

QCX
Avro
CF105
R-7-0583-2



TECHNICAL REPORT



A. V. ROE CANADA LIMITED
MALTON - ONTARIO

TECHNICAL DEPARTMENT (Aircraft)

F. Shearston

ANALYZED

AIRCRAFT: C105

REPORT NO. 7/0503/2

FILE NO.

~~CONFIDENTIAL~~

NO. OF SHEETS:

TITLE:

LOWER FIN STRESS DISTRIBUTION
BY MODIFYING MATRIX STRESSES (CRAFT)

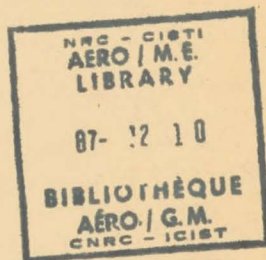
Classification cancelled / Changed to UNCLASS

By authority of AVRS

Date 30 Sep 66

Signature J.P. Sullivan

Unit / Rank / Appointment AVRS



PREPARED BY H.N. SHOJI
A. COOKE
J.L. DIXON

DATE MAY 15th 1966

CHECKED BY

DATE

SUPERVISED BY

DATE

APPROVED BY

DATE

ISSUE NO.	REVISION NO.	REVISED BY	APPROVED BY	DATE	REMARKS

15867281



AVRO AIRCRAFT LIMITED

TECHNICAL DEPARTMENT (Aircraft)

AIRCRAFT

G105

FIN

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INDEX

CONFIDENTIAL

SECTION	DESCRIPTION
1	LOAD DISTRIBUTION TO MATRIX STRUCTURE.
2	RESOLUTION OF MATRIX STRESSES IN DIRECTION OF FIN STRUCTURE.
3	CALCULATION OF STRESS DISTRIBUTION.



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SPAR REACTIONS IN POUNDS PER INCH OF SPAN

	#1	#2	#3	#4	#5	#6	#7
RPS	8.9	41.2	41.2	40.5	33.5	36.2	34.4
RFS	-	13.3	30.2	27.7	25.7	24.5	22.7
RCS	-	-	17.7	35.1	33.1	30.4	27.7
RRS	-	-	-	17.7	19.6	21.5	25.1

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1-15

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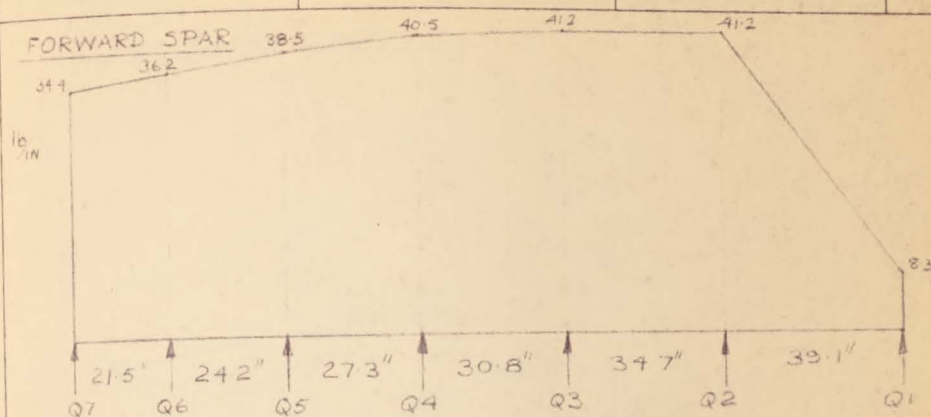
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TAKING MOMENTS ABOUT	MOMENT (M)	REACTION M + X	TOTAL
Q6	$353 \times 21.5 \times 10.66$ = 8090	$\frac{8090}{21.5} = 376$	Q7=376
Q7	$353 \times 21.5 \times 10.64$ = 8230	$\frac{8230}{21.5} = 383$	Q6=830
Q5	$37.35 \times 24.2 \times 11.98$ = 10820	$\frac{10820}{24.2} = 447$	
Q6	$37.35 \times 24.2 \times 12.22$ = 11050	$\frac{11050}{24.2} = 456$	Q5=990
Q4	$39.5 \times 27.3 \times 13.52$ = 14580	$\frac{14580}{27.3} = 534$	
Q5	$39.5 \times 27.3 \times 13.78$ = 14840	$\frac{14840}{27.3} = 544$	Q4=1171
Q3	$40.85 \times 30.8 \times 15.35$ = 19310	$\frac{19310}{30.8} = 627$	
Q4	$40.85 \times 30.8 \times 15.45$ = 19430	$\frac{19430}{30.8} = 631$	Q3=1846
Q2	$41.20 \times 34.7 \times 17.35$ = 24800	$\frac{24800}{34.7} = 715$	
Q3	$41.20 \times 34.7 \times 17.35$ = 24800	$\frac{24800}{34.7} = 715$	Q2=1306
Q1	$24.75 \times 39.1 \times 23.9$ = 23100	$\frac{23100}{39.1} = 591$	
Q2	$24.75 \times 39.1 \times 15.2$ = 14700	$\frac{14700}{39.1} = 376$	Q1=376

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CHORDAL DISTANCES (ALONG RIBS)

DISTANCES ARE MEASURED FROM X AXIS

X →	RIB #11 37°	RIB #10 61.0"	RIB #9 96.0"	RIB #8 131.0"	RIB #7 166.4"
L.E.					
$Y = (1730x + 5.0)$	11.41	15.56	21.62	27.66	33.81
FS	5.73	6.29	7.03	7.76	8.53
$Y = 1520x$	5.62	9.27	14.59	19.90	25.28
FCS	3.30	5.45	8.58	11.70	14.86
$Y = .0626x$	2.32	3.82	6.01	8.20	10.42
RCS	3.74	6.16	9.70	13.23	16.81
$Y = -.0384x$	-1.42	-2.34	-3.69	-5.03	-6.39
RS	4.20	6.93	10.90	14.87	18.83
$Y = -1520x$	-5.62	-9.27	-14.59	-19.90	-25.28
HL	10.78	9.50	7.63	5.77	3.89
$Y = (0985x + 1274)$	-16.40	-18.77	-22.22	-25.67	-29.17
TE	20.14	24.83	31.66	38.51	45.43
$Y = (2941x + 25.69)$	36.54	43.60	53.88	64.18	74.60

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RIB LOADING

1 LOCATION	2 CG	3 PRESSURE lb/sq	4 GG	5 DIST OF CG FROM FOB	6 AVERAGE PRESSURE	7 LOAD lb/in	8 DISTANCE OF CG FROM A	9 MOMENTS lb.in.
<u>RIB #7</u>					2x4	3x31	2x6	
LE.	8.53	1.83 1.84	5025	4.34	1.865	15.90	29.62	471
FE.	14.86	1.84 1.76	5040	7.49	1.800	26.75	17.91	479
FCS.	16.81	1.76 1.67	5045	8.48	1.715	28.80	2.09	60
RCS.	18.80	1.67 1.59	5045	9.52	1.630	30.78	-15.76	-484
RS.	3.83	1.53 1.56	5015	1.95	1.575	6.12	-27.22	-167
HL.	45.43	1.56 1.37	5110	23.21	1.465	66.50	-51.39	-3417
TE					TOTAL =	174.85	TOTAL =	-3058

RIB #8

LE.	7.76	1.96 1.95	5005	3.89	1.955	15.18	23.79	361
FE.	11.70	1.95 1.90	5020	5.87	1.925	23.53	14.07	331
FCS.	13.23	1.90 1.83	5030	6.66	1.865	24.68	1.63	40
RCS.	14.87	1.83 1.76	5030	7.47	1.795	25.66	-12.43	-319
RS.	5.77	1.76 1.73	5010	2.83	1.745	10.08	-22.78	-229
HL.	38.51	1.73 1.54	5095	19.61	1.635	61.35	-44.57	-2738
TE					TOTAL =	160.48	TOTAL =	-2554

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1	2	3	4	5	6	7	8	9
LOCATION	CG	PRESSURE lb/d ²	C.G.	DIST. OF C.G. FROM RH END	AVERAGE PRESSURE	LOAD lb/in	DISTANCE OF C.G. FROM X AXIS	MOMENT lb in/in
RIB # 11				2x4	2x4	2x6		
RS	10.78	0 1.43	.3333	3.59	.7150	7.70	-12.81	-99
HL	20.14	1.43 1.91	.4760	9.59	1.6700	33.60	-26.95	-905
TE						41.30		-1004

SUMMARY (AS ALL THE BENDING MOMENTS HAVE THE SAME
SIGN THEY CAN BE CONSIDERED POSITIVE)

RIB	LOAD lb/in	MOMENT lb.in /in
7	174.85	3058
8	160.48	2554
9	140.82	2166
10	97.53	1764
11	41.30	1004
12	0	0

SHEAR FORCE DIAGRAM

SHEET 1-29

SHEAR DUE TO AIRLOAD

16000
14000
12000
10000
8000
6000
4000
2000

0 20 40 60 80 100 120 140 160 180

STATION ALONG X AXIS

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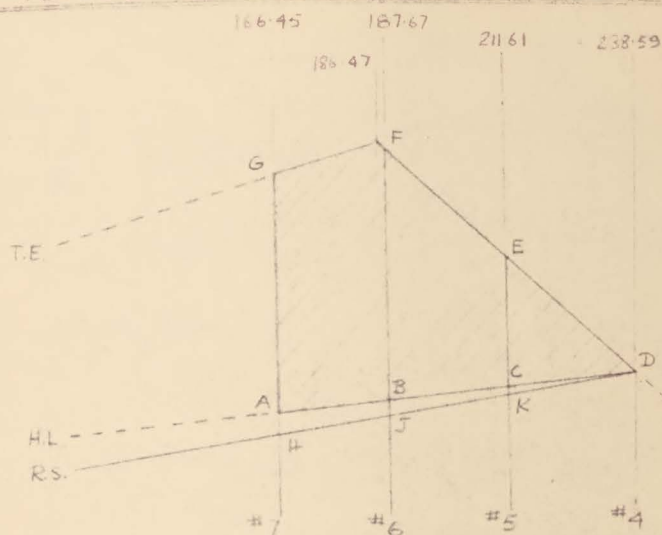
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LIMIT TORQUES & SHEARS DUE TO RUDDER PORTION BTWN #7 & #4



FROM SHEETS 3 & 24 AIRLOAD PRESSURE

AT	POINT	A	=	1.55	LB/IN ²
"	B	=	1.47	"	"
"	C	=	1.38	"	"
"	D	=	1.28	"	"
"	E	=	1.28	"	"
"	F	=	1.28	"	"
"	G	=	1.37	"	"

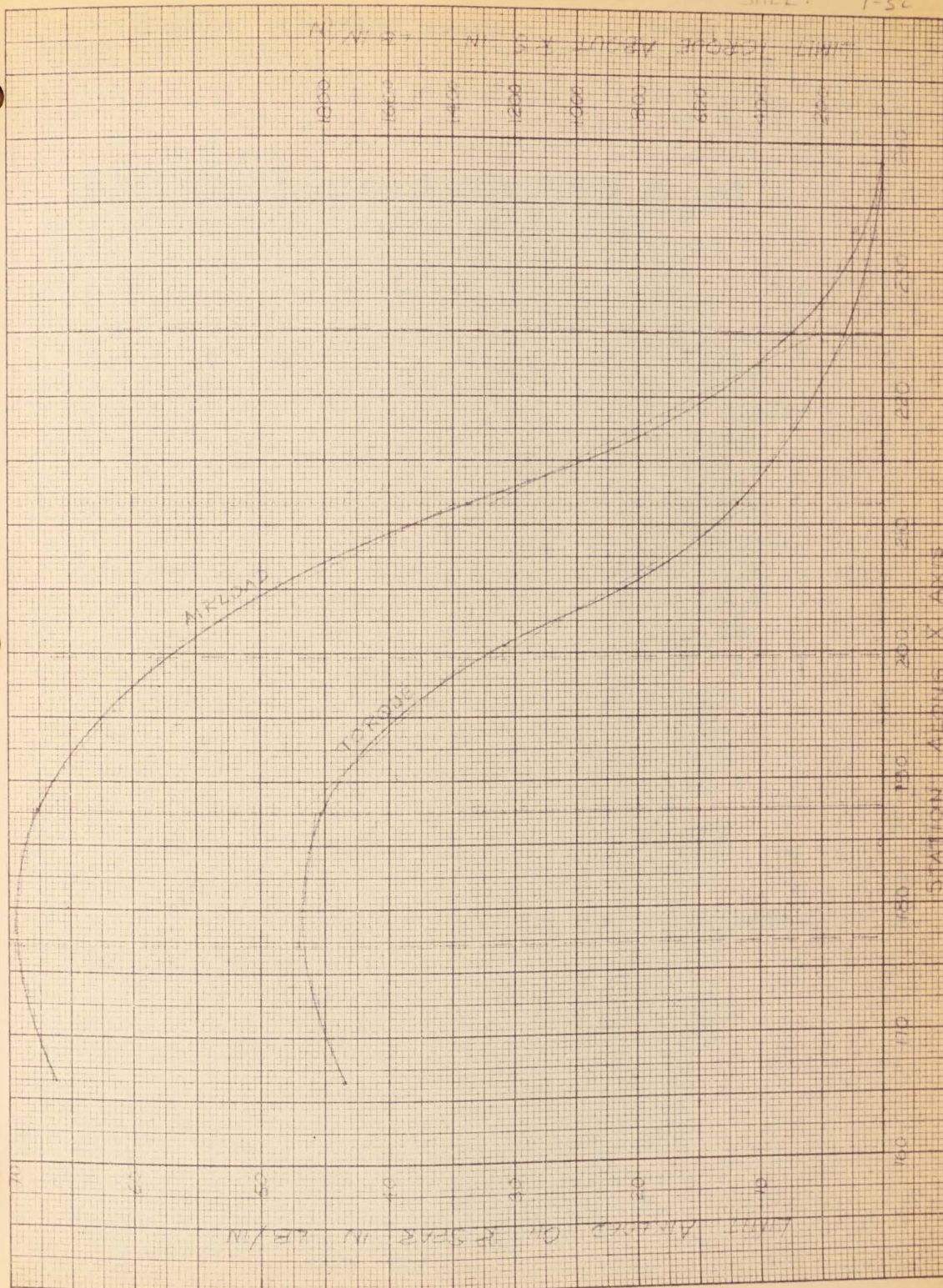
LENGTH GA = 45.43 HA = 3.89 (PAGE 21)

$$BF = (2341 \times 187.67 + 25.65) - (.0985 \times 187.67 + 12.76) = 49.30$$

$$BJ = (.0985 \times 187.67 + 12.76) - (.1520 \times 187.67) = 2.73$$

$$CE = \frac{49.30}{52.12} \times 26.98 = 25.47$$

$$CK = (.0985 \times 211.61 + 12.76) - (.1520 \times 211.61) = 1.45$$



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SHEET NO. 1-33

AIRCRAFT: _____

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DATE

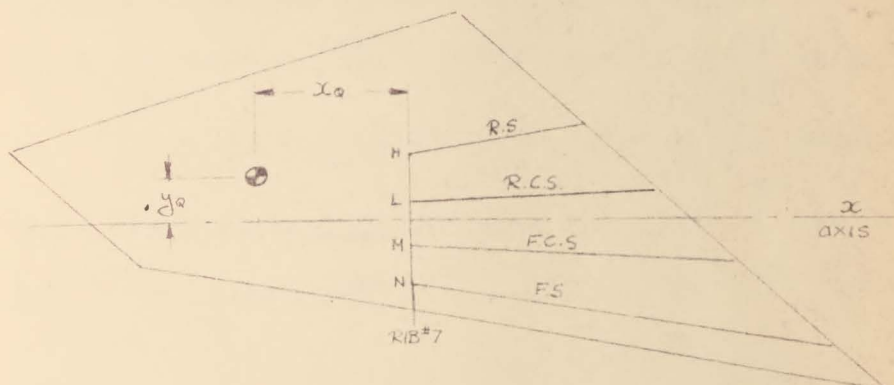
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LOADS AT RIB-SPAR INTERSECTIONS AT RIB #7



TOTAL LIMIT AIRLOAD B.M. ABOUT RIB #7 = 1,025,420 IN. LB. (SHT 23)
 " " " TORQUE " X AXIS = 297,520 IN LB (")
 " " " SHEAR AT RIB #7 = 17,723 LB (")

$$X_Q = \frac{1,025,420}{17,723} = 57.86 \text{ IN}$$

$$Y_Q = \frac{297,520}{17,723} = 16.79 \text{ IN}$$

SECTION PROPERTIES OF SPARS AT RIB #7

FRONT SPAR

$$I = 1.096 \text{ IN}^4$$

(FROM REP #70510/1 SHEET A-34)

FRONT CENTRE SPAR

$$I = 5.080 \text{ IN}^4$$

(" " " " ")

REAR CENTRE SPAR

$$I = 6.250 \text{ IN}^4$$

(" " " " A 35)

REAR SPAR

$$I = 2.058 \text{ IN}^4$$

(" " " " ")

$$\Sigma I = 14.484 \text{ IN}^4$$

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REPORT NO. _____

SHEET NO. _____

1-34

AIRCRAFT: _____

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DISTRIBUTION OF AIRLOAD BM. AT RIB #7

$$M_H = 1,025,420 \times \frac{2.058}{14.484} \times 1.01148 (\sec 2^\circ 38'1'') = 147,600 \text{ IN LB}$$

$$M_L = 1,025,420 \times \frac{6.352}{14.484} \times 1.00074 (\sec 2^\circ 12'1'') = 443,000 \text{ IN LB}$$

$$M_M = 1,025,420 \times \frac{5.082}{14.484} \times 1.00126 (\sec 3^\circ 35'1'') = 353,000 \text{ IN LB}$$

$$M_N = 1,025,420 \times \frac{1.936}{14.484} \times 1.01148 (\sec 2^\circ 32'1'') = 77,700 \text{ IN LB}$$

$$Q_H = \frac{147,600}{57.86} \times .00865 = 2,520 \text{ LB}$$

$$Q_L = \frac{443,000}{57.86} \times .00926 = 7,650 \text{ LB}$$

$$Q_M = \frac{353,000}{57.86} \times .00805 = 6,210 \text{ LB}$$

$$Q_N = \frac{77,700}{57.86} \times .00865 = 1,320 \text{ LB}$$

$$\begin{aligned} \text{TOTAL TQ AT RIB \#7} &= 297,520 + (147,600 \times .15026) + \\ &\quad (443,000 \times .03830) - (353,000 \times .06250) - (77,700 \times .15026) \\ &\quad + (2,520 \times 25.28) + (7,650 \times 6.30) - (6,210 \times 10.42) \\ &\quad - (1,320 \times 25.28) \\ &= 316,840 \text{ lb. in.} \end{aligned}$$

THIS TORQUE WILL BE PUT INTO THE STRUCTURE
AS A COUPLE AT POINTS H & N

$$\text{COUPLE LOADS} = \frac{316,840}{2 \times 25.28} = 6,260 \text{ lb}$$

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SHEET NO. 1-35

AIRCRAFT: _____

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LOADS AT RIB-SPAR INTERSECTIONS AT REAR SPAR

POINT H ON RIB #7

FROM SHEET #33

$$\text{LIMIT AIRLOAD} = \frac{1}{2} (18767 - 16645) \times \frac{1}{2} (696 + 665)$$

$$= \frac{1}{4} \times 2122 \times 1361 = \underline{722 \text{ lb}}$$

$$\text{LIMIT TORQUE} = \frac{1}{4} \times 2122 (1745 + 1895)$$

$$= \frac{1}{4} \times 2122 \times 3640 = \underline{19,520 \text{ IN LB}}$$

POINT J ON RIB #6

$$\text{LIMIT AIRLOAD} = \frac{1}{4} \times 2122 (697 + 66) + \frac{1}{4} (21161 - 18767) (585 + 576)$$

$$= \frac{1}{4} \times 2122 \times 1377 + \frac{1}{4} \times 2394 \times 1263$$

$$= 731 + 753$$

$$= \underline{1484 \text{ lb}}$$

$$\text{LIMIT TORQUE} = \frac{1}{4} \times 2122 (1885 + 1830) + \frac{1}{4} \times 2394 \times (1870 + 1350)$$

$$= \frac{1}{4} \times 2122 \times 3715 + \frac{1}{4} \times 2394 \times 3220$$

$$= 19,710 + 19,270$$

$$= \underline{38,980 \text{ IN LB}}$$

POINT K ON RIB #5

$$\text{LIMIT AIRLOAD} = \frac{1}{4} \times 2394 (587 + 349) + \frac{1}{4} (23853 - 21161) (319 + 572)$$

$$= \frac{1}{4} \times 2394 \times 936 + \frac{1}{4} \times 2698 \times 371$$

$$= 560 + 241 = \underline{801 \text{ lb}}$$

$$\text{LIMIT TORQUE} = \frac{1}{4} \times 2394 (1260 + 420) + \frac{1}{4} \times 2698 (450 + 100)$$

$$= \frac{1}{4} \times 2394 \times 1680 + \frac{1}{4} \times 2698 \times 550$$

$$= 10,050 + 3,710 = \underline{13,760 \text{ IN LB}}$$

POINT D ON RIB #4

$$\text{LIMIT AIRLOAD} = \frac{1}{4} \times 2698 \times 57$$

$$= \underline{38.4 \text{ lb}}$$

$$\text{LIMIT TORQUE} = \frac{1}{4} \times 2698 \times 22$$

$$= \underline{593 \text{ IN LB}}$$

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SUMMARY OF LIMIT LOADS

LOAD NO

LOAD

1	147,600 LB. IN.	} SHEET 35
2	443,000 LB. IN.	
3	359,900 LB. IN.	
4	77,700 LB. IN.	} SHEET 36
5	19,320 IN. LB.	
6	257 + 2520 + 722 + 6260 = 9,759 LB	
7	303 + 7650 = 7,953 LB	
8	248 + 6210 = 6,458 LB	
9	376 + 1329 - 6260 = -4,555 LB.	
10.	38,980 IN. LB.	
11.	499 + 1484 = 1,983 LB	
12.	687 LB	
13.	553 LB	
14.	830 LB	
15.	13,760 IN. LB.	
16	502 + 801 = 1303 LB	
17	840 LB	
18	659 LB	
19	990 LB	
20	887 LB	
21	796 LB.	
22	1171 LB	
23	868 LB	
24	1346 LB	
25	1306 LB	
26	376 LB	
27	325 LB	
28	361 LB	
29	593 IN. LB.	
30	251 + 38 = 289 LB	

TOTAL 35,185 LB

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CONSIDER PORTION OF RUDDER BETWEEN RIB #7 & #4

TOTAL TORQUE AT REAR SPAR = $19,320 + 38,980 + 13,760$
 $+ 523$

= 72,653 LB IN

MOMENT CREATED BY THIS TORQUE ABOUT FIN

DATUM LINE = $-72,653 \cos 40^\circ 28\frac{1}{2}'$

= -55,260 LB IN

MOMENT CREATED ABOUT YY LINE

= $72,653 \sin 40^\circ 28\frac{1}{2}'$

= 47,150 LB IN

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SHEET NO. 1-40

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PORTION BETWEEN RIB #7 & TIP OF FIN

THE LOADS DUE TO SHEAR & TORQUE ARE TAKEN INTO ACCOUNT LATER

AT POINT H; BM = 147,600 IN. LB.

MOMENT OF THIS LOAD AT FIN DATUM LINE = $147,600 \times \sin 42^\circ 07'$
= 111,590 IN. LB.

MOMENT OF THIS LOAD AT YY LINE = $147,600 \times \cos 42^\circ 07'$
= 96,607 IN. LB.

AT POINT L; BM = 443,000 IN. LB.

MOMENT OF THIS LOAD AT FIN DATUM LINE = $443,000 \times \sin 42^\circ 40'$
= 300,280 IN. LB.

" " " " YY LINE = $443,000 \times \cos 42^\circ 40'$
= 325,710 IN. LB.

AT POINT M; BM = 359,900 IN. LB.

MOMENT OF THIS LOAD AT FIN DATUM LINE = $359,900 \times \sin 36^\circ 53'$
= 216,050 IN. LB.

" " " " YY LINE = $359,900 \times \cos 36^\circ 53'$
= 287,850 IN. LB.

AT POINT N; B.M. = 77,700 IN. LB.

MOMENT OF THIS LOAD AT FIN DATUM LINE = $77,700 \times \sin 31^\circ 50'$
= 40,980 IN. LB.

" " " " YY LINE = $77,700 \times \cos 31^\circ 50'$
= 66,063 IN. LB.

TOTAL MOMENT ABOUT FIN DATUM LINE = 668,900 IN. LB.

" " " " YY LINE = 776,230 IN. LB.

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1-91

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MOMENT OF SPAR REACTIONS ABOUT YY LINE

REAR SPAR

$$\begin{aligned} (257 + 122 + 2520 + 5260) \times 2073 &= 2,022,000 \\ (492 + 1484) \times 1932 &= 383,000 \\ (502 + 501) \times 1772 &= 231,000 \\ (251 + 38) \times 1598 &= 46,100 \\ \hline &2,682,100 \end{aligned}$$

2,682,100

REAR CENTRE SPAR

$$\begin{aligned} (1650 + 305) \times 1942 &= 1,550,000 \\ 687 \times 1793 &= 123,200 \\ 840 \times 1613 &= 135,500 \\ 887 \times 1418 &= 125,800 \\ 261 \times 1195 &= 43,100 \\ \hline &1,977,600 \end{aligned}$$

1,977,600

FRONT CENTRE SPAR

$$\begin{aligned} (6210 + 248) \times 1840 &= 1,189,000 \\ 553 \times 1670 &= 92,300 \\ 659 \times 1473 &= 97,000 \\ 796 \times 1261 &= 100,500 \\ 868 \times 1019 &= 88,400 \\ 325 \times 746 &= 24,250 \\ \hline &1,591,450 \end{aligned}$$

1,591,450

FRONT SPAR

$$\begin{aligned} (1320 - 5260 + 376) \times 1744 &= -795,000 \\ 830 \times 1560 &= 129,500 \\ 990 \times 1350 &= 133,700 \\ 1171 \times 1120 &= 131,200 \\ 1346 \times 860 &= 115,800 \\ 1306 \times 567 &= 74,000 \\ 376 \times 225 &= 8,330 \\ \hline &-201,970 \end{aligned}$$

-201,970

TOTAL

6,049,280 lb.ins.

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AIRCRAFT:

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DATE

J. L. DIXON

19 NOV '54

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DATE

SINCE THE TOTAL LOAD WAS APPROX 35% TOO LOW IT
WAS DECIDED TO INCREASE THE LOADS BY THIS AMOUNT TO
ENSURE WORST CONDITIONS

LOAD NO.

LOAD

1	153,000 LB IN.
2	450,000 LB IN.
3	373,000 LB IN.
4	80,500 LB IN.
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	2,058 LB
12	712 LB
13	573 LB
14	861 LB
15	14,270 IN LB.
16	1351 LB
17	871 LB
18	683 LB
19	1026 LB
20	920 LB
21	825 LB
22	1216 LB
23	899 LB
24	1395 LB
25	1353 LB
26	390 LB
27	335 LB
28	374 LB
29	615 IN LB
30	300 LB

TOTAL 36,476 LB

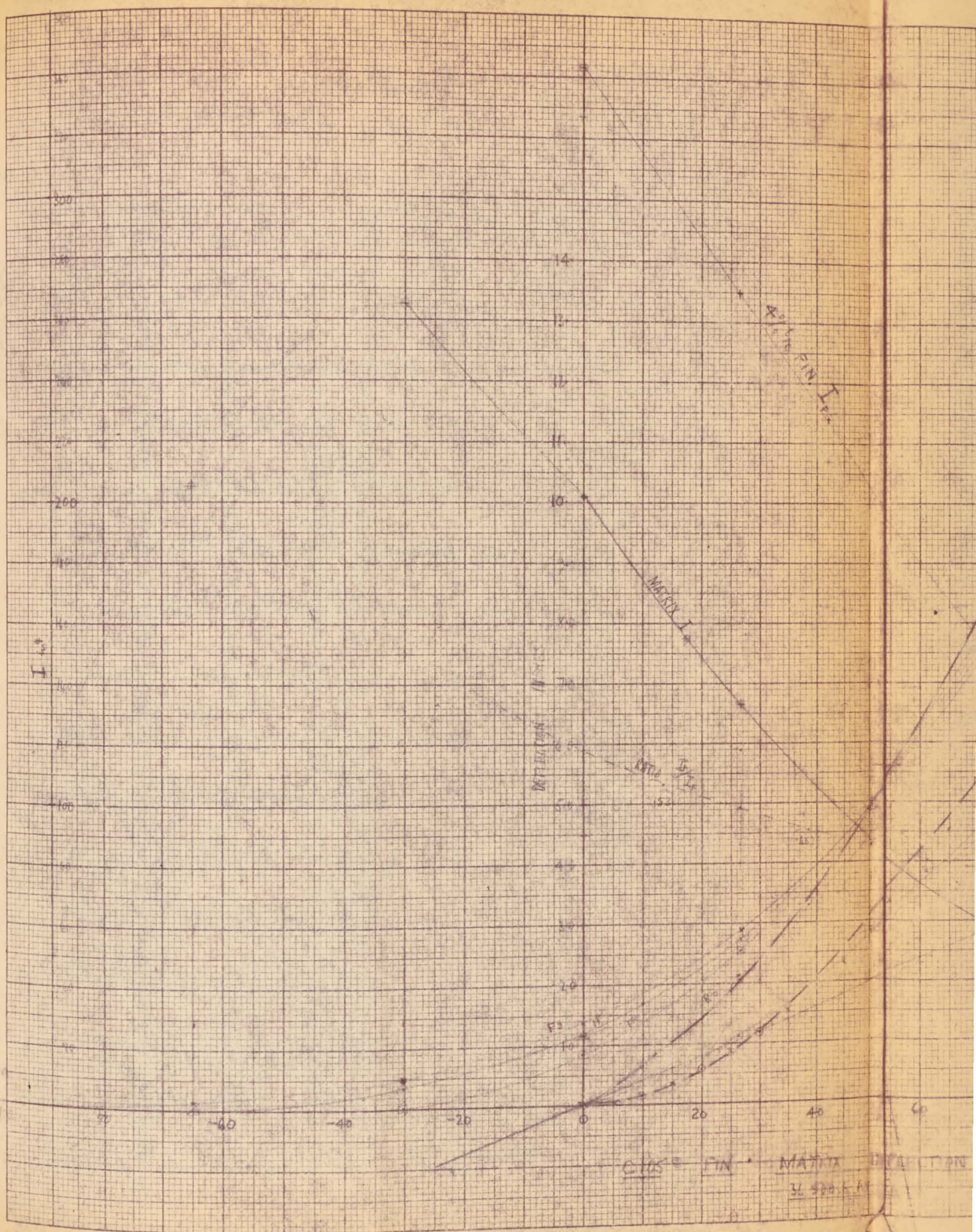
COS Fin Sec. As. Plan (H) - 30000 A-5C

※ STAR INDICATES
-VE SIGN

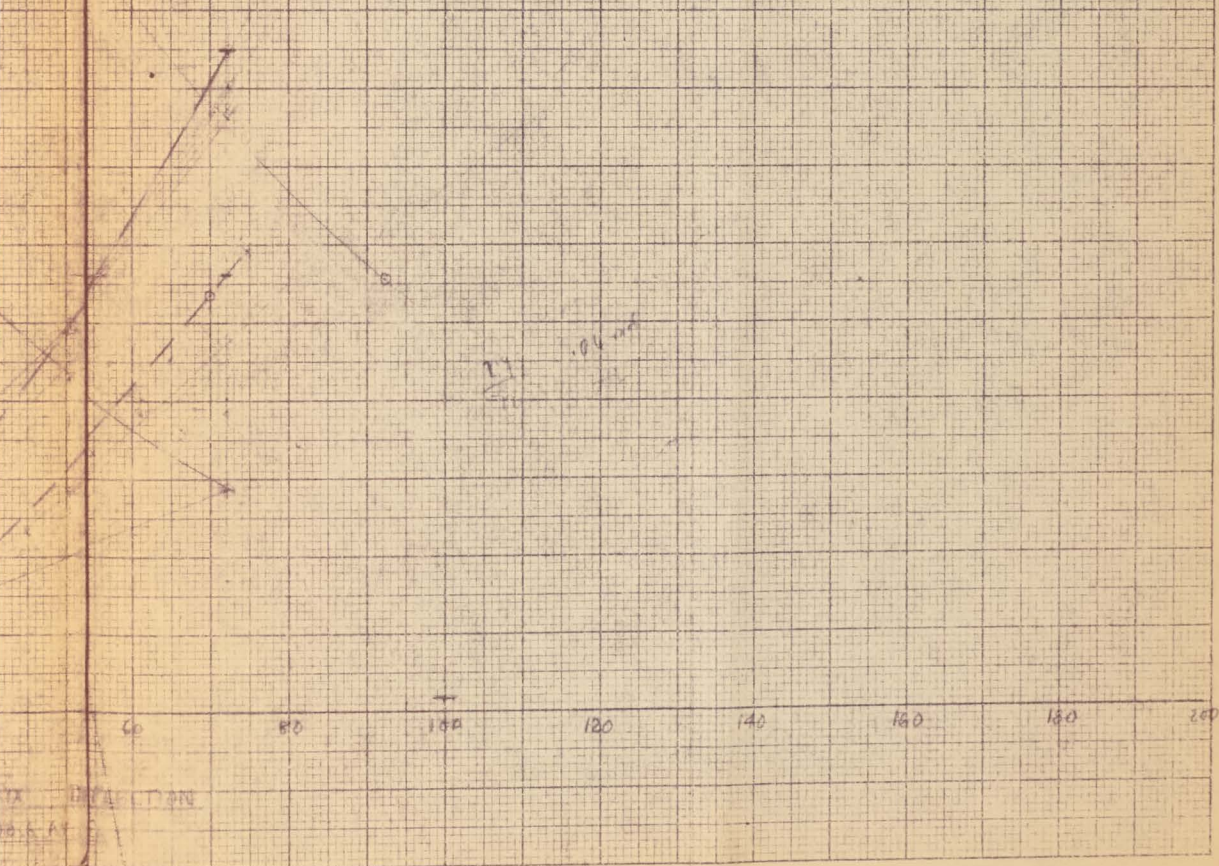
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201	31401
301	349767
401	20746
501	351523
601	13913*
701	246708
801	49715*
901	49465*
1001	41678*
1101	278983
1201	25402
1301	373895
1401	5075
1501	370848
1601	8968*
1701	238687
1801	50263*
1901	31667*
2001	19351*
2101	293784
2201	6687
2301	415187
2401	42259*
2501	352991
2601	15731*
2701	226798
2801	19755
2901	10968
3001	7853
3101	683487
3201	73471*
3301	316252
3401	6583
3501	305573
3601	25771*
3701	176861
3801	84243
3901	49065
4001	31442
4101	290396
4201	51151*
4301	146206
4401	17786
4501	127464
4601	47976
4701	23983
4801	129287
4901	13710*
5001	40688
5101	22021
5201	40443
5301	370437*
5401	239324*
5501	102860*
5601	4725*

101	004537
201	004045
301	003771
401	003548
501	00441 *
601	2011991
701	200074
801	193828
901	191304
1001	00646 *
1101	125049
1201	124444
1301	123988
1401	125084
1501	006877 *
1601	50232
1701	62928
1801	68112
1901	71992
2001	21144
2101	29636
2201	34567
2301	08697
2401	12530
2501	02977

1 6 7 2 5 1 4



2-2 A



A. V. ROE CANADA LIMITED

MALTON, ONTARIO

TECHNICAL DEPT. (AIRFRAME)

AIRCRAFT . . . C105

WEIGHT . . . _____

C. G. POSITION . . . _____

REPORT NO. . . _____

SHEET . . . 2-3

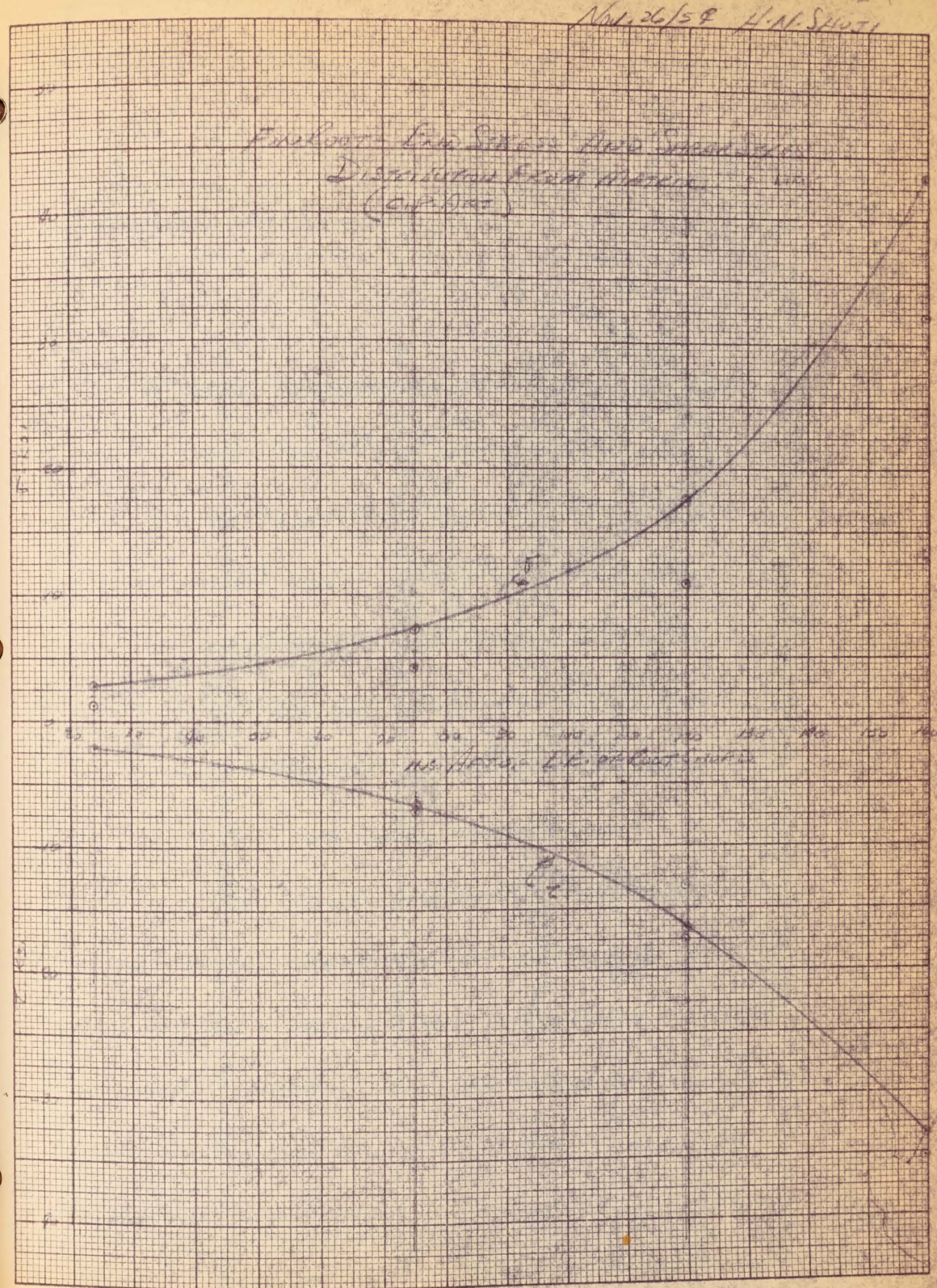
DATE . . . Nov. 26/59

PREPARED BY . . . H. N. J. HOSI

8	9	10	11	12	13	14	15	16	17	18	19
$\bar{S}_n$ (5) + (2)		(1) + (5)		(2) + (11)	$\bar{Z}_T$ (10) + (20)		$\Delta \bar{S}_n$ (3) x (12)	$\bar{S}_n$ Ave.		$\Delta \bar{Z}_T$ (3) x (12)	$\bar{Z}_T$ Ave.
32250	- .442	-31600	.494	-3630	-36230			11,050			2120
						1.212	11,020		.252	2120	
10,850	- .555	-12000		-2530	-17,530	1.815	7200	6650	.126	1060	220
						1.169	5520		.140	720	
4060	- .489	-6960		-680	-7140	.812	3300	3020	.062	300	240
						1.032	2250		.075	170	
1290	- .514	-2030	.494	0	-2030	.720	1580	1580	.105	10	10

Nov. 26/58 H.N. SHULTZ 2-4

Endroot Line Slopes And Spread Rates
 Distributed From Station
 (CH. 0.00)



FIN ROOT - END LOAD AND SHEAR DISTRIBUTION FRAMMATIC (C.P.A.T.)

COORDINATE Sta.	1	2	3	4	5	6	7	8	9
	LIMIT	SKIN							
	5. 10 ³ psi	GAGE I	p 10 ³ psi	h	ph 10 ³ psi	Ult. p 10 ³ psi	τ 10 ³ psi	g 10 ³ psi	Ult. g 10 ³ psi
22.8	3.8	.125	350	3.49	1203	478	2.2	275	275
40.0	3.8	.121	460	4.10	1856	625	3.0	363	425
		.115	527		2470	775		485	665
52.6	4.5	.123	600	4.36	2610	819	4.1	513	700
65.0	6.1	.122	745	4.53	3250	1017	5.4	660	900
		.119	917		4170	1251		845	1150
77.4	7.7	.135	1048	4.55	6600	1919	7.1	1236	1975
90.0	9.9	.135	1031	4.51	8260	2500	9.2	1700	2300
		.132	2250		10,000	3120		2110	2500
102.6	12.5	.135	2350	4.39	10,310	3210	11.6	2180	2950
115.0	15.9	.135	2940	4.16	12,220	4010	15.0	2730	3800
		.132	2770		14,590	5150		3460	4700
127.0	20.7	.138	3390	3.95	15,370	5310	19.0	2580	4900
135.0	25.0	.135	4630	3.76	17,400	6320	22.1	4090	5500
		.133	5250		19,400	7170		4690	6130
140.7	28.7	.138	5400	3.70	19,970	7330	24.5	4610	6300
150.0	35.3	.136	65100	3.47	22,800	8990	28.6	5320	7270
159.6	43.3	.133	7930	3.16	25,000	10,510	33.3	6100	8340

A. V. ROE CANADA LIMITED

MALTON, ONTARIO
TECHNICAL DEPT. (AIRFRAME)

AIRCRAFT

C105

WEIGHT

C. G. POSITION

REPORT NO.

SHEET

DATE

PREPARED BY

2-6

1/10/24/54

H.W. Smith

9	10	11	12	13	14	15	16	17	18	19
Uet 8 2644		FLOOR	Left (3x11)	Power (1x12)	7	1-7	Δ 07 (12x12)	Limit Dcorr. (1x.832)		
375		1241	.156	437	.125	3.202	14.1	2.34		
425		1241	.150	570	.125	3.972	2260	3.17		
667		1241	.147	706	.125	4.232	2950			
700		1257	.161	773	.133	4.222	3260	4.00		
901		1257	.157	940	.133	4.392	4220	5.10		
1151		1257	.153	1180	.130	4.412	5210			
1272		1190	.224	1725	.152	4.392	7890	6.42		
2300		1190	.220	2180	.152	4.350	9510	8.36		
2560		1190	.217	2710	.152	4.238	11480			
2950		1190	.225	2810	.158	4.236	11870	10.42		
3500		1190	.221	3520	.152	4.006	14100	13.27		
4700		1190	.218	4510	.154	3.796	17140			
4900		1260	.237	4910	.167	3.782	18600	17.5		
5300		1260	.233	5840	.167	3.592	21000	20.2		
6130		1260	.231	6630	.167	3.532	23400			
6300		1131	.212	6110	.151	3.542	21700	24.0		
7270		1131	.211	7850	.167	3.219	24700	29.5		
8340		1131	.207	8970	.151	3.009	26900	36.1		

[illegible]

$$= 3000,000 \text{ with } \text{Cost} \quad \text{Return} = \frac{252}{300} = 84\%$$

Total Profit

$$= 2.490000 \times 10^8 \text{ (元)}$$

Answer: $2\sqrt{2}$ and 2

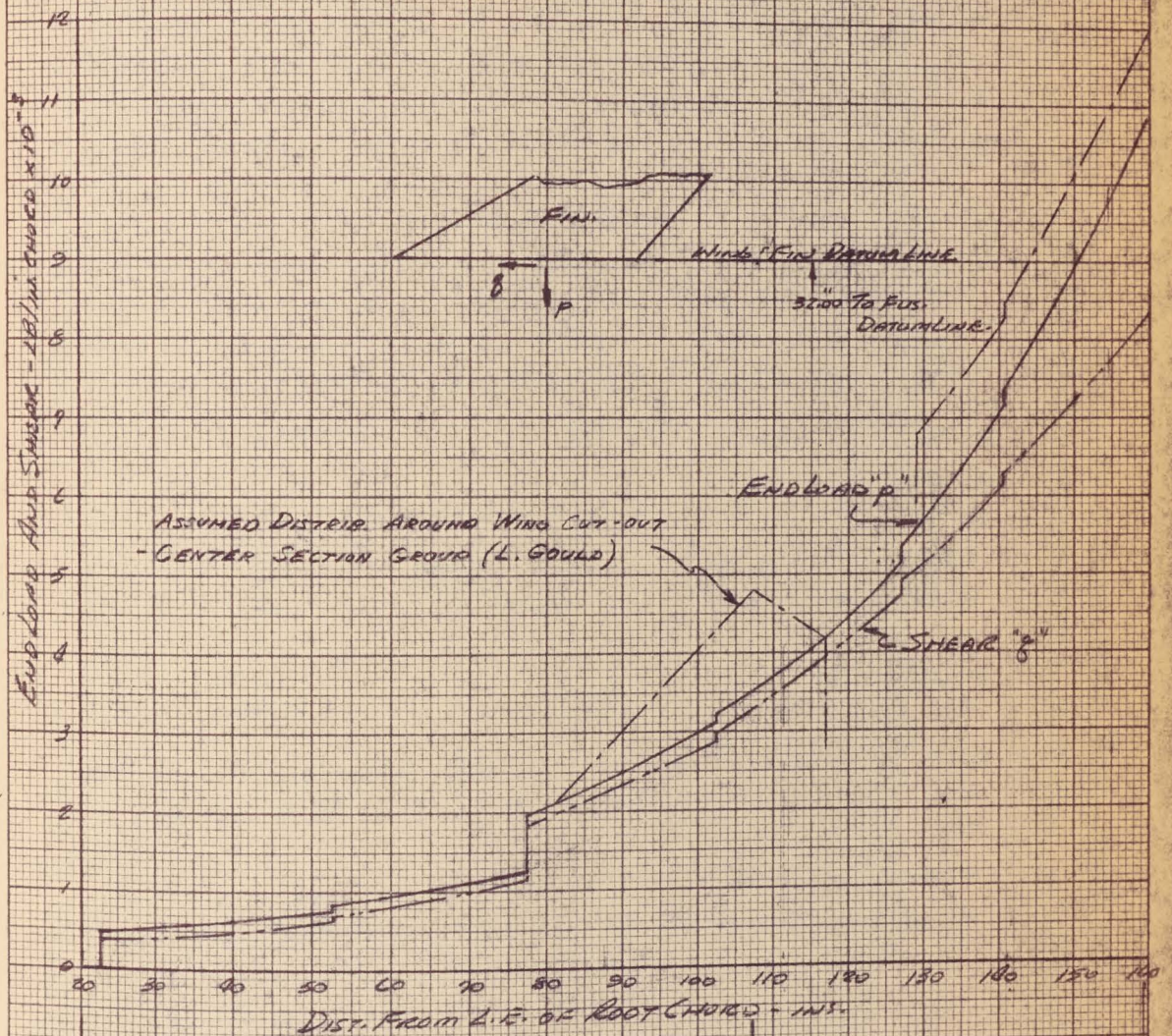
$$\frac{1}{2} \cdot \frac{1}{2} = \frac{1}{4}$$

John Brown

1000 ft. 1000 ft. 1000 ft. 1000 ft.

Nov. 29/59. H.N. SHUTI

SIDE FIN ROOT - CHORDWISE DISTRIBUTION OF
END LOADS AND SHEARS - ULTIMATE
LOADS FOR C.P. AFT CASE.

FUS STA.
22210FUS STA.
22610
(WING R/S)FUS STA.
23010
(ENGINE L/W)

TECHNICAL DEPARTMENT (Aircraft)

REPORT NO.

SHEET NO. 2-10

AIRCRAFT: C106

FIN

PREPARED BY

DATE

H. N. SHOJI

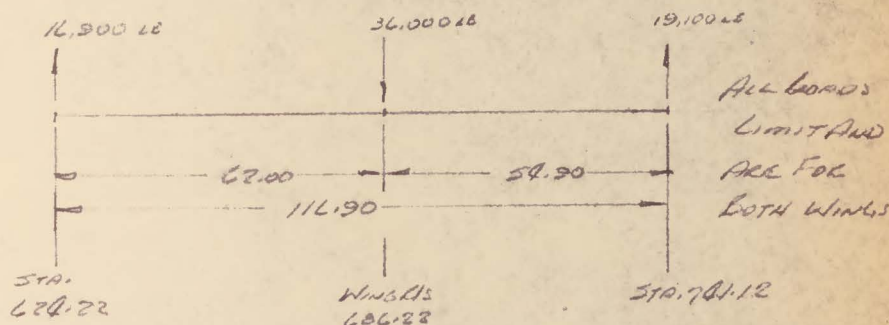
Dec. 2/58

CHECKED BY

DATE

EFFECT OF WING CHORDWISE BENDING.

WHEN THE WING IS UNDER SYMMETRIC BENDING, MOMENT, STRESSES ARE INDUCED IN THE SKIN IN THE CHORDWISE DIRECTION, MAINLY DUE TO POISSON'S RATIO. THESE STRESSES WHICH PRODUCE "BENDING" OF THE WING ROOT CHORD. IT HAS BEEN CALCULATED BY A. G. GREDERLSKI THAT IN ORDER TO KEEP THE WING CHORD STRAIGHT BETWEEN THE FIN LEADING EDGE AND FIN REAR SPAR, WHEN THE A/C HAS MAX. "G" LOADING, THE FOLLOWING SELF-EQUILIBRATED FORCES ARE REQUIRED.



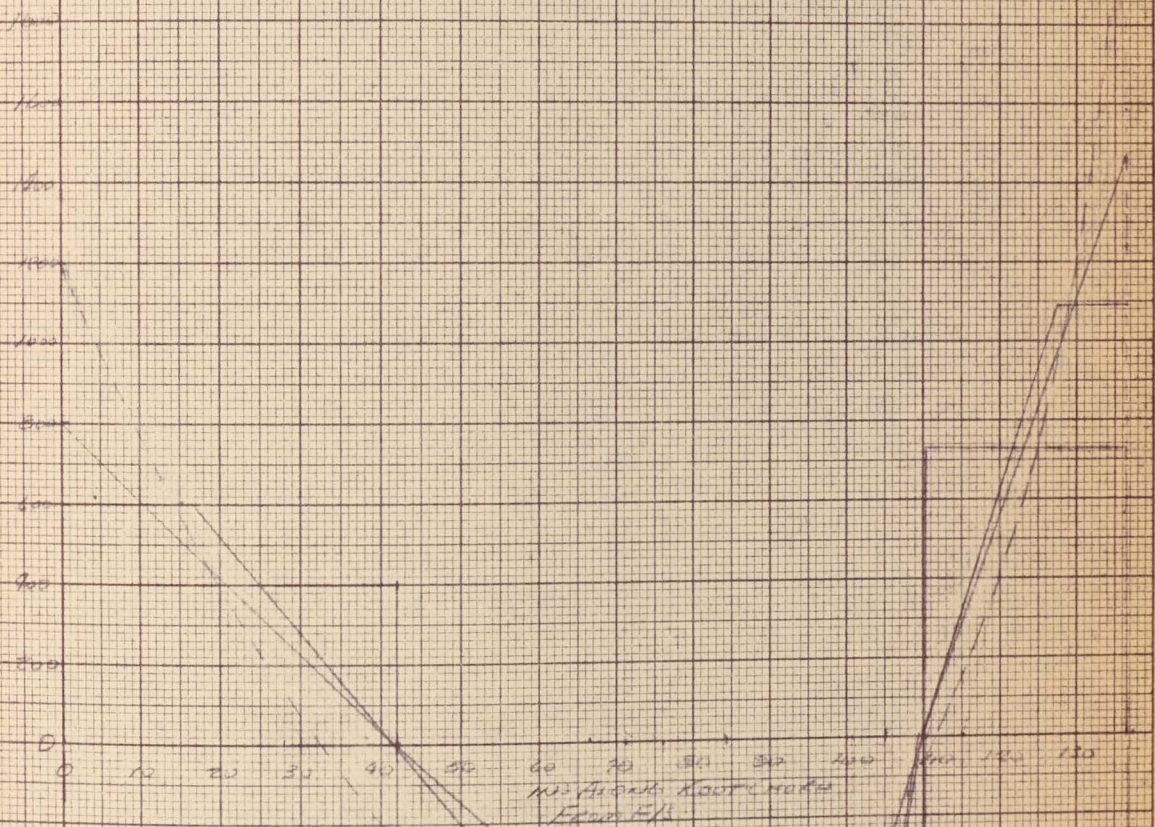
AT THE A/C DAWIN, THE FIN FRONT SPAR IS LOCATED AT STA. 606.0 AND THE REAR HINGE SPAR AT STA. 735.6

ON THE FOLLOWING SHEET, THE CONCENTRATED LOADS ARE DISTRIBUTED IN THE FOLLOWING MANNER:

- ① UNIFORM DISTRIBUTION
- ② TRIANGULAR DISTRIBUTION
- ③ TRAPEZOIDAL DISTRIBUTION
- ④ ASSUMED PARABOLIC DISTRIBUTION

F. MITCHELL FEELS THAT NO. 3 - TRAPEZOIDAL DISTRIBUTION SHOULD BE USED. THE THREE LOADS ARE SELF-EQUILIBRATED; THEREFORE, IN ORDER TO ESTABLISH STATIC EQUILIBRIUM, THE TRAPEZOIDAL LOADING FOR THE TWO END LOADS WILL BE TAKEN AS ASSUMED AND THE TRAPEZOID FOR THE CENTER LOAD WILL BE ADJUSTED.

SECTION LINE ON TOP OF
DUE TO CORRUPTION & FRAUD
OF F. J. M. M.
P. 15 CORRUPTION



Final
6015
(F. J. M. M.)

Final
12015
(F. J. M. M.)

TECHNICAL DEPARTMENT (Aircraft)

AIRCRAFT: C105

FIN

REPORT NO.

SHEET NO. 2-12

PREPARED BY

DATE

H. N. SAWZI

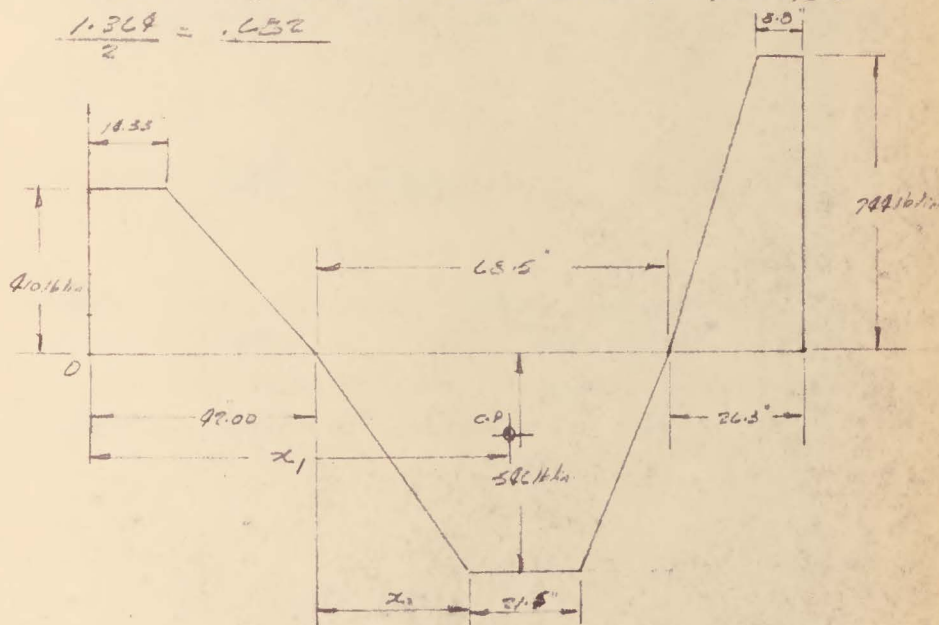
Dec. 5/58

CHECKED BY

DATE

EFFLECTOR PLING CIRCUMFERENCE

NOTE: THE LOADINGS ON THE PRECEDING SHEET ARE LIMIT
LOADS AND FOR BOTH SIDES OF THE WING. IN ORDER
TO OBTAIN ULTIMATE LOADS FOR ONE SIDE, THE
LOADS HAVE TO BE MULTIPLIED BY A FACTOR OF
 $\frac{1.368}{2} = .684$



$$\Sigma V = 0$$

$$\Sigma V = 410 \times \frac{92.00 + 10.35}{2} - 546 \times \frac{68.5 + 21.5}{2} + 784 \times \frac{26.3 + 3.5}{2}$$

$$= 410 \times 28.165 - 546 \times 95.00 + 784 \times 17.55$$

$$= 11,530 - 20,600 + 13,070 = 0 \quad \text{CHECK}$$

$$\Sigma M = 0$$

$$\Sigma M = 410 \times \frac{19.33^2}{2} + 410 \times \frac{27.67}{2} (19.33 + \frac{27.67}{3}) + 784 \times \frac{17.5}{2} \times (92.00 + 65.25 + \frac{12.5 \times 2}{3})$$

$$+ 784 \times 8.8 (136.8 - 4.4) - 24,600 x_1 = 0$$

$$= 42,100 + 133,900 + 795,000 + 868,000 - 24,600 x_1 = 0$$

$$1,838,500 - 24,600 x_1 = 0$$

$$x_1 = \frac{1,838,500}{24,600} = 74.71 \text{ in.}$$

TECHNICAL DEPARTMENT (Aircraft)

REPORT NO. _____

SHEET NO. 2-13

AIRCRAFT: C105

FIN

PREPARED BY

DATE

H. N. S. 031

Dec. 9/58

CHECKED BY

DATE

EFFECTOR WING CHORDWISE BANDING

$$40.0(79.7 - 42.00) = \frac{x_2^2}{2} \times \frac{2x_2}{3} + 21.5(x_2 + 10.75) + \frac{(47.0 - x_2)(x_2 + 21.5 + \frac{47.0 - x_2}{3})}{2}$$

$$100 \times 32.7 = \frac{x_2^3}{3} + 21.5x_2 + 231.2 + (23.5 - \frac{x_2}{3})(\frac{2x_2}{3} + 37.17)$$

$$= \frac{x_2^3}{3} + 21.5x_2 + 231.2 + 15.7x_2 - \frac{x_2^2}{3} + 873 - 18.59x_2$$

$$1303 = 13.6x_2 + 1104$$

$$x_2 = \frac{204}{13.6} = 10.95 \text{ IN. SAY } 11.0 \text{ IN.}$$

IN ORDER TO COMBINE THESE LOADS WITH THE MAXIMUM FIN LOADS; IT WILL BE ASSUMED THAT $\frac{2}{3}$ OF MAX "G" WILL BE DEVELOPED CONSEQUENTLY THE LOADS WILL BE REDUCED TO $\frac{2}{3}$.

TECHNICAL DEPT. (AIRFRAME)

C. G. POSITION

PREPARED BY .

2-16

Apr 26/34

Alfred James

[illegible]

TECHNICAL DEPARTMENT (Aircraft)

AIRCRAFT: C105

FIN

REPORT NO. _____

SHEET NO. 2-22

PREPARED BY

DATE

H. N. SHOJI

Nov. 29/58

CHECKED BY

DATE

FIN ROOT STRESS DISTRIBUTION
FROM MATRIX (C.P. PART)

SIDE SHEAR AT POINT "E"

$$\text{SPAR SHEAR} = 4629 \times 2 \times 2.75 = 25,460 \text{ LB}$$

$$\text{RIB SHEAR} = -353 \times 2 \times 2.75 = -2,105 \text{ LB}$$

$$\text{NET SHEAR} = \underline{23,345 \text{ LB}}$$

SIDE SHEAR AT POINT "F"

$$\text{SPAR SHEAR} = 1631 \times 2 \times 4.04 = 13,200 \text{ LB}$$

$$\text{RIB SHEAR} = -1525 \times 2 \times 4.04 = -12,480 \text{ LB}$$

$$\text{NET SHEAR} = \underline{-1,680 \text{ LB}}$$

SIDE SHEAR AT POINT "G"

$$\text{SPAR SHEAR} = 803 \times 2 \times 4.55 = 7,300 \text{ LB}$$

$$\text{RIB SHEAR} = -432 \times 2 \times 4.55 = -3,940 \text{ LB}$$

$$\underline{3,360 \text{ LB}}$$

SIDE SHEAR AT POINT "H"

$$\text{SPAR SHEAR} = 598 \times 2 \times 3.49 = 4,170 \text{ LB}$$

TECHNICAL DEPARTMENT (Aircraft)

REPORT NO.

SHEET NO. 2-25

AIRCRAFT: C105

FIN

PREPARED BY

DATE

H. N. SMITH

Nov. 29/60

CHECKED BY

DATE

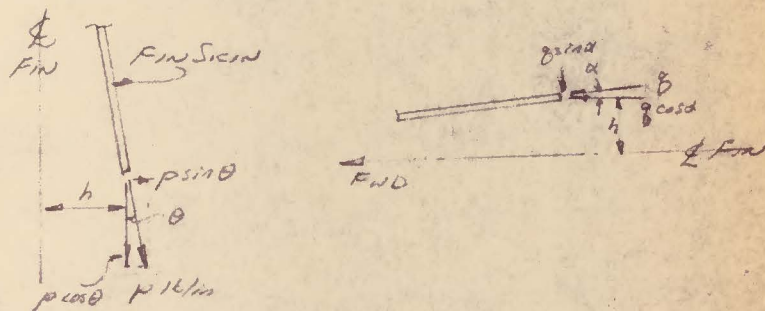
FIN ROOT STRESS DISTRIBUTION
FROM MATRIX (C.P. AIR)

IT IS REQUIRED TO SHOW THAT ALL THE FOREGOING ASSUMED STRESS DISTRIBUTIONS GIVE STRESSES AT THE ROOT SECTION IN EQUILIBRIUM WITH THE APPLIED LOADS AT THE ROOT.

THE APPLIED LOADS FROM AERODYNAMIC LOADS TAKEN ABOUT AXES PASSING THRU THE INTERSECTION OF THE L.I.E. OF FIN AND THE FIN DATUM AXIS AS FOLLOWS:

$$\left. \begin{aligned} \text{SHEAR} &= 36,500 \times 1.364 = 49,900 \text{ LB.} \\ \text{B.M.} &= 2,520,000 \times 1.364 = 3,440,000 \text{ IN. LB.} \\ \text{TORQUE} &= 2,120,000 \times 1.364 = 2,930,000 \text{ IN. LB.} \end{aligned} \right\} \text{ULTIMATE}$$

DUE TO THE TAPER IN THE FIN SECTIONS, THE SIDE SHEAR IS TAKEN PARTIALLY BY THE SCOP OF THE FIN SKIN. THE SCOP OF THE SKIN VARIES AT EACH CHORDWISE STATION.



AT CHORDWISE STATION "x"

LOADS DUE TO SKIN END LOAD "p" & SHEAR "g"

$$\text{SIDE LOAD} = 2p \sin \theta - 2g \sin \alpha$$

$$\text{B.M.} = 2h_2 p \cos \theta$$

$$\text{TORQUE} = (2p \sin \theta - 2g \sin \alpha)x + 2g h \cos \alpha$$

LOCAL VALUES OF "θ" WOULD BE OBTAINED BY $\theta = \tan^{-1} \frac{h_1 - h_2}{20.6}$

WHERE h_1 = SECTION HALF DEPTH AT ROOT CHORD

h_2 = " " " " AT SPANNISE STA. 20.6

TECHNICAL DEPT. (AIRFRAME)

C.F. 105

2-27

29-11-59

J. L. Dixon

[illegible]

C. G. POS

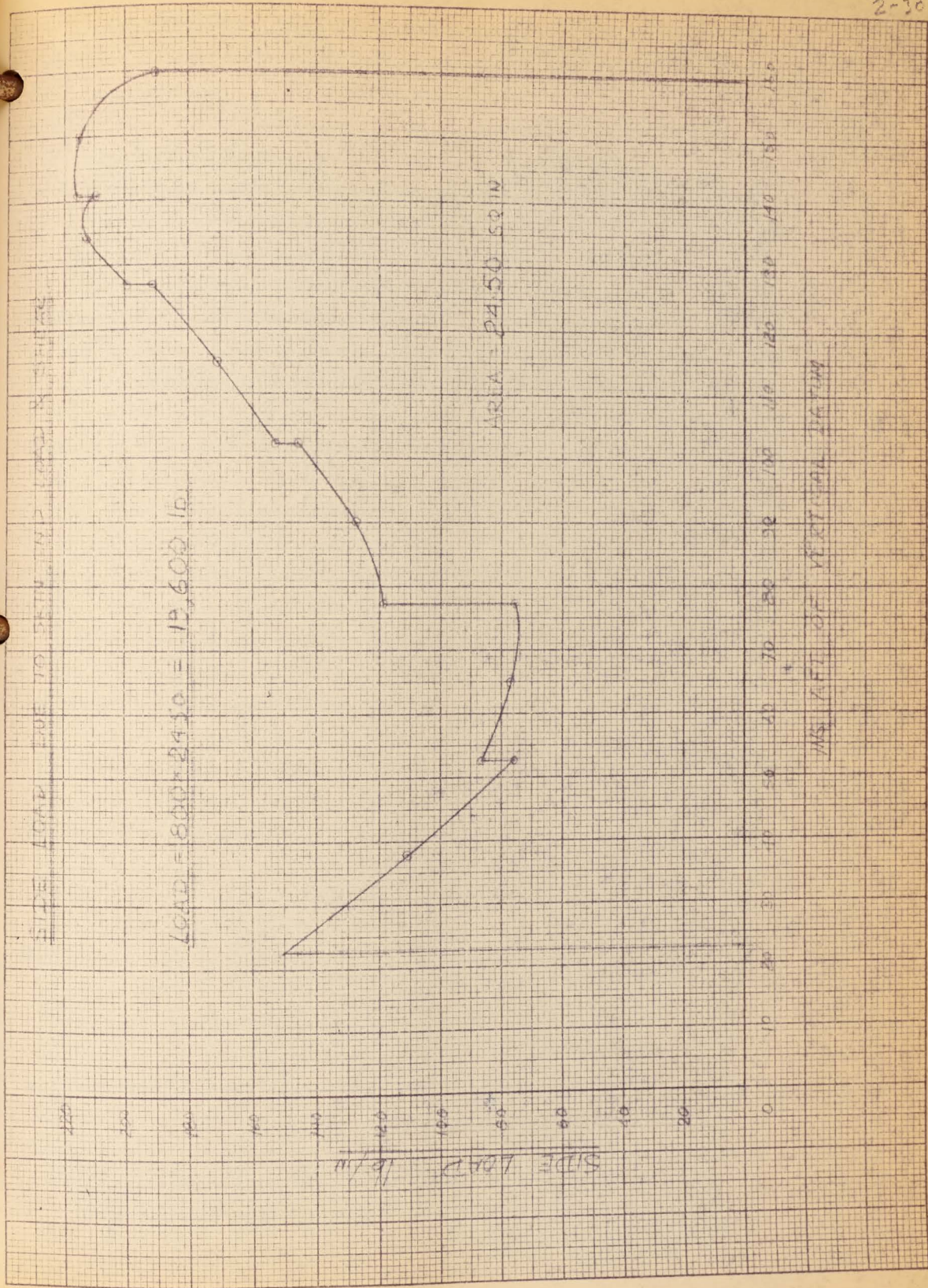
SIDE LOAD DUE TO STEEL WIND BRACING

$$LOAD = 800 \times 24.50 = 19,600 \text{ LB}$$

AREA = 24.50 SQ IN

MS. KFT OF VERTICAL DETERM

2-30



RAFT
W.

COMPONENT

SHEET No. 2-33

REPORT No.

DATE 1-18-54

PREP. BY L. MATAJON

105-110 DISTRIBUTION OF SIDE SHEARS
AT SPARK PLUG - 20 POINTS AT 100°
LIMIT SHEARS - C.P. 111

ESTIMATED SHEAR
DISTRIBUTION
NO. OF SPARKS

SPARK 100°

SPARK 100°

SPARK 100°

SPARK 100°

SPARK 100°

CHECKED SPARK - 100° FROM 111°

FORM 1738

TECHNICAL DEPARTMENT (Aircraft)

REPORT No.

SHEET No.

2-36

AIRCRAFT:

C 105

FIN ROOT SKIN SHEAR

MATRIX SHEAR

PREPARED BY

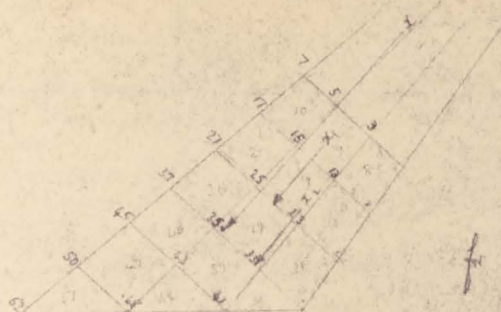
DATE

A. Cooke

JAN 3 '55

CHECKED BY

DATE



$$T = \frac{x_1 x_2}{x^2} T_m$$

for analysis $x = x_1 \text{ or } x_2$

$$T_1 = \frac{x_2}{x_1}$$

$$T_2 = \frac{x_1}{x_2}$$

x_1	166.466	$\frac{x_1}{x_2}$	.8869	$\frac{x_1}{x_2}$	1.1275
x_2	187.673	$\frac{x_2}{x_1}$	.8869	$\frac{x_2}{x_1}$	1.1275
x_3	211.606	$\frac{x_3}{x_1}$	.8869		
x_4	238.590	$\frac{x_4}{x_1}$	.8869		
x_5	269.014	$\frac{x_5}{x_1}$	.8869		
x_6	303.317	$\frac{x_6}{x_1}$	.8869		
x_7	341.226	$\frac{x_7}{x_1}$	.8869		

MATRIX NO.	T_m	T_1	T_2
8	-4.771	-5.605	-4.408
9	-4.746	-5.577	-4.387
10	-4.168	-4.699	-3.696
11	-5.026	-5.467	-4.457
12	-3.167	-3.571	-2.809
13	-1.915	-2.182	-1.716
14	+1.975	+2.227	+1.752
15	+1.037	+1.237	.973
16	.715	.885	.696
17	.8614	.9498	.7471
18	.4916	.5531	.4351
19	.3164	.3565	.2788
20	.4798	.5410	.4255
21	.2398	.2704	.2127
22	.2202	.2483	.1953

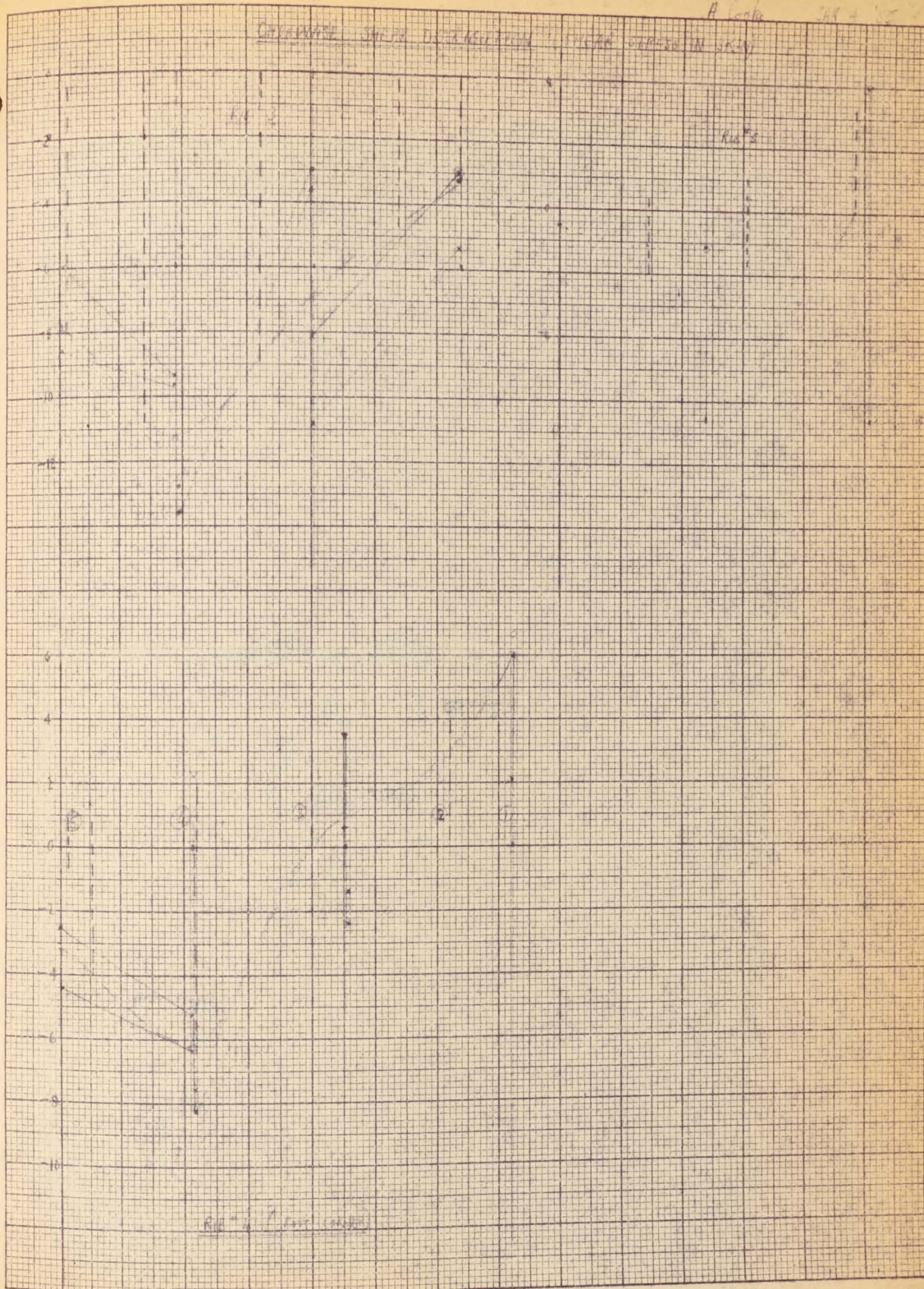
2105 PM

2-40

A Look

21-40

CHRYSLER JAMES D. KELLER 1944 JAMES IN SKY



A.V.ROE CANADA LIMITED
MALTON - ONTARIO

TECHNICAL DEPARTMENT (Aircraft)

REPORT NO.

7/0583/2

SHEET NO.

3-1

PREPARED BY:

A. Cooke

DATE:

JAN 5 '55

CHECKED BY:

DATE:

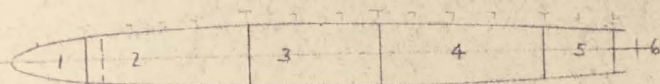
AIRCRAFT

C 105

FIN ROOT SHEARS

STN 6.00 - 14.00

CP 152 36.4012 MATRIX CORRECTION FACTOR K



ANGLE A = 12.5

LEG A = 1.476

LEG A = 1.10

1	2	3	4	5	6	7	8	9	10	11
WEB NO	b_F	t_F	$b_F t_F$	$b_F t_F$	$b_F t_F$	$A_{\text{SHEAR}} \times 10^3$	$A_1 = 4.0$	$b_F t_F \cos \theta$	B_1	$A_L = 10 - 1.1 t_F$
1-2	6	.051	.308	1.03	1.33	.777	2.107	.059	2.068	1.927
2-3	10.5	.099	1.03	1.51	2.50	.979	3.517	.070	3.449	3.329
3-4	9.0	.168	1.51	1.90	3.41	.979	4.389	.072	4.317	4.037
4-5	10.9	.174	1.90	1.65	2.765	.827	3.592	.056	3.536	3.536
5-6	2.75	.182	.86	.65	1.31	150	1.66	.025	1.635	1.635
							15.017			

	12	13	14	15	16	17	18	19	20	21
	σ_L	σ_L	$\sigma_L A_1$	$\sigma_L A_2$	$\sigma_L A_1 - \sigma_L A_2$	T_L	T	T	T	T
1-2	22.000	13.000	44.354	36.618	800	-6900	.038	-6800	-2800	-9200
2-3	52.400	31.800	114.016	107.000	700	-5400	.168	-9100	+6850	+9300
3-4	37.000	36.880	162.393	159.000	340	-1300	.176	-2250	+3710	+5050
4-5	65.800	40.500	164.000	142.000	2150	+800	.100	+1460	-1260	-1980
5-6	58.000	44.200	84.600	63.627	2125					

	$19 \times 10^6 \times 654$ $= K \times \Delta y$	Δy	HEIGHT OF WEB
1-2	-1420	-14.500	5.1
2	-1900	-11.300	7.3
3	-470	-2.700	7.6
4	+305	+1.600	7.5
5-6			5.2

22	23	24
WEB SHEAR	WEB SHEAR	WEB SHEAR
-1420	-620	-3150
-480	+220	+1600
+2640	+1780	+13600
+780	+2930	+19000
-305	+1820	+10000
		+41050
		54490

MALTON, ONTARIO
TECHNICAL DEPT. (AIRFRAME)

REPORT NO.

SHEET

DATE _____

PREPARED BY -

AIRCRAFT

WEIGHT

C. G. POSITION

8	9	10	11	12	13	14	15	16	17	18	19	
		(3) - (4)				(4) - 5				5 - 6		
$\frac{\sigma A_1 - \sigma A_2}{L}$	A	σ	σA	$\frac{\sigma A_1 - \sigma A_2}{L}$	A	σ	σA	$\frac{\sigma A_1 - \sigma A_2}{L}$	A	σ	σA	$\frac{\sigma A_1 - \sigma A_2}{L}$
460	4.43 4.36	37 37	164 16	330	3.64 3.61	50.5 45.2	123 165	3000	14.55 71 1.45 58	106 84	470	
880	4.25	36.8	156	600	3.51	40	140	2500	1.62 46.2	63	2100	
900	4.18	36.4	150	690	3.46	36.6	126	1750	1.21 36	51	1500	
1010	4.07	35.6	145	550	3.35	31.2	111	1500	1.38 29	40	1100	
1110	4.00	34.8	138	875	3.28	31.6	103	1400	1.37 26.4	36	500	
1050	3.90	33.5	130	800	3.20	29.4	94	900	1.34 25.4	33.6	260	
										47.0		
										10.70 + 36.30		

A. V. ROE CANADA LIMITED

MALTON, ONTARIO

TECHNICAL DEPT. (AIRFRAME)

AIRCRAFT

C 105

WEIGHT

C. G. POSITION

REPORT NO.

SHEET

3-4

DATE

JAN 6 '55

PREPARED BY

H. Condon

8

9

10

11

12

13

14

15

16

17

18

19

P_{cont}
LBS/INCH
= $\frac{P}{L} \times L$

1.24

3.2

3.78

4.40

5.15

7.14

7.59

7.77

7.99

8.21

9.6

9.15

10.5

12.2

16.0

5.94

3.45

A. V. ROE CANADA LIMITED

MALTON, ONTARIO

TECHNICAL DEPT. (AIRFRAME)

REPORT NO. -

SHEET -

DATE -

PREPARED BY -

3-5

JAN 21 '55

JAN 26 '55

A. Lorke

AIRCRAFT -

C 105 FIN

WEIGHT -

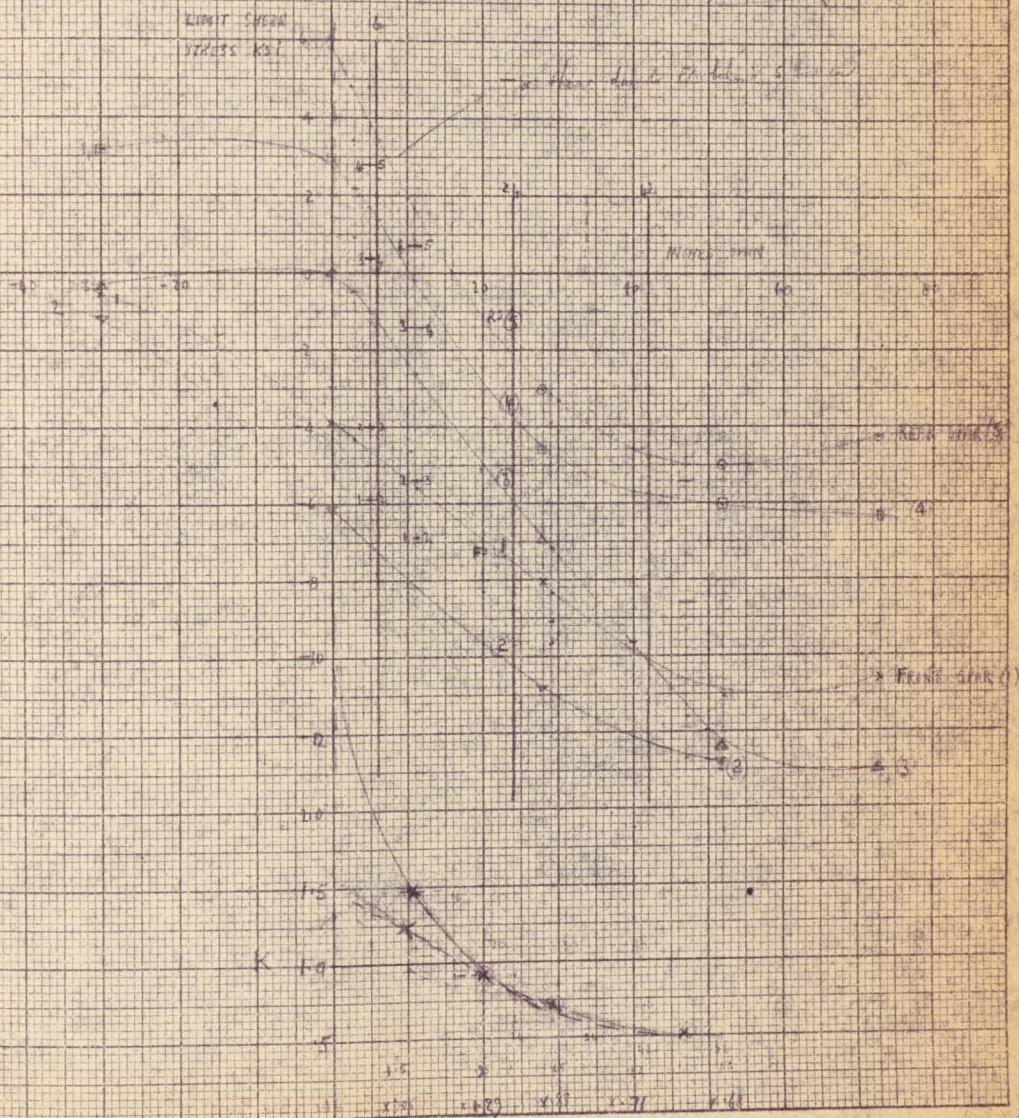
C. G. POSITION -

9	10	11	12	13	14	15	16	17	18	19
STN	INCHES FROM H.L.	WT σ Ksi	t in	y in	MOMENT PER INCH $\sigma t y = M$		$G \times 10^3$ $\sigma_{max} y$	COLLECTED ULT END LOAD PER IN. $\sigma_{max} \times t_{avg}$		
10	44.5	210	2.51	23.500				9.35		
35	44.5	210	2.61	24.500				9.35		
70	43	210	2.75	26.900				9.05		
130	40	210	2.95	24.700				8.60		
		218		25.700				8.70		
250	37	218	3.35	27.000				1.00		
36.62	36.2	218	3.50	27.500				7.900		
		212		25.900				7.700		
44.0	34.6	212	3.50	25.700				7.250		
52.62	32.0	212	3.35	22.700				6.800		
		212		16.300				4.860		
61.0	28	152	3.00	12.800				4.200		
70.62	20	152	2.25	6.810				3.640		
		078		3.510				1.660		
75	13	078	1.5	1.530				1.040		

A. Cooper JAN 5 1954

LIMIT STRESS IN SKIN PANELS (CHG)

MATRIX VALUES ADJUSTED TO 5/16" STRUCTURE



A.V.ROE CANADA LIMITED
MALTON - ONTARIO

TECHNICAL DEPARTMENT (Aircraft)

REPORT NO. 7 0583/1

SHEET NO. 3-9

AIRCRAFT

L105

FIN ROOT SHEARS

STN $X_{M=}$ 24.0 + 38.0

PREPARED BY:

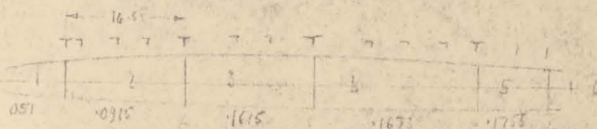
A. Cooke

DATE:

JAN 7 '55

CHECKED BY:

DATE:



WEB NO	2	3	4	5	6	7	8	9	10	11
	b_F	t_F	$b_F t_F$	$b_A t_A$	$b_L t_L$	A_{SMALL}	A_1	$t_L b_L$	8-9	A_2
1-2	6	.051	.304	.755	1.061	.777	1.838	.051	1.787	1.674
2-3	8.25	.0915	.755	1.451	2.205	.979	3.184	.042	3.122	3.009
3-4	9.0	.1615	1.451	1.820	3.270	.979	4.269	.072	4.177	4.177
4-5	10.3	.1675	1.820	.830	2.650	.827	3.477	.056	3.421	3.421
5-6	6.75	.1755	.830	.430	1.260	.15	1.416	.025	1.385	1.385

	12	13	14	15	16	17	18	19	20	21
	$W_2 A_2$	$W_3 A_3$	$W_4 A_4$	$W_5 A_5$	$W_6 A_6$	T_{SMALL}	t	$t_L b_L$		$16 + 21$
1-2	18 000	16 000	33 000	26 780	700	-4000	.0915	-500	-500	0
2-3	31 000	30 000	97 780	90 270	970	-6000	.1615	-1310	-510	+160
3-4	36 500	35 600	155 290	149 000	700	-9100	.1675	-2060	-750	-130
4-5	36 700	33 100	126 100	113 260	1400	-7600	.1755	-2290	-230	+150
5-6	36 000	29 000	50 760	40 160	1059				+2270	+3369

	HEIGHT OF WEB	WEB UNDER LIFT
1	6.58	0
2	6.67	+1030
3	6.8	-885
4	5.88	+6730
5	5.12	-17100

$$Shear \text{ by } .05026 \times 18 = .00905$$

A.V. ROE CANADA LIMITED
MALTON - ONTARIO

TECHNICAL DEPARTMENT (Aircraft)

REPORT NO. 7/0563/1

SHEET NO. 3-10

AIRCRAFT C 105

FIN ROOT SHEARS

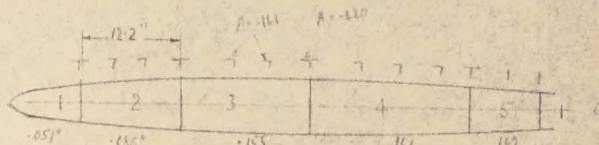
STN X_{fm} 42.0 - 52.0

PREPARED BY:
A. Cooke

DATE:
JAN 7 '56

CHECKED BY:

DATE:



1	2	3	4	5	6	7	8	9	10	11
WEB NO	b_f	t_f	$b_f t_f$	$b_R t_R$	$b t = b + b_R$	$A_{average}$	$A_1 = b + t$	$b + b_R / 2$	$b - b_R$	A_2
1-2	6	.051	306	519	825	581	1.406	.022	1384	1.279
2-3	6.1	.085	519	1.400	1.919	742	2.661	.056	2.607	2.502
3-4	9.0	.155	1.400	1.760	3.160	822	3.981	.072	3.910	3.910
4-5	10.9	.161	1.760	800	2.560	711	3.271	.056	3.215	3.215
5-6	4.75	.169	800	420	1.220	150	1.370	.025	1.345	1.345

$$71.5 \times 1.67 = 119.4$$

	12	13	14	15	16	17	18	19	20	21
	$\sigma_1 A_1$	$\sigma_2 A_2$	$\sigma_1 A_1$	$\sigma_2 A_2$	$\frac{\sigma_1 A_1 - \sigma_2 A_2}{t}$	τ_{max}	E	$\tau_{max} \times b$	q_{max}	$q_{max} \times b$
1-2	16,300	12,800	20,100	1560	510	11600	.085	-1340 K	-1240 K	-700
2-3	28,400	27,060	76100	6755	1050	11900	.155	-2500 K	+620 K	+600
3-4	36,800	33,100	138,600	1360	800	8600	.161	-1880 K	+640 K	+335
4-5	31,400	29,460	107,000	940	260	5400	.169	-1260 K	+1240 K	+664
5-6	26,400	25,100	36,000	320						

	22	23	24	25	26
	SPR WEB	$R_0 A_0$	HEIGHT OF WEB	WEB + SHEAR	WEB + SHEAR
1-2	.0082	1170	4.68	-190	-850
2-3	.0190	1480	6.10	+760	+2750
3-4	.0110	1520	6.70	+1128	+7520
4-5	.0082	840	5.90	+1235	+7290
5-6	.0082	300	6.15	+904	+4650

$$\Sigma P_v = 4310 \text{ lb}$$

$$2 P_v = 8620$$

Reaction

$$29,980 \text{ lb}$$

$$\text{Applied shear} = 32,000 \text{ lb}$$

A.V. ROE CANADA LIMITED
MALTON - ONTARIO

TECHNICAL DEPARTMENT (Aircraft)

REPORT NO. 7/0582/1

SHEET NO. 3-11

AIRCRAFT C 105

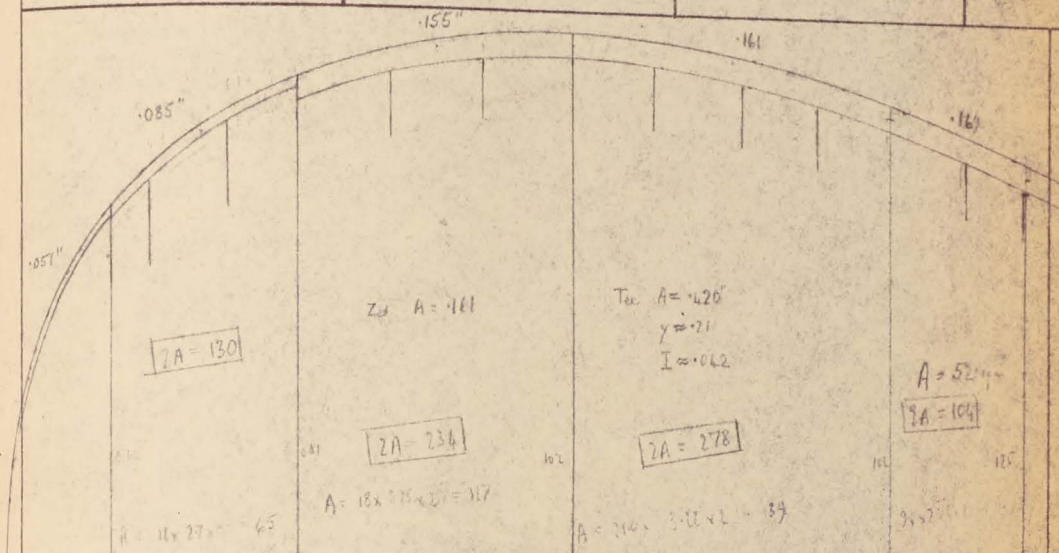
FIN RIB AT x_{nw} 42.00
SECTION PROPERTIES

PREPARED BY:
A. Cooke

DATE:
JAN 10 '55

CHECKED BY: x

DATE:



A.V.ROE CANADA LIMITED
MALTON - ONTARIO

TECHNICAL DEPARTMENT (Aircraft)

AIRCRAFT

C105

FIN ROOT SHEETS

STN 6 - 16

REPORT NO.

SHEET NO.

3-14

PREPARED BY:

A. Cooke

DATE:

JAN 14 55

CHECKED BY:

DATE:

TO DETERMINE FACTOR k FOR kT TO GIVE CORRECT TORQUE.

MOMENT OF SHEAR FLOW - IN WEBS

MOMENT OF VERT. COMPT SPAR END LOADS

WEB NO	S	$Y + 16$ S'	WEB DEPTH Y	MOMENT ARM X	xy	S_{xy}	S_{xy}	SPAR WEB TAPERED	P_y	P_z
1-2	840	-920 k	50	76	380	319 200	-349 600	.0157	727	55 350
2-3	880	-310 k	72	52.62	379	333 520	-117 490	.0157	1775	100 500
3-4	600	+330 k	73	34.68	2527	151 620	+235 010	.0156	1880	65 90
4-5	2500	+505 k	63	13.0	819	204 750	+41 360	.0028	1350	11 000
5-6	2100	-178 k	52	3.5	782	38 220	-3 600	.0012	690	2 400
						1 067 310	+134 324 k		6422	236 960

216 12 864 278 466 490

MOMENT OF SHEAR FLOW IN SKINS

	A	y	A_y	S_y
$A_1 = 1.75 \times 21$	161.75	-920 k	130.456	
$A_2 = 3.72 \times 18$	66.96	-1260 k	82.361	
$A_3 = 2.82 \times 21.5$	60.63	-305 k	118.492	
$A_4 = 2.50 \times 13$	32.50	+198 k	6.635	
			-224 874 k	

2989 449 768 k

1 067 310 - 644 7



$T_0 = 401 000$

MOMENT DUE TO TAPER OF F/S (76 16)

$$P_z = -46 200 \times x \cdot 2376 \times 5.0$$

$$P_x = -55 000$$

TOTAL EXTERNAL MOMENT - 501 000

BY CRT

$$1067 310 - 194 324 k + 466 480 - 55 000 - 449 768 k = 501 000$$

$$- 644 272 k$$

$$k = 1.48$$

A.V. ROE CANADA LIMITED
MALTON - ONTARIO

TECHNICAL DEPARTMENT (Aircraft)

REPORT NO. _____

SHEET NO. 3-15

AIRCRAFT

C105

FIN ROOT SHEARS

15. 42.0

PREPARED BY:

A Cooke

DATE:

JAN 16 55

CHECKED BY:

DATE:

TO DETERMINE FACTOR 'K' FOR KT TO GIVE CORRECT TORQUE

MOMENT OF SHEAR FLOW IN WEBS

WEB NO	S	WEB DEPTH	MOMENT ARM	x	x^2	S_{xx}	P_x	P_{xx}
1-2	510	-1340K	6.0	64.5	285.	144,000 - 380,000K	170	11,000
2-3	1050	-1150K	6.0	52.62	315.	331,000 - 366,000K	1480	77,900
3-4	800	+619K	6.6	36.62	229.	183,000 + 142,000K	1520	53,000
4-5	900	+1400K	5.6	13.0	73.	65,500 + 46,400K	840	10,900
5-6	200	+1240K	5.0	3.5	17.5	4,500 + 21,600K	300	6,050

728,000 - 536,000K

2Kx = 154,000

22Kx = 308,000

MOMENT OF SHEAR FLOW IN SKINS

	A	q	$A_y = \int T$
$A_1 = 172 \times 6.35$	77.5	-1340K	-106,000K
$A_2 = 18 \times 3.90$	70.1	-2500K	-176,000K
$A_3 = 218 \times 2.65$	58	-1880K	-109,000K
$A_4 = 9.5 \times 2.35$	22.3	-1240K	-27,600K
		$2A_5 = -416,600K$	
		$\Sigma 2A_5 = T = -833,200$	

728,000 - 956,100K

728,000 - 1,369,000K

Total moment by EBT = 308,500K. 32,300K all skin for H.

Moment due to tapes of FS

$$P = -14,300 \times 13.74$$

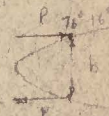
$$M = -3,400 \times 64 = -15,000K$$

$$728,000 + 308,000 - 15,000 - 186,900K = 308,500$$

$$712,500 = 1,369,000K$$

$$K = \frac{712,500}{1,369,000}$$

$$K = .52$$



A.V. ROE CANADA LIMITED
MALTON - ONTARIO

TECHNICAL DEPARTMENT (Aircraft)

REPORT NO. 7/0583/1

SHEET NO. 3-17

AIRCRAFT

C 105

FIN ROOT SHEARS

MATRIX SHEAR CORRECTION

PREPARED BY:

A Cooke

DATE:

JAN 18 '55

CHECKED BY:

DATE:

STN X_{RSD} 24 $\rightarrow$ 34

MOMENT OF SHEAR FLOW IN WEBS

WEB N°	S	$T \times S'$	WEB DEPTH y	MOMENT ARM - x	xy	S_{xy}	S'_{xy}	SMALL WEB TAPER - IN	P_y	P_x
1-2	700	-1190 k	4.48	69.12	309.66	216 760	-368 490 k	.02	662	46 000
2-3	970	-800 k	6.42	52.62	337.86	327 660	-270 260 k	.02	1940	102 000
3-4	700	+630 k	6.80	34.62	235.4	166 780	+148 300 k	.0167	2200	76 200
4-5	1400	+410 k	5.88	12.0	76.14	107 020	+31 360 k	.0081	1040	13 500
5-6	1059	+950 k	5.12	3.5	17.92	18 972	+17 020 k	.0082	415	1460
						835.197	-442 090 k		6257	239 166

26.478 320

MOMENT OF SHEAR FLOW IN SKINS.

	A	y	$A_y = \frac{1}{2} T$
A_1	675 x 16.5	111	-1190 k
A_2	395 x 18	71	-1990 k
A_3	275 x 21.5	59	-1360 k
A_4	25 x 13	32.5	-950 k
			-384 000 k

$\Sigma A_y = -768 000 k$

$$835 200 - 442 090 k - 768 000 k - 34 200 + 478 320 = 390 000$$

$$-1 210 090 k = -589 320$$

$$k = .733$$



$$T_{in} = 390 000 \text{ lb-in}$$

T	t	$\frac{y}{t} \times 136$	Shear flow q
-7600	.0915	-1190 k	-1190 k
-9100	.1415	-1990 k	-900 k
-6000	.1615	-1360 k	+630 k
-4000	.1755	-950 k	+410 k
			+950 k

MOMENT DUE TAPER OF FS

$$P_x = -32 200 \times .2374 \times 4.68$$

$$P_x = -34 200 \text{ lb-in}$$

A.V. ROE CANADA LIMITED
MALTON - ONTARIO

TECHNICAL DEPARTMENT (Aircraft)

REPORT NO. 7/0583/1

SHEET NO. 3-18

AIRCRAFT

C 105

FIN ROOT SHEARS

MATRIX SHEAR CORRECTION

PREPARED BY:

A Cooke

DATE:

JAN 18 '55

CHECKED BY:

DATE:

STN 0 → 6

WEB NO	S'	x y	S' x y
1-2	-720 K	380	- 273 600 K
2-3	- 10 K	379	- 3 790 K
3-4	+ 766 K	253	+ 264 600 K
4-5	+ 604 K	32	+ 49 530 K
5-6	- 840 K	182	- 15 290 K
			+ 1 250 K

-5000

-3000

+ 1000

+ 4000

T	t	gall. vol. t l x 1/36	gall. vol. y
-5400	.098	-720 K	-720 K
-3200	.168	-730	- 10
+1000	.174	+236	+966
+3400	.182	+840	+604
			-840

MOMENT DUE TO TAPER OF FS.

$$P = 46,700 \times .2374 \times 5.0$$

$$P_s = -55,000 \text{ lb.}$$

	A	y	A _y = $\frac{1}{2} A y$
A ₂ 6.75 x 21	141.9	-720 K	-102,500 K
A ₃ 3.72 x 18	66.96	-730 K	-48,800 K
A ₄ 2.82 x 21.5	60.6	+236	+14,300 K
A ₅ 2.50 x 13	32.5	+840	+27,000 K
			-109,500 K

$$7H_s = 468,480 \text{ lb.}$$

$$S_{ay} = 1,047,310 \text{ lb.}$$

$$T_s = 501,000 \text{ lb.}$$

$$\Sigma 2H_s = -219,000 \text{ K lb.}$$

$$1047,310 + 468,480 - 501,000 - 55,000 = +217,790 \text{ K}$$

$$959,790 = 217,750 \text{ K}$$

$$K = 6.4$$

Plot curve for shear stress in the joint

959,790

$$959,790 = 137,500 \text{ K}$$

$$72 = K$$

A.V.ROE CANADA LIMITED
MALTON - ONTARIO

TECHNICAL DEPARTMENT (Aircraft)

AIRCRAFT

C 105

FIN. ROOT SHEARS.

STW 0 → 6.

REPORT NO.

7/0583/1

SHEET NO.

3-23

PREPARED BY:

A. Locke

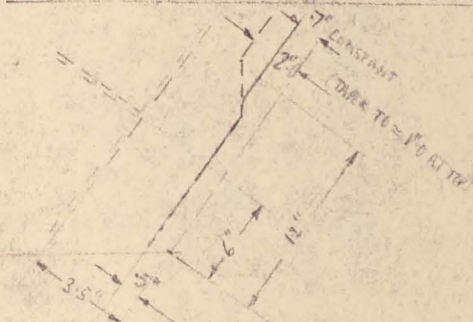
DATE:

JAN 19 '55

CHECKED BY:

DATE:

AREA OF REAR SPAR + EFFECTIVE SKIN



FOR CALC. SKIN WIDTHS AT REAR SPAR TAKEN AS
4.75" FORWARD & 2.5" AFT OF SPAR DATUM + .15" CAP AREA

$$\therefore \text{at } R. O. \quad t = 6 \times 0.0036 + 182 = 18415$$

$$\begin{aligned} \text{Area} &= 7.25 \times 18415 + .15 \\ &= 13351 + .15 \end{aligned}$$

$$\text{Area} = 1.485 \text{ sqm}$$

A.V.ROE CANADA LIMITED
MALTON - ONTARIO

TECHNICAL DEPARTMENT (Aircraft)

REPORT NO. 7/0583/1

SHEET NO. 3-24

AIRCRAFT

C105

FIN ROOT SHEAR STRESS

WEBS

PREPARED BY:

A Cooke

DATE:

JAN 19 55

CHECKED BY:

DATE:

STN. 42.0 K=52

WEB NO	S	S'	ST WEB SHEAR FLOW	S	q ₂₅ WEB SHEAR FLOW	h	F
1	510	-700	-190	690	-10	4.2	-42
2	1050	-600	+450	920	+360	5.7	2050
3	800	+320	+1120	750	+1070	6.35	6800
4	900	+333	+1233	110	1440	5.5	7900
5	240	+643	+903	20	+1200	4.5	5800

ΣF 22500 ✓

STN. 0 K=127

K=36

WEB NO	S	S'	ST WEB SHEAR FLOW	S'	ST
1	500	-920	-420	-2400	-2400
2	660	-14	+646	+36	+620
3	330	-1230	-900	+3450	+3780
4	3000	+770	+3770	+2170	+5170
5	4700	-1070	+3630	-3000	+1700

23700 x 136 = 32000.

C 106 FIN.

GEOMETRY OF THE SLANTED MAIN RIB AT STN 600'

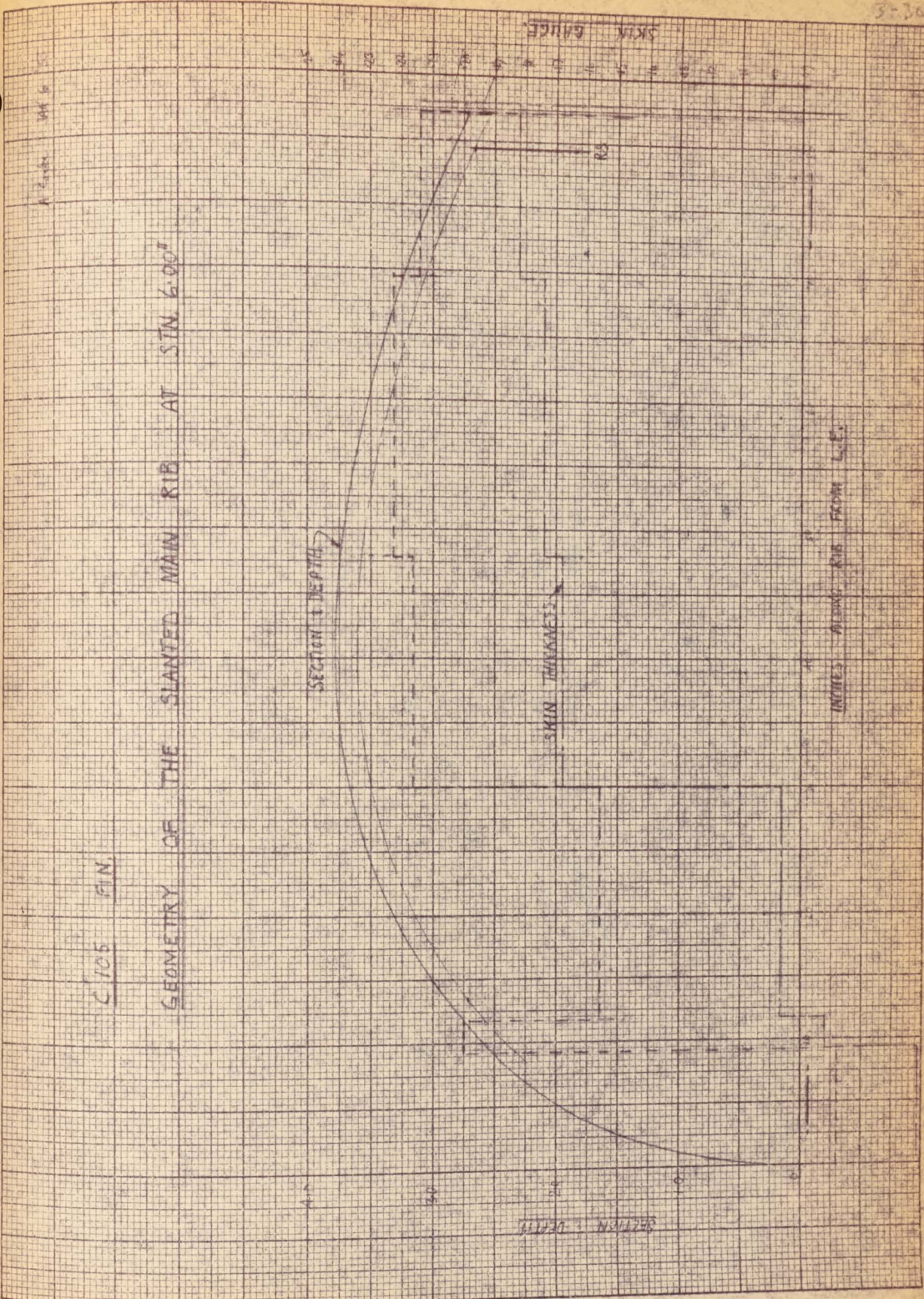
SECTION 1 DEPTH

SKIN THICKNESS

INCHES ALONG RIB FROM L.E.

SECTION 2 DEPTH

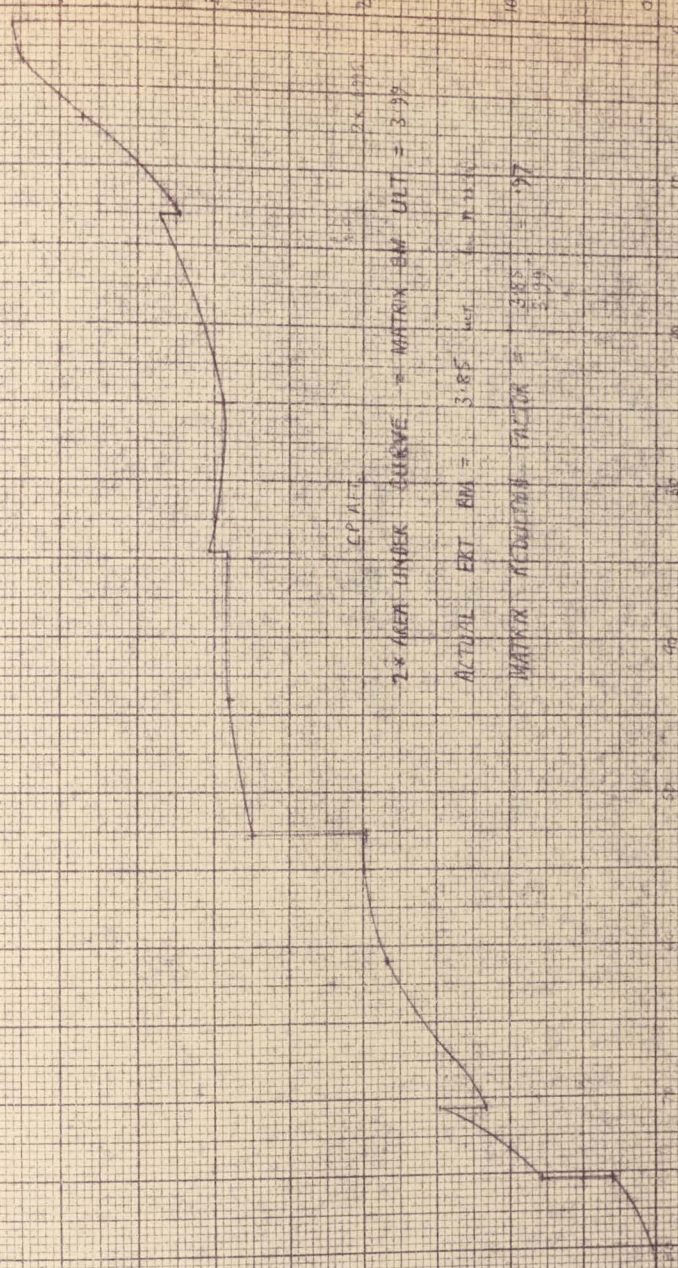
SKIN GAUGE



CLOS. FIN.

Actual 44.56

MOMENT PER INCH AT STN 0
(AT ULT. LOAD)



2x AREA UNDER CURVE = MATRIX RM ULT = 3.99

ACTUAL ERT RM = 3.85

MATRIX REDUCTION FACTOR = $\frac{3.85}{3.99} = .97$

MOMENT
LBS IN PER INCH

A.V.ROE CANADA LIMITED
MALTON - ONTARIO

TECHNICAL DEPARTMENT (Aircraft)

REPORT NO.

SHEET NO.

3-37

PREPARED BY:

A Cooke

DATE:

JAN 25

CHECKED BY:

DATE:

AIRCRAFT

C105

FIN ROOT SHEARS.

CORRECTION TO σA END LOADS
AT 16.0, 6.0 & 0

CHECK ON BM AT STN 16.00

SPAR	σA	h	$\sigma A \times h = M$
1	42.5	4.5	192
2	107.8	6.7	720
3	158	7.0	1110
4	138	5.92	820
5	69	5.24	361
			3198

Actual EBT BM = $3.18^{16} \text{ in} \checkmark \times 1.0057$

STN 6.00

SPAR	σA	h	$\sigma A \times h = M$	σA_{cor}
1	48	4.65	223.2	49.1
2	116.5	7.0	808.5	118
3	156	7.12	1110.72	160
4	146	6.2	905.2	149.9
5	87.5	5.3	463.75	89.9
			3511.37	

Actual EBT BM = $3.59^{16} \text{ in} \checkmark \times 1.0274$

STN 0

SPAR	σA	h	$\sigma A \times h = M$
1	53.7	4.75	255.08
2	129	7.2	928.8
3	156	7.32	1141.92
4	158	6.2	979.6
5	100.8	5.5	554.40
			3859.80

Actual EBT BM = $3.85^{16} \text{ in} \checkmark \times 1.0025$

A.V.ROE CANADA LIMITED
MALTON - ONTARIO

TECHNICAL DEPARTMENT (Aircraft)

REPORT NO. _____

SHEET NO. _____

3-38

PREPARED BY:

A Cooke

DATE:

JAN 26 '55

CHECKED BY:

DATE:

AIRCRAFT

C 105

FIN ROOT SHEARS

CHECK ON BM AT STN 24.0

SPAR	σA	h	$\sigma A h = M$	σA_{net}
1	32.2	4.4	142.56	33.8
2	97	6.37	617.89	102
3	150.5	6.77	1018.88	158
4	126	5.82	733.32	132
5	51	5.1	260.1	53.5
			2772.75	

Actual EBT BM = 2710¹⁶

x 1.0495

STN 34.0

SPAR	σA	h	$\sigma A h = M$	σA_{net}
1	25.6	4.3	110.08	27.5
2	86.9	6.6	571.4	92.9
3	165	6.55	949.75	154.5
4	111	5.45	607.15	118
5	40	4.93	197.2	43
			2405.58	

Actual EBT BM = 2577¹⁰⁷

x 1.0685

STN 42.0

SPAR	σA	h	$\sigma A h = M$	σA_{net}
1	20.5	4.2	86.10	22
2	78	5.75	448.50	83
3	138	6.35	876.30	168
4	103	5.5	566.5	110
5	36	4.8	172.8	38.5
			2150.2	

Actual EBT BM = 2298⁶¹⁷

x 1.0687

A.V.ROE CANADA LIMITED
MALTON - ONTARIO

TECHNICAL DEPARTMENT (Aircraft)

REPORT NO. _____

SHEET NO. 3-33

AIRCRAFT

C 105

FIN ROOT SHEARS.

STN. 0 6.

PREPARED BY:

A Cooke

DATE:

JAN 26 '55

CHECKED BY:

DATE:

see also Jan 20 & 18 for design sheet.

x = moment arm about HL
 y = depth of web.

WEB	S_{x1}	x_{cg}	S_{x2}	SPAR WEB TAPER + 2	I_x	I_{xz}	I_y
1	950	380	316 000	0.157	840	64,000	76.0
2	2250	379	852 750	0.157	2020	106,000	52.6
3	0	253	0	0.114	1810	63 000	34.6
4	2000	82	164 000	0.157	1300	16 800	13.1
5	2210	18.2	40 222	0.082	830	2 900	3.5
+ 1 372 972					$2I_x = 6800$	$252 700$	
					$2I_y = 13 600 lb$	$+ 505 400 lb_{in} = 276.8$	

MOMENT OF SHEAR FLOW IN SKINS $2Z A_y = -649 740 k$

" " " " IN WEBS $S_{x2} = -194 326 k$
 $-664 072 lb_{in}$

MOMENT OF TAPER AT FS. $P_x = -55 000 lb_{in}$

EXTERNAL NET TORQUE = 501 000 LB IN

$$1,372,972 + 505,400 - 55,000 - 664,072 k = 501,000 lb_{in}$$

$$1,322,972 = 664,072 k$$

$$2.05 = k$$

SPAR WEB SHEAR FLOW (STN 6-0)

WEB	S'	S'_{x2}	S	WEB SHEAR FLOW	WEB DEPTH	WEB SHEAR FORCE
1	-920k	-1890	950	-940	5	-4 700
2	-810k	-630	2 250	+1 620	7.2	+ 11 600
3	+950k	+1910	0	+1 910	7.3	+ 13 900
4	+505k	+1060	2 000	+3 060	6.3	+ 19 100
5	-198k	-105	2 210	+1 805	5.2	+ 9 400

$$F + 49 300$$

$$P_y + 13$$

$$62 900$$

EXTERNAL SF = 40,000 LBS

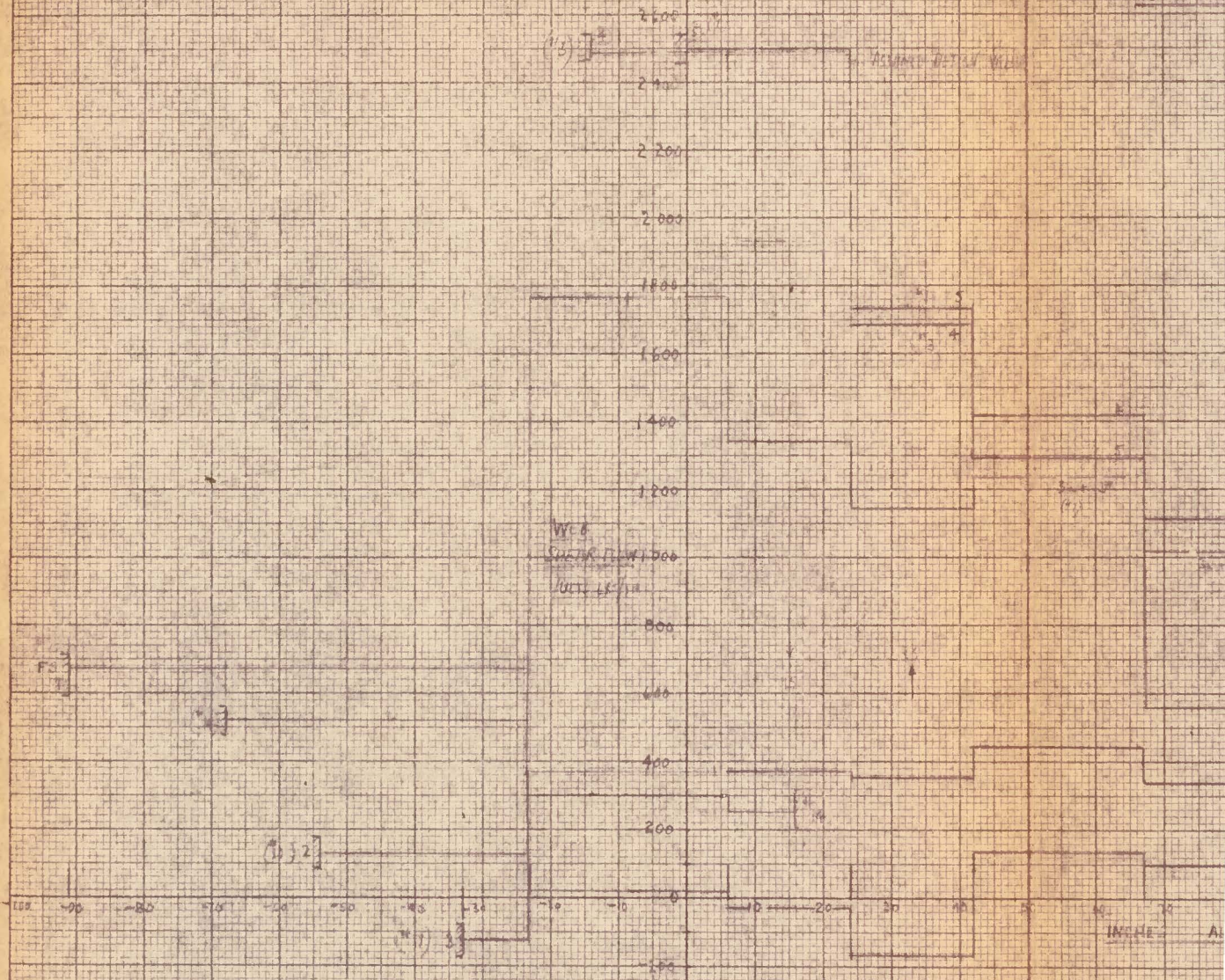
MALTON, ONTARIO
TECHNICAL DEPT. (AIRFRAME)

PREPARED BY - A Locke

C. G. POSITION . CP AFT . ULT. LOAD.

[illegible]

SPAR V



0.05

FM

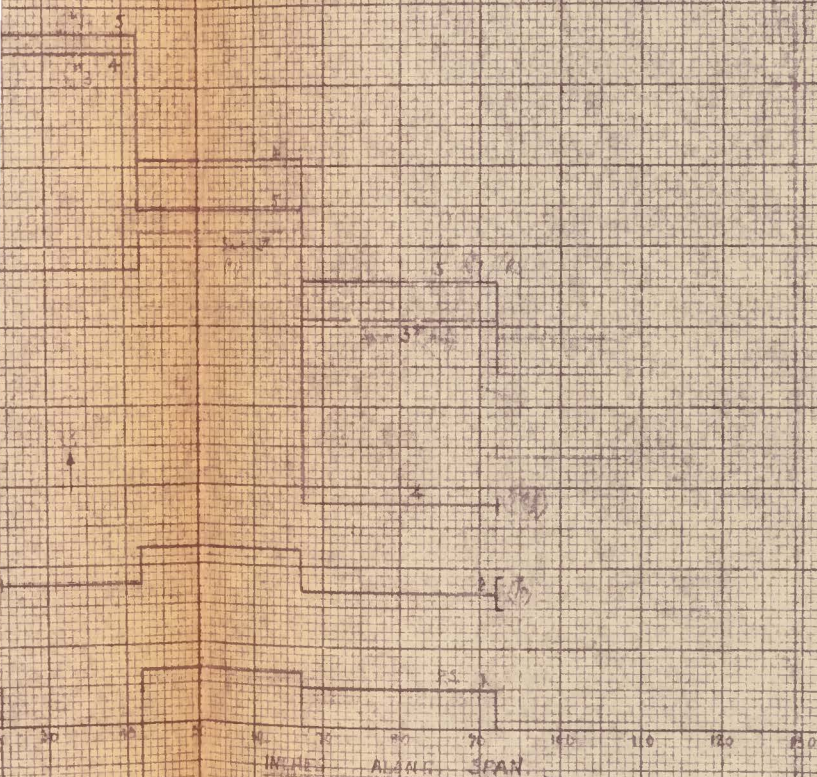
A. Carter

附錄

SPAR WEB SHEAR FLOWS

1017

AS 1000 02744 101



Train bowing in this case is large
 because of the fact that the cross-sections are
 of plane curved max. to max.

Max. bowing for side

