

QCX
Avro
CF105
R-7-0583-16



TECHNICAL REPORT

A. V. ROE CANADA LIMITED
MALTON - ONTARIO

TECHNICAL DEPARTMENT (Aircraft)

REPORT NO.

7/0583/16

SHEET NO.

AIRCRAFT:

C105

MATRIX
RIBS

PREPARED BY

DATE

S. YOUNG

AUG 24/55

CHECKED BY

DATE

CONFIDENTIAL

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TECHNICAL DEPARTMENT (Aircraft)

REPORT NO.

7/0583/16

SHEET NO.

1-1

AIRCRAFT:

C/05

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INTRODUCTION

THE MATRIX RIBS DENOTE THE RIBS USED IN THE LOWER FIN ANALYSIS, WHICH WAS DONE BY THE UNIT LOAD MATRIX METHOD OF A. GRZEDZIELSKI.

THE FIN LOADING CASE IS C.P. AFT, 36,500 LB. LIMIT, AND THE FIN GEOMETRY FOR THE $4\% \frac{1}{2}$ FIN. 7/0583/2B

THE FIN STRUCTURE IS THE $3\frac{1}{2}\% \frac{1}{2}$ FIN WITH 0.250" THICK. ROOT SKIN. 7/0510/1

THE RIB LOADING WAS BY THE DIFFERENCE OF END LOAD METHOD. WHEN THE RIBS DID NOT BALANCE WITH THE APPLIED LOADING, CORRECTIVE SHEAR FLOWS WERE USED. THE CORRECTIVE SHEAR FLOWS WERE NOT LARGE.

THE RIB SHEAR & B.M. DIAGRAMS WERE THEN DRAWN.

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LOADING

SECTION 2



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MATRIX
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2-3

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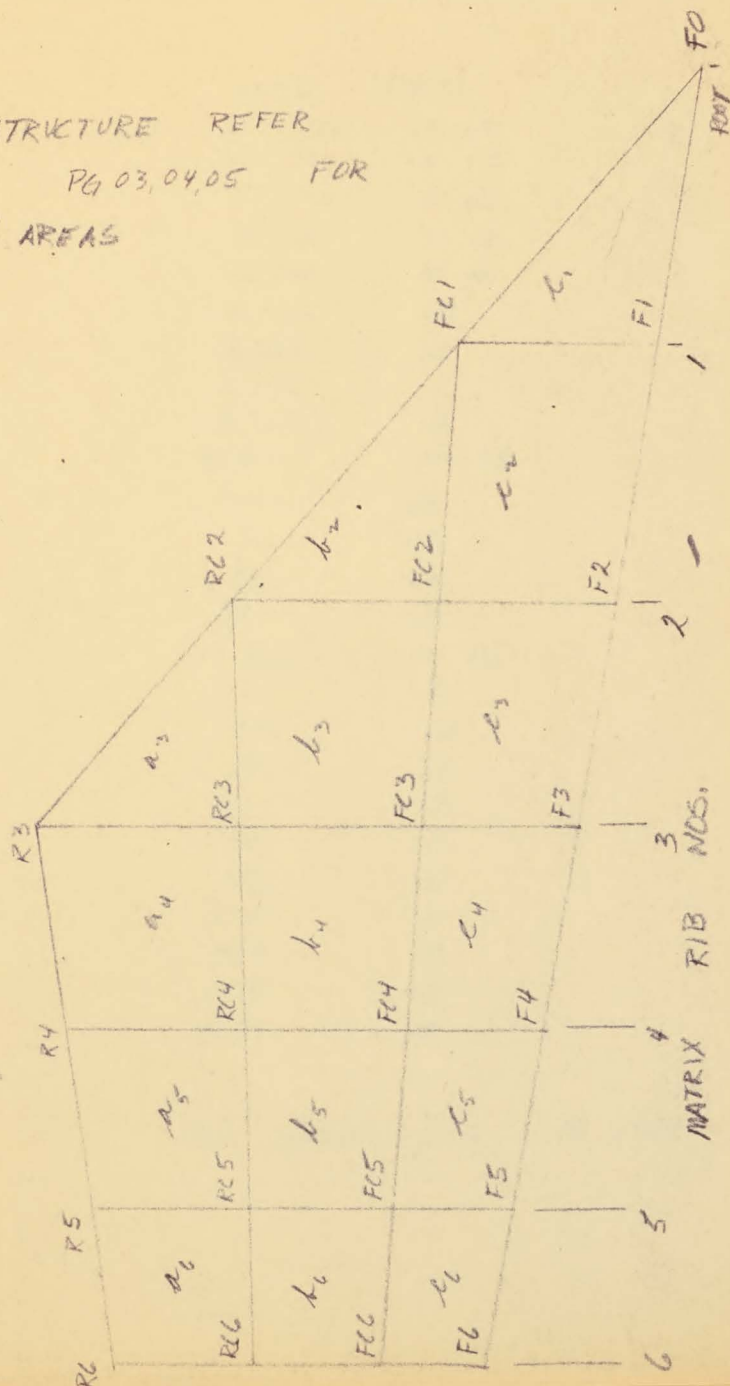
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FOR MATRIX STRUCTURE REFER
TO 7/0510/1 PG 03, 04, 05 FOR
DIMENSIONS & AREAS

POINT NOS FOR REFERENCE
PURPOSES,
PANEL LETTER FOR REFERENCE
PURPOSES.





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REPORT NO. 7/0583/16

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LOAD NO.

LOAD (LIMIT)

1	153,000	IN. LB
2	454,000	IN. LB
3	373,000	IN. LB.
4	80,500	IN. LB.
5	20,020	IN. LB
6	10,100	LB
7	8,250	LB
8	6,700	LB
9	-4,725	LB
10	40,400	IN. LB
11	2,056	LB
12	712	LB
13	573	LB
14	861	LB
15	14,270	IN. LB
16	1,351	LB
17	871	LB
18	183	LB
19	1026	LB
20	920	LB
21	825	LB
22	1215	LB
23	899	LB
24	1395	LB
25	1363	LB

REF. 7/0583/2B PG 1-44

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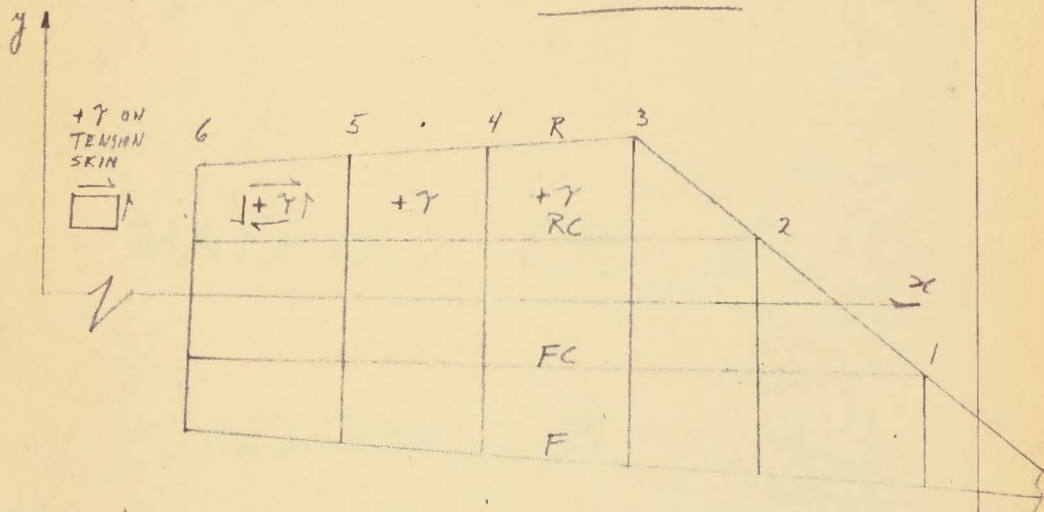
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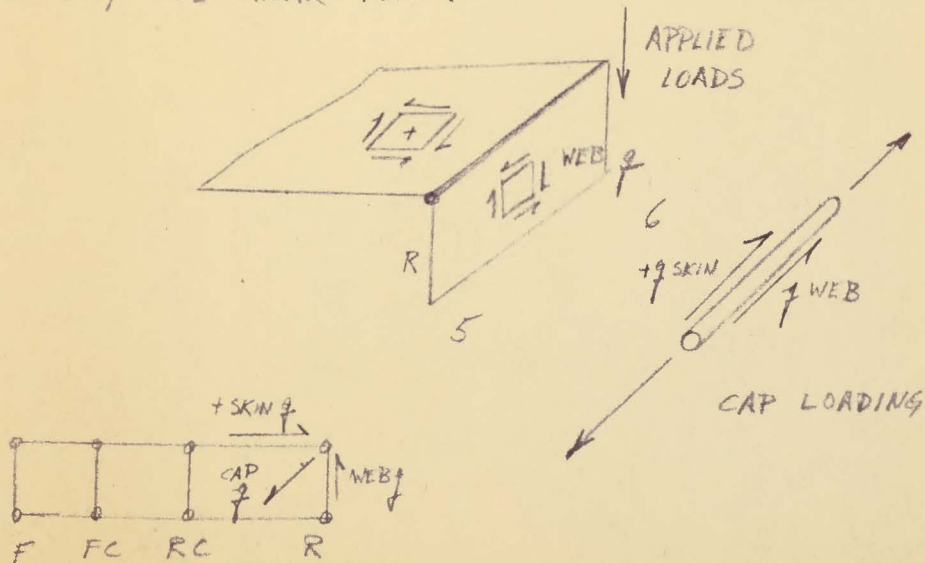
LOADING

SIGN CONVENTION:

POSITIVE SKIN FLOW



PANEL & WEB SHEAR FLOW:





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7/0583/116

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3-1

AIRCRAFT:

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MATRIX

RIB 6

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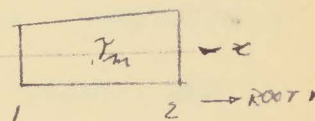
SPAR ITEM	f	A	P	ΔP	L	q_m
RG	27612	1869	51600			
R5	27898	2216	61800	10200	21227"	-481
RL6	34977	3443	120200			
RC5	37390	4089	153000	32800	21227"	-1548
FL6	35152	2777	97600			
FC5	37085	3213	123000	25400	21227"	-1198
FG	24671	1213	29900			
F5	23869	1453	34750	4850	21227"	-228

-q ACTING OUT OF CAP



PANEL SHEAR FLOWS

$$\gamma = \gamma_m \frac{x_1 x_2}{x^2}$$



$$\text{i.e. } \gamma_1 = \frac{x_2}{x_1} \gamma_m$$

$$\gamma_2 = \frac{x_1}{x_2} \gamma_m$$

$$x = 166.446" \text{ RIBS}$$

$$x = 187.673" \text{ RIBS}$$

$$\frac{x_5}{x_6} = \frac{187.7}{166.4}$$

PANEL	γ_m PSI	γ_1 PSI	t IN	f_{net}	q_m
a6	4972	5600	2052	-1150	-1020
b6	4947	5580	1900	-1060	-940
c6	4688	4700	1701	-800	-704

NOTATION: + SKIN γ GIVES CLOCKWISE TORQUE
ABOUT REAR SPAR.



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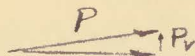
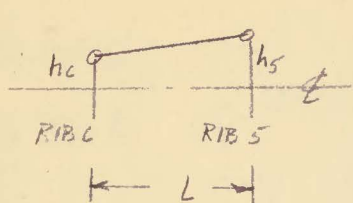
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CALCULATE CAP LOAD SLOPE SHEAR (P_v)

$$P_v \approx \frac{h_s - h_c}{L} P$$

ITEM	h_s	h_c	$h_c - h_s$	L	P	P_v
R	1.6714	1.4824	.1890	21.227	51600	-460 #
RC	2.1488	1.9158	.2430	"	120200	-1380
FC	2.1541	1.9105	.2436	"	97600	-1120
F	1.5161	1.3450	.1714	"	29900	-242

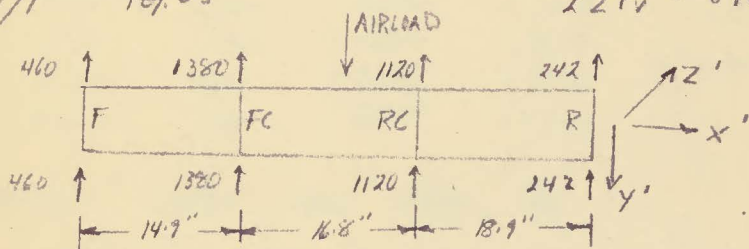
$$\Sigma P_v = -3202$$

DIMENSIONS FROM

7/0510/1

Fig. 05

$$2 \Sigma P_v = -6400 \#$$

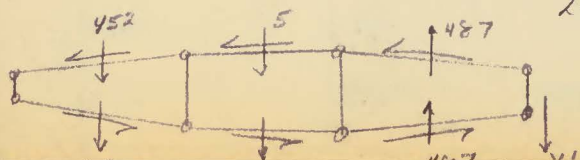


CALCULATE SHEAR CARRIED BY SKIN SHEAR FLOW

ITEM	h_c	ITEM	Δh	S	
R	1.6714	R-RC	+ .4234	1150	-467 #
RC	2.1488	RC-FC	+ .0047	1060	+ 5
FC	2.1541	FC-F	- .5655	800	+452
F	1.5161				

$$\Sigma S = -30$$

$$2 \Sigma S_{SKIN} = -60$$





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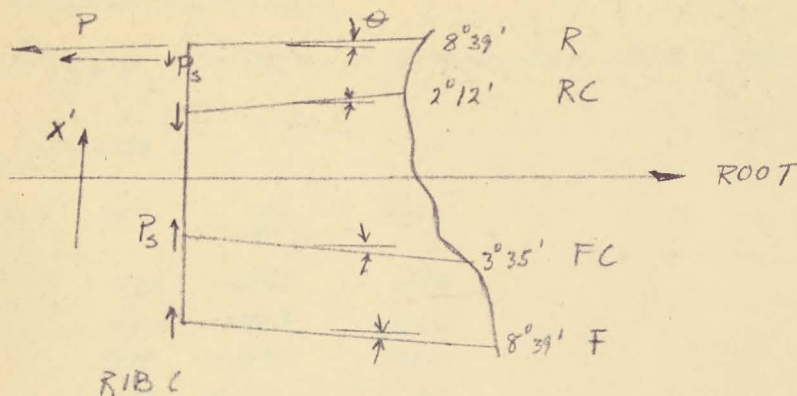
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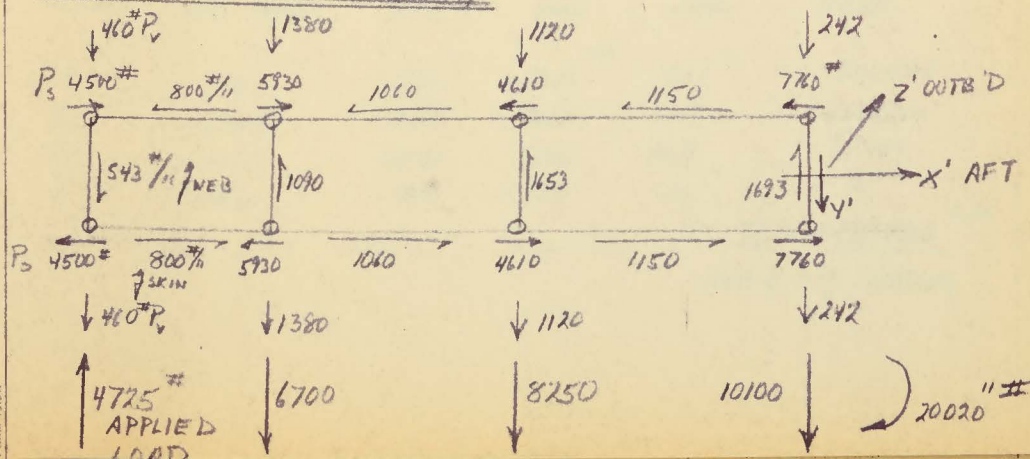
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CALCULATE SPAR SWEEP SHEAR LOADS P_s 

ITEM	θ	$\tan \theta$	P TENSION SIDE	P_s	#
R	8°39'	.1504	+51600	-7760	
RC	2°12'	.0384	+120200	-4610	
FC	3°35'	.0609	+97600	+5930	
F	8°39'	.1504	+29900	+4500	

+VE IN

X' DIRECTION

THE APPLIED LOADS ARE FROM T₆FINAL RIB LOADING

FORM 139A

A. V. ROE CANADA LIMITED
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$$\sum T @ F = 0$$

SKIN TORQUE

$$2A = x_i' y_{i+1}' - x_{i+1}' y_i'$$

ITEM	X' FROM F SPAR	Y'	X _i ' Y _{i+1} '	X _{i+1} ' Y _i '	2 A
R	50.6	1.4824	96.4	48.0	48.4
RC	31.7	1.9058	60.5	28.4	32.1
FC	14.9	1.9105	20.05	0	20.05
F	0	1.3450			

ITEM	q	2A q
R-RC	1150	-16050
RC-FC	1060	-34000
FC-F	800	-55600

$$\sum = -105650$$

$$2SKINS \sum = -211300$$

SWEEPBACK TORQUE

ITEM	LOAD	h _c 1/2 DEPTH	T
R	7760	1.4824	-11500
RC	4610	1.9058	-8760
FC	5930	1.9105	+11320
F	4500	1.3450	+6060

$$\sum = -2900$$

$$2SKINS \sum = -5800$$

$$REACTIVE TORQUE = -682600 - 211300 - 5800$$

$$= -899700 \quad \text{"#}$$

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AIRCRAFT:

C105

MATRIX
RIB 6

$$\Sigma T @ F = 0$$

$$\begin{aligned} \text{APPLIED TORQUE} &= +6700 \times 14.9'' + 8250 \times 31.7 + 10100 \times 50.6 \\ &+ 20020 = +99800 + 261500 + 512100 + 20020 \\ &= +893320'' \end{aligned}$$

$$\text{ERROR} = -6380''$$

$$\% \text{ ERROR} = \frac{6380}{893320} \times 100 = 0.72\%$$

CHECK TORQUE ABOUT REAR SPAR					
WEB & P ₁ TORQUE ITEM	WEB SNEAR	2P ₁	LOAD	ARM	TORQUE
R	- 5020	- 920	- 5940	0	0
RC	- 6300	- 2760	- 9060	18.9	+171200
FC	- 4100	- 7240	- 6400	35.7	+228500
F	+ 1460	- 480	+ 980	50.6	- 49600
					$\Sigma = +350,100$

SKIN TORQUE

ITEM	X'	Y'	X ₁ Y ₁	X ₁ Y ₁	2A	T
R	0	1.4824	28.0	0	28.0	1150
RC	18.9	1.9058	68.0	36.1	31.9	1060
FC	35.7	1.8105	96.7	48.0	48.7	800
F	50.6	1.3450				
						$\Sigma = -104500$
						2SKINS $\Sigma = -209000$

$$\begin{aligned} \text{REACTIVE TORQUE} &= +350100 - 209000 - 5800 \text{ SWEEP TORQUE} \\ &= +134700'' \end{aligned}$$

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$$Z_{T@R} = 0$$

$$\begin{aligned} \text{APPLIED TORQUE} &= +4725 \times 50.6 - 6700 \times 35.7 - 8250 \times 18.9 + 20020 \\ &= +239000 - 239000 - 156000 + 20020 \\ &= -135980 \end{aligned}$$

$$\text{ERROR} = -1280$$

$$\% \text{ ERROR} = \frac{1280}{135980} \times 100 = 0.94\%$$

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RIB 5

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4-0

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MATRIX RIB 5

SECTION 4

TECHNICAL DEPARTMENT (Aircraft)

REPORT NO. 7/0583/16

SHEET NO. 4-1

AIRCRAFT:

C 105

MATRIX

RIB 5

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FROM RIB 6 CALCULATIONS, THE END LOAD f_m WAS DETERMINED. CALCULATE THE f OUTB'D OF RIB 5 FROM RIB DISTANCES x FROM ORIGIN.

$$f_5 = \frac{x_6}{x_5} f_m = \frac{166.4}{187.7} f_m$$

ITEM	f_m	f_5 OUTB'D
R5	481	+427
RC5	1548	+1372
FC5	1198	+1062
F	228	+202

CALCULATE f_5 INB'D

$$f_5 = \frac{x_4}{x_5} f_m = \frac{211.6}{187.7} f_m$$

SPAR ITEM	f	A	P	ΔP	L	f_m	f_5
R5			61800	15600	2393	652	-735
R4	29378	2637	77400				
RC5			153000	49000	2393	2045	-2305
RC4	41519	4870	202000				
FC5			123000	17000	2393	711	-801
FC4	35299	3966	140000				
F5			34150	4850	2393	203	-229
F4	22680	1747	3800				

TECHNICAL DEPARTMENT (Aircraft)

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SHEET No. 4-2

AIRCRAFT:

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MATRIX
RIB 5

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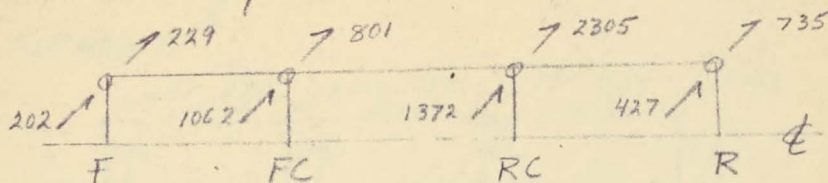
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CAP END LOAD ϕ AT RIBS



$\therefore \phi_s$ -27 +261 -933 -308
NOTE: ϕ ACTS INTO CAP ELEMENT

COMPUTE SKIN ϕ AT RIB 5

ITEM	T_m	t	ϕ_m	ϕ_s	ϕ_m	ϕ_s	ϕ_s
R-RC	5026	2162	-1085	-1222	-1020	+905	-317
RC-FC	3167	2008	-636	-717	-940	+835	+118
FC-F	1935	1811	-350	-394	-704	+624	+230
			RIB 5 - RIB4		RIB6 - RIB5		RIB5

PANEL RIB5-RIB4

$$\phi_s = \frac{x_4}{x_5} \phi_m = \frac{211.6}{187.7} \phi_m$$

+VE SKIN ϕ
PRODUCES CLOCKWISE
TORQUE ABOUT
REAR SPAR.

PANEL RIB6-RIB5

$$\phi_s = \frac{x_6}{x_5} \phi_m = \frac{166.4}{187.7} \phi_m$$

394	717	222
624	835	905

F FC RC R

RIB4

RIB5

RIB6

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MATRIX
RIB S

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COMPUTE SWEEP SHEAR AT CAP ELEMENTS

ITEM	TAN- θ	CAP θ	P_s
R	.1504	-308	-46
RC	.0384	-933	-36
FC	.0609	+261	-16
F	.1504	-27	+4

+ve P_s IN DIRECTION OF x' (ACTING AFT)

APPLIED LOADS

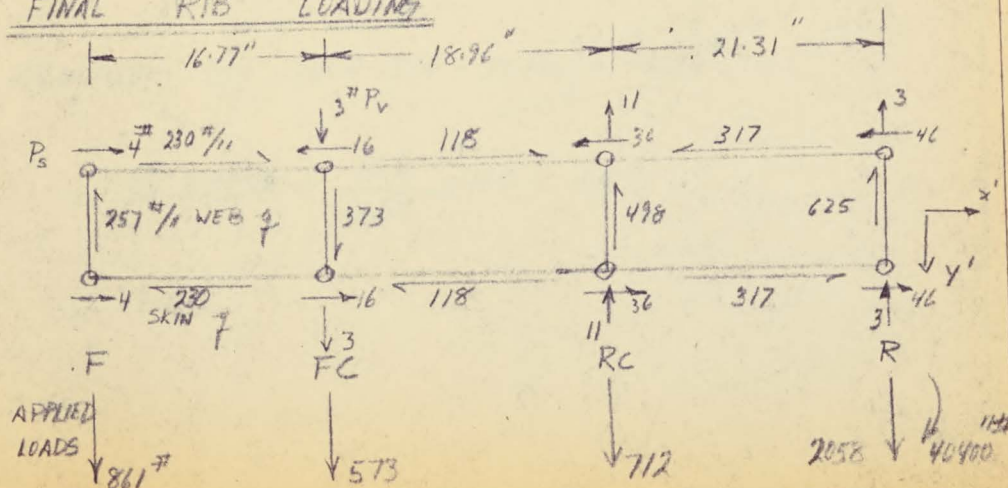
AT R $M = +40400$ " # $S = +2058$ #

AT RC $P = +712$ #

AT FC $P = 573$ #

AT F $P = 861$ #

FINAL RIB LOADING



TECHNICAL DEPARTMENT (Aircraft)

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MATRIX
RIB 5

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$$\sum T_{@F} = 0$$

$$\text{REACTIVE TORQUE} = -18520 - 169800 - 364 = -188684 \text{ " \#}$$

$$\text{ERROR} = +2826 \text{ " \#}$$

$$\% \text{ ERROR} = \frac{2826}{192510} \times 100 = 1.5\%$$

CHECK TORQUE ABOUT REAR SPAR

$$\begin{aligned} \text{APPLIED TORQUE} &= -861 \times 57.04 - 573 \times 40.27 - 712 \times 21.31 + 40400 \\ &= -49100 - 23050 - 15150 + 40400 \\ &= -46,900 \text{ " \#} \end{aligned}$$

SKIN ITEM	TORQUE X	Y	X _i Y _i	X _{i+1} Y _i	2A	T
R	0	1.6714	0	35.6	35.6	-11300
RC	21.31	2.1488	45.8	86.5	40.7	+4800
FC	40.27	2.1541	60.9	122.5	61.6	+14180
F	57.04	1.5164				+7680

$$2\text{SKINS } \sum = 15360$$

WEB # ITEM	P _v TORQUE WEB P _v LOAD	ARM	T
R	-2096	0	0
RC	-2162	21.31	+46000
FC	+1610	40.27	-64800
F	-778	57.04	+44300
			$\sum +25500$

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$$\Sigma T_{OR} = 0$$

$$\text{SWEEP TORQUE} = -364$$

$$\text{REACTIVE TORQUE} = 15360 + 25500 - 364 = +40496 \quad " \#$$

$$\text{ERROR} = -6404 \quad " \#$$

$$\% \text{ ERROR} = \frac{6404}{40400} \times 100 = 15.8\%$$

NOTE :

THE APPLIED LOAD AT REAR SPAR INCLUDES
FIN LOAD & RUDDER LOAD.

$$\text{FIN LOAD} = 499 \# \times 1.035 = 518$$

7/0583/2B

$$\text{RUDDER LOAD} = 1484 \times 1.035 = 1540$$
$$\underline{2058 \#}$$

PG 1-12, 1-36, 1-44

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RIB SHEAR & BM

COMPUTE APPLIED RIB SHEAR & TORQUE
ABOUT THE REAR SPAR — PG

COMPUTE REACTIVE RIB SHEAR & TORQUE
ABOUT THE REAR SPAR.

BY REFERRING THE TORQUE FROM THE REAR
SPAR TO THE SECTIONS CONSIDERED, THE
RIB SHEAR & B.M. ARE COMPUTED.

MATRIX RIB 5

SHEAR & B.M.

A. V. RO

TECH

AIRCRAFT

WEIGHT

C. G. POSITIO

	1	2	3	4	5	6	7	8	9	10	11
ITEM	APPLIED LOAD	S	ARM	ELEMENT TORQUE ABOUT R. (1)(2)	TORQUE ABOUT R.		ITEM	SHEAR & P LOADS	ITEM	SHEAR	ITEM
F	+861	0	57.04	-49100	-49100		F	-778	F	0	F
FC	573	861	40.27	-23100	-49100 -72200		SKIN F-FC	(-147)2	FC	-1072	FC
RC	712	1434	21.31	-15150	-72200 -87350		FC	+1610	RC	+540	RC
R	518	2146	0	0	-87350		SKIN FC-RC	(+1)2	R	-1924	R
AFT OF R	1540	2664					RC	-2162		-4020	
		4204					SKIN RC-R	(-151)2			
							R	-2096			
ITEM	Z (30) TORQUE		FINAL (21) SHEAR	FINAL (22) TORQUE	ARM (23)	(21)(23)	FINAL BM				
F	0		0	0	57.04	0	0				
	+44300		+83	-4800		+4740	+60				
FC	+72660		-211	+23560		-8500	+15060				
	+7860		1972	-64340	40.27	+79400	+15160				
RC	+11460		1974	-54740		+42100	-12640				
	+63460		522	-23890	21.31	+11120	-12770				
R	+40860		222	-46490		0	-46490				
			-1356		0	0					
			S.				BM.				

TECHNICAL DEPARTMENT (Aircraft)

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SHEET No.

5-2

AIRCRAFT:

C105

MATRIX

RIB 4

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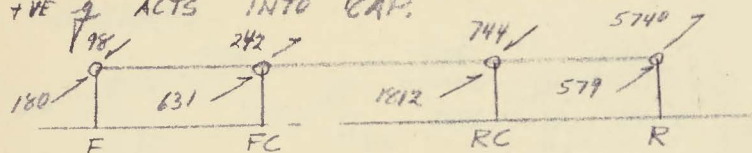
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CAP END LOAD q AT RIB 4

+VE q ACTS INTO CAP.



CAP q : 1278 +389 +2556 -5161

COMPUTE SKIN q AT RIB 4

ITEM	γ	t	q_m	INB'D q_4	q_m	OUTB'D q_4	SKIN q_4
R-RC	1976	.2286	223	+252	1085	+964	+1216
RC-FC	1097	.2128	233	+263	636	+565	+828
FC-F	785	.1934	152	+172	350	+311	+483

RIB 4 - RIB 3

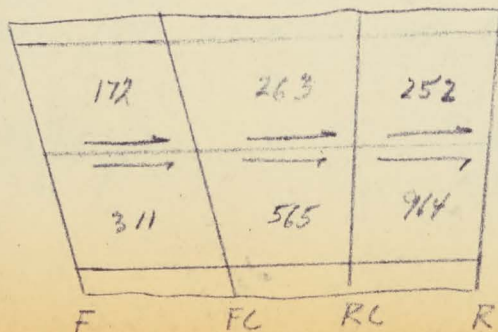
RIB 5 - RIB 4

RIB 4

$$\text{INB'D } q_4 = \frac{x_3}{x_4} q_m = \frac{2386}{211.6} q_m$$

$$\text{OUTB'D } q_4 = \frac{x_5}{x_4} q_m = \frac{187.7}{211.6} q_m$$

+VE SKIN q (ON TENSION SIDE SKIN) PRODUCES CLOCKWISE TORQUE AT REAR SPAR.



RIB 3

RIB 4

RIB 5

TECHNICAL DEPARTMENT (Aircraft)

REPORT No.

7/0583/M

SHEET No.

5-4

AIRCRAFT:

C105

MATRIX

RIB 4

PREPARED BY

S. YOUNG

DATE

JULY 28/55

CHECKED BY

DATE

COMPUTE SWEEP SHEAR AT CAP ELEMENTS

ITEM	TAN θ	CAP $\frac{1}{2}$	P_s
R	.1504	-5161	-776
RC	.10384	+2556	+98
FC	.10609	+389	+24
F	.1504	+278	+42

+VE P_s IN DIRECTION OF x' (ACTING AFT)

APPLIED LOADS

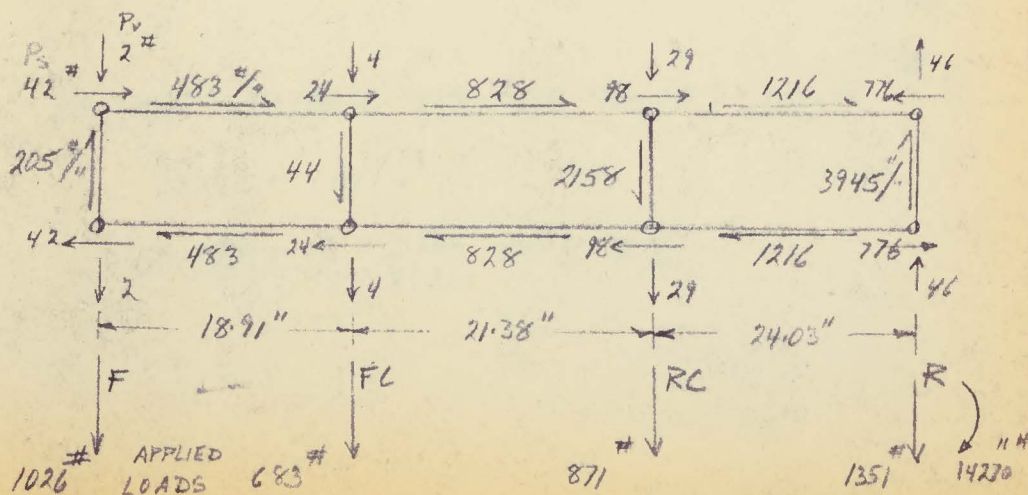
AT R $M = +14270$ " # $P = +1351$ #

AT RC $P = 871$ #

AT FC $P = 683$ #

AT F $P = 1026$ #

FINAL RIB LOADINGS



TECHNICAL DEPARTMENT (Aircraft)

REPORT NO.

7/0583/16

SHEET NO.

5-6

AIRCRAFT:

C105

MATRIX
RIB 4

PREPARED BY

S. YOUNG

DATE

JULY 28/5

CHECKED BY

DATE

CHECK TORQUE ABOUT FRONT SPAR = 0.

APPLIED TORQUE = $4683 \times 18.91'' + 871 \times 40.29 + 1351 \times 64.32 + 14270$

= $+12910 + 35100 + 86800 + 14270$

= $+149080''$

SKIN TORQUE

ITEM	X'	Y'	X ₁ Y ₁	X ₂ Y ₂	2A	T
R	64.32	1.8846	155.5	75.9	79.6	+1216
RC	40.29	2.4229	97.7	45.7	52.0	+828
FC	18.91	2.4288	32.3	0	32.3	+463
F	0	1.7099				15600

$\Sigma = +155500$

2SKINS $\Sigma = 311,000$

WEB SHEAR & P₃ TORQUE

ITEM	WEB SHEAR	P ₃	LOAD	ARM	T
R	-14880	-92	-14972	64.32	-964,000
RC	+10440	+58	+10458	40.29	+421,000
FC	+212	+8	+220	18.91	+4160
F	-762	+4	-716	0	0

$\Sigma = -538,800$

SWEEP TORQUE

ITEM	P ₃	h ₄	T
R	-776	1.8846	-1462
RC	+98	2.4229	+232
FC	+24	2.4288	+58
F	+42	1.7099	+72

$\Sigma = -1100$

2SIDES $\Sigma = -2200$

REACTIVE TORQUE = $+311,000 - 538,800 - 2200 = -230,000$

ERROR = $-81,000''$

A. V. ROE CANADA LIMITED
MALTON - ONTARIO

TECHNICAL DEPARTMENT (Aircraft)

REPORT NO. 7/0583/16
5-7

SHEET NO.

AIRCRAFT:

C105

MATRIX
RIB 4

PREPARED BY

DATE

S. YOUNG

Aug. 19/55

CHECKED BY

DATE

CHECK TORQUE ABOUT REAR SPAR = 0
APPLIED TORQUE = $+14270 - 1026 \times 64.32 - 683.4541 - 871 \times 24.03$
= $-103,530$ " #

SWEED TORQUE = -2200

WEB ITEM	P _i TORQUE LOAD	ARM	TORQUE
R	-14972	0	0
RC	+10458	2403	-251000
FC	+220	4541	-10000
F	-716	6432	+46000
			$\Sigma = -215000$

SKIN ITEM	X'	Y'	X _i Y _i	X _{i+1} Y _i	2A	T
R	0	1.8896	0	45.8	45.8	55700
RC	2403	2.4229	583	110.0	51.5	42700
FC	4541	2.4288	777	155.5	77.8	37600
F	6432	1.7079				
						$\Sigma = +136000$
						2SKINS $\Sigma = +272000$

REACTIVE = $-2200 - 215000 + 272000$
= $+54800$ " #

ERROR = -48730 " #

TECHNICAL DEPARTMENT (Aircraft)

REPORT No. 7/0583/116

SHEET No. 5-8

AIRCRAFT:

C 105

MATRIX

RIB 4

PREPARED BY

DATE

S. YOUNG

AUG. 22/55

CHECKED BY

DATE

RIB BALANCE

ADJUST THE RIB LOADING TO FORCE A
MOMENT BALANCE. ERROR: $T_R = -48730 \text{ " #}$ $T_F = -81000 \text{ " #}$

STEP 1. ADD A CORRECTIVE TORQUE OF $+48730 \text{ " #}$
TO THE RIB WHICH WILL GIVE MOMENT BALANCE
ABOUT THE REAR SPAR.

STEP 2. ADD A SHEAR LOAD TO THE REAR
SPAR TO GIVE MOMENT BALANCE ABOUT THE
FRONT SPAR.

STEP 3. THE RIB WILL BE OUT OF BALANCE
IN SHEAR.

STEP 1. BALANCE IN DIRECT PROPORTION TO
THE SKIN SHEAR FLOW IN EACH TORQUE CELL.

BAY F-TC

$$T = \frac{483}{483 + 828 + 1216} \times +48730 \text{ " #} = +9340 \text{ " #}$$

$$\text{CELL AREA} = \frac{1}{2} \cdot L \cdot (2h_f + 2h_{fc}) \quad h = \frac{1}{2} \text{ DEPTH}$$

$$= 18.91 (1.7099 + 2.4288) = 78.1 \text{ " #}$$

$$q = \frac{T}{2A} = \frac{+9340}{2 \times 78.1} = +60 \text{ #/4}$$

TECHNICAL DEPARTMENT (Aircraft)

REPORT NO. 7/0583/16

SHEET NO. 5-9

AIRCRAFT:

C105

MATRIX

RIB 4

PREPARED BY

DATE

S. YOUNG

AUG 12/55

CHECKED BY

DATE

BAY FC-RC

$$T = \frac{828}{483+828+1216} \times 48730 = +15950 \text{ " #}$$

$$\text{CELL AREA} = \frac{1}{2} L (2h_{FC} + 2h_{RC}) = 21.38(2.4288 + 2.4229) = 103.5 \text{ "}$$

$$\gamma = \frac{+15950}{2 \times 103.5} = +77 \text{ #/"} \text{ "}$$

BAY RC-R

$$T = \frac{1216}{483+828+1216} \times 48730 = +23400 \text{ " #}$$

$$\text{CELL AREA} = 24.03(2.4229 + 1.8846) = 103.5 \text{ "}$$

$$\gamma = \frac{23400}{2 \times 103.5} = +113 \text{ #/"} \text{ "}$$

STEP 2

RIB UNBALANCE ABOUT FRONT SPAR

$$= -81000 + 48730 = -32,270 \text{ " #}$$

ARM FROM REAR TO FRONT SPAR = 64.32"

° REAR SPAR MOMENT CORRECTIVE

$$\text{LOAD} = + \frac{+32,270}{64.32} = +503 \text{ #}$$

$$\text{OR } \gamma = \frac{503}{2.18846} = +252 \text{ #/"} \text{ "}$$

+VE Y' DIRECTION

STEP 3

$$\begin{aligned} \text{° RIB UNBALANCE} &= -311 \text{ OLD BALANCE} + 503 \text{ #} \\ &= +192 \text{ #} \end{aligned}$$

TECHNICAL DEPARTMENT (Aircraft)

REPORT NO. 7/0583/16

SHEET NO. 5-10

AIRCRAFT:

C105

MATRIX
RIB 4

PREPARED BY

S. YOUNG

DATE

AUG 22/55

CHECKED BY

DATE

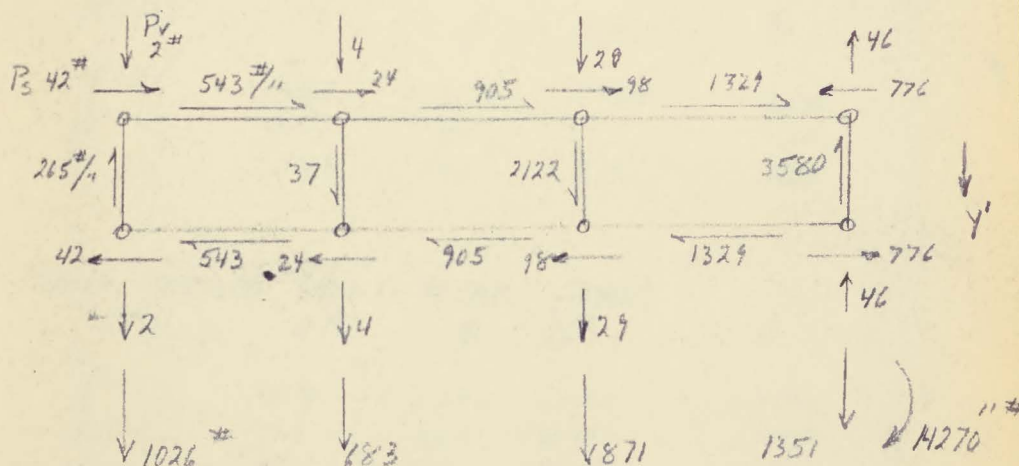
FINAL RIBS LOADING

ADD +60 #/IN TO BAY F-FC

" +77 " " FC-RC

" +113 " " RC-R

" +252 " " WEB R



COMPUTE RIB 4 SHEAR & B.M. CURVE

SIMILAR TO RIB 5 CALCULATIONS.

NOTE: THE APPLIED REAR SPAR LOAD CONSISTS OF

$$\text{FIN' LOAD} = 502 \times 1.035 = 520 \#$$

$$\text{RUDDER LOAD} = 802 \times 1.035 = 831 \#$$

7/0583/28 PG 1-12, 1-36, 1-44

TECHNICAL DEPARTMENT (Aircraft)

REPORT NO.

7/0583/16

SHEET NO.

5-11

AIRCRAFT:

C105

MATRIX
RIB 4

PREPARED BY

DATE

S. YOUNG

Aug 22/55

CHECKED BY

DATE

WEB SHEAR & P_v LOAD

ITEM	q	h_v	$\frac{1}{2}S$	P_v	$S+2P_v$ WEB LOAD
R	-3580	1.8846	-6750	-46	-13592
RC	+2122	2.4229	+5130	+29	+10318
FC	+37	2.4288	+90	+4	+188
F	-265	1.7099	-453	+2	-902

SKIN SHEAR

ITEM	Δh	q	$\frac{1}{2}S$	S
R-RC	.5383	+1329	+115	+1430
RC-FC	.0059	+905	+5	+10
FC-F	-.7189	+543	-390	-780

SKIN TORQUE (ABOUT REAR SPAR)

ITEM	ΔA	q	$\frac{1}{2}T$	T
R-RC	45.8	1329	61000	122000
RC-FC	51.5	905	46700	23400
FC-F	77.6	543	42300	84600

MATRIX RIB 4

SHEAR & BM

A. V. ROE C

MALT

TECHNICAL

AIRCRAFT

WEIGHT

C. G. POSITION

ITEM	1 APPLIED LOAD	2 S	3 ARM	4 ELEMENT TORQUE ABOUT R D ₂ D	5 Z TORQUE ABOUT R	6 ITEM	7 SKIN SHEAR	8 ITEM	9 WEB P LOADS	10 SHEAR	11 ARM TO R	12 ITEM
F	+1026	0 1026	64.32	-65900	-65900	F-FC	-780	F	-902	-902	64.32	+
FC	+683	1026 1709	45.41	-31000	-65900 -96900	FC-RC	+10	FC	+188	-1682 -1494	45.41	-
RC	+871	1709 2580	24.03	-70000	-96900 -117800	RC-R	+1430	RC	+1038	-1484 +8834	24.03	-
R	+520	2580 3100	0		-117800			R	-13502	+10264 -3228	0	
AFT OF R	+831	3931	0	+14270	-103530							
ITEM	Z (20) TORQUE		FINAL (21) SHEAR	FINAL (22) TORQUE	ARM (23)			FINAL BM				
F	0 58000		0 124	0 -7900	64.32 7900			0 0				
FC	142600 134060		-156 +215	+76700 +37160	45.41 -29800 +9750			+46910 +46910				
RC	227460 -20540		+225 +11,414	130560 -138340	24.03 5400 274500			135960 136160				
R	101460		+12844 -703	-16340	0 0			-16340				
			<u>S</u>					<u>M</u>				

TECHNICAL DEPT. (AIRFRAME)

AIRCRAFT

WEIGHT

C. G. POSITION

REPORT NO.

SHEET

DATE _____

PREPARED BY -

[illegible]

A. V. ROE CANADA LIMITED
MALTON - ONTARIO

TECHNICAL DEPARTMENT (Aircraft)

REPORT NO. 7/0583/14
SHEET NO. 6

AIRCRAFT:

C 105

MATRIX
RIB 3

PREPARED BY

S. YOUNG

CHECKED BY

DATE

AUG. 18/55

DATE

FROM RIB 4 CALCULATIONS, THE CAP END LOAD f_m BETWEEN RIBS 4-3 ARE RATIOED BY $\frac{x_4}{x_3}$ TO OBTAIN END LOAD f_3 OUTB'D

$$\text{OUTB'D } f_3 = \frac{x_4}{x_3} f_m = \frac{211.606}{238.590} f_m$$

ITEM	f_m	f_3 OUTB'D
R	+5090	+4510
RC	-659	-584
FC	+215	+191
F	-87	-77

COMPUTE CAP END LOAD f_m FOR BAY RIB 3-2 &

$$\text{HENCE } f_3 \text{ INB'D} = \frac{x_2}{x_3} f_m = \frac{269.014}{238.590} f_m$$

ITEM	f	A	P	ΔP	L	f_m	f_3 INB'D
R3			215000	0	30.404	0	0
R2			215000				
RC3			184200	+18800	"	+619	-619
RC2	29040	6989	203000				
FC3			145800	-61800	"	-2030	+2030
FC2	14620	5744	84000				
F3			37250	-4700	"	-155	+155
F2	12746	2550	32550				

A. V. ROE CANADA LIMITED
MALTON - ONTARIO

TECHNICAL DEPARTMENT (Aircraft)

REPORT No. 7/0583/16

SHEET No. 6-2

AIRCRAFT:

C105

MATRIX
RIB 3

PREPARED BY

S. YOUNG

DATE

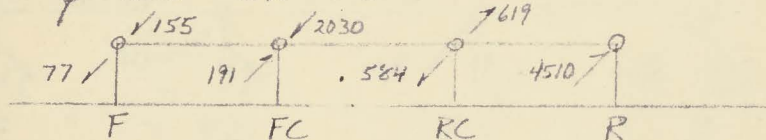
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DATE

CAP END LOAD q AT RIB 3

+VE q ALTS INTO CAP



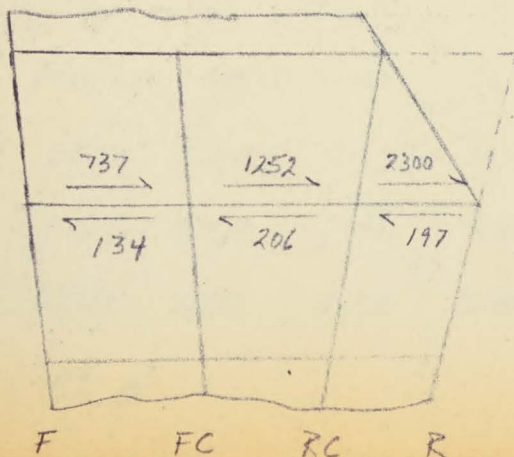
CAP q_3 : +78 +2221 -1203 +4510

COMPUTE SKIN q AT RIB 3.

ITEM	T	t	f_m	INBD q_3	f_m	OUTBD q_3	SKIN q_3
R-RC	8424	.2426	2040	2300	223	197	+2103
RC-FC	4907	.2265	1110	1252	233	206	+1046
FC-F	3144	.2073	653	737	152	134	+603
RIB 3-RIB 2					RIB 4-RIB 3		RIB 3

$$\text{INBD } q_3 = \frac{269.014}{238.590} f_m$$

$$\text{OUTBD } q_3 = \frac{211.606}{238.590} f_m$$



RIB 2

+VE SKIN q
RIB 3 (ON TENSION SKIN
SIDE) PRODUCES
CLOCKWISE TORQUE
AT REAR SPAR.

RIB 4

TECHNICAL DEPARTMENT (Aircraft)

REPORT NO. 7/0583/16

SHEET NO. 6-3

AIRCRAFT:

C 105

MATRIX
RIB 3

PREPARED BY

S. YOUNG

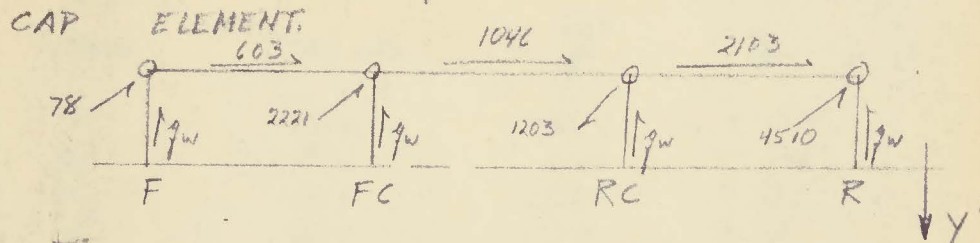
DATE

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DATE

COMPUTE WEB q BY BALANCE OF EACH CAP ELEMENT.



WEB

WEB-CAP q

WEB q

F $q + 78 - 603 = 0$

$q = +525$

-525

FC $q + 603 + 2221 - 1046 = 0$

$q = -1778$

$+1778$

RC $q + 1046 - 1203 - 2103 = 0$

$q = +2260$

-2260

R $q + 2103 + 4510 = 0$

$q = -6613$

$+6613$

+VE q ACTS
INTO CAP

+VE q ACTS
IN +VE Y'
DIRECTION

COMPUTE SLOPE SHEAR P_v AT CAP ELEMENTS.

ITEM	h_3	h_2	$h_2 \cdot h_3$	L	CAP q	P_v
R	1.8846 (h_4)	2.1249 (h_3)	2403	26.38	+4510	+40
RC	2.7318	3.0802	3484	30.404	-1203	-14
FC	2.7385	3.0877	3492	30.404	+2221	+25
F	1.9279	2.1737	2458	30.404	+78	+1

$\Sigma = +41$

$P_v = \frac{\Delta h}{L} q$

2 SIDES $\Sigma P_v = +82$

TECHNICAL DEPARTMENT (Aircraft)

REPORT No. 7/0583/16
SHEET No. 6-4

AIRCRAFT:

C105

MATRIX
RIB 3

PREPARED BY

DATE

S. YOUNG

AVG 18/55

CHECKED BY

DATE

COMPUTE SWEEP SHEAR AT CAP ELEMENTS.

ITEM	TAN ϕ	CAP f	P_s
R	.1504	+4510	+ 678
RC	.0384	-1203	- 46
FC	.0609	+2221	+ 135
F	.1504	+ 78	+ 12

FOUNDATION RIB REACTIONS AT JUNCTION OF
THE REAR SPAR, RIB 3, AND ROOT RIB.

RIB CAP STRESS = -7347 PSI

AREA = 6.712 in^2

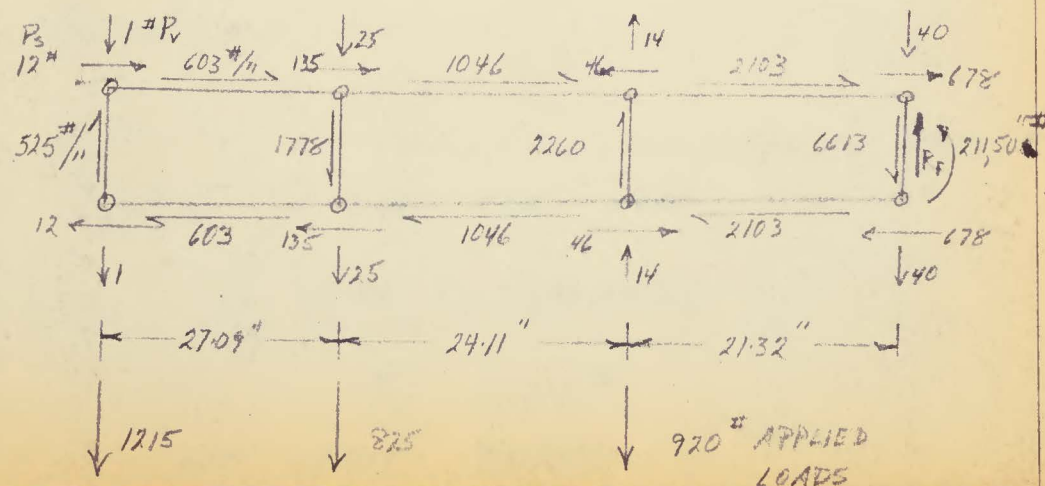
LOAD = -49800 #

1/2 RIB HEIGHT = 2.1249

RIB MOMENT = -211,500 $\text{in} \cdot \text{lb}$

RIB SHEAR = R_F

FINAL RIB LOADING



TECHNICAL DEPARTMENT (Aircraft)

REPORT No.

7/0583/16

SHEET No.

6-5

AIRCRAFT:

C105

MATRIX
RIB 3

PREPARED BY

S. YOUNG

DATE

Aug 18/55

CHECKED BY

DATE

CHECK SHEAR = 0

APPLIED SHEAR = $+1215 + 825 + 920 = +2960$ #

ITEM	q	h ₃	1/2 S	S
R	+6613	27249	+14050	+28100
RC	-2260	27318	-6170	-12340
FC	+1776	27385	+4870	+9740
F	-525	19279	-1010	-2020
				<u>Σ +23,480</u>

SKIN SHEAR

ITEM	h ₃	ITEM	Δh	q	SHEAR
R	21249	R-RC	.6069	2103	+ 1272
RC	27318	RC-FC	.0067	1046	+ 7
FC	27385	FC-F	-.8106	503	- 488
F	19279				<u>Σ = +791</u>

2 SKINS Σ = 1582 #

$$\begin{aligned} \text{REACTIVE SHEAR} &= +23480 + 1582 + 82(P_r) - R_F \\ &= +25144 - R_F \end{aligned}$$

NOTE: R_F IS FOUNDATION SHEAR REACTION FROM
RIB 3 & THE REAR SPAR.

$$\therefore 25144 - R_F + 2960 \text{ APPLIED} = 0$$

$$R_F = 28100 \text{ #}$$

FOR SHEAR BALANCE

TECHNICAL DEPARTMENT (Aircraft)

REPORT No.

7/0583/16

SHEET No.

6-6

AIRCRAFT:

C105

MATRIX

RIB 3

PREPARED BY

S. YOUNG

DATE

APR. 19/55

CHECKED BY

DATE

CHECK TORQUE ABOUT FRONT SPAR = 0

APPLIED TORQUE = $920 \times 51.20 + 825 \times 27.09 = +69,450$ ^{11#}

SKIN TORQUE

ITEM	X'	Y'	X ₁ Y ₁	X ₂ Y ₂	2A	q	T
R	72.52	212.49	198.0	108.8	89.2	2103	187,800
RC	51.20	273.18	140.0	74.0	66.0	1046	69,000
FC	27.09	273.85	52.2	0	52.2	103	31,500
F	0	1.9279					

$\Sigma = +288,300$

2 SKINS $\Sigma = 576,600$

WEB SHEAR & P_v TORQUE

ITEM	WEB SHEAR	P _v	LOAD	APM	T
R	(+78100 - 28100)	+80	+80	72.52	+5800
RC	-12340	-26	-12368	51.20	-632,000
FC	+9740	+50	+9790	27.09	+265,500
F	-2020	+2	-2018	0	0

$\Sigma = -360,700$

SWEEP TORQUE

ITEM	P _s	h _s	T
R	+678	212.49	+1440
RC	-46	273.18	-126
FC	+135	273.85	+370
F	+12	1.9279	+23

$\Sigma = +1707$

2 SIDES $\Sigma = +3414$ ^{11#}

REACTIVE TORQUE = $-211,500 + 576,600 - 360,700 + 3414 = +7,814$

ERROR = +77,264 ^{11#}

A. V. ROE CANADA LIMITED
MALTON - ONTARIO

TECHNICAL DEPARTMENT (Aircraft)

REPORT No.

7/0583/16

SHEET No.

6-7

AIRCRAFT:

C105

MATRIX
RIB 3

PREPARED BY

S. YOUNG

DATE

Aug. 19/55

CHECKED BY

DATE

CHECK TORQUE ABOUT REAR SPAR = 0.

$$\text{APPLIED TORQUE} = -920 \times 21.32 - 825 \times 45.43 - 1215 \times 72.52 \\ = -145,200 \text{ " \#}$$

$$\text{SWEEP TORQUE} = +3414$$

WEB & R TORQUE

ITEM	LOAD	ARM	TORQUE
R	+80	0	0
RC	-12368	21.32	+263500
FC	+9790	45.43	-445000
F	-2018	72.52	+146000
			$\Sigma = -35500$

SKIN TORQUE							
ITEM	X'	Y'	X ₁ Y ₁	X ₂ Y ₂	2A	θ	T
R	0	21249	0	452	452	2103	95000
RC	2132	27318	582	124	6518	1046	68800
FC	4543	27385	876	198	1104	603	66700
F	7252	19279					
							$\Sigma = +230500$
							$2 \text{ SKINS } \Sigma = +461000$

$$\text{REACTIVE TORQUE} = +3414 - 35500 + 461000 - 211500 \\ = +217,414 \text{ " \#}$$

$$\text{ERROR} = +72,214 \text{ " \#}$$

A. V. ROE CANADA LIMITED
MALTON - ONTARIO

TECHNICAL DEPARTMENT (Aircraft)

REPORT No.

7/0583/116

SHEET No.

6-8

AIRCRAFT:

C105

MATRIX
RIB 3

PREPARED BY

DATE

S. YOUNG

AUG 23/55

CHECKED BY

DATE

RIB BALANCE

ADJUST THE RIB LOADING TO FORCE A
MOMENT BALANCE. ERROR: $T_R = +72214$ "in" $T_F = +77264$ "in"

STEP 1. -- ADD A CORRECTIVE TORQUE OF
 -77214 "in" TO THE RIB WHICH WILL GIVE
MOMENT BALANCE ABOUT THE REAR SPAR.

STEP 2. ADD A SHEAR LOAD TO THE REAR
SPAR TO GIVE MOMENT BALANCE ABOUT THE
FRONT SPAR.

STEP 3. THE RIB WILL BE OUT OF
BALANCE IN SHEAR.

~~11.~~

STEP 1. BALANCE IN DIRECT PROPORTION
TO THE SKIN SHEAR FLOW IN EACH TORQUE
CELL.

BAY F-FC

$$T = \frac{603}{603 + 1046 + 2103} \times -77214 = -11,620 \text{ "in"}$$

A. V. ROE CANADA LIMITED
MALTON - ONTARIO

TECHNICAL DEPARTMENT (Aircraft)

AIRCRAFT:

C105

MATRIX
RIB 3

REPORT NO.

7/0583/16

SHEET NO.

6-9

PREPARED BY

DATE

S. YOUNG

AUG. 23/55

CHECKED BY

DATE

$$\text{CELL AREA} = \frac{1}{2} \cdot l (2h_F + 2h_{FC}) \cdot h = \frac{1}{2} \text{ DEPTH}$$

$$= 2709" (1.9279 + 2.7385) = 126.5 \text{ D}''$$

$$f = \frac{T}{2A} = \frac{-11620}{2 \times 126.5} = -46 \text{ #/"}''$$

BAY FC-RC

$$T = \frac{1046}{603 + 1046 + 2103} \times -72214 = -20,100 \text{ '' #}$$

$$A = 24.11 (2.7385 + 2.2318) = 132 \text{ D}''$$

$$f = \frac{-20100}{2 \times 132} = -77 \text{ #/"}''$$

BAY RC-R

$$T = \frac{2103}{603 + 1046 + 2103} \times -72214 = -40500 \text{ '' #}$$

$$A = 21.32 (2.7318 + 2.1249) = 103.5 \text{ D}''$$

$$f = \frac{-40500}{2 \times 103.5} = -196 \text{ #/"}''$$

STEP 2

RIB UNBALANCE ABOUT FRONT SPAR

$$= +77264 - 12214 \text{ CORRECTIVE} = +5,050 \text{ '' #}$$

ARM REAR TO FRONT SPAR = 72.52"

$$\text{LOAD} = \frac{-5050}{72.52} = -70 \text{ #}$$

$$f = \frac{-70}{2 \times 21249} = -17 \text{ #/"}''$$

STEP 3

$$\therefore \text{RIB UNBALANCE} = 0 \text{ #, OLD BALANCE} -70 \text{ #}$$

$$= -70 \text{ #}$$

A. V. ROE CANADA LIMITED
MALTON - ONTARIO

TECHNICAL DEPARTMENT (Aircraft)

REPORT NO.

7/0583/116

SHEET NO.

6-11

AIRCRAFT:

C105

MATRIX
RIB 3

PREPARED BY

DATE

S. YOUNG

AUG. 23/55

CHECKED BY

DATE

WEB SHEAR & P_v LOAD

ITEM	q	h_3	$\frac{1}{2} S$	P_v	$S + 2P_v$ WEB LOAD
R	+6400	21249	+13600	+40	+ 27280
RC	-2141	27318	-5850	-14	- 11728
FC	+1809	27385	+4940	+25	+ 9930
F	-479	19274	-924	+1	- 1846

SKIN SHEAR

ITEM	Δh	q	$\frac{1}{2} S$	S
R-RC	5383	+1907	+1128	+2256
RC-FC	10059	+969	+6	+12
FC-F	-7189	+557	-401	-802

SKIN TORQUE (ABOUT REAR SPAR)

ITEM	$2A$	q	$\frac{1}{2} T$	T
R-RC	45.2	1907	86200	+172400
RC-FC	65.8	969	63800	+127600
FC-F	110.4	557	61600	+123200

SHEAR & B.M.

MAL
TECHNIC

WEIGHT

C. G. POSITION

FORM 1343

A. V. ROE CANADA LIMITED

MALTON, ONTARIO

TECHNICAL DEPT. (AIRFRAME)

AIRCRAFT

WEIGHT

C. G. POSITION

REPORT NO

SHEET

DATE _____

PREPARED BY :

[illegible]

A. V. ROE CANADA LIMITED
MALTON - ONTARIO

TECHNICAL DEPARTMENT (Aircraft)

REPORT No.

7/0583/16

SHEET No.

7-0

AIRCRAFT:

C105

MATRIX
RIB 2

PREPARED BY

DATE

S. YOUNG

APR 24/55

CHECKED BY

DATE

MATRIX RIB 2

SECTION 7

TECHNICAL DEPARTMENT (Aircraft)

REPORT NO.

7/0583/16

SHEET NO.

7-1

AIRCRAFT:

C105

MATRIX
RIB 2

PREPARED BY

S. YOUNG.

DATE

AUG 19/55.

CHECKED BY

DATE

FROM RIB 3 CALCULATIONS, THE CAP END
LOAD q_m BETWEEN RIBS 3-2 ARE RATIOED BY

$\frac{x_3}{x_2}$ TO OBTAIN q_2 OUTB'D.

$$\text{OUTB'D } q_2 = \frac{x_3}{x_2} q_m = \frac{238.590}{269.014}$$

ITEM	q_m	q_2 OUTB'D
R	0	0
RC	+619	+549
FC	-2030	-1800
F	-155	-138

COMPUTE CAP END LOAD q_m FOR BAY RIB 2-1

∴ HENCE q_2 INB'D = $\frac{x_1}{x_2} q_m = \frac{303.317}{269.014} q_m$

ITEM	f	A	P	ΔP	L	q_m	q_2 INB'D
RC 2			203000	0		0	0
RC 1			2030+0				
FC 2			84000	+5900	34303	+172	-194
FC 1	12929	6952	89900				
F 2			32550	-19930	34303	-581	+655
F 1	4069	3.099	12620				

A. V. ROE CANADA LIMITED
MALTON - ONTARIO
TECHNICAL DEPARTMENT (Aircraft)

REPORT NO. 7/0583/116

SHEET NO. 7-2

AIRCRAFT:

C105

MATRIX
RIB 2

PREPARED BY

S. YOUNG

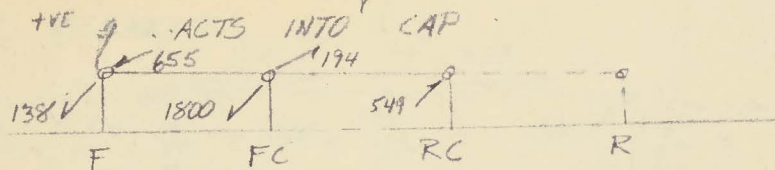
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DATE

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CAP END LOAD ∇ AT RIB 2.



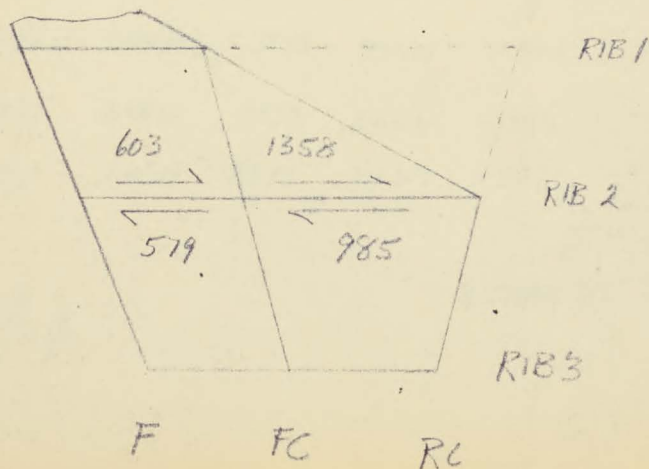
CAP ∇ : + 517 -1994 +549

COMPUTE SKIN ∇ AT RIB 2.

ITEM	γ	t	f_m	INB'D ∇	f_m	OUTB'D ∇	SKIN ∇
RC-FC	4798	.2418	1160	1358	1110	985	373
FC-F	2398	.2230	535	603	653	579	24
RIB 2 - RIB 1				RIB 3 - RIB 2		RIB 2	

$$\text{INB'D } \nabla = \frac{303.317}{269.014} \nabla$$

$$\text{OUTB'D } \nabla = \frac{238.590}{269.014} \nabla$$



TECHNICAL DEPARTMENT (Aircraft)

REPORT No. 7/0583/116

SHEET No. 7-3

AIRCRAFT:

C105

MATRIX
RIB 2

PREPARED BY

S. YOUNG

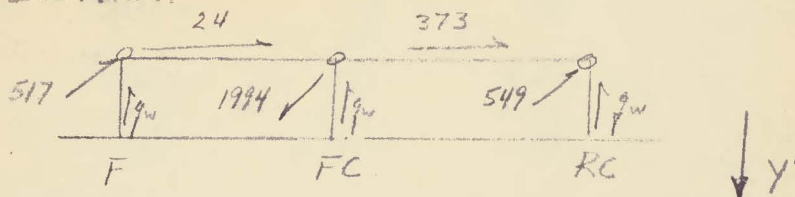
DATE

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DATE

COMPUTE WEB q BY BALANCE OF EACH CAP ELEMENT.



WEB	WEB-CAP q	WEB q
RC $q + 373 + 549 = 0$	$q = -922$	$+922$
FC $q - 373 - 1994 + 24 = 0$	$q = +2343$	-2343
F $q + 517 - 24 = 0$	$q = -493$	$+493$
	the q ACTS INTO CAP	the q ACTS IN Y' DIRECTION

COMPUTE SLOPE SHEAR P_v AT CAP ELEMENTS.

ITEM	h_2	h_1	Δh	L	CAP q	P_v
RC	27318(h_2)	310802(h_1)	3484	301404	+549	+6
FC	310877	34816	3939	34303	-1994	-23
F	21737	24509	2872	34303	+517	+4
						$\Sigma = -13$

2 SIDES $\Sigma = -26^\#$

$$P_v = \frac{\Delta h}{L} q$$

TECHNICAL DEPARTMENT (Aircraft)

REPORT NO.

7/6583/116

SHEET NO.

7-4

AIRCRAFT:

C105

MATRIX

RIB 2

PREPARED BY

S. YOUNG

DATE

Aug. 19/65

CHECKED BY

DATE

COMPUTE SWEEP SHEAR AT CAP ELEMENTS.

ITEM	TAN θ	CAP $\frac{P}{Y}$	P_3
RC	.0384	+549	+21
FC	.0609	-1994	-122
F	.1504	+517	+78

FOUNDATION RIB REACTION AT JUNCTION OF THE
REAR CENTRE SPAR, RIB 2, AND ROOT RIB.

RIB CAP STRESS = -5115 PSI

AREA = 7.591 in^2

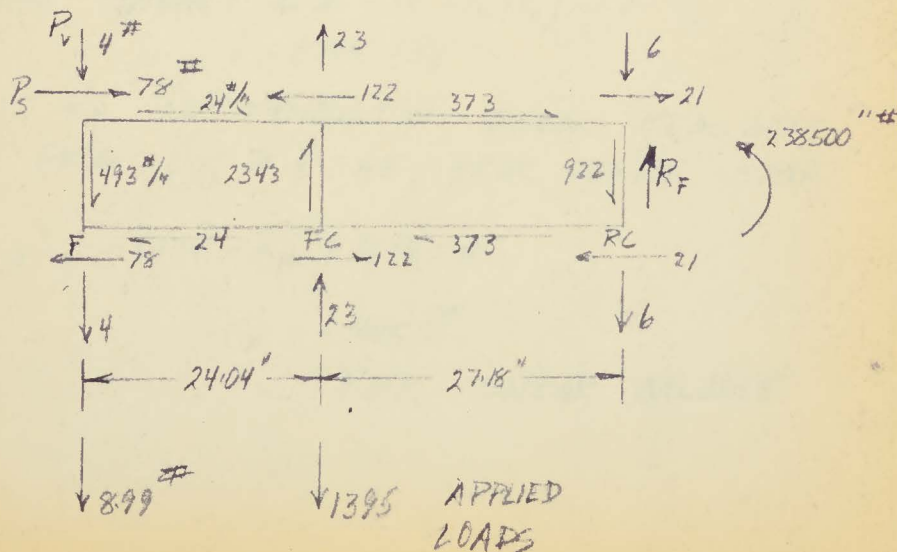
LOAD = -38800 #

$\frac{1}{2}$ RIB HEIGHT = 3.0802"

RIB MOMENT = -238,500 $\text{in} \cdot \text{lb}$

RIB & SPAR SHEAR = R_F

FINAL RIB LOADING



TECHNICAL DEPARTMENT (Aircraft)

AIRCRAFT:

C105

MATRIX
RIB 2

REPORT No

7/0583/16

SHEET No

7-5

PREPARED BY

S. YOUNG

DATE

AUG 19/55

CHECKED BY

DATE

CHECK SHEAR = 0

APPLIED SHEAR = +899 + 1395 = +2294 #

WEB SHEAR

ITEM	q	h_2	$\frac{1}{2} S$	S
RC	+922	3.0802	+2840	+5680
FC	-2343	3.0877	-7250	-14500
F	+493	2.1737	+1070	+2140
				$\Sigma = -6680$

SKIN SHEAR

ITEM	h_2	ITEM	Δh	q	SHEAR
RC	3.0802	RC-FC	.0075	+373	+ 3
FC	3.0877	FC-F	-.9140	+24	- 22
F	2.1737				$\Sigma = -19$
					2SKINS $\Sigma = -38$

REACTIVE SHEAR = -6680 - 38 - 26(R_v) - R_F
= -6744 - R_F

NOTE: R_F IS FOUNDATION SHEAR REACTION
FROM RIB 2 & THE REAR CENTRE SPAR.

$$0 = -6744 - R_F + 2294 = 0$$

$$R_F = -4450$$

FOR SHEAR BALANCE

TECHNICAL DEPARTMENT (Aircraft)

REPORT NO.

7/0583/16

SHEET NO.

7-6

AIRCRAFT:

C105

MATRIX
RIB 2

PREPARED BY

S. YOUNG

DATE

APR. 19/55

CHECKED BY

DATE

CHECK TORQUE ABOUT FRONT SPAR = 0

APPLIED TORQUE = $+1375 \times 24.04 = +33,500$ " #

SKIN TORQUE

ITEM	X'	Y'	X ₁ , Y ₁	X ₂ , Y ₂	2A	T
RC	51.32	3.0802	158.5	74.1	84.4	+31500
FC	24.04	3.0877	52.3	0	52.3	+1255
F	0	2.1137				

$\Sigma = +32755$

2SKINS $\Sigma = +65510$

WEB SHEAR & P₂ TORQUE

ITEM	WEB SHEAR	P ₂	LOAD	ARM	T
RC	(45680 + 4430)	+12	+10142	51.32	+521000
FC	-14500	-46	-14546	24.04	-350000
F	+2140	+18	+2148	0	0

$\Sigma = +171000$

SWEEP TORQUE

ITEM	P ₃	h ₂	T
RC	+21	3.0802	+65
FC	-122	3.0877	-376
F	+178	2.1737	+170

$\Sigma = -141$

2SKINS $\Sigma = -282$

REACTIVE TORQUE = $+65510 + 171000 - 282 - 238500 = -2272$ " #

ERROR = $+31,228$ " #

A. V. ROE CANADA LIMITED
MALTON - ONTARIO

TECHNICAL DEPARTMENT (Aircraft)

REPORT No. 7/0583.1/16

SHEET No. 7-7

AIRCRAFT:

C 105

MATRIX
RIB 2

PREPARED BY

DATE

S. YOUNG

Aug 19/55

CHECKED BY

DATE

CHECK TORQUE ABOUT REAR CENTRE SPAR = 0

APPLIED TORQUE = $-1395 \times 27.18 - 899 \times 51.32 = -84,100$ " #

SKIN TORQUE

ITEM	X'	Y'	X _{i-1} Y _{i-1}	X _{i-1} Y _i	2A	q	T
RC	0	30802	0	83.7	83.7	+373	+31,200
FC	27.18	30817	57.0	158.0	99	+24	+2370
F	51.32	21737					
							$\Sigma = +33570$

2 SKINS $\Sigma = +67140$

WEB SHEAR & P_v TORQUE

ITEM	WEB SHEAR	P _v	LOAD	ARM	T
RC	(5680 + 4450)	+12	+10142	0	0
FC	-14500	-46	-14546	27.18	+395000
F	+2140	+8	+2148	51.32	-110300
					$\Sigma = +284700$

SWEEP TORQUE = -282

FOUNDATION MOMENT = -238500

REACTIVE TORQUE = $+67140 + 284700 - 282 - 238500 = +113,058$ " #

ERROR = +28958 " #

TECHNICAL DEPARTMENT (Aircraft)

REPORT NO.

7/0583/16

SHEET NO.

7-8

AIRCRAFT:

C105

MATRIX

RIB 2

PREPARED BY

S. YOUNG

DATE

AUG. 23/55

CHECKED BY

DATE

RIB BALANCE

ADJUST THE RIB BALANCE TO FORCE A
MOMENT BALANCE. ERROR: $T_{RC} = +28958$ $T_F = +31228$

STEP 1. ADD A CORRECTIVE TORQUE OF -28958
TO THE RIB WHICH WILL GIVE MOMENT BALANCE
ABOUT THE REAR CENTRE SPAR.

STEP 2. ADD A SHEAR LOAD TO THE REAR
CENTRE SPAR TO GIVE MOMENT BALANCE ABOUT
THE FRONT SPAR.

STEP 3. THE RIB WILL BE OUT OF
BALANCE IN SHEAR.

STEP 1. BALANCE IN DIRECT PROPORTION
TO THE SKIN SHEAR FLOW IN EACH TORQUE
CELL,

BAY F-FC

$$T = \frac{24}{24 + 373} \times -28958 = -1748$$

$$A = \frac{1}{2} \cdot L (2h_F + 2h_{FC}) \quad h = \frac{1}{2} \text{ DEPTH}$$

TECHNICAL DEPARTMENT (Aircraft)

AIRCRAFT:

C105

MATRIX
RIB 2

REPORT NO.

7/0583/16

SHEET NO.

7-9

PREPARED BY

S. YOUNG

DATE

AUG. 23/55

CHECKED BY

DATE

$$A = 2404 (2.1737 + 3.0877) = 1265 \text{ "}$$

$$\gamma = \frac{T}{2A} = \frac{-1748}{2 \times 1265} = -7 \text{ #/"} \text{ "}$$

BAY FC-RC

$$T = \frac{373}{24 + 373} \times -28958 = -27200 \text{ "}$$

$$A = 27.18 (3.0877 + 3.0802) = 167.2 \text{ "}$$

$$\gamma = \frac{-27200}{2 \times 167.2} = -81 \text{ #/"} \text{ "}$$

STEP 2.

$$\text{RIB UNBALANCE ABOUT FRONT SPAR} \\ = +31,228 - 28958 \text{ CORRECTIVE} = +2270 \text{ "}$$

$$\text{ARM FRONT TO REAR CENTRE SPAR} = 51.32 \text{ "}$$

$$\text{LOAD} = - \frac{2270}{51.32} = -44 \text{ #}$$

$$\gamma = \frac{-44}{2 \times 3.0802} = -7 \text{ #/"} \text{ "}$$

STEP 3.

$$\text{SHEAR UNBALANCE} = 0 \text{ #, OLD BALANCE} - 44 \text{ #} \\ = -44 \text{ #}$$

A. V. ROE CANADA LIMITED
MALTON - ONTARIO

TECHNICAL DEPARTMENT (Aircraft)

REPORT NO. 7/0583/16

SHEET NO. 7-10

AIRCRAFT:

C105

MATRIX
RIB 2

PREPARED BY

DATE

S. YOUNG

AUG. 23/55

CHECKED BY

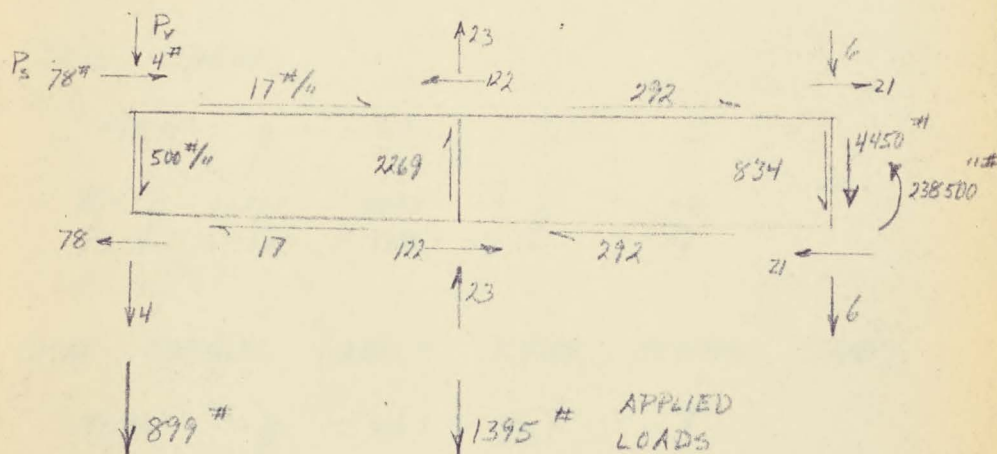
DATE

FINAL RIB LOADING

ADD -7 #/11 TO BAY F-FC

" -81 " " FC-RC

" -7 #/11 " WEB RC



COMPUTE RIB 2 SHEAR & BM

A. V. ROE CANADA LIMITED
MALTON - ONTARIO

TECHNICAL DEPARTMENT (Aircraft)

REPORT NO.

7/0583/16

SHEET NO.

7-11

AIRCRAFT:

C105

MATRIX

RIB 2

PREPARED BY

S. YOUNG

DATE

AUG 23/55

CHECKED BY

DATE

WEB SHEAR $\frac{1}{2} P_v$ LOAD

ITEM	q	h_2	$\frac{1}{2} S$	P_v	$S+2P_v$ WEB LOAD
RC	+834	3.0802	+2570	+6	+5152 [#]
FC	-2269	3.0877	-7000	-23	-14046
F	+500	2.1737	+1088	+4	+2184

SKIN SHEAR

ITEM	q	Δh	$\frac{1}{2} S$	S
RC-FC	+292	.0075	+2	+4
FC-F	+17	-.9140	-16	-32

SKIN TORQUE (ABOUT REAR CENTRE SPAR)

ITEM	q	$2A$	$\frac{1}{2} T$	T
RC-FC	+292	83.7	+24450	+48900
FC-F	+17	99.	+1685	+3370

SHEAR & BM

AIRCRAFT	.	.
WEIGHT	.	.
C. G. POSITION	.	.

FORM 1543

7/0583/16
7-13

MATRIX RIB 2

SHEAR & BM

BM

IN LB

SHEAR

LB

-22000

-280000 -10000

-150000 -7000

-120000 -8000

-140000 -7000

-120000 -6000

-100000 -5000

-80000 -4000

-60000 -3000

-40000 -2000

-20000 -1000

0 0

20000 +1000

40000 +2000

60000 +3000

80000 +4000

— SHEAR
- - - B.M.

FG

RG

INCHES FROM FRONT SPAR

TECHNICAL DEPARTMENT (Aircraft)

REPORT NO.

7/0583/16

SHEET NO.

8-2

AIRCRAFT:

C105

MATRIX
RIB 1

PREPARED BY

S. YOUNG

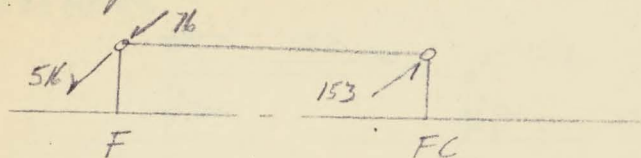
DATE

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DATE

CAP END LOAD $\uparrow$ AT RIB 1
+VE $\uparrow$ ACTS INTO CAP.



CAP $\uparrow$: -440

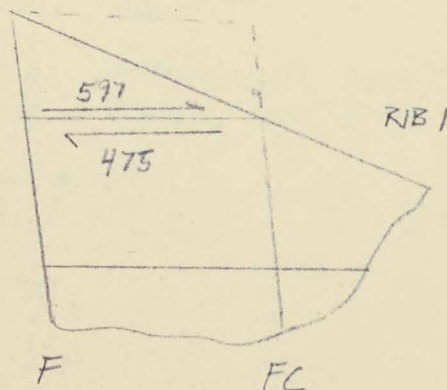
+153

COMPUTE SKIN $\uparrow$ AT RIB 1.

ITEM	γ	t	f_m	INB'D f_1	f_m	OUTB'D f_1	SKIN f_1
FC-F	2202	2406	529	597	535	475	122
				RIB1 - RIB 0	RIB2 - RIB1		RIB 1

$$\text{INB'D } f_1 = \frac{341.994}{303.317} \uparrow$$

$$\text{OUTB'D } f_1 = \frac{269.014}{303.317} \uparrow$$



A. V. ROE CANADA LIMITED
MALTON - ONTARIO

TECHNICAL DEPARTMENT (Aircraft)

REPORT NO.

7/0583/16

SHEET NO.

8-4

AIRCRAFT:

C105

MATRIX
RIB 1

PREPARED BY

S. YOUNG

DATE

Aug. 22/55

CHECKED BY

DATE

COMPUTE SWEEP SHEAR AT CAP ELEMENTS.

ITEM	TAN θ	CAP θ	P_3
FC	.0609	+153	+9
F	.1504	-404	-61

FOUNDATION RIB REACTION AT JUNCTION OF
THE FRONT CENTRE SPAR, RIB1, AND ROOT RIB.

RIB CAP STRESS = -1371

AREA = 8.478

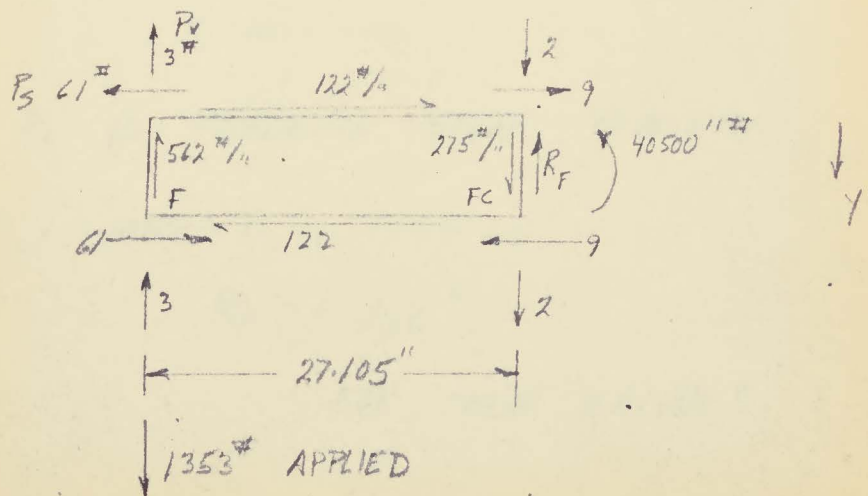
LOAD = -11620

$\frac{1}{2}$ HEIGHT = 3.4816

RIB MOMENT = -40,500 "H

RIB & SPAR SHEAR = R_F

FINAL RIB LOADING



A. V. ROE CANADA LIMITED
MALTON - ONTARIO

TECHNICAL DEPARTMENT (Aircraft)

REPORT NO.

7/0583/16

SHEET NO.

8-6

AIRCRAFT:

C105

MATRIX
RIB 1

PREPARED BY

S. YOUNG

DATE

Aug. 22/58

CHECKED BY

DATE

CHECK TORQUE ABOUT FRONT SPAR = 0

APPLIED TORQUE = 0

SKIN TORQUE

ITEM	X'	Y'	X ₁₁ Y ₁₁	X ₁₁ Y ₁	2A	T
FC	27.105	3.4816	66.2	0	66.2	+122 8080
F	0	2.4509				

2SKINS Z = +16,160

WEB SHEAR & P₁ TORQUE

ITEM	WEB SHEAR	P ₁	LOAD	ARM	T
FC	+1985 - 266 P _F	+2	+1652	27.115	+44,800
F	-2750	-3	-2753	0	

SWEEP TORQUE

ITEM	P ₃	h ₁	T
FC	+9	3.4816	+31
F	-61	2.4509	-150

Z = -119

2SKINS Z = -238

REACTIVE TORQUE = +16,160 + 44,800 - 238 - 40500 FOUNDATION
= +20,222 " #

ERROR = +20,222 " #

A. V. ROE CANADA LIMITED
MALTON - ONTARIO

TECHNICAL DEPARTMENT (Aircraft)

REPORT NO.

7/0583/16

SHEET NO.

8-7

AIRCRAFT:

C105

MATRIX
RIB 1

PREPARED BY

S. YOUNG

DATE

AUG 22/55

CHECKED BY

DATE

CHECK TORQUE ABOUT FRONT, CENTRE SPAR = 0
APPLIED TORQUE = $-1353 \times 27.105 = -36,650$ " #

SKIN TORQUE

$$2A = 27.105 \times 34816 = 94.3$$

$$\begin{array}{l} \uparrow = +122 \\ T = +11,500 \end{array}$$

$$2 \text{ SKINS } T = +23000 \text{ " #}$$

WEB SHEAR $\frac{1}{2}$ P, TORQUE

$$\text{LOAD AT } F = -2753 \text{ #}$$

$$T = 2753 \times 27.105 = +74800 \text{ " #}$$

$$\begin{aligned} \text{REACTIVE TORQUE} &= +23000 + 74800 - 238 - 40500 \\ &= +57062 \text{ " #} \end{aligned}$$

$$\text{ERROR} = +20412 \text{ " #}$$

A. V. ROE CANADA LIMITED
MALTON - ONTARIO

TECHNICAL DEPARTMENT (Aircraft)

REPORT NO.

7/0583/16

SHEET NO.

8-9

AIRCRAFT:

C105

MATRIX
RIB 1

PREPARED BY

S. YOUNG

DATE

Aug 24/55

CHECKED BY

DATE

COMPUTE WEB SHEAR & BM.

AT FRONT SPAR:

$$FWD S = 0$$

$$AFT S = +1353 - 6 - 499 \frac{1}{4} \times 24509 \times 2 = -1098$$

$$M = 0$$

AT FRONT CENTRE SPAR:

$$FWD S = -1098 - 59 \frac{1}{4} \times 10307 \Delta h \times 2 = -1098 - 1220 = -1220 \#$$

$$AFT S = -1220 + 4 + 212 \frac{1}{4} \times 34816 \times 2 = -1220 + 4 + 1475 = +259 \#$$

$$FOUNDATION REACTION = -266 \# \quad OK$$

$$FWD M = -1098 \times -27.105 + 59 \frac{1}{4} \times 27.105 \times 3.4816 \times 2 \\ = +29,750 + 11,120 = +40,870 \#$$

$$FOUNDATION M = -40500 \# \quad OK.$$

7/0587/16
8-10

MATRIX RIB 1 SHEAR & BM

SHEAR
LB
-1200

BM
IN LB
-1000

SHEAR
-1000

-700

-4000 -800

-700

30 000 -600

-500

20 000 -400

-300

10 000 -200

-100

0 0 F

0 0

100

200

300

----- SHEAR
----- BM

INCHES FROM
TRUNK SPAR

