98,2	5.9	44,0	52,0	50
7	0.72	0.52	0.37	7,2	54,0	61,2	1.7	19,5	22,1	21,2

Sollec per carico concentr | Sollecitaz totale

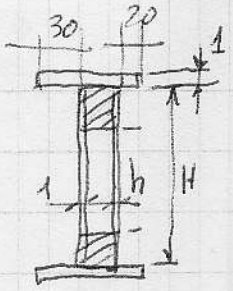
Cent	T		Mf	Mf	T	T	Mf	Mf.
1	90,3	1,1 + 36 37,5 + 34,5 41,2	79,8 (110)	76,6	270	270	231,8 (324)	223,7
2	69,3	– 26,8 + 36	66,6	62,8	237,4	227,3	189,0	180,3
3	69,3	– 18,6 + 32	56,3 (74)	50,6	215,4	205,8	148,7 (204)	141,9
5	69,3	– 3,5 + 24,5 23,5	26,9	27,0	174,0	167,5	78,9	77
7	22,8	15,2		15,2	87,7	84,0	38,1	36,4

22,1 × 0,05

179,7 +
90,3
2700

Carichi sulle cerniere

Cerniera	Quarzia cent	C
1ª	1	22 21
2ª	5	48,8 46,5
3ª	11	23,8 22,8



103
89
192
96

Longherone fisso

Oltre al longherone si considera una striscia di soletta larga 50 cm + b.

Cent	H	h	b	J_c	J_f	J_{tot}	W	σ_f	τ	A	τ
1	14.6	7,3	2,0	620	81	701	95	257	0,1	2,8	101
2	13.6	6,6	1.85	344	68,5	412,5	59,8	305	0,1	2,6	91
3	12.6	8.9	1.7	183	55,9	238,9	37,4	380	0,1	2,4	90
5	10.6	7.5	1.4	90	32	122	22,6	340	0,1	2,1	83
7	8,6	6.	1.1	38,5	22,9	61.4	14	260	0,1	1,7	51

Longherone mobile.

Si considerano isolate le tratte da una cerniera all'altra

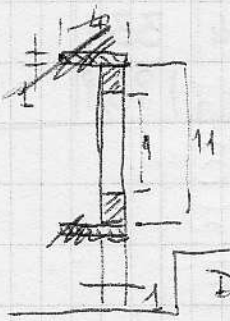
Tratta da cent 1 a 2° cerniera:

$S = 0.26$; Carico = 45 Kg

$M_{max} = \frac{Pl}{8} = \frac{45 \cdot 0.75}{8} = 4,22$ Kgmt

Sez rientr:

74 + 56 / 130

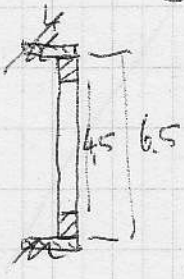


$J_c = \frac{1}{12} \cdot \frac{1340}{730/610} = 50,8$; $W = 9,25$; $\sigma = \frac{422}{9,25} = 45,5$

~~$J_f = \frac{4}{12} \frac{1400}{1340/60} = 22$~~ ; ~~$W = 12,65$ $\sigma = 33,7$~~

Da 2ª cen a 3ª:

S = 0.3 : Carico = 52,2 kg $M_{max} = \frac{52,2 \cdot 1}{8} = 6,5$ Kgmt



$J_c = \frac{1}{12} \frac{375 - 91}{284} = 236$; $W = 7,25$; $\sigma = \frac{650}{7,25} = 90$ kg/cm²

~~$J_f = \frac{4}{12} \frac{300}{275/25} = 8,72$~~

Longh piano orizz. €40/appendice 31

① $J_l = \frac{2}{12} \cdot \frac{3100 - 390}{3710} = 620$

$J_f = \frac{7}{12} \cdot \frac{3250}{3110} \quad 140 = 81$

701 $W = 95\,cm^3$ $\sigma = \frac{23180}{95} = 245$

---

② $J_l = \frac{1.85}{12} \cdot \frac{2520}{2233} = 344$

$J_f = \frac{6.85}{12} \cdot \frac{2640}{2520} \quad 120 = 68.5$

412,5 $W = 59,8$ $\sigma = \frac{18900}{59,8} = 316$

---

③ $J_l = \frac{1.7}{12} \cdot \frac{2000}{710} \quad 1290 = 183$

$J_f = \frac{6.7}{12} \cdot \frac{2100}{2000} = 55,9$

2389 $W = 37,4$ $\sigma = \frac{14870}{37,4} = 397$

---

⑤ $J_l = \frac{1.6}{12} \cdot \frac{1200}{430} \quad 770 = 90$

$J_f = \frac{6,4}{12} \cdot \frac{1260}{80} = 32$

122 $W = 22,6$ $\sigma = \frac{7890}{22,6} = 350$

---

⑦ $J_l \quad \frac{11}{12} \cdot \frac{635}{215} \quad 420 = 38,5$

$J_f \quad \frac{6.1}{12} \cdot \frac{680}{635} \quad 45 = 22,9$

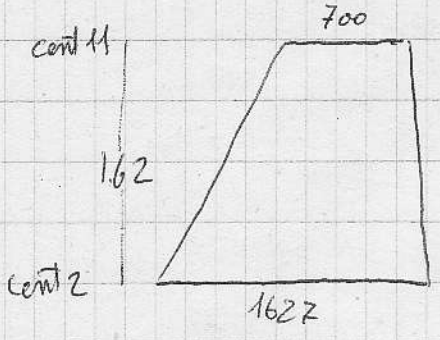
61,4 $W = 14$ $\sigma = \frac{3810}{14} = 272$

②

144 → 180 ~~24~~ 162

P. verticale

$P_{max} = 168$ kg/mq ultimate



eqz. corde $= 0.6 \cdot x + 0.7$

$S = 0.3\,x^2 + 0.7\,x$

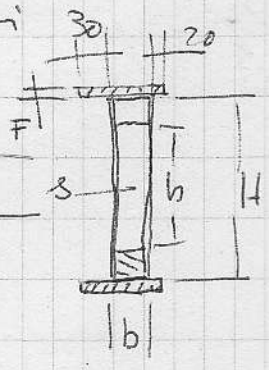
$T = 50{,}3\,x^2 + 118\,x$

$Mf = 16{,}76\,x^3 + 59\,x^2$

Cent	x	x^2	x^3			T			Mf
2	1.62	2.62	4.25	132	191	323	71	155	226
3	1.44	2.07	3	104	170	274	50	122	172
5	1.08	1.16	1.26	59	137	196	21	69	90
7	0.72	0.52	0.37	28,5	85	113,5	6.2	30	36,2

Longherone fino

Oltre al longherone si considera una striscia di fasciame larga 50 mm + b



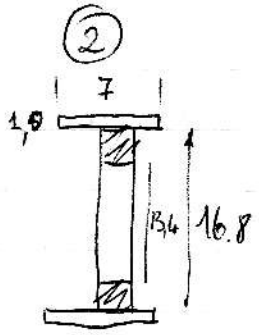
C	H	h	b	F	Je	Jc	J+	W	σ	s	A	T
2	16.8	13.4	2	0,15	392	146	538	63	360	1	3.36	96
3	15.4	12.2	1.85	0.15	282	120	402	51,3	335	1	3.08	89
5	13	10.2	1.58	0.1	150	54.8	204,8	31	290	1	2.6	75
7	10.2	7.9	1.3	0.1	61.5	31.5	93	17.9	202	2.04	2.04	55

C40/Verifica appendice 32

$f = ax + b \qquad b = 0.7$

$1{,}627 = a \cdot 1.62 + 0.7$

$a = \frac{1.627 - 0.7}{1.62} = 0.6$

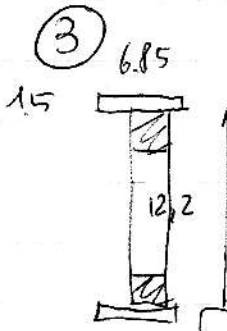


$J_l = \frac{2}{12} \cdot \frac{4750}{2400} \cdot \frac{}{2350} = 392$

~~$J_f = \frac{7}{12} \cdot \frac{4900}{4750} \cdot \frac{}{150} = 87$~~

479 $W = 564$ $\sigma = \frac{22600}{564} = 400$

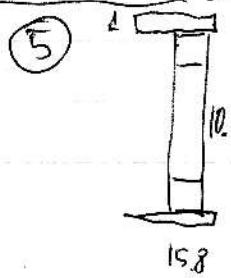
$s = 1{,}5$ $J_f = \frac{7}{12} \cdot \frac{5000}{4750} \cdot \frac{}{250} = \frac{146}{538}$ $W = 63$ $\sigma = 360$



$J_l = \frac{1.85}{12} \cdot \frac{3650}{1820} \cdot \frac{}{1830} = 282$

$J_l = \frac{6.85}{12} \cdot \frac{3860}{650} \cdot \frac{}{210} = 120$

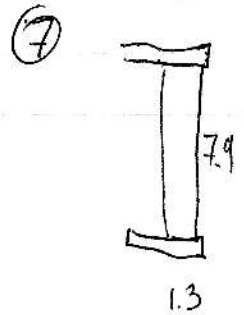
402 $W = 513$ $\sigma = \frac{17200}{513} = 335$



$J_l = \frac{1.58}{12} \cdot \frac{2200}{1060} \cdot \frac{}{1140} = 150$

$J_f = \frac{6.58}{12} \cdot \frac{2300}{200} \cdot \frac{}{100} = 54.8$

204,8 $W = 31$ $\sigma = \frac{9000}{31} = 290$



$J_l = \frac{1.3}{12} \cdot \frac{1060}{490} \cdot \frac{}{570} = 61.5$

$J_f = \frac{6.3}{12} \cdot \frac{1120}{60} = 31.5$

93,0 $W = 17.9$ $\sigma = \frac{3620}{17.9} = 202$

Fusaliera ~~268~~ 276 ~~402~~ 414

Carichi:

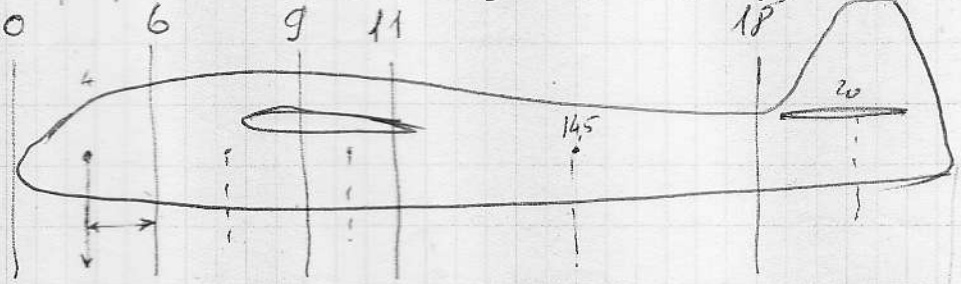
a) Carico ~~ultimate~~ su piano orizzontale:

verso il bano: ~~375~~ × 1.5 = ~~562~~ Kg ultimate (latrato a vento)

oppure " l'alto 238 × 1.5 = 358 " " (caso ~~A~~)

applicati a ord 20

b) Peso proprio × n (caso A): $n_1 = 5$ (manf) 7,5 (ult)



Zona	A	B	C	D	E	Tot	
Qn	25	25	25	15	25	115	
Cu	90	~~110~~	~~110~~	—	—	200	315
Qt	115	~~135~~	35	15	25		
n=7.5	860	~~1010~~ 1010	262	112.5	188		

c) Carico su piano verticale: (combinato con a)

323 Kg (ultimate)

d) Carichi di lancio: gancio anteriore: aerobaino

≠ 1000 Kg allineati

− 1000 Kg a 20° in alto: comp. ver. 340 Kg

— " " a 40° " basso: " " 640 "

— " " laterale 25°: " later 420 "

e) Carichi lancio: gancio anteriore: venicello

− ~~695~~ Kg a 75° in bano: comp. ver. ~~650~~ Kg

~~805~~ 840 805

Fusaliera segue ipotesi

f) Carichi di lancio: gancio posteriore: venicello a 130 dietro ord 7.
2000 Kg verso il basso

g) atterraggio
- caso A: α di Cl: 0 a +4°:
1260 Kg : 630 a ord 4 + 315 R + 95 lat
630 a ord 7 + 315 R + 95 lat ✓

~~- caso B: E max:~~
~~3075 Kg su mota + 1540 R + 920 lat~~

- caso B : E Max
3075 Kg + 1540 R + 920 lat. ✓
50% mota: 1038 + 770 + 460 lat
50% pattino: " " "
di cui: 2/3 ord 7 690 + 515R + 307 lat
1/3 ord 4 348 + 255R + 153 lat

caso C: cabrato
su mota: 3075 + 1540R + 920 lat. ✓

caso D: + cabrato
su pattino coda:
246 + 123R + 37 lat ✓

Fusoliera: T ed Mf nelle ordinate

a): ~~402~~ 414 / ~~562~~ Kg a ord 20:

Ord	x	T	Mf		Ord	x	Mf	
9	4.28	562	~~2400~~	1770	12	3.12	1770	1290
~~14~~ 11	3.51	"	1970	1450	13	2.73	1530	1125
15	~~2.73~~ 1.95	"	~~1530~~ 1090	~~780~~ 805	14	2.34	1310	960
18	~~1.95~~ 0.78		~~1090~~ 438	~~314~~ 322	16	1.56	880	650

b) $Q \times m_1 \times 1.5$

Ord	Z	x	P	T	Mf	Ord	Z	x	P	T	Mf
6	A	0.67	860	860	575	7	A	1.005	860		860
9	A	1.675	860		1440		B/3	0.16	~~310~~ 336		~~56~~ 914
	B	0.5	~~940~~ 1010		~~505~~ 470						
				1870	1945	8	A	1.34	860		1150
11	D	1.365	112.5		154		2B/3	0.335	~~620~~ 672		~~225~~ ~~207~~ ~~1357~~ 1375
	E	3.51	188		660						
				3005	814						
18	D	0.78	188		93						

c) 323 su verticale: a ord 20 | LATERALE

Ord	Z	x	P	T	Mf
9		4.28	323	323	[1400]
11		3.51	"	"	1130
15		~~2.73~~ 1.45	"	"	~~630~~
18		0.78	"	"	252
12		3.12			1010
13		2.73			880
14		2.34			755
16		1.56			502

d) Lancio: carico su fancio ant: aerotraino

−340 Kg alto:				640 in basso				240 a lato	
Ord	x	T	Mf	Ord	x	T	Mf	T	Mf
6	1.645	340	560	6	1645	640	1050	240	395
9	2,650	"	900	9	2.65	"	1700	"	636

LATERALE

Ord	x		
7	240	1.98	476
8	"	2,315	560

e) Lancio venic: fancio anteriore

~~685~~ 805 ~~650~~ vert in basso

Ord	x	T	Mf				
6	1.645	~~650~~ 805	~~1070~~ 1330	7	~~650~~ 805	1.98	~~1280~~ 1600
9	2.65	"	~~1720~~ 2130	8	~~650~~ "	2,315	~~1500~~ 1860

f) Lancio venic: fancio poster: 2000 Kg.

Ord	x	T	Mf
9	~~0,1400~~ 0.55	2000	1100

g) Athena dep: ~~A~~

A				B				C
Ord	x	T	Mf	Ord	x	T	Mf	3075 in quota
6	0.66	~~600~~ 630	~~330~~ 415	6	0.66	348	230	
9	1.67	~~500~~ 630	1050	9	1.67	348	580	
	0.67	~~500~~ 630	422		0.67	690	233	
		1260	1472			1038	813	

Riassunto sollecitazioni ordinate

Nel piano verticale

Ord.	a	b	d	e	f	g
	Mf	Mf	Mf	Mf	Mf	Mf
6		575	1050	1330	—	-415
7		917	1280	1600	—	
8		1375	1480	1860	—	
9	1770	1945	1700	2130	1100	-1472
11	1450	814				
12	1290					
13	1125					
14	960					
15	805					
16	650					
18	322	93				

Nel piano orizzontale

Ord	c		d lato
6		-	345
7		-	476
8		-	560
9	1400	-	636
11	1130	1400	
12	1010	1130	
13	880	1010	
14	755	880	
15	630	755	
16	502	630	
18	252		

Riassunto sollecitaz ordinate

Nel piano verticale.

Ord	a T	a M	b T	b M	d T	d M	e Verifica-g ant		f		g	
6			860	~~575~~ ~~1440~~	-340 +640	-560 +1050	+650	1070			-630 -348	-415 -230
7		~~910~~		910				1280				
8		~~1357~~		1357				1500				
9	402 [~~562~~] -	[~~340~~] 1720	1800	1910	-340 +640	-900 +1070	650	1720	2000	1100	-1260 -1038	-1472 -813
11	"	1410 ~~1470~~	300	814								
12 ~~750~~ 1250												
13 ~~1530~~ 1100		780										
14 ~~1310~~ 940	15	"	~~1040~~ ~~1530~~									
~~16~~	16	650	~~890~~									
	18	"	~~1040~~ 314	188	93							
~~17~~		"										

Nel piano orizzontale

Ord	C T	C M	d Later T	d Later M
6			240	395
7				476
8				560
9			"	636
11	323	1130		
15	"	~~6~~30		
16		502		
18	"	252		

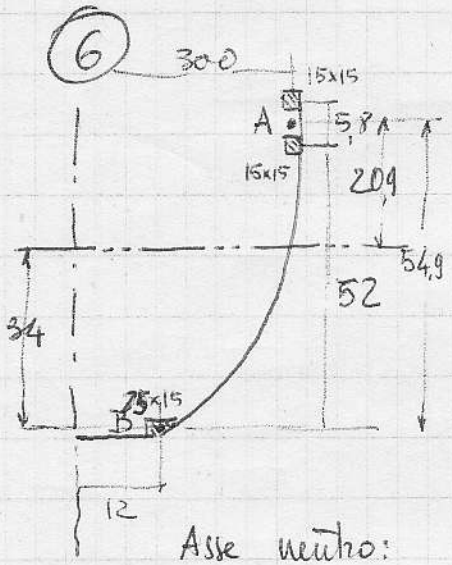
Tensione

12	1010	
13	890	
14	755	

Verifica sezioni fusoliera

$S = 2$

Le sez resistenti considerate per la ~~resistenza~~ flessione sono l'area del listello più una striscia di fasciame incollata di volta in volta.



→ Nel piano verticale

sez A: lat. $2 \times 15 \times 15$	=	$4,5\ cm^2$
~~ant~~ conf: ~~10~~ $\times 0,2$	=	~~462~~
conf. int: 10×0.1	=	1
tot.		7,5

sez B:

list: 25×15 ridotto	3
conf. est: 10×0.2	2
	5

Asse neutro: $7,5 \times 54,9 = 410 : 7,5 + 5 = 34$

	A	D^2	J
$J =$	$2 \times 7,5 \times$	435	$= 6550$
	$2 \times 5 \times$	1150	$= 11500$
			$18050\ cm^4$

$W_{mx} = \frac{18050}{20,9} = 865 \qquad \sigma = \frac{107000}{865} = 124$

$W_{inf} = \frac{18050}{34} = 532 \qquad \frac{107000}{532} = 202$

→ Nel piano orizz:

	A	D^2	J
$J =$	$2 \times 7,5 \times$	900	$= 13500$
	$2 \times 5 \times$	144	1440
	tot		14940

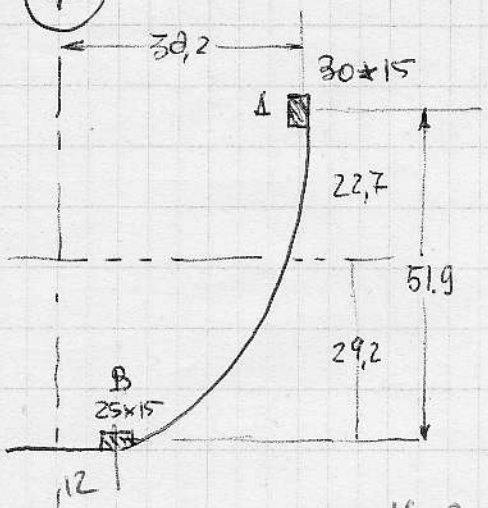
$W = \frac{14940}{30} = 495$

$\sigma = \frac{39500}{495} = 80$

s = 2

541 - 22 = 519

(7)



A:	30×15	4,5
	9×0.2	1.8
		6,3
B:	25×15	3.5
	7×0.2	1.4
		4.9

An: $\frac{6.3 \cdot 51.9 \cdot 326}{6.3+4.9} = 29,2$

11,2

P Vert: ~~1600~~ ~~1280~~ M

A	D	J	W	σ
2·6.3	~~2·4.9~~ 22,7	6400	650	~~197~~ 247
2.4.9	29.2	5400	510	~~250~~ 315
		14800		

P vinc: 476

2. 6.3 · 30,2 = W = 380 σ = 125 + ~~197~~ 247 = 322 372

Pvinc:

A	D	D²	J
2·6,3 ·	30.2		11500
2·4,9 ·	12		1400
			12900

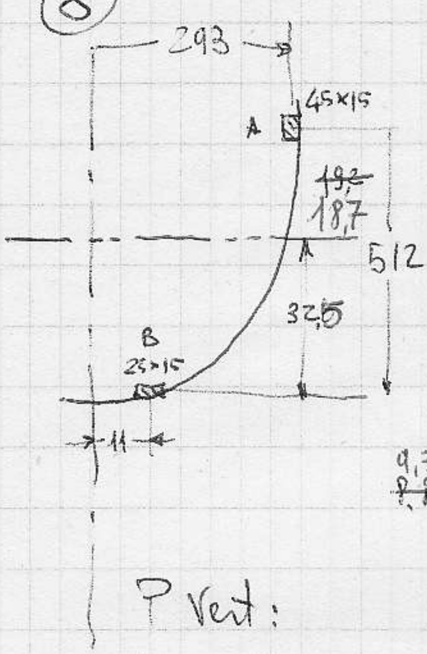
$W = \frac{12900}{30,7} = 415$ $\sigma = \frac{476}{4,15} = 115$

PV: 1357
PO 560

542
30

λ = 2,0 λ = 2,5

(8)



A	45×15	=	6.75
C	10,5×0.25	=	2,62
			9,37
B.	25×15		3,~~1~~
	~~9~~ × 0.25		2,25 ~~1.6~~
			~~4.4~~ 5,35

Non considerato comp. rotto per pavimento

A neutro

$\frac{9{,}37}{\cancel{8{,}85}} \cdot 51.2 = \frac{480}{\cancel{454}} / \frac{\cancel{8.85+4.4}}{\cancel{13.25}\ 14{,}72} = 32{,}5$

P Vert: M = ~~1357~~ 1860

A	D	J	W	σ
2·~~8.85~~ 9,37	~~19.2~~ 18,7	~~6500~~ 6550	~~360~~ 355	~~158~~ ~~216~~ 195
2·~~4.4~~ 5,35	~~32~~ 32,5	~~10 000~~ 11300	~~515~~ 550	263 338
		~~16500~~ 17850		

P orizz: 560

~~Solo A:~~
~~2·8,85 · 29,3 = W = 520 σ = 100 + 158 = 258~~

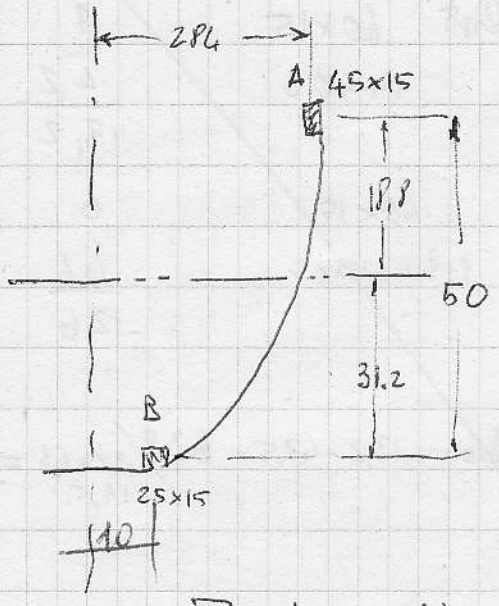
A	D	J
2·9,37	29,3	16000
2·5,35	11	1300
		17300

W = 576

σ = 97

$\delta = 0.3$

(9)



A = 45×15 = 6.75

c 13,5·0.3 = 4.05

10.8

B: 25×15 3.4 [3.75→)

11,5 ~~10~~ ·0.3 3.4

6.5

Am $10.8 \cdot 50 = 540$ $10.8+6.5=17.3$ = 31.2

T verific: M = 1910

A	D	J	W	σ	
2·10.8	18,8	7600	1070	179	A
2·6.5	31.2	12600	645	296	B
		20'200			

T min: 636

W = 2·10,8·28,4 = 613 σ = 104 + 179 = 283

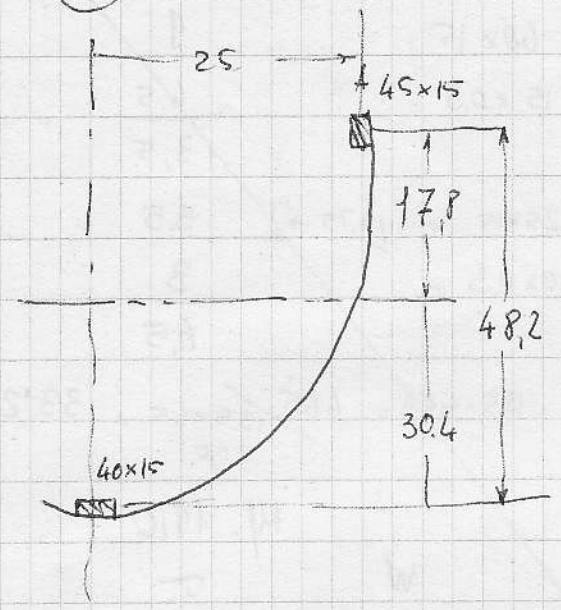
A	D	J
2·10,8	28,4	17400
2·6,5	10	1300
		18700

W = 645

σ = 99

$\delta = 0.3$

(11)



A:	45×15	6.75	
	13.5×0.3	4.05	
		10.8	
B	40×15	6	
	9+9+4 = 22.0.3	6.6	
		12.6	

A neutro: $10.8 \cdot 48{,}2 = \frac{520}{10.8 + 12.6} = 30.4$ ~~23,4~~ 17.1

P vertic: M = 1410

A	D	J	W	σ
2·10.8	17.8	6800	1030	137
12.6	30.4	11600	610	231
		18400		

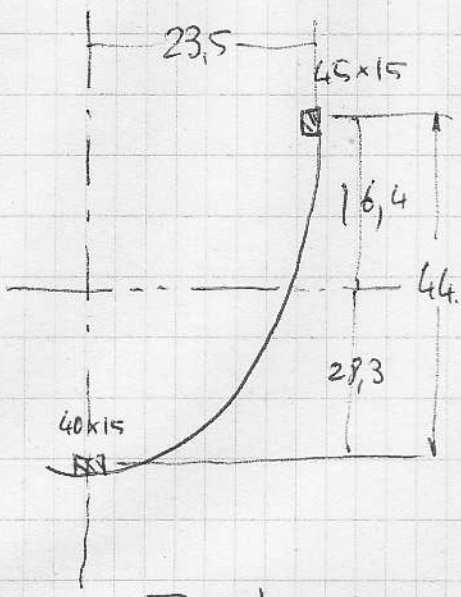
P oriz: M 1130

$W = 2 \cdot 10{,}8 \cdot 25 = 540$

$\sigma = 210 + 137 = 347$

$\nu = 0.3$

(12)



A	45×15		6.75
	13.5·0.3		4.05
			10.8
B	40×15		6
	9+9+4=22·3		6.6
			12.6

$A_{neutro} = 10.8 \cdot 44.7 - \frac{481}{10.8+6.3} = 283$

17.1

P vertic: ~~1250~~ 1240

A	D	J	W	σ
2·10.8	16.4	5800	970	~~127~~ 133
12.6	28.3	10100	562	~~222~~ 230
		15900		

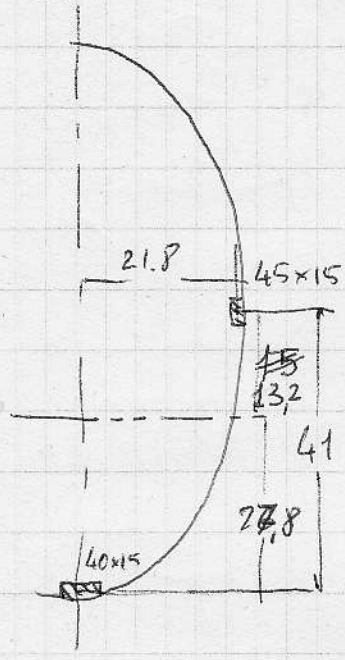
P orizz: 1010

$W = 2 \cdot 10{,}8 \cdot 23{,}5 = 510$

$\sigma =$ 198 +
~~127~~ 133
~~325~~ 331

Conf. 1 = 3

(13)



Non si considera la parte superiore ma si considera la striscia conf. adiacente a lit mal, 1 = 3

A: 45×15 = 6.75

c: 9+9+4,5 = 22,5 × 0.3 = 6.75

13.5

B: 40×15 = 6

c: 9+9+4 = 22 × 0.3 = 6,6

12,6

A neutro:

$\frac{10.8 \cdot 41}{13,5} = \frac{550}{444} \quad 10.8 + 6.3 = 26\ 27,8$

13,5+6,3 = 19,8 ~~7,1~~

Nel p. verticale: Mf = ~~1530~~ ~~1100~~ 1125

	A	D	J	W	σ		
2.	13,5 ~~10.8~~	13,2	~~4850~~ 4700	~~890~~ 1100	~~172~~ ~~140~~	A	~~100~~ 102
	12.6	~~27~~ 8	~~8500~~ 9800	~~515~~ 520	29~~5~~	B	216
			~~13350~~ 14,500				

Nel p. orizz: Mf = 890

$W = 2 \cdot \frac{10.8}{13.5} \cdot 21.8 = \frac{472}{590}$

σ = ~~186~~ + 150 +

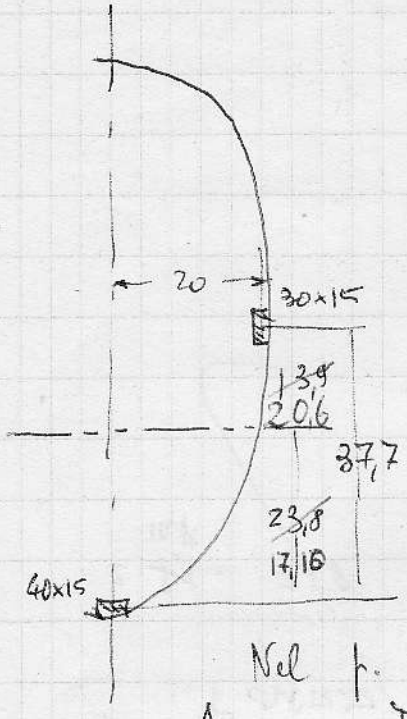
~~172~~ ~~100~~ 102

~~358~~ ~~250~~ A252

$s = 0.3$ (2,5)

(14) Comp $n=3$

Non si considera struttura: ma si considera la comp. adiacente



A lit: $30 \times 15 = 4,5$

C: $9+9+3 = 21 \times 0.3 = 6.3$ $\quad 7,5+7,5+3 = 18,25 = 4,5$ (9)

$10,8$

B: lit: $40 \times 15 = 6$

C: $9+9+4 = 22 \times 0.3 = 6,6$ $\quad 19 \cdot 2,5 = 4,75$ (10,75)

$12,6$

Asse neutro

$\frac{10,8 \cdot 37,7}{9} = 339$

$\frac{407}{10,8 + 6,3 + 19,75} = 17,1$

$= 23,8$ (17,16)

Nel p. verticale $\quad M_f = 1310\ 940\ 960$

A	D	J	W	σ
$2 \cdot 10.8\ 9$	$13.9\ 20,6$	$4150\ 7650$	$820\ 680$	$160\ 115\ 141$
$12.6\ 10,75$	$23.8\ 17,1$	$7200\ 6300$	$478\ 815$	285 B 118
		$11350\ 13950$		

Nel p. orizz: $\quad M_f = 755$

$W = 2 \cdot 10.8 \cdot 20 = 432$

$J = 2 \cdot 9 \cdot 20^2 = 7200$

$W = 360$

$\sigma = 175$

160

835 A

115

290

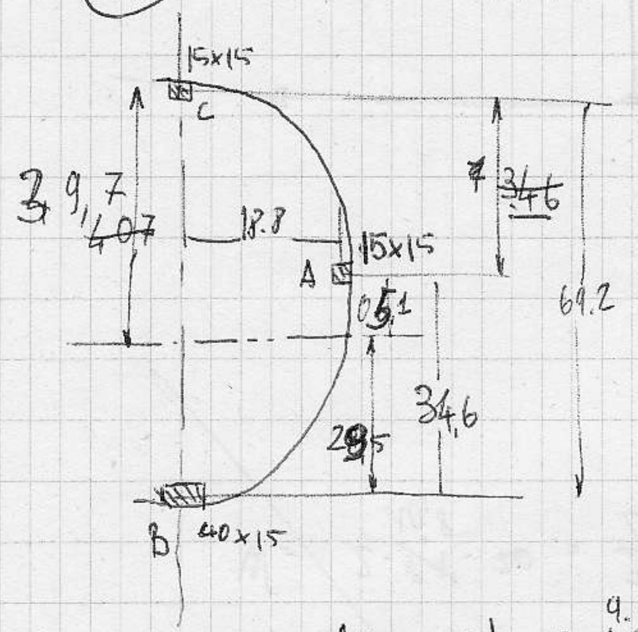
$\sigma = 210$

141

351

(15) Si considera tutta la sezione

S = ~~0.20~~ 0,25



A: lat 15x15 = 2.25

cong: ~~6+6+1.5=13.5×0.25~~ = 2.7 ~~3.75~~ 4.1

7,5+7,5+1,5 = 16.5 ——— 4,45 ——— 6,35

B: lat. 40x15 = 6

~~6+6+4=16·0.2~~ 3.2 4.75

7,5+7,5+4 = 19 · 0,25 ~~9.2~~ 10 75

C lat 15x15 2.25

C ~~2.7~~ 4.1

~~4.45~~ 6.35

Asse neutro: 2 · ~~4.45~~ 9.9 · 34,6 = 344

~~2~~ · 4.45 · 69.2 ——— 344 / 688 = ~~28~~

9.2 / 24.05

6.35 · 69,2 = 440

12.7 · 34.6 = 440 / 880

10.75 / 2980 — 29,5

P vert: M = ~~1040~~ 780

A		D	J		W	σ		
6.35 ~~4.45~~		~~40.7~~ 39,7	~~8200~~	9900 C	~~388~~ 495	~~282~~	~~220~~	158
12.7 ~~9.9~~	·	~~6.1~~ 5,1	~~360~~	330 A	~~2600~~ 3850	~~42~~	~~28,5~~	20
10.75 ~~4.2~~	·	~~28.5~~ 29,5	~~7200~~	9400 B	~~555~~ 668	~~196~~	~~163~~	117
			~~15760~~	19630				

P orizzontale.

Mf = ~~780~~ 630

W = ~~4.4~~ 12.7 · 18,8 = ~~186~~ 238

σ = ~~338 + 42 = 380~~

264 ~~+ 28,5 = 292,5~~

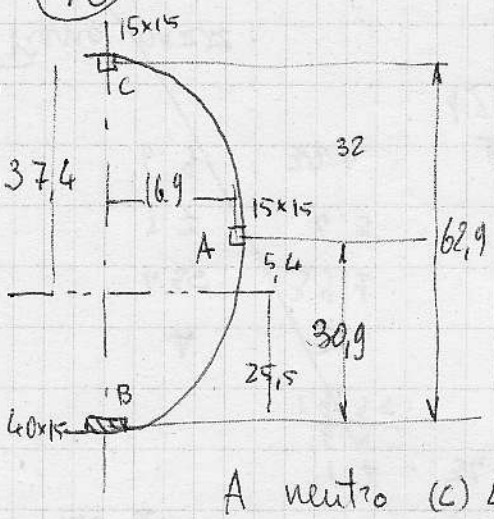
20

284

C40/Verifica

$\delta = 0.2$

(16)



A	15×15	2,25
	13.5×0.2	2.7
		4.95
B	15×40	6
	160×2	3.2
		9.2
C	(A)	4.95

A neutro (C) $4.95 \cdot 62.9$ 310

(A) $9.9 \cdot 30.9$ 305

615 $= 25,5$

~~9.80~~

24,05

M p. rettic = ~~810~~ 650

A	D	J	W		σ	
4.95	37.4	6900	354	C	~~250~~	184
9.9	5.4	280	2440	A	~~36~~	26,5
9.2	25.5	6000	522	B	~~168~~	125
		13180				

Nel p. orizz: 502

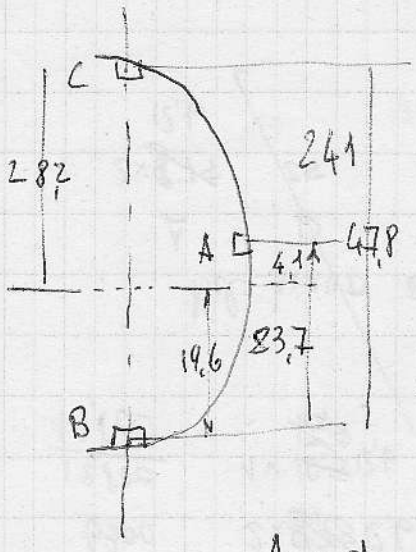
$W = 9.9 \cdot 16.9 = 167$ $\sigma = 302 +$

~~36~~ 26.5

~~338~~ 328,5

$\lambda = 0.2$

(18)



A = 15×15 — 2.25

c 6+6+1,5 = 13.5 × 0.2 — 2.7

4.95

B: 40×15 — 6

6+6+4 = 16·0.2 — 3.2

9,2

4.95

A netto

4.95 · 47.8	237		
9.9 23.7	235		19.6
4.2	472		
2405			

P sentic M = ~~438~~ ~~314~~ 322

	A	D	J	W		σ
4	4.95	28.2	3900	268		~~164~~ ~~117~~ 120
	9.9	4.1	165	1950	A	~~24~~ ~~17~~ 17,4
4	9.2	19.6	3500	387	B	~~113~~ ~~81~~ 83
			7565			

Pozzi: M = 252

W = 9.9 · 13.5 = 134 σ ~~197~~ ~~+24 = 221~~ 187

17 ~~= 214~~ 17,4

~~104~~

204,4

Torsione flessionale.

caso E3-3-5,5 Strappo cavo veric in fase ant.

Pozzz: $P_{c\,max}$ = ~~562~~ 415 $\frac{2}{3}$ = 376 un lato

$\frac{1}{3}$ = ~~188~~ 138 altro lato

Torsione: P · braccio = 138 ~~188~~ × 0.94 = ~~176~~ 130 Kgmt.

P. verticale: $P_{c\,max}$ · braccio = 323 × 0.89 = 288 "

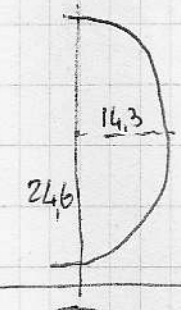
~~464~~ 418 " ult:

---

(18) $\lambda = 0.2$

Area = $\pi \cdot 14.3 \cdot 24.6 = 1110\ cm^2$

$\tau = \frac{46{,}400}{2 \cdot 1{,}110 \cdot 0.2} = \frac{418}{94}$ ~~104~~ kg/cm^2



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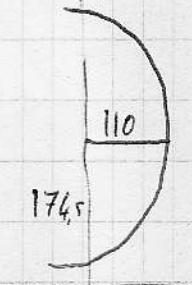
(20)

Area $\pi \cdot 11.0 \cdot 17.45 = 600\ cm^2$ $\frac{418{,}00}{2 \cdot 600 \cdot 0.2} = 174$

τ = ~~194~~ kg/cm^2



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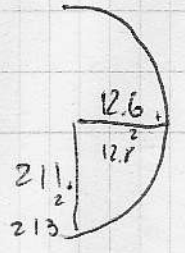
(14)

$\pi \cdot 12.8 \cdot 21.3 = 820$ $\hat{\tau}$ = ~~142~~

$\frac{418}{2 \cdot 8{,}2 \cdot 0.2} = 127$



Attacco principale : tav 5121

Attacco semiali fra loro

Spina a 240 mm da ℄.

4450 + 1235 · 0,076 =

M a spina : = M_{centr} + T · 0.07 = ~~4475 + 1237 · 0.07~~ =

~~86.5~~ + 93

~~4561.5~~ 4543

Carico su spinotti principali : $\frac{4543}{0.29}$ (~~4561.5~~) = 15700 kg

Spinotti principali : ∅ 30 foro ∅ 20

718 – 314 = 404 — Taglio : area 404×2 = 808 : τ = 19.5 kg/mmq

— Press spec : area : 10×30×2 = 600 mm² : 26,2 kg/mmq

Piastra

~~— Sez orizz. occhio : area 2×(45+49) = 188 ; σ = 83~~ (94)

— Sez vertic occhio : 2·2·94 = 376 σ = 41.8

— Sez 1° bullone : 2·150 = 300 σ = 52,5

Sez 2° " 2·132 = 264 15.700 – 1430 = 14270 σ = 54

1430 per bull. Sez 3° " 2·120 = 240 12840 53.5

Ultimo " 2×24 = 48 30

Bulloni piastra a longh: ∅ 10, n° 11, l = 6,7

carico per bullone: 1430 kg.

press spec bullone - piastra : area 60 mmq. p.sp. = 23,8

taglio bullone, forato ∅ 5 : area 59 mm : τ = 24,2

p. sp bull – legno area 6,7 cm² : p.sp. = 214

78.5 – 19.5 = 59.0

Attacco post

a) 1ª Ipotesi: ~~Le~~ carico su ~~gruppo~~ impennaggi (condiz E3/5.3.1)
verticale: 323 Kg
orizz: 274 " (carico di bilanciamento: l. vernice: pag 15)

Il carico sul verticale provoca rotazione del velivolo.

Essendo $J_{fus} = 88$

$J_{ala} = \frac{Q_{ala}}{g} \cdot \left(\frac{b}{6}\right)^2 = \frac{165}{g} \cdot 2.92^2 = 144$

$J_{tot} = 232$ $\quad Kg \cdot m \cdot sec^2$

$\frac{Kg \cdot sec^2}{m} \cdot m^2 =$

$\frac{165}{g} \cdot \left(\frac{b}{6}\right)^2 = \frac{165}{g} \cdot 2.21^2 = 84$

$J_{tot} = 172$

$M =$

$M_{baricentrico} = 323 \cdot 4{,}28 = 1520$ Kgmt

si ha

$\varepsilon = 8.85$ quel ang $= \varepsilon = \frac{1520}{232} = 6{,}5$ rad/sec²

e quindi il M necessario per accelerare a ε l'ala è:

$8.85 \cdot 84 = 740$ $\quad 6{,}5 \cdot 144 = 940$ Kgmt

equivalenti a un carico negli attacchi post di

$\frac{740}{0.77} = 965$ Kg $\quad \frac{940}{0.77} = 1220$ Kg : 610 Kg per semiala (con orizz nello spirato)

= 482 per semiala

Il carico sull ~~orizzontale~~ si può supporre equilibrato da carico nel cavo (vericello), oppure da carichi di inerzia (beccheggio). Il carico ~~vert~~ nell'att post è in ogni caso quello dovuto all'Mt aerodinamico

Il carico sull orizz è bilanciato in parte dal carico nel cavo di vernic, in parte da Mt ala, che vale ($V = 115$ K/h = $V^2 = 1020$)

$M = C_m \cdot \frac{\rho}{2} \cdot V^2 \cdot S \cdot CMA =$

$0.34 \cdot \frac{1}{16} \cdot 1020 \cdot 20{,}2 \cdot 1.191 = 520$ Kgmt mom rif. b attacco

$C.P.\% = \frac{C_{am}}{C_e} = \frac{0.34}{0.96} = 35{,}5\%$

$C_m = C_e \cdot x$

$C_{m_{45\%CMA}} = 0.96 \cdot 0{,}1 = 0{,}096$

$0{,}09 + 0{,}26 C_e$

$C_e = 0.96$ $\quad C_M = 0.34$

$M = 0.096 \cdot \frac{1}{16} \cdot 1020 \cdot 20.2 \cdot 1.191 = 146$ Kgmt

Per definire invece il car vert su spinotto bisogna consid il Mt alare: ~~infatti il car~~ v. pag 15: ipotesi G a 70%.

si ha: P = ~~1275~~ Kg. 1242

$$X = \frac{1275}{1242} \cdot 0.107 + 0.072 = 0,11 + 0.072 = 0,172 \text{ mt}$$

Quindi P si trova a 172 mm dietro G che è a 238 mm dietro b attacco ala (vedi a prima longit): quindi P è a 310 dietro b. attacco quindi M rif. attacco ant (ord 9) vale

P. (dist b att a ord 9 - dist P da b att) =

P. (739 - 310) = P. 429 = 530 Kmt (catastr) max

704,6
34
7586

= 265 Kmt per semiala max

= 396 " " " ult

Carico vert su spinotto ~~per~~ att vert (per semiala)

$$\frac{396}{0.77} = 515 \text{ Kg.}$$

In ~~co~~ riassunto, car su spin att vert: per semiala, ~~per~~ ult:

orizz: 610 Kg (stesso verso per ambedue spinotti)

vert 515 " (in su)

---

b) 2° ipotesi: punto D dell'inviluppo manovra, + car vel piano alare.

Mt max ult = 805 Kgmt = 402 per semiala: car vert = 525 Kg (in su)

Carico sul p. alare con diruttori aperti (v. pag 24)

Kg 360 ult per semiala x 350 mm = 1260 Kgmt:

$$\frac{1260}{0.77} = 1640 \text{ Kg}$$

Risp: su spin att vert, per semiala ult:

orizz: 1640 Kg (sempre contrario, verso mezzeria alare)

vert 525 " (in su)

risultante 1720 Kg

$63+14=P$

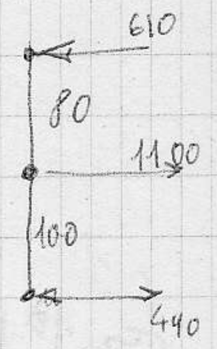
15 +
75 +
10
100

Att part verif.

~~Piastra~~ Attacco di fusol

Ipotesi più gravosa è la 1ª. per semiala { orizz carrin 610 ; " vert 515 }

Si considerano separate le piastre: schema per car orizz:



Si ha:

su gruppo sup. bulloni ($3\times\phi 8$ $s=20$) sup. 4.8

comp. orizz = 1100 kg.

" vert $=\frac{515}{7,2}\cdot 4,8 = 345$ kg.

risultante 1155

- taglio bulloni: area $3\times\phi 8$ = ~~150~~ 500 mq $\tau = 7.7$
- p. spec " /piastra: $3\times 8\times 3 = 72$ p.s. = 16 kg/mm²
- " " /legno: $3\times 8\times 2 = 4{,}8$ cm² " = 240 kg/cm²

inf: $2\times\phi 6\times s:20$ = 2.4; 4.8; 7,2; 940

su gruppo inferiore $2\times\phi 6$ $s=20$ $a=2.4$

comp. orizz: 440

" vert: $\frac{515}{7,2}\cdot 2.4 = 172$

risult 570

- taglio bull = $2\times\phi 6$ = 56 $\tau = 9.3$
- p. sp. " piastra $a = 2\times 6\times 3 = 36$ p.s. 14,4 kg/mm²
- " " /leg. $a = 2\times 6\times 2$ 2,4 " 216 kg/cm²

Piastra

Sez a 1° bullone: $J = 10600$, $W = 606$ $\frac{Mf}{W}$ = $610\times 65 = 39600$ $\sigma = 65$

$A = 81$ cm² $T(oL) = 515$ $\tau = 6{,}5$

Tot 71,5

$412\times 65 = 31400$
$\sigma = 52$
6,5
58,5

Vedi retro

Att vert:

177 = 50 • Spinotto. Ø15 foro Ø8
ipotesi più gravosa la 2ª : P = 1720 kg
– taglio : area 127 mmq : τ = 13,5
– p spec : " 165 " : psp = 10,4

• Piastra dell'ala
ipotesi più gravosa la 2ª   car assiale 1640
" vert 525

Gruppo 3 bull Ø8 s = 30 :
car vert: $\frac{525}{16,3} \cdot 21 = 676$ kg
risult ~~740~~ 1400 kg
car orizz: $\frac{1640}{4} \cdot 3 =$ ~~410~~ 1230

– taglio : area ~~300~~ mmq   τ = ~~5,3...~~ 4,7
– p sp. bull / piastra : area 72 mmq : psp = 19,5 kg/mmq
– " " legno " 7,2 cm² " 195 "

Bullone estremo : 1, Ø8 s = 30
car vert = $\frac{525}{16,3} \cdot 4,7 = 151$ kg
risultante 440
car orizz = $\frac{1640}{4}$ = 410

– taglio: area 100   τ = 4,4
– p sp. bull/piastra area 24   psp = 18,3
" " legno " 2,4 " 183

Controllo attacco ant ala fusoliera : ipotesi 1: car orizz = 1220 kg tot
Piastra fusol: sez 1° bullone : (1 coppia: Mf = 610×66 = 40000)

10 [] 28 $J = \frac{6}{12} \cdot 28^3 - 10^3 = \frac{6}{12} \cdot \frac{22000 - 1000}{21000} = 10500$, $W = \frac{10500}{14} = 750$ σ = 54

At post - piastra ala

Vert piastra:

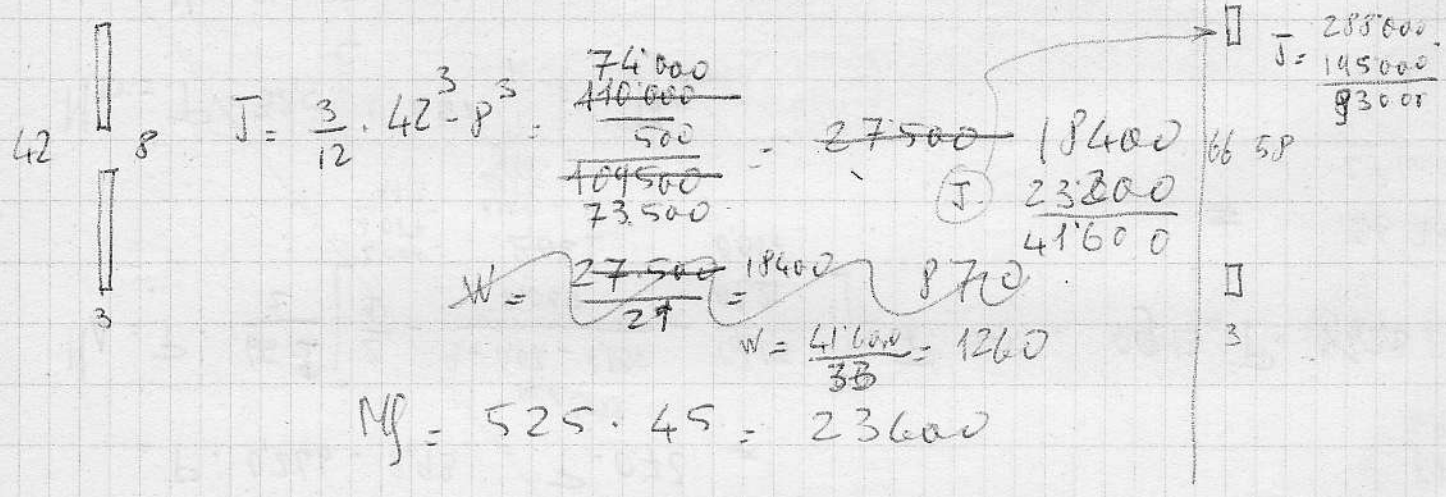
Sez vert anima: area $\begin{array}{r} 254 \\ p\ 46 \\ c\ 32 \\ \hline 134 \end{array}$

tau2 $1640/134 = 12,2$ kg/mm²

Sez a 3 bull:

area 126

$1640/126 = 13$ "



$J = \frac{3}{12} \cdot 42^3 - 8^3 = \frac{74000}{440000}$

500

~~109500~~

73.500

~~27500~~ 18400

J 23200

41600

$J = \frac{285000}{145000}$

93000

$W = \frac{27500}{27} = 18400$ 870

$W = \frac{41600}{33} = 1260$

$M_f = 525 \cdot 45 = 23600$

$\sigma = \frac{23600}{870} = \frac{272}{18,8}$

1260

A = 126 mm²:

$T = \frac{1640}{126} = 13$

$\sigma_{tot} = \frac{40,2}{31,8}$

Attacchi del piano orizz.

Attacco principale a ord 20

226 / ~~223,7~~ / ~~152~~ Kgmt. T = 280 / ~~270~~ / ~~127~~ Kg. (Dati liberi: 107 Kgmt, 135 Kg.)

D spinotti: 12 cm. 226 / ~~223,7~~ / ~~152~~ / 0.12 = ~~1860~~ 1890 / ~~1270~~ Kg

T per spinotto:

Piastra longherone.

Bulloni: 5 × ∅ 8 λ = 20 : car cad. ~~370~~ / ~~245~~ 378 Kg

p.f. bull - legno : area = 1.6 cm²: psp ~~160~~ / ~~232~~ Kg/cm² 236

p.x " piastra : " 24 " ~~160~~ / ~~155~~ " mm² 16

15 / 32 / 47 / 94

Mf = 140×34 = 4750 Kgmm

per piastra a 1° bull:

J = 3/12 · 24³ − 8³ = 13800 / 500 / 13300 ; W = 1110 ; σ = 4750 / 1110 = 43

23 − 8 = 15 × 3 = 45 mm: σ = ~~29,4~~ ~~41,5~~ ~~42~~ 39,5 + 43 / 43,8

30 +

per piastra all'occhio

" 134 σ = ~~10~~ ~~9,5~~ 14,2

Spinotto: ∅ 10

p.sp: area min 160 mm² ~~16~~ Kg/mm² ~~11,6~~ 11,8

taglio " ~~80~~ 100 ~~16~~ " ~~23,5~~ 18,5

Piastra di giunzione

Mf 140×40 = 5600

30 / 64 W = 1110 σ = 5,1 / 94

per vert occhio a: 94 σ = ~~43,5~~ 20

per 1° bullone: 63 ~~22~~ ~~29,8~~ 30

21

Bulloni attacco piastra a ord 20

~~Sono~~ Caso di carico 1/3 un lato, 2/3 altro lato

Carico libero $\frac{1800}{2}$ = ~~1350~~ 945

Bull: 3 × 0.8 λ = 32: car cad: 315

area legno: 2.55 ; psp = 12,4 Kg/cm²

" ferro 24 " = 13,2 " mm²

Ruota e suoi attacchi

La ruota è una 365×150 : schiacciamento max reale circa 10 cm.

Definizione dei carichi.
I carichi di pag. 18 sono eccessivi per la ruota che, come già segnalato, ha una maggior elasticità.
Considerando:

carico da catalogo	max	62 Kgmt
~~cata~~ schiacciam	max	8 cm (80% del max)

si ha

$$R_{finale} = \frac{2E}{c} = \frac{2 \cdot 62}{0{,}08} = 1540 \text{ kg (max)}$$

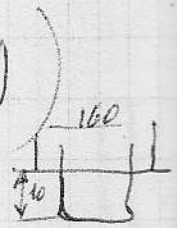
id, 2310 " (ult.)

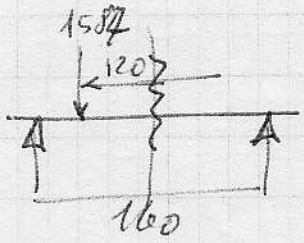
(Nota: con reg RAI sarebbe: (n=2,5)
~~centim~~ $R = 480 \cdot 2.5 \cdot 2 = 2400$ kg (rob))

e quindi, riassumendo: (ult)

reaz. vert	2310
" laterale	690
" indietro	1155

quindi sulla gamba + caricata:
$690 \cdot \frac{10}{16} = 432$
$2310/2 = \frac{1155}{1587}$





- Assale: 30/22
  schema a lato

$M_f = 1587 \times 20 = 31800$ dgm

$W = 1900$

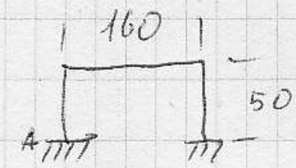
$\sigma = 16{,}7$

– Gamba

– p. sf. anale acchio: area 640 p sp = 2.4 Kg/mm²

– pressoflessione: (si consid la sez a 50 cm sopra l'anale, perchè ~~al di sopra c'è nervatura~~ è la + sollecitata)

consid lo schema a lato: (portale incastrato)



J anale = 28800

J gamba = 1055 W = 300

si ha: $Mf_A = \frac{P \cdot H}{2} \cdot 0.5 = 8600$ Kg mm: $\sigma_f = 28,6$

e C = 1587 : A = 180 mmq $\sigma_C = 9,4$

38,0

– bulloni attacco a ord 9 (4, ø 8, l = 42): C = 1587:

taglio: ~~4~~ area	400 mmq	4.2
p. sf. bull/piastra:	area 128 mmq	13.2
" " legno	· 12,5 cmq	135

Il carico indiretto di 1155 è assorbito tutto dai due tiranti, che sopportano quindi 580 Kg cad:

– bullone tirante/gamba: 1, ø 8, l = 4 mm

~~p. sf.~~ taglio:	area 100	5,8
p. sf. :	area 32	18

– tirante: ø 14 s = 1: Carg esub.

bulloni attacco tirante a fus: 2, ø 6

taglio:	area 56 mmq	10,4
p. sf. bull/tirante:	area 24	24
" " /legno	" 3,6 cmq	162 ~~240~~ Kg/cm²

Nota. Essendo la ruota protetta da urti dal davanti (dal pattino) ed essendo senza freno, non si vede come si possa arrivare al carico suddetto

Appendice al calcolo statico

1 - Aumento di peso
2 - Variazione centraggi

Aumento pesi

1) Pesi ~~fusol + C.U. + ala + zav~~

	Previsto		Reale max	
ala	165		182	
fusoliera e piani	115	315	140	350
zavorra centraggio	0		20	
C.U	200		190	
Tot	480		532	

2) Variazione carichi da ~~cu~~ baricentro: (v. pag 7)
il Pc è proporzionale al peso fusol + C.U + zavorra:
quindi:

	A, A_1		B, B_1	
	previsto	reale	previsto	reale
Pc	191	212	113,5	126

~~3) Pesi C.G. e carichi pesi max~~

~~Arretrato max: 47,5%~~

Avanzato max: 37,5% peso corrisp. 532 Kg o meno

Arretrato	42,5%	" "	532 " " "
	47,5%	" "	502 " " "
	~~45%~~		512 " " "

3) Pesi max e posizioni C.G.

190	532 Kg:	da	37,5	a	42,5
170	512 "	"	37,5	a	45
160	502 "	"	"	a	47,5

Variazioni carichi ala e piani per
- aumento peso
- variaz. centraggio

– uno: centr 35% 532 Kg
1 mar 63 e 532 x 45%

(A) (pag 8) CG 37,5%: Q×n, 532×5 = 2660 (35%)

,45 (42) | 4,235 (4,265)

$P + P_c = 2660$

$4{,}235\,P_c = -Px$ (4,265)

$x = ~~0.107~~\ 186/P + 0.31 - 0.45 = 186/P - 0.14$ (0.42; 0.11)

182×5 / 0

$4{,}235\,P_c = 0.14P - 186;\ P_c = 0.033P - 44$ (4,265; 0.11; 0.0258; 43.6)

$1.033P = 2660 + 45 = 2704$: (1.026; 43.6)

P = 2620 − 910 = 1710 (2642)
Pc = 40 (18) (in su)
Becch a picch: 212 " "
Pc tot 252 " " (230)

CG 42,5% Q×n = 532×5 = 2660 (45%)

4,685 − 51 = 175

.500 (54) | 4,175 (4,145)

$x = 186/P + 0.31 - 0.51 = 186/P - 0.2$ (0,54; 0.23)

$P_c = ~~0{,}0335P - 44{,}5~~\ 0{,}048P - 44{,}0$ (45)

~~1,0335 P = 2660 + 44,5 = 2704,5~~ ~~P = 2620~~

$1{,}048P = 27040$ (1,0559; 2705)

P = 2580 − 910 = 1670 (2565)
Pc = 80 (95)
Becch. a picch 212
Pc tot 292 (307)

4,685 − 54 = 4,145

CG 45% Q×N = 512 = 2560

54 | 4,154

$x = 186/P + 0.31 - 0.54 = 186/P - 0{,}23$

$P_c = 0{,}0554P - 45$

$1.0554P = 2605$

P = 2470 − 910 = 1560
Pc = 90
Becch 212
302

— vino cent. 532 45%

(A) CG 47,5 $Q \times N = 502 \times 5 = 2510$

$x = 186/P + 0.31 - 0.57 = 186/P - 0.26$

$P_c = 0{,}0662P - 45{,}2$

$1.0662P = 2555{,}2$

57 — 4,115

$P = 2400$ — 1/10 = 1490

$P_c = 110$ — 2/3 = 735

Beah 212 — 1/2 106

P_c tot 322 — 179,5

(B) ~~pag 9. CG~~ Va a pag 5

(D) CG 42,5% (45) $532 \times 2{,}5 = 1330$

51 (54) — 4,175 (4,145)

$x = 186/P - 0.2$ (0.23)

$P_c = 0.048P - 44.6$ (0.0555 — 45)

$1.048P = 1374.6$ (1.0555 — 1375)

$P = 1310$ (1305)

$P_c = +20$ (+25)

(B) C.G 42,5 (45) $532 \times 4 = 2130$

51 (54) — 4.175 (4.145)

$x = 535/P - 0.2$ (0,23)

$P_c = 0.048P - 12.8$ (0.0555 — 12,9)

$1.048P = 2258$ (1,0555 — 2259)

$P = 2150$ (2140) $- 728 = 1422$

$P_c = -20$ (-10)

Beah a pich $+126$

-146

106

+116

–vero: con le 35%, 532 kg
1 mar 63

4

(B) (pag 1)

CG ~~37,5%~~ 35 ; Vd = 226 K/h   N: Q×n = 512×4 = ~~2048~~ 2130 kg (532)

K = 5000

P + Pc = ~~2048~~ 2130

4,235 · Pc = −Px (4,265)

x = 0.107 K/P + 0.31 − 0.45 (0.42) = 0.107 K/P − 0.14 (0.11) = 535/P − 0.14 (0.11)

.45 (42) · 4,235 (4,265)

4,235 Pc = + 0.14 P − 535 ; Pc = 0,033 P − 126,5
(4,265; 0.11; 0.026; 125,2)

P + 0,033 P (0,026) = ~~21745~~ 22565 2255,2

P = ~~2080~~ ~~2180~~ 2200 − 182×4 = 728 ; resta 1452 (Qa)

− 50 − 70

Pc = − ~~12~~ in giù

Beech a picco (su) + ~~119~~ 126

tot ~~107~~ ~~176~~
76 56

(era − 36

V pag 3 → 42,5 a 532

(B)

CG 47,5%   Q×n = 502 × 4 = 2008   V

P + Pc = 2008

4,~~235~~ 115 Pc = − Px

x = 0.107 K/P + 0.31 − 0.57 = 0.107 K/P − 0,26 = 535/P − 0.26

57 · 4,115

4,~~235~~ 115 Pc = + 0.26 P − 535 , Pc = 0,063 P − 130

1.063 P = 2138

P = 2006 − 728 = 1278

Pc = + 2 su

Beech a picco (su) ~~111~~ 126
124

(era 63

CG 45%   512 × 4 = 2048

54 · 4.154

x = 535/P − 0.23

Pc = 0,0553 P − 129

1.0553 P = 2177

P = 2060 − 728 = 1332

Pc = −12 + Beech 126 = 114

— meno = 35%, 532 Kg
conti 1 nov 63

(C) (pag 10)

n = zero

Molla = 535 Kg/m

P_c max con CG 47,5%, braccio 4,115:

P_c = 130 Kg in giù (era 129)

(D)

CG ~~37,5%~~ 35 $Q \times n$ = ~~512~~ 532 × 2,5 = ~~1280~~ 1330 Kg (45 / 42, 4,235 / 4,265)

P + P_c = ~~1280~~ 1330 K = 1720

~~4,235~~ 4,265 P_c = −Px

x = 0.107 K/P + 0.31 − 0.~~45~~ 42 = 0.107 K/P − 0.~~14~~ 0,11 = 186/P − ~~0.14~~ 0,11

→ ~~4,235~~ 4,265 P_c = 0.~~14~~ 0,11 P − 186 ; P_c = ~~0.033~~ 0,026 P − ~~44~~ 43.6

~~1.033~~ 1,026 P = ~~1324~~ 1374 1373.6

P = ~~1280~~ 1330 1340 (inverso: saletta ~~dorso~~ ventre comp.) − 455 = 875

P_c = Zero V (meno

V. pag 3 → 10 (verso il basso, e cioè in v. zav saletta dorso compr.

CG 47,5% $Q \times n$ = 502 × 2,5 = 1250 (57, 4,115)

P + P_c = 1250

4,115 P_c = −Px

x = 0.107 K/P + 0.31 − 0.57 = 0.107 K/P − 0.26 = 186/P − 0.26

P_c = 0.063 P − 45,2

1.063 P = 1295,2

P = 1216 (inv: ventre comp. − 455 = ~~7~~ 761

P_c = 34 " " " (meno

CG 45% $Q \times n$ = 512 × 2,5 = 1280 (54, 4,154)

x = 186/P − 0.23

P_c = 0.0554 P − 45

1.0554 P = 1325 P = 1255 − 455 = 800

P_c = +25

Vedi pag 3 per 42,5%

— = carlz 35% 532 kg
1 nov 63

6

(A1) 134 K = 1720

CG ~~37,5%~~ 35 %   Q×n = ~~512~~ 532

45 | 4,235
43 | 4,265

P+Pc = ~~512~~ 532

4,235 Pc = −Px
4,265

x = 186/P − 0.14
0.11

Pc = 0.033 P − 44
0.026 — 43,6

1.033 P = ~~556~~ 576
1,026 — 575,6

P = ~~538~~ 555
561

Pc = − 2~~7~~5 −29 (in giù v

banco a calmare −~~200~~ 212

−~~226~~ (meno

23~~5~~ 5 −241

CG 47,5%   502 kg   V

57 | 4,115

P+Pc = 502

4,115 Pc = −Px

x = 186/P − 0.26

Pc = 0,063P − 45,2

1.063 P = 547,2

P = 515

Pc = −13 (giù

banch a calmare −~~212~~

−~~213~~ 225 (meno

CG 42,5%   532
45

51 | 4,175
54 | 4.145

x = 186/P − 0.2
0.23

Pc = 0.048P − 44
0.0555 — 45

1.048P = 576
1.0555 — 577

P = 550 546

Pc = −18 −14

Banch calm −212 −212

−230 226

CG 45 a 512

54 | 4,154

x = 186/P − 0.23   Pc = 0,0554P − 45

1.055P = 557

P = 528

Pc = −16

B a calm −212

228

— = coda 35%, 532 kg
1 mar 63

7

B1

C.G. 37,5 (35) : ~~512~~ 532

$P + P_c = $ ~~512~~ 532

$4{,}235\ P_c = -P_x$ (4265)

$x = 535/P - 0{,}14$ (0,11)

$P_c = 0{,}033\ P - 126{,}5$ (0,026 ; 125,15)

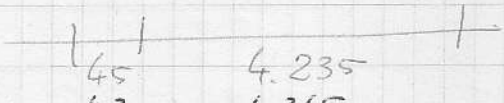
$1{,}033\ P = 638{,}5$ (1.026) 658,5 (657,5)

$P = $ ~~617~~ 635 (641)

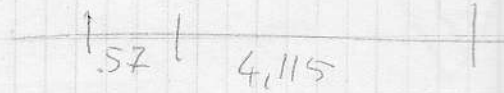
$P_c = $ ~~-105~~ -103 (109) in giù

aggiunta a cabr. ~~-114~~ 126

~~-234~~ 229 (-235) (meno



C.G. 47,5% 502



$P + P_c = 502$

$4{,}115\ P_c = -P_x$

$x = 535/P - 0.26$

$P_c = 0.063\ P - 130$

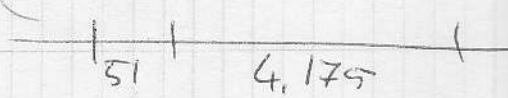
$1.063P = 632$

$P = 594$

$P_c = -92$

+ neu ~~-114~~ 126

~~-211~~ 218 (meno



C.G. 42,5 (45) 532

$x = 535/P - 0.2$ (0.23) : $P_c = 0{,}048P - 128$ (0.0555 ; 129)

$1.048\ P = 660$ (1.0555 ; 661) $P = 630$ (626) $P_c = -98 - 126 = -224$ (-94 ; -220)

C.G. 45% 512

$1.0553P = 641$ $P = 609$ $P_c = -97 - 126 = -223$

caso	A				B				C	D				A_1				B_1			
V	134	"	"	"	226	"	"	"	226	134	"	"	"	134				226	"	"	"
n	$n_1=5$				$n_2=4$	"	"	"	$n=0$	$n_3=2,5$	"	"	"	$n=1$				$n=1$	"	"	"
Q+	532	532	512	502	532	532	512	502		532	532	512	502	532	532	512	502	532	532	512	502
CG %	37,5	42,5	45	47,5	37,5	42,5	45	47,5	47,5	37,5	42,5	45	47,5	37,5	42,5	45	47,5	37,5	42,5	45	47,5
Praal																					
Pc Kg	40	80	90	110	-50	-20	-12	+2	130	0	20	25	34	-23	-18	-16	-13	-103	-98	-97	-92
Pc+bech "	212	292	302	322	76	106	114	124	—	—	—	—	—	-235	~~-225~~ -230	-228	-225	-229	-224	-223	-218
Pala	2620	2580	2470	2400	2180	2150	2060	2006	—	1330	1310	1255	1216	555	~~515~~ 550	528	515	635	630	609	594
Pala-Qmax "	1710	1670	1560	1490	1452	1422	1332	1278	—	875	855	800	761								
M+45%	345	"	"	"	69	"	"	"	535												

~~Effetti della~~ variazione delle sollecitazioni

~~Ala~~

~~Ibx~~ max carico normale (max) para da 1655 a 1710 Kg: aumento del 3,1 %: uguale è l'aumento delle sollecitazioni specifiche; ~~ad es. è ammissibile (ad es. si para da 515 a 532 Kg/cmq per le talette long~~

- saletta longh: da 515 a 532 (Max) Kg/cmq
- pattino principale: " 52,5 a 54,3 " /mmq

Il max carico normale ~~in~~ rovescio para da 855 a 875 Kg; aumento del 2.2 %

L'aumento di carico è quindi ammissibile

Piano orizzontale

~~Ala~~ Ia Il Pc max para da 276 a 322 Kg. Sul semipiano più caricato si ha:

	Tat	semip. + caric:
carico di equilibrio:	110	2/3 = 73
" " baionetta	212	1/2 = 106
		179

Poiché il ~~V~~ semi piano è stato calcolato e provato per 185 Kg, il carico suddetto è ammissibile, nella ipotesi di carico tipo b.

Quanto all'ipotesi a, in essa il caso più sfavorevole è quello in cui si suppone che il ~~V~~ max carico di ~~bilanciamento~~ bilanciamento sia applic a 0% (b attacco) del piano: in tal caso, ~~le sollecitaz. aumentano del ; poiché il carico para~~ dato che il suddetto diminuisce (para da ~~#~~ 150 Kg a 110 Kg) le sollecitaz. diminuiscono.

Fusaliera

La variaz è sensibile a et nella if. b): peso ~~fusal~~ × n.
b): peso fus × 7,5 (ultimate)
La not effett è: (situaz più gravosa)

Zona	A	B	C	D	E	Tot
Qp	25	30	35	20	30	140 Qp
CU	100	90	—	—	—	190
Zavorra	20					20
Q+	145	120	35	20	30	350
n=7,5	~~1165~~	~~825~~	262,5	150	225	
	1090	900				

825 + 335 = 1160 ; 335 = 495 ; 16 + 335 = 445 ; 825 + 335 + 335 + 335 = 1830 ; 335 + 165 = 500

variano quindi i Mf relativi, che valgono:

Ord 6: 1090 ~~1165~~ × 0,825 · 900 | e = 1330

" 7: 1090 ~~1165~~ × 1,16 ~~1350~~ 1260

B/3: 300 ~~275~~ × 0.16 4844 ~~1394~~ 1308 | e = 1600

" 8: 1090 ~~1165~~ × 1.165 ~~1360~~ 1280

600 ~~550~~ × 0,495 ~~272~~ 297 ~~1682~~ 1577 | e = 1860

" 9: 1090 ~~1165~~ × 1.83 ~~2140~~ 2000

900 ~~825~~ × 0.5 ~~412~~ 450 ~~2552~~ 2450 | e = 2130

Ord 9: variaz σ.

piano rett: 2552 kg/mt

W mag = 1070 σ = 230

W min = 645 σ = 380

(car 414
= 483 ult

a) car su p. orizz. : 322 Kg. (a ord 20)

Ord	9	11	12	13	14	15	16	18	
braccio	4.28	3.51	3.12	2.73	2.34	1.95	1.56	0.78	
Mf	1380	1130	1005	880	755	628	502	251	magg
	2070	1700	1510	1320	1140	945	752	376	

sollecitaz ordinate

ord 11 : Mf = 1700
piano vert: W_{magg} = 1030 cm³ σ = ~~201~~ 165
W_{min} = 610 σ = ~~340~~ 279
piano orizz: σ = 210 tot A: ~~411~~ 375 Kg/cm²

ord 12 Mf = 1510
p. vert W_{magg} = 970 σ = 156
W_{min} = 562 268
p. orizz: 198 tot A 354

ord 13 Mf 1320
p. vert W = 1100 σ 120
W = 520 σ 254
p oriz 150 270

ord 14 M = 1140
vert W = ~~1~~680 σ 140
815 168
orizz 210 350

ord 15 Mf = ~~952~~ 945
vert W_A 3850 σ 25
W_B 668 125
W_C 445 169
oriz 264 289

ord 16 Mf = 752
vert W_A 2440 31
B 522 144
C 354 212
oriz. 302 333

le sollecit vert q. ammiss.

Attacchi, cannello e altre parti non verificate: ~~restano~~ le sollecitaz. restano ~~acc~~ ~~li~~ accettabili

EC 40/60

Calcolo statico secondo CAR3 - Append 2 — 1 miglio = 1,853

Definizione carichi sull'ala.

$n_1 \times \frac{W}{S} = 20,7$

1) Cat V: $n_1 = 4,4$ — Q = 480 S = 21 $\frac{Q}{S} = 23$

2) Carico alare: $23 \frac{Kg}{mq} = 4,72 \frac{lb}{ft^2}$

3) V_{Pmin} = Vmin manovra = $17\sqrt{n_1 \cdot \frac{W}{S}} = 17\sqrt{4,4 \cdot 4,72} = 77,5$ mph = 144 Km/h

4) V_{Dmin} = $27,3\sqrt{4,4 \cdot 4,72}$ = 125 " = 232 "

5) V_c = 88,5 166 "

6)

	ostiv
$n_1 = 4,4$	5,3
$n_2 = -2,2$	4
$n_3 = n_1$	-1,5
$n_4 = n_2$	-2,65

Carichi prova = carichi limiti

" rottura = limite × 1,5

Q-QA

~~Piccola Ala~~

Carico verticale sull'ala: CAR 3 | RA1 (n=4) | RA1 (n=3,69) | cont. | ostiv

	CAR 3	RA1 (n=4)	RA1 (n=3,69)	cont.
carico di prova:	$1.05 \times 4.4 = 4.62$ (Q-QA)	5 (Q-QA)	4.62	dest.
" " rottura:	$1.5 \times 4.62 = 6.93$	8	7.4	rott.

Carico nel piano alare

	CAR 3	RA1 1ª, n=4	3ª, n=4
prova	25% = 1.155 (Q-QA) [315 · 1.155 = 363	1/8 n·Q = 0.5·Q 0.5·480 = 240	$\frac{n}{b} \cdot \frac{(Q-Q_A)}{L} = 0.667(Q-Q_A)$
rottura	" = 1.73 [315 · 1.73 = 545 Kg]	1 Q [480 Kg]	1,334 (Q-QA) [315 · 1.334 = 420 Kg]

Torsione. Δp = somma max deviazioni = 25 + 10 = 35°

$\Delta a = \frac{V_n}{V_c} \times \Delta p = \frac{77,5}{88,5} \cdot 35 = 30,6$: $\delta a = \frac{30,6}{35} \times 10 = 8,8$

$\Delta b = \frac{V_n}{V_b} \times \Delta p = \frac{77,5}{125} \cdot 35 = 21,6$: $\delta b = \frac{21,6}{35} \times 10 = 6,2$

$K = \frac{-0.097 - 0.01 \cdot 6.2}{-0.097 - 0.01 \cdot 8.8} \cdot \frac{V_d^2}{V_c^2} = \frac{-.159}{-.185} \cdot \frac{125^2}{88,5^2} = 0.86 \cdot \frac{15600}{7800} = 1.7 > 1$

Δb = Δ critico = 21.6 : $\delta u = \frac{21.6}{35} \cdot 25 = 15.4$ $C_m = -0.097 + .01 \cdot 25 = 0.153$

V_d = Vcrit = 64.5 m/sec δa = " · 10 = 6.2 : $C_m = -0.097 + 0.01 \cdot 6.2 = .154$

$M_{semiala}$ = parte elettone: $\frac{64,5^2}{4150} \times \frac{1}{16} \times 0.95 \times 3.49 \cdot 0.159 = 136.5$ Kg mt

parte senza alett " $\times 1.45 \times 6.56 \cdot 0.097 = 240$

376,5 prova : 565 rottura

RA1 : 0.2 · n · Q · ℓ = 0.2 · 4 · 480 · 1.27 = 488 rott. 1 semiala — 488 "

305 prova

mp. Verticale ~~orizzontale~~

			limite	rottura
Carico limite:	$3.66 \cdot (4.4 \cdot 4.72)^{\frac{1}{2}}$	$= 3.66 \cdot 4.55 = 16,7$ psf	81.4 Kg/mq	122 Kg/mq
RAI:	minimi	60 cent	~~75~~ mura	120 rott Kg/mq
	~~$\frac{0.2nQL}{a} = \frac{488}{5} = 98 = 31$~~	cent	39	62 "
	$n\frac{Q}{5} =$	93 cent	115	185 "

mp. ~~verticale~~ Orizzontale

			limite	rottura
Limite:	$4.8 + 0.534 (n_1 \frac{W}{5})^1 = 4.8 + 11,1 = 15,9$ psf		77.5 Kg/mq	116
Rai:	minimi	60 cent	75	120
	$\frac{0.2nQL}{a} = 98$ (S: ~~15~~)	31	39	62

Alettoni

			limite	rottura
Limite:	$0.466 \cdot n_1 \frac{W}{5} = 0.466 \cdot$	$= 9.65$ psf =	47	70.5
Rai:	minimi	40	50	80
	$0.6\, n \frac{Q}{5}$	55	69	110

Sforzi pilota

			~~CAR~~ limite	~~to~~ limite	rottura
Barra:	avanti o indietro		CAR	76 ~~32~~	114 ~~45,6~~
		Rai:	50 cent	67,5	100
	laterale	CAR		32	45,6
		RAI	25	31.2	50
Pedali		CAR		91	136
		RAI	50	62,5	100
			75	94	150

EC 40/61 sett 61 Cavi

Calcolo stat secondo OPTIV.

Velocità: posto $\frac{W}{S} = 23$: $V_S =$ ~~Km~~ Km/h 55

$\frac{S}{W} = 0{,}044$ $V_M = V_b =$ ~~Km~~ 127

$V_D =$ 223

Manovra: $n_1 = 5{,}3 - 7{,}95$

$n_2 = 4 - 6$

$n_3 = -1{,}5 - -2{,}25$

$n_4 = -2{,}65 - -4$

Raffica

$n_1 \leq 1{,}25 \frac{V_b^2}{V_S^2} = 1{,}25 \frac{127^2}{55^2} = 1{,}25 \frac{16'000}{3{,}000} = 6{,}7$

$n_2 \leq 1{,}25 \cdot \frac{223^2}{55^2} \frac{V_D}{V_S} = 1{,}25 \cdot \frac{50'000}{3000} = 21$

$a = 0{,}61 \cdot 0{,}044 \cdot$ ~~4~~ $6{,}6 = 0{,}027 \cdot 6{,}6 = 0{,}178$ * v

[5,5] [0,15] ←

→ V_b: V = 30 m/sec : $V_b = 127$ K/h = 35,5 m/s

$a \times V = 0{,}178 \times 30 = 5{,}3$ * F 0,2 *

[4,5] ← F = 0,22

$n_{1_2} = 1 + 1{,}2 \cdot 0{,}15 \cdot \frac{4{,}5}{g} \cdot \frac{30 \cdot 0{,}22}{1} \cdot 35{,}5 = 1 + 1{,}2 \cdot \frac{35{,}5}{g} = 1 + 4{,}3 =$

→ * = 1 + 4,6 = 5,6 / 8,4 = n_{1_2} *

[$n_{1_2} = 5{,}3$ mod / 8 ultimate]

V_D → 223 K/h = 62 m/s V = 4 m/s

$a = 0{,}15$ · $aV = 0{,}6$ $F = 0{,}6$

$n_{2_2} = 1 + 1{,}2 \cdot 0{,}15 \cdot \frac{0{,}6}{g} \cdot 4 \cdot 0.6 \cdot 62 = 1 + 1{,}2 \cdot \frac{0{,}36}{g} \cdot 62 = 1 + 2{,}72 = 3{,}72$

[3,72 mod / 5,6 ultimate]

* $a = 0{,}178$ $aV = 0{,}71$ $F = 0{,}6$ *

→ * $n_{2_2} = 1 + 3{,}2 = 4{,}2 / 6{,}3$ *

Carico sul verticale: $V = 230\ K/h = 64\ m/s$; $S = 1$ $Ce = 1.4$

$P = \frac{1}{2} \cdot \frac{1}{8} \cdot 1 \cdot 1.4 \cdot \frac{64^2}{410} = 360\ Kg/mq$ $\quad$ proof: 540 ultimate

Orizzontale $S = 1$ $V = 230\ K/h = 64\ m/s$

$\frac{d\,Ce}{d\,\alpha} = 6$ $\quad a = 0{,}15$ $\quad F = 0{,}6$ $\quad V = 4\ m/s$ $\quad S = 1$

$\triangle = \frac{1}{2} \cdot 1 \cdot 6 \cdot 4 \cdot 0{,}6 \cdot \frac{V}{64} = 460\ Kg/mq$ proof

700 ultimate

Impennaggio orizzontale. C40 (1

Distribuz. lungo la corda secondo BEARE

	A	B	C	D	E
$E = \frac{Cm}{Ct}$	~~$\frac{36}{110}=0328$~~	~~$\frac{33}{99}=0,333$~~	~~$\frac{30}{85}=0353$~~	~~$\frac{27}{81}$~~	
	$\frac{36}{108}=0,333$	$\frac{33}{99}=0,333$	$\frac{30}{90}=0,333$	$\frac{27}{81}=0,333$	$\frac{24}{72}=0,333$

$P = \frac{185}{1.8} = 102,5$ Kg/mt

Caso $d = 0$ ≡ ~~Beare~~ = C. Fremiere su bordo attacco.

$$P_1 = \frac{P}{C} \cdot 2\left(\frac{2 - E - 3x0}{1 - E}\right) = \frac{P}{C} \cdot 2\left(\frac{2 - 0,333}{1 - 0,333}\right) = \frac{P}{C} \cdot 5,03 \quad +$$

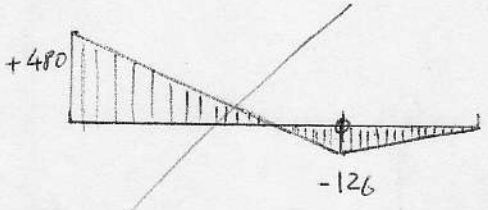
(1.666 / 0.666)

$$P_2 = \frac{P}{C} \cdot 2(3x0 + E - 1) = \frac{P}{C} \cdot 2(0,333 - 1) = \frac{P}{C} \cdot -1.332 \quad -$$

(-0,666)

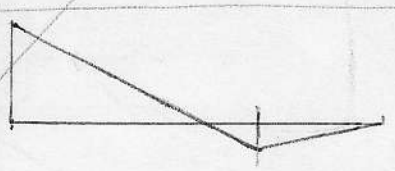
(A) $P_1 = 5,03 \cdot \frac{102,5}{1.08} = +480$ Kg/mq

$P_2 = -1,332 \cdot \frac{102,5}{1.08} = -126$ "



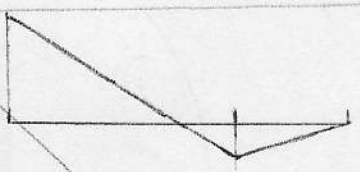
(B) $P_1 = 5,03 \cdot \frac{102,5}{,99} = +525$ "

$P_2 = -1,332 \cdot \frac{102,5}{99} = -138$ "



(C) $P_1 = 5.03 \ \frac{102,5}{90} = 575$ "

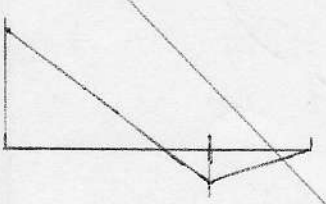
$P_2 = -1.332 \cdot$ " $= -151$



2 / 1.833 / 0,167

(D) $P_1 = 5.03 \ \frac{102,5}{81} = 640$ "

$P_2 = -1.332 \cdot$ " $= -168$



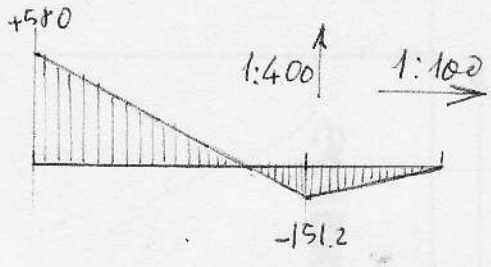
(V proj 2)

$\nu = 0$; $E = 0.333$ $\quad P = 185$ kg/cm² $\quad \sigma = 114$ kg/mq $\quad$ C40

(A) $S = 0.39 \times 114 = 44.5$ kg $= P_{zona\,A}$: $\quad P = \frac{44.5}{0.36} = 124$ kg/mt

$P_1 = 5.03 \cdot \frac{124}{1.08} = +580$ kg/mq

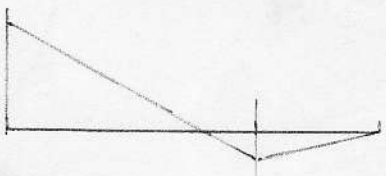
$P_2 = -1.332 \cdot$ " $= -151.2$ "



(B) $S = 0{,}354 \times 114 = 40{,}2$ kg $= P_{zona\,B}$ $\quad P = \frac{40{,}2}{0.360} = 112$

$P_1 = 5.03 \cdot \frac{112}{99} = -570$ kg/mq

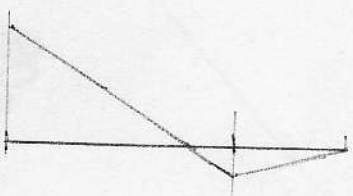
$P_2 = -1.332 \cdot$ " $= -150$ "



(C) $S = 0.326 \times 114 = 37{,}2$ $= P_{zona\,C}$ $\quad P = \frac{37.2}{,36} = 103{,}5$

$P_1 = 5.03 \cdot \frac{103{,}5}{900} = 580$ kg/mq

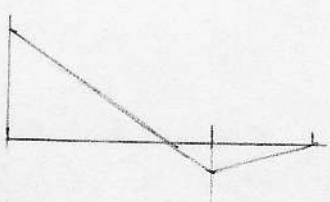
$P_2 = -1.332$ " $= -151.2$ "



(D) $S = 0{,}291 \times 114 = 33{,}2 = P_{zona\,C}$ $\quad P = \frac{33{,}2}{,36} = 92.2$

$P_1 = 5.03 \cdot \frac{92{,}2}{81} = 575$ kg/mq

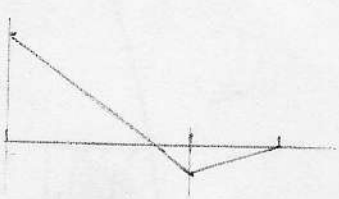
$P_2 = -1.332$ " $= -151$ "



(E) $S = 0.259 \times 114 = 29.5$ $\quad P = \frac{29.5}{,36} = 82$

$P_1 = 5.03 \cdot \frac{82}{72} = 575$ kg/mq

$P_2 = -1.332 \cdot$ " $= -151$ "



C·40 (3)

$\alpha = 50\%$ · $\alpha = +0.5$

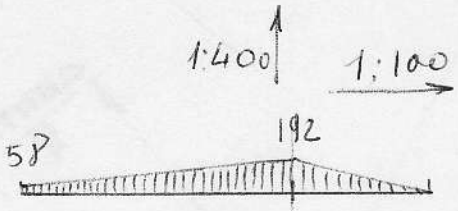
$P_1 \rightarrow 2\left(\frac{2 - E + 3\alpha}{1 - E}\right) = 2\left(\frac{2 - 0.333 + 1.5}{1 - 0.333}\right) = 2 \cdot \frac{+0.167}{0.666} = +0{,}503$

$P_2 \rightarrow 2(3\alpha + E - 1) = 2(1.5 + 0{,}333 - 1) = 2 \cdot 0{,}833 = +1.67$

(A) S, P, P/mt v. pag 2

$P_1 = 0.503 \cdot \frac{124}{1.08} = +58$ kg/mq

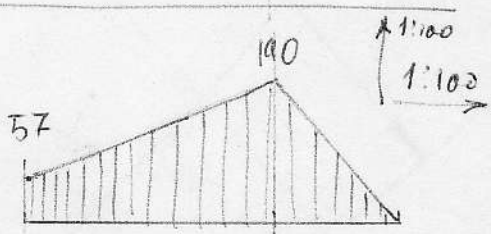
$P_2 = 1.67 \cdot$ " $= +192$ "



(B)

$P_1 = 0.503 \cdot \frac{112}{99} = +57$ kg/mq

$P_2 = 1.67 \cdot$ " $= 190$ "



(C)

$P_1 = 0.503 \cdot \frac{103{,}5}{90} = 58$ "

$P_2 = 1.67 \cdot$ " $= 192$ "

(D)

$P_1 = 0.503 \cdot \frac{92.2}{81} = 58$ "

$P_2 = 1.67 \cdot$ " $= 192$ "

(C)

$P_1 = 0.503 \cdot \frac{82}{72} = 57{,}5$ kg/mq

$P_2 = 1.67 \cdot$ " $= 190$ "

Calcolo a rottura EC 40-61

Alettone

		cont	elett	rott
Rai: 0,6 m Q/S	=	55	69	110 Kg/mq (n = 4)
[CAR 3 Utility			47	73,5]

Sup. 1 alett: 0,89 mq = 98 Kg;

Cerniera intermedia: 0,28 mq = 31 Kg

Sforzo comando $\frac{98 \times b = 45}{b_{com} = 82} = 54$ Kg Solo su cerniera comando

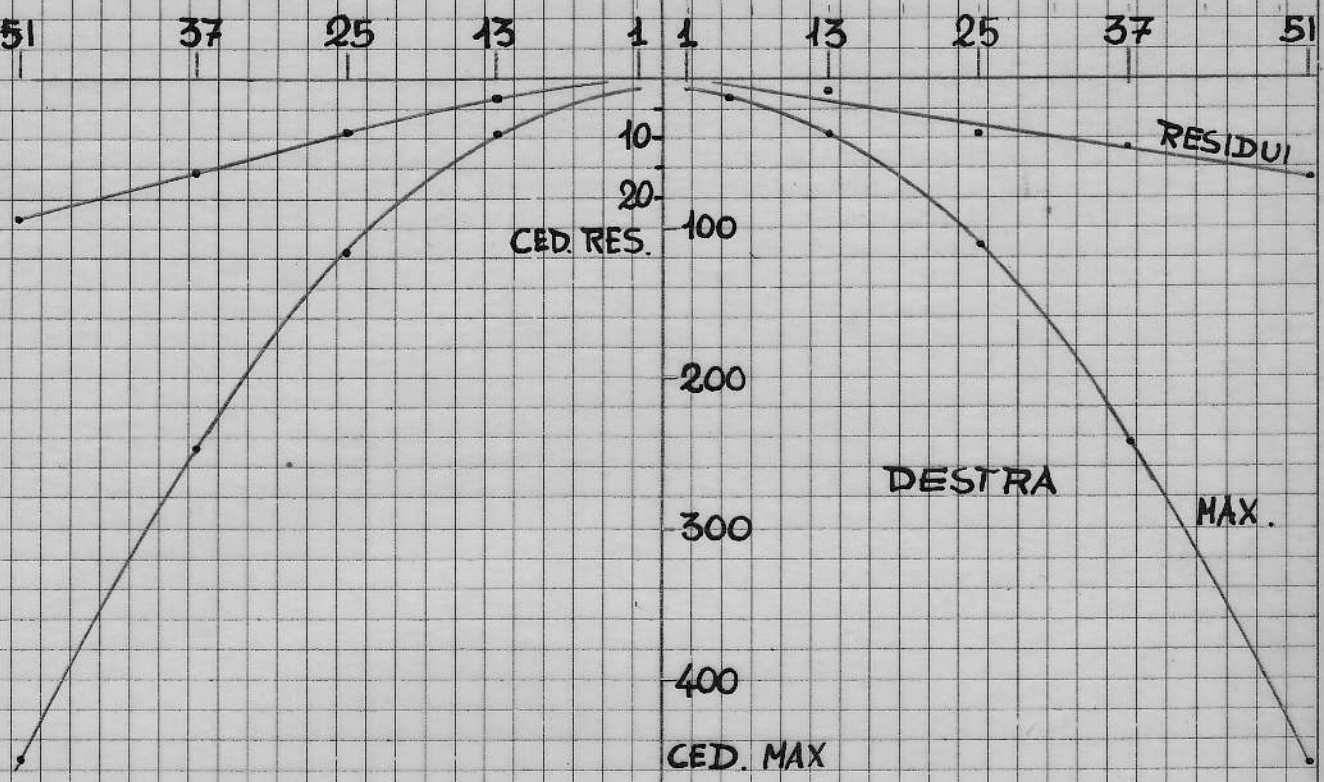
Cerniera senza comando: 31 Kg verific;

Sforzo bulloni: $\frac{31 \times 86}{35} = 76$ Kg = 38 cad. ϕ 3

Leva rinvio all'ala:

$M_f = 54 \times 90 = 5000$ Kg mm $\sigma = 40$ $W_n = 125$

$\frac{b \cdot H^2}{6} = \frac{2 \times 24}{6} = 190$ mm^2 $\sigma = 26,5$



EC-40 - FIG 1.

ALA - PROFILO CEDIMENTI MAX e RESIDUI STADIOLINE A

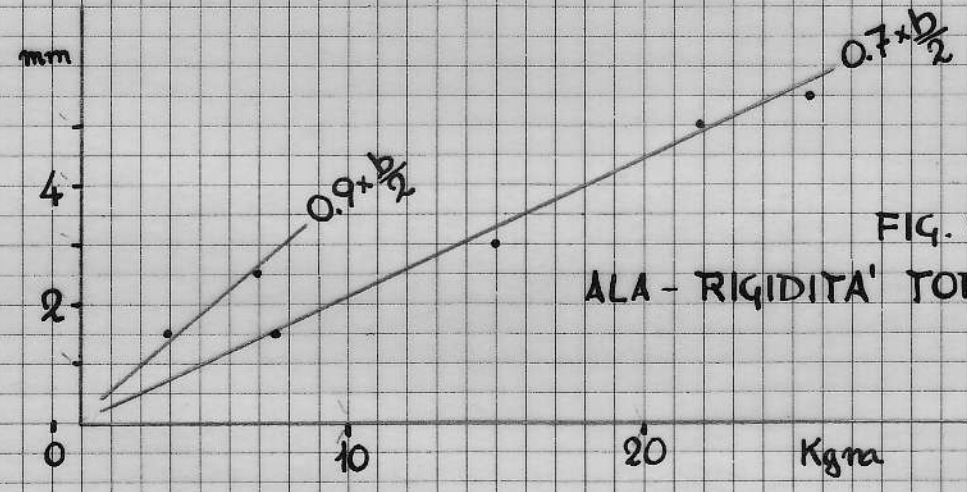


FIG. 2

ALA - RIGIDITA' TORSIONALE

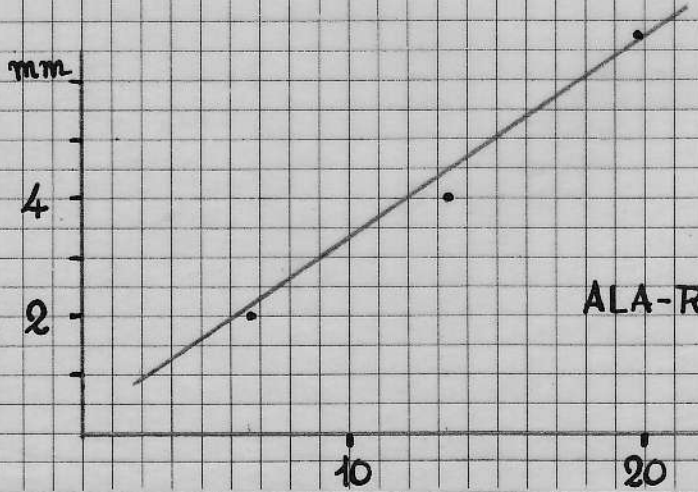


FIG. 3

ALA - RIGIDITA' A FLESSIONE.

CIANI - 1963

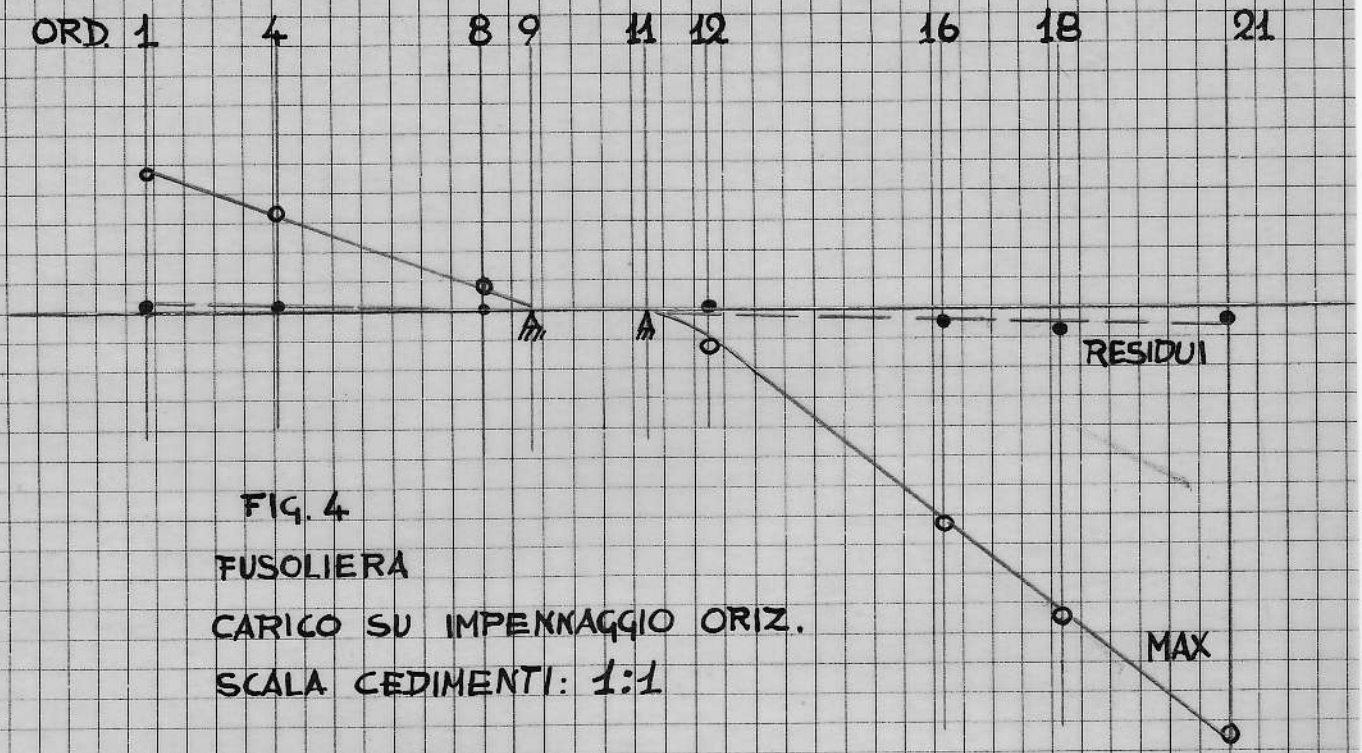


FIG. 4
FUSOLIERA
CARICO SU IMPENNAGGIO ORIZ.
SCALA CEDIMENTI: 1:1

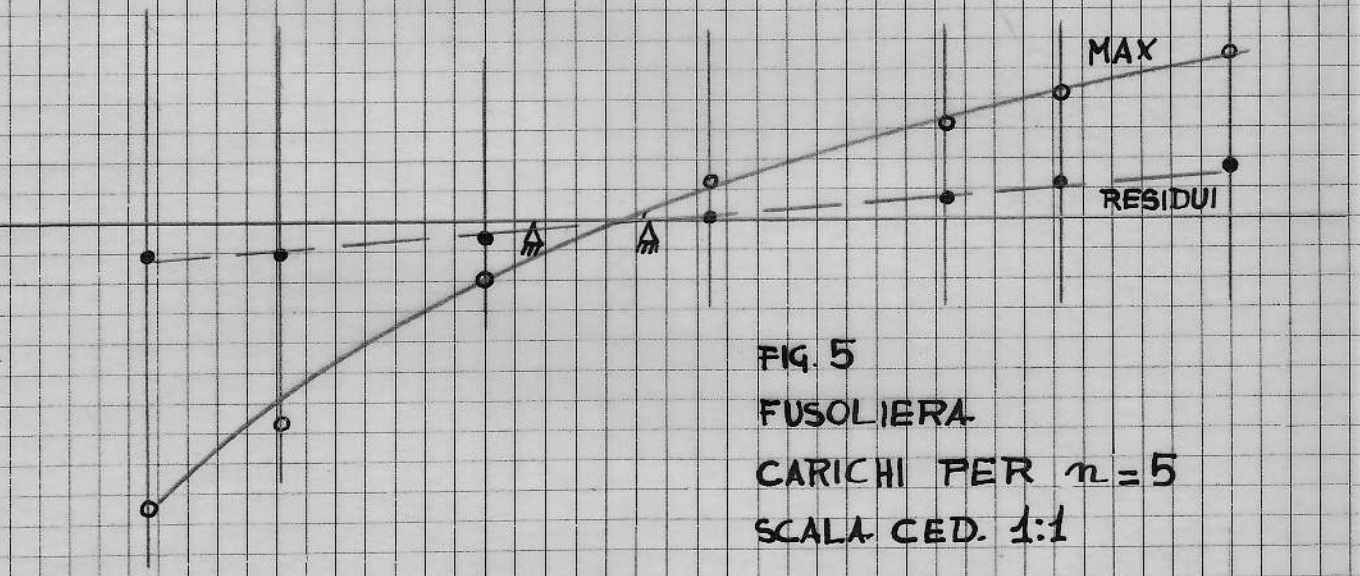


FIG. 5
FUSOLIERA
CARICHI PER $n = 5$
SCALA CED. 1:1

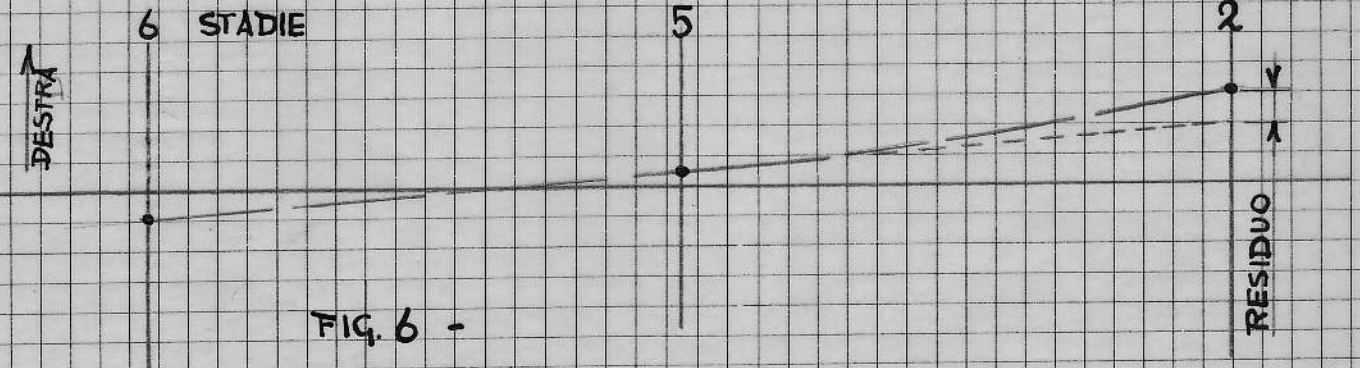


FIG. 6 -
FUSOLIERA
CARICO SU IMP. VERTICALE - RESIDUI 1:1

CIANI - 1963

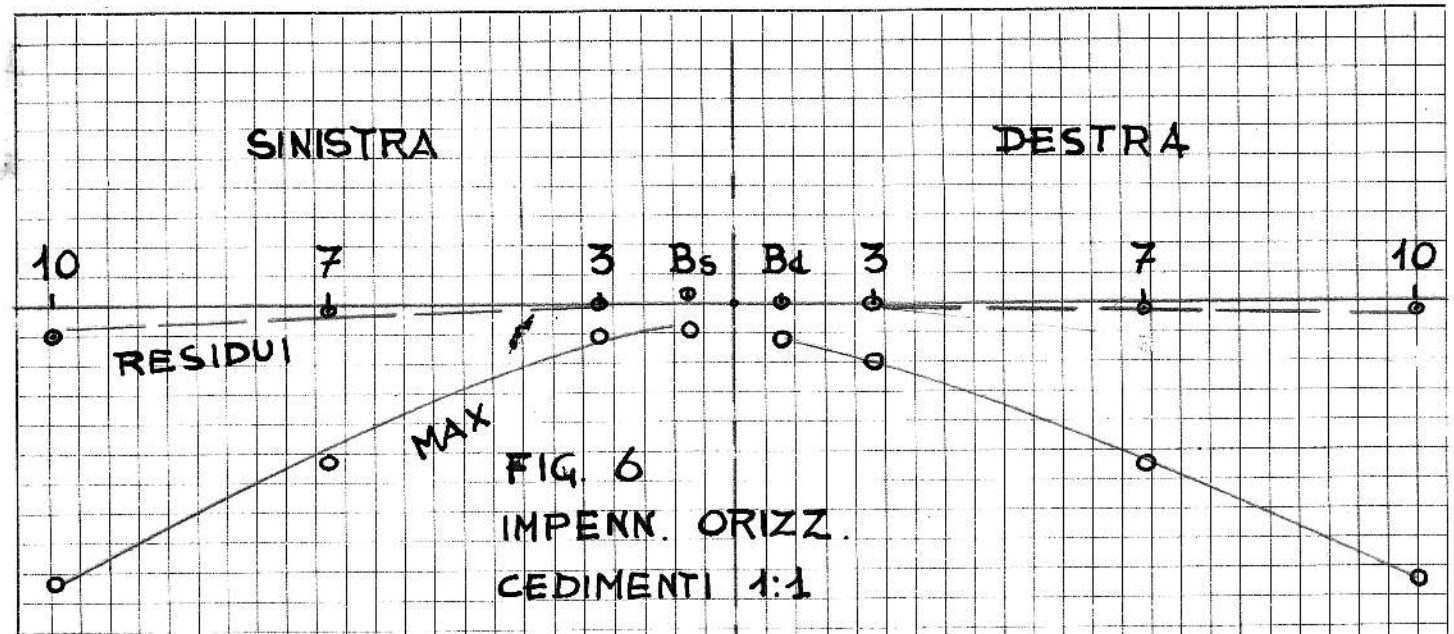


FIG. 6
IMPENN. ORIZZ.
CEDIMENTI 1:1

FIG. 7 - PATTINO e RUOTA
CEDIM. 1:1

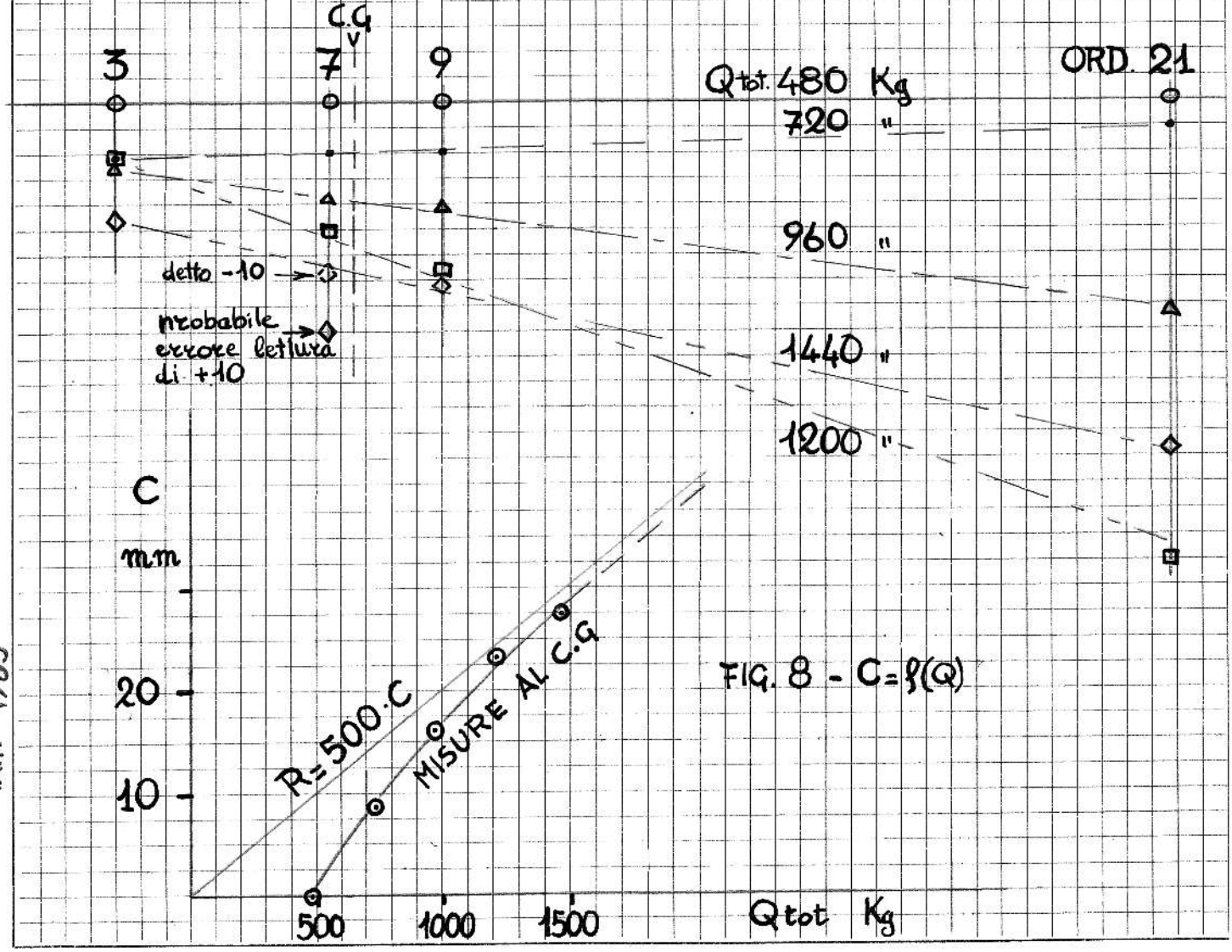


FIG. 8 - C=f(Q)

CIANI - 1963