

QCX
Avro
CF105
R-7-0683-17



TECHNICAL REPORT



A. V. ROE CANADA LIMITED
MALTON - ONTARIO

ANALYZED

TECHNICAL DEPARTMENT (Aircraft)

AIRCRAFT:

C105

REPORT NO.

7/0583/17

FILE NO.

NO OF SHEETS:

110

TITLE:

~~CONFIDENTIAL~~

Classification cancelled / Changed to UNCLASS

By authority of AVRS

Date

30 Sept 68

Signature

ABW

Unit / Rank / Appointment AVRS

FIN

ENGINEER'S BENDING DISTRIBUTION

NRC - CISTI
AERO / M.E.
LIBRARY

87- 12 10

BIBLIOTHÈQUE
AÉRO / G.M.
CNRC - ICIST

PREPARED BY

S. YOUNG

DATE

SEPT 23/1968

CHECKED BY

DATE

SUPERVISED BY

DATE

APPROVED BY

DATE

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

15867392

A. V. ROE CANADA LIMITED
MALTON - ONTARIO

TECHNICAL DEPARTMENT (Aircraft)

REPORT NO. 7/0583/17

SHEET NO.

AIRCRAFT:

C105

FIN

PREPARED BY

DATE

S. YOUNG

SEPT 23/65

CHECKED BY

DATE

CONFIDENTIAL

INDEX

SECTION

INTRODUCTION

1

BAY 24-42

2

BAY 42-67

3

BAY 67-92

4

BAY 92-112

5

BAY 112-137

6

SPANWISE WEB SHEAR

7

SPANWISE SKIN SHEAR FLOW

8

SPANWISE SPAR BENDING STRESSES

9

A. V. ROE CANADA LIMITED
MALTON - ONTARIO

TECHNICAL DEPARTMENT (Aircraft)

REPORT NO. 7/0583/11

SHEET NO. 1-1

AIRCRAFT:

C105

FIN

PREPARED BY

DATE

S. YOUNG

SEPT 23/55

CHECKED BY

DATE

INTRODUCTION

THE ENGINEER'S BENDING DISTRIBUTION IS CALCULATED FOR THE FIN BETWEEN STATIONS 24 AND 137 FOR THE C.P. AFT CASE.

THE FIN LOADING CURVES OF B.M., SHEAR, AND TORQUE AT THE HINGE LINE ARE FROM REPORT 7/0583/3B, PAGE 2-14. THESE CURVES INCLUDE THE EFFECT OF FIN AND RUDDER INTERACTION DEFLECTION LOADS.

THE FIN SECTION PROPERTIES ARE RECALCULATED FROM THE INFORMATION GIVEN IN REPORT 7/0583/3B, SECTION 1, WHICH QUOTES SPAR TO SPAR SHEAR FLOWS. THIS REPORT QUOTES STRINGER TO STRINGER SHEAR FLOWS AND THE SECTION PROPERTIES MUST BE ADJUSTED ACCORDINGLY.

A. V. ROE CANADA LIMITED
MALTON, ONTARIO

TECHNICAL DEPARTMENT (Aircraft)

REPORT NO.

7/0582/17

SHEET NO.

1-2

AIRCRAFT:

C105

FIN

PREPARED BY

DATE

S. YOUNG

SEPT 23/55

CHECKED BY

DATE

INTRODUCTION

IN THIS REPORT, SPAR (OR CORRECTLY, STRINGER) #4 IS TAKEN AS CONTINUOUS THROUGH THE ACCESS DOOR BETWEEN STA 42 AND 92. THE ACCESS DOOR IS CONSIDERED FULLY EFFECTIVE AND CONTINUING SPAR #4 THROUGH THE ACCESS DOOR IS ONE METHOD OF TREATING THE ACCESS DOOR PROBLEM.

THERE IS A WEB AT SPAR #5 BETWEEN STATIONS 42 AND 92 — THIS WEB IS NOT CONSIDERED EFFECTIVE.

PROCEEDING INBOARD TO THE ROOT, EACH NEW SPAR IS TAKEN AS FULLY EFFECTIVE ONE RIB INBOARD OF ITS APPEARANCE. IN SOME CASES, THIS CAUSES A REVERSAL OF SHEAR FLOW IN SKIN PANELS ADJACENT TO THE FRONT SPAR.

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

REPORT NO. 7/0583/17
SHEET NO. 2-6

AIRCRAFT:

C105

FIN

PREPARED BY

DATE

S. YOUNG

SEPT. 21/55

CHECKED BY

DATE

BAY 24-42 SECTION PROPERTIES

DETERMINE MID BAY SECTION PROPERTIES BY
AVERAGING STA 24 & 42 (SIMILAR TO BAY 92-112)

CELL AREAS

$$A_d = 2 \left[A_{1-2} + A_{2-3} - \frac{1}{2} X_2 \bar{Y}_3 + \frac{1}{2} X_1 \bar{Y}_1 \right] = 2A_{1-2} + 2A_{2-3} - X_2 \bar{Y}_3 + X_1 \bar{Y}_1$$

$$= 10.4 + 11.9 + 13.0 \times 2.80 - 3.5 \times 2.96 = 50.1 \text{ in}^2$$

$$A_c = 2A_{3-4} + 2A_{4-5} + 2A_{5-6} + 2A_{6-7} - X_7 \bar{Y}_1 + X_3 \bar{Y}_3$$

$$= 12.1 + 11.5 + 16.1 + 16.1 + 34.6 \times 3.28 - 13.0 \times 2.80 = 132.9 \text{ in}^2$$

$$A_b = 2A_{7-8} + 2A_{8-9} + 2A_{9-10} - X_{10} \bar{Y}_{10} + X_7 \bar{Y}_7$$

$$= 19.0 + 22.8 + 28.0 + 52.6 \times 3.04 - 34.6 \times 3.28 = 116.1 \text{ in}^2$$

$$A_a = 2A_{10-11} + 2A_{11-12} + 2A_{12-F} - X_F \bar{Y}_F + X_{10} \bar{Y}_{10}$$

$$= 23.0 + 29.2 + 35.5 + 66.9 \times 2.20 - 52.6 \times 3.04 = 75.1 \text{ in}^2$$

$$A_{a1} = 77.4 \text{ in}^2 \quad \text{STA 24} \quad 7/2/52/38 \quad 1-5$$

$$A_a = 24.8 \quad \text{STA 42}$$

$$A_a = 26.1 \text{ in}^2$$

A. V. ROE CANADA LIMITED

MALTON, ONTARIO

TECHNICAL DEPT. (AIRFRAME)

AIRCRAFT

WEIGHT

C. G. POSITION

REPORT NO.

SHEET

DATE

PREPARED BY

7/0583/12

2-7

SEPT. 21/55

S. YOUNG

7	8	9	10	11	12	13	14	15	16	17	18	19
	X ₁₁	X ₁₁	ITEM	2A		ITEM	L	t	r		CELL	n
									4/2			
	-9.25	19.7	1-2	10.4		1-2	4.5	112	262		n	424
	-224	343	2-3	11.9		2-3	5	112	291		n'	454
	-383	504	3-4	12.1		3-4	5	115	303		b	366
	-565	680	4-5	11.5		4-5	5	115	303		c	381
	-71.8	87	5-6	16.1		5-6	5	115	303		n	205
	-91.9	108	6-7	16.1		6-7	6.6	115	40.0			
	-114	133	7-8	17		7-8	6	159	377			
	-130.7	152	8-9	22.8		8-9	6	159	377		CELL	A
	-141.5	161.5	9-10	280		9-10	6	159	377		n	26.1
	-149	172	10-11	23.0		10-11	4	1090	444		n'	75.1
	-143.8	173	11-12	27.2		11-12	4.5	110	500		b	116.1
	-134.5	176	12-F	35.5	170-200 173-40	F-N-7	5.8	110	644			
							18.5	1051	363		c	132.9
						1-1	4.12	125	313			
						3-3	5.6	110	549		d	50.1
						7-7	6.56	102	644			
						10-10	6.08	1021	750			
						F-F	4.40	1072	612			

A. V. ROE CANADA LIMITED
MALTON - ONTARIO

TECHNICAL DEPARTMENT (Aircraft)

REPORT NO. 7/0583/17

SHEET NO. 2-8

AIRCRAFT:

C105

FIN

PREPARED BY

DATE

S. YOUNG

SEPT. 21/55

CHECKED BY

DATE

BAY 24-42

DETERMINE THE CELL TRANSFORMATION FACTORS.

F	10	7	3	1
a	a'	b	c	d

$$d = \frac{\lambda_{WEB}}{\lambda_{CELL}}$$

$$i.e. d_{a-a'} = \frac{\lambda_{F-P}}{\lambda_a}$$

$$d_{a'-a} = \frac{\lambda_{F-P}}{\lambda_{a'}}$$

$$d_{a-a'} = \frac{61.2}{424} = .1445$$

$$d_{a'-a} = \frac{61.2}{454} = .1345$$

$$d_{a'-b} = \frac{75.0}{454} = .165$$

$$d_{b-a'} = \frac{75.0}{366} = .205$$

$$d_{b-c} = \frac{64.4}{366} = .176$$

$$d_{c-b} = \frac{64.4}{381} = .169$$

$$d_{c-d} = \frac{54.9}{381} = .1442$$

$$d_{d-c} = \frac{54.9}{205} = .268$$

BAY 24-42

SLOPE & SWEEPBACK SHEAR

A. V. F

AIRCRAFT

WEIGHT

C. G. PC

	1	2	3	4	5	6	7	8	9	10	
ITEM	$\bar{Y}_{24}$	$\bar{Y}_{42}$	ΔY	P_{CAP} STA 24	P_i	X	$P \cdot X$				$X - Y$ 24 42
1	2.62	2.39	.13	22050	164	-3.5	-574				
2	2.71	2.57	.14	29250	228	-8	-1825				
3	2.85	2.74	.11	43800	268	-13	-3480				
4	2.96	2.94	.02	34000	38	-16	-625				
5	3.21	3.06	.15	35600	297	-23	-6840				
6	3.34	2.89	.45	43500	1088	-28	-30450				
7	3.38	3.18	.20	58500	650	-34.6	-22500				
8	3.41	3.17	.24	44300	591	-40.6	-23950				
9	3.35	3.08	.27	43500	653	-46.6	-30400				
10	3.21	2.87	.34	44700	849	-52.6	-44700				
11	3.11	2.54	.57	21850	692	-56.6	-39150				
12	2.84	(2.24)	.60	22900	764	-61.1	-46600				
F	2.27	2.12	.15	21550	180	-66.9	-1205				-4.2
Σ					+6462		-252,359				

A. V. ROE CANADA LIMITED
MALTON - ONTARIO

TECHNICAL DEPARTMENT (Aircraft)

REPORT NO. 7/0583/17

SHEET NO. 2-12

AIRCRAFT:

C105

FIN

PREPARED BY

DATE

S. YOUNG

SEPT 21/55

CHECKED BY

DATE

BAY 24-42

COMPUTE THE BENDING SHEAR FLOWS q_0 , THE
CORRECTIVE SHEAR q_s , & THE CORRECTIVE TORQUE
 A_t IN SIMILAR FASHION TO BAY 92-112.

ITEM AREAS ABOUT H.L.

F-N-F

$$2A = 2A_n - 2X_{F/F} \bar{Y} = 2 \times 26.1 - 2 \times 16.9 \times 2.20 \\ = 52.2 + 294.5 = 346.7 \text{ in}^2$$

1-1

$$2A = 2X_{F/F} \bar{Y} = 2 \times 3.5 \times 2.46 = 17.2 \text{ in}^2$$

3-3

$$2A = 2 \times 13.0 \times 2.80 = 72.9$$

7-7

$$2A = 2 \times 34.6 \times 3.28 = 227.$$

10-10

$$2A = 2 \times 52.6 \times 3.04 = 320.$$

F-F

$$2A = 2 \times 16.9 \times 2.20 = 294.5$$

A. V. ROE CANADA LIMITED

MALTON, ONTARIO

TECHNICAL DEPT. (AIRFRAME)

AIRCRAFT

WEIGHT

C. G. POSITION

REPORT NO.

SHEET

DATE

PREPARED BY

7/0583/17

2-13

SEPT. 21/55

J. YOUNG

8	9	10	11	12	13	14	15	16	17	18	19
		2A	2A ₂₀	Σ 2A ₂₀			SHEAR CORRECTION	TORQUE CORRECTION	9		
							7 ₂	7 ₁	(2+3+12)		
363	0	3467	0				151	334	183		
644	8500	355	4680				1047	864	-51		
50.0	70200	292	41000				1047	864	1221		
444	68900	23.0	35150				1047	864	1368		
37.7	80000	28.0	59400				2284	1545	1382		
37.7	92200	22.8	55700				2284	1545	1707		
31.7	103900	19.0	52300				2284	1545	2018		
40.0	124,000	16.1	50200				3191	1635	1562		
30.3	101,000	16.1	53700				3191	1635	1781		
30.3	103,300	11.5	39200				3191	1635	1853		
30.3	105000	12.1	41900				3191	1635	1909		
29.1	107300	11.9	43900				3640	1283	1336		
26.2	106000	704	43600	2x 52120			3640	1283	1467		
39.3	155000	17.2	-67900	-67900			3640	1283	1589		
54.9		72.9					444	352	801		
24.4	0	227					907	-90	817		
75.0	0	320					1207	-481	556		
1.2	0	294.5					88	-530	366		
				+974,500							

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

REPORT NO. 7/0583/17
SHEET NO. 2-14

AIRCRAFT:

C105

FIN

PREPARED BY

DATE

S. YOUNG

SEPT. 21/55

CHECKED BY

DATE

BAY 24-42

SHEAR LOAD ACTING AT SHEAR CENTRE

1ST APPROXIMATION $f'_s = \frac{\sum f_0 z}{\sum z}$

$$\sum_a f_0 z = 0$$

$$\sum_a' f_0 z = 2(8500 + 70200 + 68,900) = 295,200$$

$$\sum_b f_0 z = 2(80,000 + 92,210 + 103,800) = 552,000$$

$$\sum_c f_0 z = 2(124,800 + 101,000 + 103,300 + 105,000) = 868,200$$

$$\sum_d f_0 z = 2(107,300 + 100,000) + 155,000 = 570,600$$

$$\sum_a z = 424$$

$$\sum_c z = 381$$

$$\sum_a' z = 454$$

$$\sum_d z = 205$$

$$\sum_b z = 366$$

0 0 $f'_{s_a} = 0$

$$f'_{s_a'} = \frac{295,200}{454} = 650$$

$$f'_{s_b} = \frac{552,000}{366} = 1509$$

$$f'_{s_c} = \frac{868,200}{381} = 2280$$

$$f'_{s_d} = \frac{570,600}{205} = 2785$$

A. V. ROE CANADA LIMITED
MALTON - ONTARIO

TECHNICAL DEPARTMENT (Aircraft)

AIRCRAFT:

C105

FIN

REPORT NO.

7/0583/17

SHEET NO.

2-16

PREPARED BY

S. YOUNG

DATE

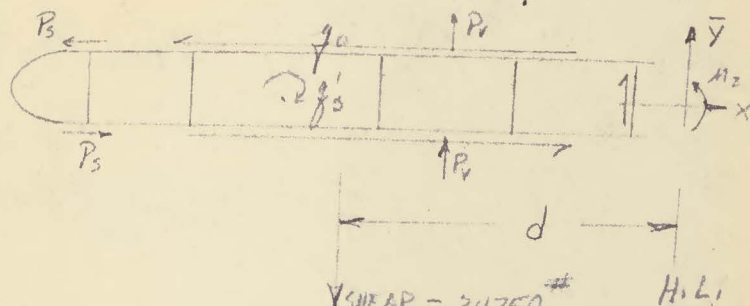
SEPT. 21/55

CHECKED BY

DATE

BAY 24-42

DETERMINE THE SHEAR CENTRE POSITION.



ABOUT H.L.

$$\Sigma M_z = +S.d + \Sigma 2Aq_0 + 2P_1.X + 2P_2.Y + \Sigma 2Aq'_0 = 0$$

$$34750 d + 974,560 - 504,718 + 22800 - 2 \times 26.1 \times 151 - 2 \times 75.1 \times 1047$$

$$- 2 \times 116.1 \times 2284 - 2 \times 132.9 \times 3191 - 2 \times 50.1 \times 3640 = 0$$

$$34750 d + 974,560 - 504,718 + 22,800 - 7880 - 157,000 - 528,000$$

$$- 841,000 - 371,000 = 0$$

$$d = \frac{1,412,278}{34750} = 407''$$

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

REPORT NO. 7/0583/17

SHEET NO. 2-17

AIRCRAFT:

C105

FIN

PREPARED BY

DATE

S. YOUNG

SEPT. 2/55

CHECKED BY

DATE

BAY 24-42

TORSIONAL SHEAR FLOW q'_T

1ST APPROX $q'_T = \frac{2A}{\Sigma L}$

$$q'_{Ta} = \frac{2 \times 26.1}{424} = .123$$

$$q'_{Tb} = \frac{2 \times 75.1}{454} = .331$$

$$q'_{Tc} = \frac{2 \times 116.1}{366} = .635$$

$$q'_{Td} = \frac{2 \times 132.9}{381} = .698$$

$$q'_{Te} = \frac{2 \times 50.1}{205} = .497$$

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

REPORT NO. 7/0583/17

SHEET NO. 2-19

AIRCRAFT:

C105

FIN

PREPARED BY

DATE

S. YOUNG

SEPT. 21/55

CHECKED BY

DATE

BAY 24-42

AT S.C.; $M_2 = +345000 - 34750 \times 40.7 = -1,067,000$ 11-#

FACTOR ON $q'_r = \frac{1067000}{627.4} = 1702$

$q'_{1a} = 1962 \times 1702 = 334$

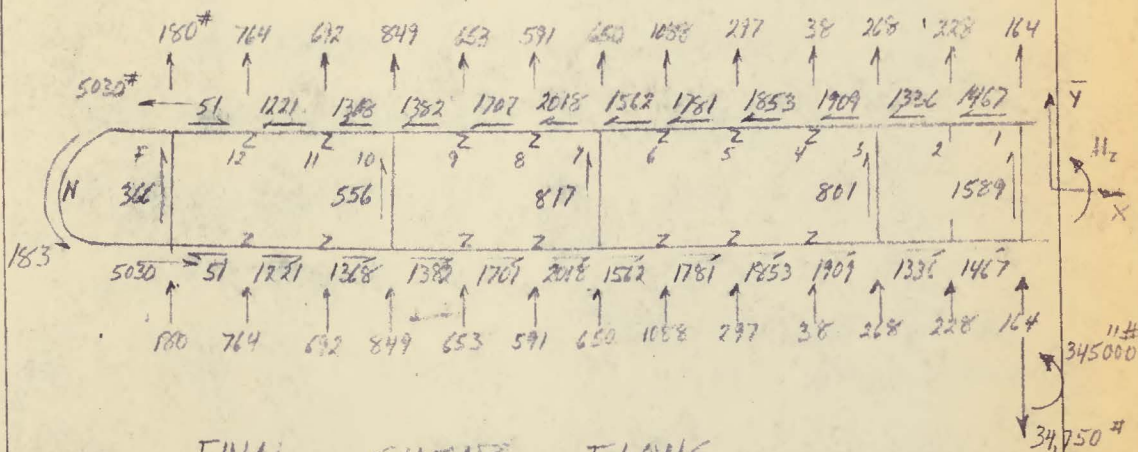
$q'_{1c} = 9596 \times 1702 = 1635$

$q'_{1a} = 5064 \times 1702 = 864$

$q'_{1d} = 754 \times 1702 = 1283$

$q'_{1b} = 2079 \times 1702 = 1545$

ADD THE BENDING SHEAR FLOW q_0 , CORRECTIVE SHEAR q'_c ,
AND CORRECTIVE TORQUE q'_t .



FINAL SHEAR FLOWS

BAY 24 - 42

C.P. AFT CASE

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

REPORT No. 7/0583/17

SHEET No. 2-20

AIRCRAFT:

C105

FIN

PREPARED BY

DATE

S. YOUNG

SEPT. 21/55

CHECKED BY

DATE

BAY 24-42

CHECK THE VERTICAL SHEAR BALANCE

$$\text{SKIN SHEAR} = 2(357) = +714$$

$$\text{WEB \& NOSE SHEAR} = 21,825$$

$$P_v \text{ SHEAR} = 12,924$$

$$+35463 \text{ REACTIVE SHEAR}$$

$$-34,750 \text{ APPLIED SHEAR}$$

CHECK THE H.L. TORQUE BALANCE

$$\text{SKIN TORQUE} = 2(310,640) = +621,280$$

$$\text{WEB \& NOSE TORQUE} = -493,150$$

$$P.X \text{ TORQUE} = -504,718$$

$$P.Y \text{ TORQUE} = +22,800$$

$$-353,788 \text{ REACTIVE TORQUE}$$

$$+345,000 \text{ APPLIED TORQUE}$$

BAY 24-42

SHEAR $\frac{1}{2}$ TORQUE BALANCE CHECK

A. V.

AIRCRAFT

WEIGHT

C. G.

	1	2	3	4	5	6	7	8	9	10
ITEM	MID BAY $\bar{Y}$	ITEM	$\Delta \bar{Y}$	$\bar{Y}$	SHEAR					
F	270	F-N-F	4.40	183	-805					
12	254	F-12	.34	-51	+17					
11	283	12-11	.29	1221	-354					
10	304	11-10	.21	1368	-287					
9	322	10-9	.18	1382	-247					
8	329	9-8	.07	1707	-119	$\frac{1}{2}$ SKIN SHEAR = +357				
7	328	8-7	-.01	2018	20	Σ WEB & NOSE SHEAR = +21825				
6	312	7-6	-.16	1562	250					
5	314	6-5	+02	1781	-36					
4	285	5-4	-.19	1853	352					
3	280	4-3	-.15	1909	286					
		3-2	-.16	1336	213					
2	264	2-1	-.18	1467	264					
1	246	1-1	4.92	1559	7800					
		3-3	560	801	4480					
		7-7	656	877	5360					
		10-10	608	556	3380					
		F-F	4.40	366	1610					

A. V. ROE CANADA LIMITED

MALTON, ONTARIO

TECHNICAL DEPT. (AIRFRAME)

REPORT NO.

7/0583/17

SHEET

2-21

DATE

SEPT 21/55

PREPARED BY

S. YOUNG

AIRCRAFT

C105

WEIGHT

C. G. POSITION

7	8	9	10	11	12	13	14	15	16	17	18	19
				ITEM	2A	7	2A7					
				F-N-F	346.7	183	63400					
				F-12	35.5	-51	-1810					
				12-11	292	1221	35700					
				11-10	73.0	1368	31450					
				10-9	28.0	1382	38700					
				9-8	22.8	1707	38900					
				8-7	19.0	2078	38300					
				7-6	16.1	1582	25150					
				6-5	16.1	1761	28700					
				5-4	11.5	1853	21300					
				4-3	12.1	1909	23100					
				3-2	11.9	1836	15900					
				2-1	10.4	1467	15250					
				1-1	17.2	1589	-21350					
				3-3	72.9	801	-58400					
				7-7	227	817	-185500					
				10-10	320	556	-177500					
				F-F	294.5	366	-107800					

IN SHEAR = +357

WEIGHT & SHEAR = +21825

1/2 SKIN. TORQUE = +310,640

WEB & NOSE TORQUE = -493,150

TECHNICAL DEPARTMENT (Aircraft)

REPORT NO. 7/0583/17

SHEET NO. 3-5

AIRCRAFT:

C105

FIN

PREPARED BY

DATE

S. YOUNG

SEPT. 19/55

CHECKED BY

DATE

BAY 42-67

DETERMINE MID-BAY SECTION PROPERTIES BY
AVERAGING STA 42 & 67 (SIMILAR TO BAY 12-112).

CELL AREAS

$$A_d = 2 \left[A_{1-2} + A_{2-3} - \frac{X_2 \bar{Y}_3}{2} + \frac{X_1 \bar{Y}_4}{2} \right]$$

$$= 2A_{1-2} + 2A_{2-3} - X_2 \bar{Y}_3 + X_1 \bar{Y}_4$$

$$= 970 + 111 + 130 \times 2.63 - 35 \times 2.29 = 47.0 \text{ in}^2$$

$$A_c = 2 \left[A_{3-4} + A_{4-5} + A_{5-6} + A_{6-7} - \frac{X_2 \bar{Y}_7}{2} + \frac{X_3 \bar{Y}_2}{2} \right]$$

$$= 107 + 121 + 15.4 + 15.5 + 34.6 \times 3.03 - 130 \times 2.63 = 124.3 \text{ in}^2$$

$$A_b = 2A_{7-8} + 2A_{8-9} + 2A_{9-10} - X_{11} \bar{Y}_{10} + X_7 \bar{Y}_7$$

$$= 18.9 + 23.3 + 30.0 + 526 \times 2.60 - 346 \times 3.03 = 103.9 \text{ in}^2$$

$$A_{a'} = 2A_{10-11} + 2A_{11-F} - X_F \bar{Y}_F + X_{10} \bar{Y}_{10}$$

$$= 28.1 + 28.3 + 61.8 \times 1.97 - 526 \times 2.60 = 41.7 \text{ in}^2$$

$$A_a = 24.8 \text{ in}^2$$

7/0583/3B

PG 1-7

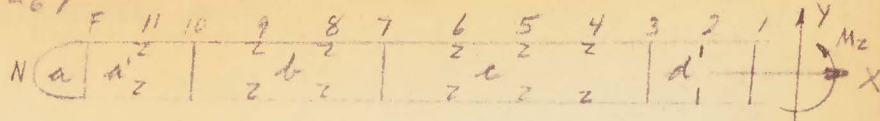
STA 42

$$A_a = 19.3$$

STA 67

$$\therefore A_a = 22.1 \text{ in}^2$$

BAY 42-67



$$2A = X_i X_{i+1} - X_{i+1} Y_i$$

A. V. R

AIRCRAFT

WEIGHT

C. G. PO

ITEM	1	2	3	4	5	6	7	8	9	10	
	STA	67	STA	42	MID	BAY					
	X	Y	X	Y	X	Y		$X_i \bar{Y}_{i+1}$	$-X_{i+1} Y_i$	ITEM	
1	-35	2.18	-35	239	-3.5	229		-845	1836	1-2	
2	-80	236	-80	257	-80	247		-210	221	2-3	
3	-130	251	-130	274	-130	263		-367	474	3-4	
4	-180	270	-180	294	-180	282		-528	649	4-5	
5	-230	280	-230	306	-230	293		-667	821	5-6	
6	-280	290	-280	289	-280	290		-848	1000	6-7	
7	-346	287	-346	318	-346	303		-104	1224	7-8	
8	-406	282	-406	317	-406	300		-1165	1398	8-9	
9	-466	266	-466	308	-466	287		-121	151	9-10	
10	-526	232	-526	287	-526	260		-1189	147	10-11	
11	(-566)	(1.97)	-566	254	-566	226		-1115	1398	11 F	
F	-588	182	-648	212	-618	197					
N	-661	0	-730	0	-696	0					
NOTE (X Y) FOR ITEM 11; STA 67											
ARE ASSUMED VALUES.											

A. V. ROE CANADA LIMITED

MALTON, ONTARIO

TECHNICAL DEPT. (AIRFRAME)

AIRCRAFT

C105

WEIGHT

C. G. POSITION

REPORT NO.

7/0582/17

SHEET

3-6

DATE

SEPT. 16/55

PREPARED BY

S. YOUNG

7	8	9	10	11	12	13	14	15	16	17	18	19
	$X_i \bar{Y}_{(i)}$	$-X_{i+1}$	ITEM	2A		ITEM	L	t	$\frac{r}{t}$		CELL	$\frac{r}{t}$
	-845	183	1-2	9.70		1-2	4.5	164	27.4		a	384.8
	-210	224	2-3	11.1		2-3	5.	164	30.5		a'	386.5
	-367	474	3-4	10.7		3-4	5.	157	31.8		L	353.8
	-528	647	4-5	12.1		4-5	5.	157	31.8		c	385.8
	-667	821	5-6	15.4		5-6	5.	157	31.8		d	203.9
	-848	100	6-7	15.5		6-7	6.6	157	42.0			
	-104	122	7-8	18.9		7-8	6.0	150	40.0			
	-116.5	139	8-9	23.3		8-9	6.0	150	40.0		CELL	A
	-121	151	9-10	30.0		9-10	6.0	150	40.0		a	22.1
	-118.9	147	10-11	28.1		10-11	4.0	1082	48.8		a'	41.7
	-111.5	139	11-F	28.3		11-F	4.5	1082	54.9		L	103.9
					1512-67 179-42	F-N-F	16.9	1051	33.2		c	124.3
						1-1	4.58	115	36.6			
						3-3	5.26	102	51.5		d	47.0
						7-7	6.06	102	59.5			
						10-10	5.20	1081	54.3			
						F-F	3.44	1072	54.8			

A. V. ROE CANADA LIMITED
MALTON - ONTARIO

TECHNICAL DEPARTMENT (Aircraft)

REPORT NO. 7/0583/17

SHEET NO. 3-9

AIRCRAFT:

C105

FIN

PREPARED BY

DATE

S. YOUNG

SEPT. 19/55

CHECKED BY

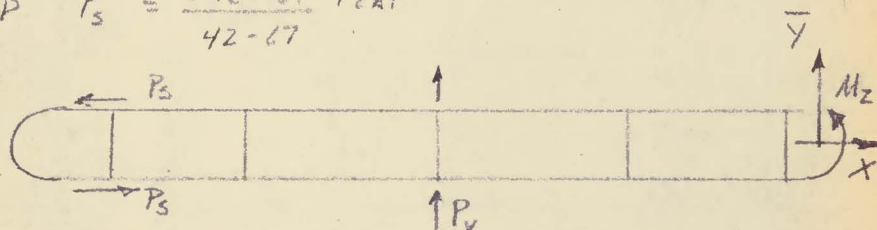
DATE

BAY 42-67

SLOPE & SWEEPBACK SHEARS

$$\text{SLOPE } P_v = \frac{\bar{Y}_{42} - \bar{Y}_{67}}{42-67} P_{CAP} = \frac{\Delta \bar{Y}}{-25} P_{CAP}$$

$$\text{SWEEP } P_s = \frac{X_{42} - X_{67}}{42-67} P_{CAP}$$



$$2 \text{ SKINS } \Sigma P_v = 2 \times 4688 = + 9376 \text{ \#}$$

$$2 \text{ SKINS } \Sigma P_v \cdot X = 2 \times -174620 = - 349,240 \text{ \# \text{in}}$$

$$\text{FRONT SPAR } \Sigma P_s \cdot \bar{Y} = 2 \times 9750 = + 19,500 \text{ \# \text{in}}$$

BAY 42-67

SLOPE & SWEEPBACK SHEAR

A. V. F.

AIRCRAFT

WEIGHT

C. G. PO

	1	2	3	4	5	6	7	8	9	10
ITEM	$\bar{Y}_{42}$	$\bar{Y}_{67}$	$\Delta \bar{Y}$	P_{CAP} \$7A42	P_v	X	$P_v X$			$X_{42} - X_{67}$
1	239	218	.21	20450	172	-3.5	-600			
2	257	236	.21	26900	226	-8.	-1810			
3	274	251	.23	39700	365	-13.	-4750			
4	294	270	.24	33000	317	-18.	-5700			
5	306	280	.26	34300	357	-23.	-8210			
6	289	290	0	39550	0	-28	-0			
7	318	287	.31	52000	645	-34.6	-22300			
8	3.17	282	.35	38700	542	-40.6	-22000			
9	3.08	266	.42	37650	633	-46.6	-29500			
10	287	232	.55	34650	763	-52.6	-40100			
11	254	(1.97)	.57	19200	438	-56.6	-24750			
F	212	182	.30	19180	230	-64.8	-14900			-60
Z					+4688		-174620			

MALTON, ONTARIO
TECHNICAL DEPT. (AIRFRAME)

REPORT NO. 7/0583/17

SHEET . . . 3-10

DATE . . . SEPT. 16/55

PREPARED BY - S. YOUNG

AIRCRAFT C-105

WEIGHT

C. G. POSITION -

[illegible]

A. V. ROE CANADA LIMITED
MALTON - ONTARIO

TECHNICAL DEPARTMENT (Aircraft)

AIRCRAFT:

C105

FIN

REPORT NO.

7/0583/17

SHEET NO.

3-11

PREPARED BY

S. YOUNG

DATE

SEPT. 19/55

CHECKED BY

DATE

BAY 42-67

COMPUTE THE BENDING SHEAR FLOWS,
CORRECTIVE SHEAR q_s FLOW & CORRECTIVE TORQUE
 q_t FLOW IN SIMILAR FASHION TO BAY 92-112

ITEM AREAS ABOUT H.L.

F-N-F

$$2A = 2A_s - 2X\bar{Y}$$

$$2 \times 221 - 2 \times 61.8 \times 1.97 = 442 + 2435 = 2877 \text{ in}^2$$

1-1

$$2A = 2X\bar{Y}$$

$$= 2 \times 3.5 \times 2.29 = 16.0$$

3-3

$$2A = 2 \times 13.0 \times 2.63 = 65.7$$

7-7

$$2A = 2 \times 34.6 \times 3.03 = 209.5$$

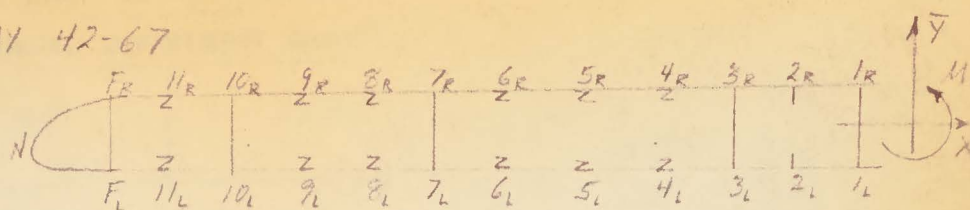
10-10

$$2A = 2 \times 52.6 \times 2.60 = 274.$$

F-F

$$2A = 2 \times 61.8 \times 1.97 = 243.5$$

BAY 42-67



A. V. ROE

M
TECH

AIRCRAFT

WEIGHT

C. G. POSITION

ITEM	1	2	3	4	5	6	7	8	9	10	11
	P_{42}	$-P_{67}$	$P_{42}-P_{67}$	$\frac{P_{42}-P_{67}}{42-67}$		ITEM	q_0	q_1	q_2	$2A$	$2A^2$
			ΔP	$\Delta P / -25$							
1 _R	20450	-10470	3960	-158		F-N-F _R	0	332	0	2877	0
2 _R	26920	-21850	5090	-202		F _R -11 _R	262	54.9	14330	28.3	7420
3 _R	39700	-32000	7700	-308		11-10 _R	1030	48.8	50300	28.1	28950
4 _R	33070	-25450	7550	-302		10 _R -9 _R	1366	40.0	54600	30.0	40900
5 _R	34300	-26500	7800	-312		9 _R -8 _R	1746	40.0	69700	23.3	40700
6 _R	37550	-31150	8400	-336		8 _R -7 _R	2096	40.0	83800	18.9	39600
7 _R	52000	-40900	11100	-444		7 _R -6 _R	2540	42.0	106700	15.5	39400
8 _R	38700	-29950	8750	-350		6 _R -5 _R	2876	31.8	91400	15.4	44300
9 _R	34650	-28150	9500	-380		5 _R -4 _R	3188	31.8	101900	12.1	38600
10 _R	34650	-26250	8400	-336		4 _R -3 _R	3490	31.8	111000	8.7	37400
11 _R	19200	-0	19200	-768		3 _R -2 _R	3798	30.5	115400	11.1	4720
F _R	19180	-12520	6660	-262		2 _R -1 _R	4000	27.4	109600	9.7	3680
						1 _R -1 _R	4158	36.6	152300	16.0	-6500
						3 _L -3 _R	0	51.5	0	15.7	0
						7 _L -7 _R	0	59.5	0	209.5	0
						10 _L -10 _R	0	54.3	0	274	0
						F _L -F _R	0	54.8	0	243.5	0

A. V. ROE CANADA LIMITED

MALTON, ONTARIO

TECHNICAL DEPT. (AIRFRAME)

AIRCRAFT

C105

WEIGHT

C. G. POSITION

REPORT NO.

7/0583/17

SHEET

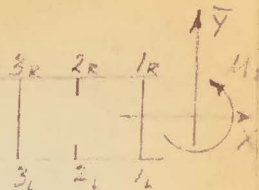
3-12

DATE

SEPT. 19/55

PREPARED BY

S. YOUNG



7	8	9	10	11	12	13	14	15	16	17	18	19
90	12	19	2A	2A ₂	Σ 2A ₂			SHEAR CORRECTION	TORQUE CORRECTION	9 ⑦ ⑩ ⑪		
0	332	0	2877	0				104	302	198		
262	549	1430	283	7420				-730	744	276		
1030	488	5020	281	28950				720	744	1044		
1366	400	54000	300	40900				-1773	1315	971		
1746	400	69000	233	40700				-1773	1378	1351		
2096	400	83800	189	39600				-1773	1354	1701		
2540	420	106700	155	39400				-2896	1482	1126		
2876	318	91400	154	44300				-2896	1462	1462		
3188	318	101400	121	38600				-2896	1482	1774		
3490	318	111000	87	37400				-2896	1462	2076		
3792	305	115400	111	42200				-3690	1170	1278		
4000	274	109400	97	38800	2x 131820			-3690	1170	1480		
4158	366	152400	110	-65010	-65000			-3690	1170	1638		
0	515	0	157	0				+794	312	1106		
0	535	0	2075	0				+1123	-104	1019		
0	543	0	274	0				+1043	-634	409		
0	548	0	2435	0	731540			+676	-442	184		

TECHNICAL DEPARTMENT (Aircraft)

REPORT NO. 7/0583/17

SHEET NO. 3-13

AIRCRAFT:

C105

FIN

PREPARED BY

DATE

S. YOUNG

SEPT. 19/55

CHECKED BY

DATE

BAY 42-67

SHEAR LOAD ACTING AT SHEAR CENTRE

1ST APPROXIMATION $f'_s = \frac{\sum q_0 r}{\sum r}$

$\sum q_0 r = 0$

$\sum_a q_0 r = 2(14380 + 50300) = 129,360$

$\sum_b q_0 r = 2(54600 + 69700 + 83800) = 416,200$

$\sum_c q_0 r = 2(106,700 + 91400 + 101,500 + 111,000) = 821,200$

$\sum_d q_0 r = 2(115,900 + 109600) + 152,200 = 603,200$

$\sum_a r = 386.8$

$\sum_c r = 385.8$

$\sum_a r = 316.5$

$\sum_d r = 203.9$

$\sum_b r = 353.8$

$\sum q'_s = 0$

$f'_{sa} = \frac{129360}{316.5} = 408$

$f'_{sb} = \frac{416200}{353.8} = 1175$

$f'_{sc} = \frac{821200}{385.8} = 2130$

$f'_{sd} = \frac{603200}{203.9} = 2960$

TECHNICAL DEPARTMENT (Aircraft)

AIRCRAFT:

C105

FIN

REPORT NO.

7/0583/17

SHEET NO.

3-15

PREPARED BY

S. YOUNG

DATE

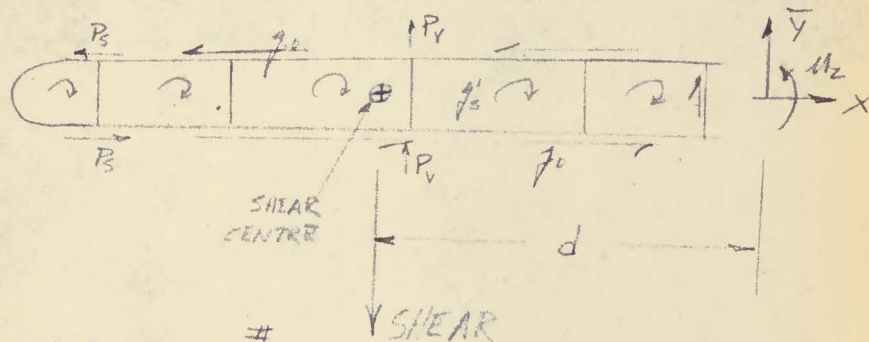
SEPT. 11/55

CHECKED BY

DATE

BAY 47-67

DETERMINE THE SHEAR CENTRE POSITION.



BAY SHEAR = 30750

$$\sum M_z \text{ AT H.L.} = S \cdot d + \sum 2Aq_0 + \sum P_v \bar{x} + \sum P_s \bar{y} + \sum 2Aq_s = 0$$

$$+ 30750d + 731,540 - 349,240 + 19500 - 2 \times 22.1 \times 104 - 2 \times 41.7 \times 730$$

$$- 2 \times 103.7 \times 1773 - 2 \times 1243 \times 2896 - 2 \times 470 \times 3690 = 0$$

$$30750d + 731,540 - 349,240 + 19,500 - 4,600 - 60,900 - 368,500$$

$$- 720,000 - 347,000 = 0$$

$$d = \frac{1099200}{30750} = 35.75''$$

TECHNICAL DEPARTMENT (Aircraft)

REPORT NO. 7/0583/117

SHEET NO. 3-18

AIRCRAFT:

C/05

FIN

PREPARED BY

DATE

S. YOUNG

SEPT. 19/55

CHECKED BY

DATE

BAY 42-67

AT S.C., $M_z = +258,000 - 30750 \times 3575 = -841,000$ " #

FACTOR ON UNIT TORQUES, q'_t

$$\frac{841000}{487.2} = 1737$$

$$q'_{1a} = .1751 \times 1737 = 302$$

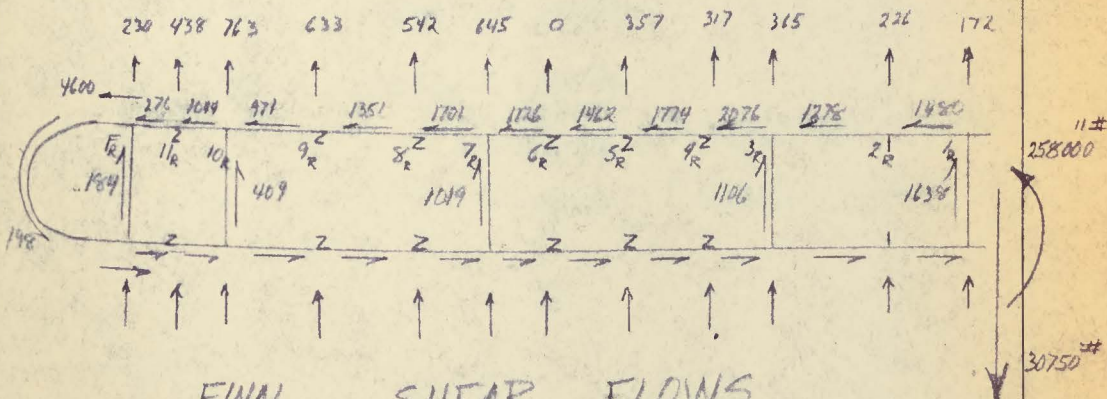
$$q'_{1c} = .8587 \times 1737 = 1482$$

$$q'_{1a} = .4309 \times 1737 = 744$$

$$q'_{1d} = .6775 \times 1737 = 1170$$

$$q'_{1b} = .7979 \times 1737 = 1378$$

ADD THE ASSUMED BENDING SHEAR FLOW q_0 , CORRECTIVE SHEAR q'_2 , AND CORRECTIVE TORQUE q'_t .



FINAL SHEAR FLOWS

BAY 42-67

C.P. AFT CASE

TECHNICAL DEPARTMENT (Aircraft)

REPORT NO. 7/0583/17

SHEET NO. 3-19

AIRCRAFT:

C105

FIN

PREPARED BY

DATE

S. YOUNG

SEPT. 19/55.

CHECKED BY

DATE

BAY 42-67

CHECK THE VERTICAL SHEAR BALANCE.

SKIN	SHEAR = 2(237)	= +474	
WEB & NOSE	SHEAR "	21565	
P _v	SHEAR =	<u>9376</u>	
		+31415 [#]	REACTIVE SHEAR
		-30750 [#]	APPLIED SHEAR

CHECK H.L. TORQUE BALANCE

SKIN	TORQUE = +484,340	
WEB & NOSE	TORQUE = -412,400	
P _v	TORQUE = -349,240	
P _s	TORQUE = +19500	
	<u>-257800</u> ^{"#}	REACTIVE TORQUE
	+258000 ^{"#}	APPLIED TORQUE

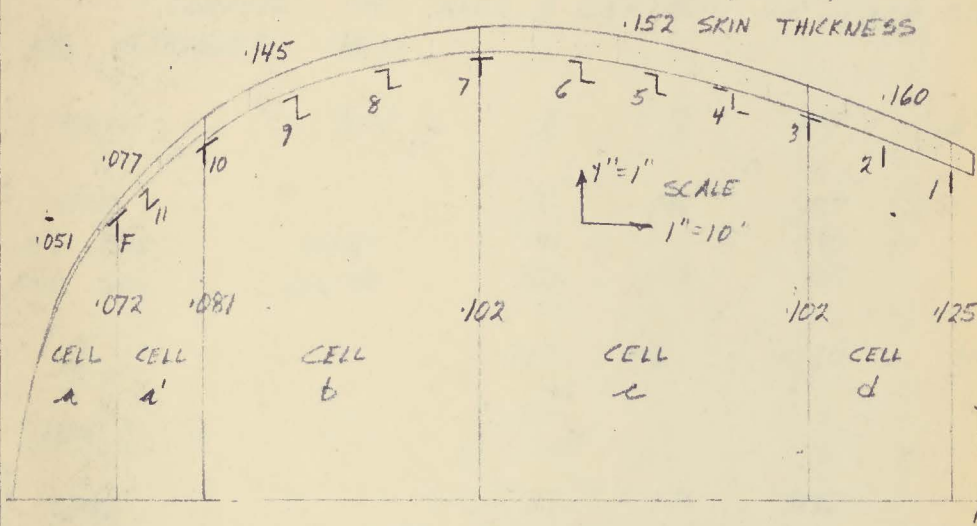
AIRCRAFT:

C105

FIN

STA 67 SECTION PROPERTIES

7/0583/3B 1-8



NOTE: THERE IS AN ACCESS DOOR BETWEEN SPARS 3 & 5 WHICH IS CONSIDERED AS A FULLY EFFECTIVE STRESS CARRYING DOOR. HENCE ASSUME SPAR 4 IS CONTINUOUS. SPAR 11 STARTS AT STA 67 & HENCE WILL HAVE ZERO CAP LOAD.

ITEM SPARCAP A CAPY X

1	117	160	-3.5
2	117	176	-8.0
3	140	230	-13.0
4	137	225	-18.0
5	137	235	-23.0
6	137	253	-28.0
7	144	266	-34.6
8	135	238	-40.6
9	135	221	-46.6
10	140	211	-52.6
F	264	161	-58.8
N		0	-66.1

A. V. ROE CANADA LIMITED

MALTON, ONTARIO

TECHNICAL DEPT. (AIRFRAME)

AIRCRAFT

WEIGHT

G. POSITION

REPORT NO.

SHEET

DATE

PREPARED BY

7/0583/17

4-5

SEPT. 15/55

S. YOUNG

6	7	8	9	10	11	12	13	14	15	16	17	18	19
AY													
Y		X ₁ Y ₁	-X ₁ Y ₁	ITEM	2A		ITEM	L	t	1/2		CELL	1/2
07		-7.9	16.6	1-2	8.7		1-2	4.5	.152	.296		a	342
25		-19.2	29.4	2-3	10.0		2-3	5.0	.152	.32.9		a'	178.5
40		-33.4	43.1	3-4	9.8		3-4	5.0	.144	.34.7		L	364.4
57		-47.9	59.1	4-5	11.3		4-5	5.0	.144	.34.7		c	378.8
66		-63.0	74.5	5-6	11.5		5-6	5.0	.144	.34.7		d	205.1
74		-74.3	94.8	6-7	20.5		6-7	6.0	.144	.45.8			
85		-90.4	107.8	7-8	17.4		7-8	6.0	.137	.43.8			
91		-97.0	121.8	8-9	24.8		8-9	6.0	.137	.43.8		CELL	AREA
99		-93.7	125.6	9-10	32.1		9-10	6.0	.137	.43.8		a	17.8
101		-91.5	112.1	10-F	20.5		10-F	3.1	.077	.40.3		a'	11.9
104						14.0-92 15.8-67	F-N-F	14.9	.051	.294		L	88.1
							1-1	4.14	.125	.33.1		c	113.6
							3-3	4.80	.102	.47.0		d	42.6
							7-7	5.30	.102	.52.0			
							10-10	4.02	.081	.49.6			
							F-F	3.48	.072	.48.3			

A. V. ROE CANADA LIMITED
MALTON - ONTARIO

TECHNICAL DEPARTMENT (Aircraft)

REPORT No. 7/0583/17

SHEET No. 4-6

AIRCRAFT:

C105

FIN

PREPARED BY

DATE

S. YOUNG

SEPT 15/55

CHECKED BY

DATE

BAY 67-92

DETERMINE MID-BAY SECTION PROPERTIES BY
AVERAGING, STA 67 & 92 (SIMILAR TO BAY 92-112).

CELL AREAS:

$$\begin{aligned} A_d &= 2 \left[A_{1-2} + A_{2-3} - \frac{1}{2} X_3 \bar{Y}_3 + \frac{1}{2} X_1 \bar{Y}_1 \right] \\ &= 2A_{1-2} + 2A_{2-3} - X_3 \bar{Y}_3 + X_1 \bar{Y}_1 \\ &= 8.7 + 10.0 + 13.0 \times 2.40 - 3.5 \times 2.07 = 42.6 \text{ sq"} \end{aligned}$$

$$\begin{aligned} A_e &= 2A_{3-4} + 2A_{4-5} + 2A_{5-6} + 2A_{6-7} - X_7 \bar{Y}_7 + X_3 \bar{Y}_3 \\ &= 9.8 + 11.3 + 11.5 + 20.5 + 34.6 \times 2.65 - 13.0 \times 2.40 = 113.6 \text{ sq"} \end{aligned}$$

$$\begin{aligned} A_b &= 2A_{7-8} + 2A_{8-9} + 2A_{9-10} - X_{10} \bar{Y}_{10} + X_7 \bar{Y}_7 \\ &= 17.4 + 24.8 + 32.1 + 52.6 \times 2.01 - 34.6 \times 2.65 = 88.1 \text{ sq"} \end{aligned}$$

$$\begin{aligned} A_{a'} &= 2A_{11-F} - X_F \bar{Y}_F + X_{10} \bar{Y}_{10} \\ &= 20.5 + 55.7 \times 1.74 - 52.6 \times 2.01 = 11.9 \text{ sq"} \end{aligned}$$

$$A_a \text{ STA 67} = 19.3 \text{ sq"} \quad 7/0583/3B \quad 1.9$$

$$A_a \text{ STA 92} = 16.2 \text{ sq"} \quad 1.9$$

$$A_a = 17.8 \text{ sq"} \quad 1.9$$

BAY 67-92

SLOPE & SWEEPBACK SHEAR

A. V. F.

AIRCRAFT

WEIGHT

C. G. P.

ITEM	1	2	3	4	5	6	7	8	9	10	
	$\bar{Y}_{67}$	$\bar{Y}_{92}$	$\Delta \bar{Y}$	P_{CAP} STA 67	P_v STA 67	X	$P_v \cdot X$				$X_{67} - X_{92}$
1	2.18	1.95	.23	16490	152	-3.5	-533				
2	2.36	2.14	.22	21850	193	-8.0	-1545				
3	2.51	2.28	.23	32090	295	-13.0	-3840				
4	2.70	2.44	.26	25450	265	-18.0	-4780				
5	2.80	2.52	.28	26500	297	-23.0	-6840				
6	2.90	2.57	.33	31150	411	-28.0	-11520				
7	2.87	2.42	.45	40900	736	-34.6	-25500				
8	2.82	2.39	.43	29950	515	-40.6	-20800				
9	2.66	2.11	.55	20150	619	-46.6	-28900				
10	2.32	1.70	.62	26250	652	-52.6	-34300				
F	1.82	1.65	.17	12520	85	-58.8	-5010				-6.2
Σ					+4220		-74360				

A. V. ROE CANADA LIMITED

MALTON, ONTARIO

TECHNICAL DEPT. (AIRFRAME)

AIRCRAFT

C105

WEIGHT

C. G. POSITION

REPORT NO.

7/0583/17

SHEET

4-12

DATE

SEPT. 15/55

PREPARED BY

S. YOUNG

6	7	8	9	10	11	12	13	14	15	16	17	18	19
EM	9.	12	1	2A	2Ag	22Ag			SHEAR CORRECTION	TOTAL CORRECTION	FINAL SECTION		
									f _s	f _t	②+③+④		
1-F _R	0	294	0	296	0				-42	264	+222		
10 _R	-115	403	-460	205	-2360				-367	603	+181		
9 _R	935	438	4100	321	30000				-1755	1088	+768		
8 _R	1265	438	5500	248	31400				-1255	1088	1098		
7 _R	1565	438	6200	174	27200				-1255	1088	1398		
6 _R	1931	458	8850	205	39600				-2167	1235	999		
5 _R	2193	347	7270	115	25300				-2167	1235	1261		
4 _R	2319	347	8320	113	27150				-2167	1235	1467		
3 _R	2593	347	9000	98	25400				-2167	1235	1661		
2 _R	2835	329	9330	100	28350				-2167	998	1047		
1 _R	3004	296	8100	87	26150	2(25810)			-2167	998	1216		
1 _R	3136	331	10390	145	45500	-44500			-2796	998	1348		
3 _R	0	470	0	625	0				619	237	856		
7 _R	0	520	0	1835	0				912	-147	765		
10 _R	0	496	0	211	0				948	-485	463		
F _R	0	483	0	194	0	471880			265	-239	-74		

A. V. ROE CANADA LIMITED
MALTON - ONTARIO

TECHNICAL DEPARTMENT (Aircraft)

AIRCRAFT:

C105

FIN

REPORT NO.

7/0583/17

SHEET NO.

4-13

PREPARED BY

DATE

S. YOUNG

SEPT. 15/55

CHECKED BY

DATE

BAY 67-92

SHEAR LOAD ACTING AT SHEAR CENTRE

1ST APPROXIMATION $f'_0 = \frac{\sum f_0 r}{\sum r}$

$\sum_a r = 342$

$\sum_{a'} r = 178.5$

$\sum_b r = 364.4$

$\sum_c r = 398.8$

$\sum_d r = 205.1$

$\sum_a f_0 r = 0$

$\sum_{a'} f_0 r = 2(-4630) = -9260$

$\sum_b f_0 r = 2(41000 + 55400 + 68500) = 329,800$

$\sum_c f_0 r = 2(88500 + 72700 + 83200 + 90000) = (334,400)2 = 668,800$

$\sum_d f_0 r = 2(93300 + 89000) + 103900 = 468,500$

$f'_a = 0$

$f'_c = \frac{668800}{398.8} = +1678$

$f'_{a'} = \frac{-9260}{178.5} = -52$

$f'_d = \frac{468500}{205.1} = 2290$

$f'_b = \frac{329800}{364.4} = +905$

A. V. ROE CANADA LIMITED
MALTON - ONTARIO

TECHNICAL DEPARTMENT (Aircraft)

REPORT No. 7/0583/17

SHEET No. 4-14

AIRCRAFT:

C105

FIN

PREPARED BY

DATE

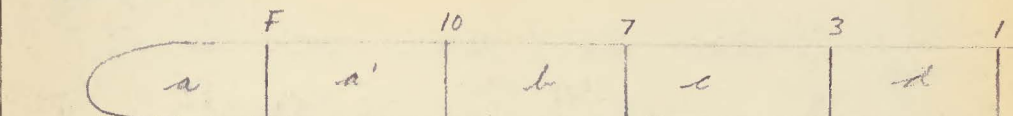
S. YOUNG

SEPT. 15/55

CHECKED BY

DATE

BAY 67-92



d	.141	.2705	.278	.136	.1428	.1302	.1169	.229
d TRANSPOSE	.2705	.141	.136	.278	.1302	.1428	.229	.1169

f'_s 1 ST APPROX	0	-52	+905	+1678	+2290
2 ND "	-7.3	0	-1.1	2296	384
3 RD "	35.4	-1.0	61.8	34.2	55.0
4 TH "	84.1	9.6	24.8	8.1	10.5
f'_s	36.5	293.2	1235.3	2159.0	2779.0

1 ST ITERATION	41.4	9.8	343.5	39.8	308
f'_s 1 ST APPROX	0	-52	905	1678	2290
f'_s	41.4	301.3	1252.8	2163.5	2785

2 ND ITERATION	42.4	11.2	348	40.9	309
f'_s 1 ST APPROX	0	-52	905	1678	2290
f'_s	42.4	307.2	1254.9	2166.5	2786

BY INSPECTION, THE f'_s VALUES MUST BE NEGATIVE TO BALANCE THE SECTION.

$$f'_{a'} = -42$$

$$f'_{s_2} = -2167$$

$$f'_{s_1} = -307$$

$$f'_{s_1} = -2786$$

$$f'_{s_2} = -1255$$

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

REPORT NO. 7/0583/17

SHEET NO. 4-15

AIRCRAFT:

C105

FIN

PREPARED BY

DATE

S. YOUNG

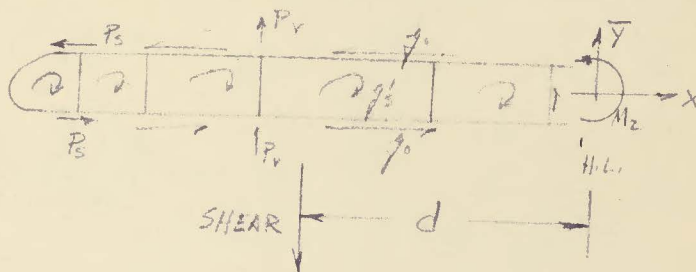
SEPT 14/55

CHECKED BY

DATE

BAY 67-92

DETERMINE THE SHEAR CENTRE POSITION



$$\sum M_z \text{ AT H.L.} = +S \cdot d + \sum 2A_p y_0 + \sum P_v \cdot X + \sum P_s \cdot Y + \sum 2A_p y'_s = 0$$

BAY SHEAR = 22000 #

$$22000 d + 471,880 - 287,320 + 11,320 - 2,178 \times 42 - 2,119 \times 307 \\ - 2 \times 281 \times 1255 - 2 \times 113.6 \times 2167 - 2 \times 426 \times 2786 = 0$$

$$22000 d + 471,880 - 287,320 + 11,320 - 1,495 - 7310 - 221,000 \\ - 492,000 - 237000 = 0$$

$$d = \frac{762,925}{22000} = 34.7''$$

A. V. ROE CANADA LIMITED
MALTON - ONTARIO

TECHNICAL DEPARTMENT (Aircraft)

AIRCRAFT:

C105

FIN

REPORT NO. 7/0583/17

SHEET NO. 4-18

PREPARED BY

DATE

S. YOUNG

SEPT. 16/55

CHECKED BY

DATE

BAY 67-92

$$M_z = -186,000 - 22,000 \times 34.7$$

$$= -577,000 \quad \text{TORQUE AT SHEAR CENTRE}$$

$$\text{RATIO ON } q'_T = \frac{577,000}{336.1} = 1718$$

$$q'_{Ta} = 1534 \times 1718 = 264$$

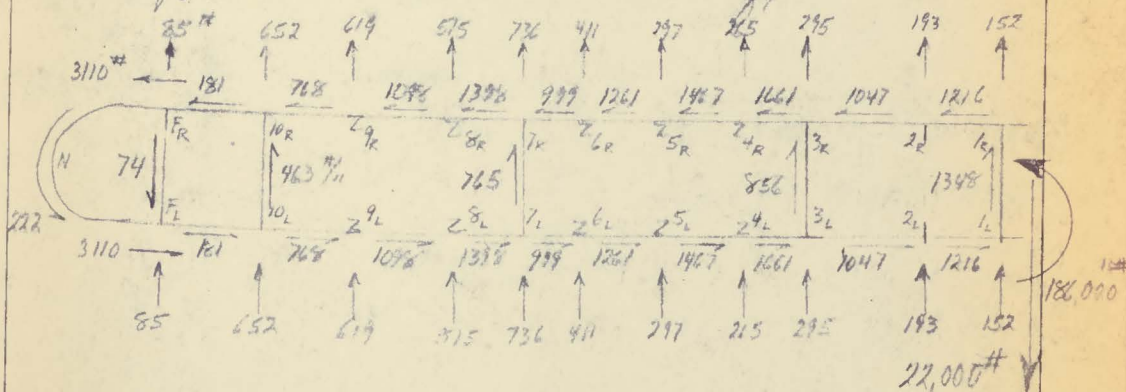
$$q'_{Tc} = 7194 \times 1718 = 1235$$

$$q'_{Ta'} = 3509 \times 1718 = 603$$

$$q'_{Td} = 5808 \times 1718 = 998$$

$$q'_{Tb} = 6342 \times 1718 = 1088$$

ADD THE ASSUMED BENDING SHEAR FLOW q_c , CORRECTIVE SHEAR q'_s , AND CORRECTIVE TORQUE q'_t .



FINAL SHEAR FLOWS

BAY 67-92

C.P. AFT CASE

BAY 67-92

SHEAR & TORQUE BALANCE CHECK

A. V. ROE

TECH

AIRCRAFT

WEIGHT

C. G. POSITIO

ITEM	1	2	3	4	5	6	7	8	9	10	11	
	MID BAY $\bar{Y}$	ITEM	$\Delta \bar{Y}$	$\bar{Z}$	SHEAR					ITEM	2A	
F	174	F-N-F	3.48	222	-773					F-N-F	229.6	
10	201	F-10	.27	181	-49					F-10	20.5	
9	234	10-9	.38	768	-292					10-9	32.1	
8	261	9-8	.22	1098	-241					9-8	24.8	
7	265	8-7	.04	1398	-56	$\sqrt{2}$ SKIN	SHEAR = +164*				8-7	17.4
6	274	7-6	.09	999	-89	Σ WEB NOSE	SHEAR = +14580*				7-6	20.5
5	266	6-5	-.08	1261	101					6-5	11.5	
4	257	5-4	-.09	1467	132					5-4	11.3	
3	240	4-3	-.17	1661	732					4-3	9.8	
2	225	3-2	-.15	1047	157					3-2	10.0	
1	207	2-1	-.18	1216	219					2-1	8.7	
		1-1	4.14	1348	5580					1-1	14.5	
		3-3	4.80	856	4110					3-3	62.5	
		7-7	5.30	765	4060					7-7	183.5	
		10-10	4.02	463	1860					10-10	211	
		F-F	3.48	-74	-257					F-F	194	

A. V. ROE CANADA LIMITED

MALTON, ONTARIO

TECHNICAL DEPT. (AIRFRAME)

AIRCRAFT

WEIGHT

C. G. POSITION

REPORT NO.

SHEET

DATE

PREPARED BY

7/0583/17

4-20

SEPT. 16/55

S. YOUNG

	7	8	9	10	11	12	13	14	15	16	17	18	19
				ITEM	2A	f	2A9						
				F-N-F	229.6	222	51000						
				F-10	20.5	181	3710						
				10-9	32.1	768	24700						
				9-8	24.8	1098	27200						
SKIN SHEAR = +164 *				8-7	17.4	1398	24300	1/2 SKIN TORQUE = +168,740					
WEL & NOSE SHEAR = +14520 *				7-6	20.5	799	20500	2 WEL & NOSE TORQUE = -245,900					
				6-5	11.5	1261	14500						
				5-4	11.3	1467	16550						
				4-3	9.8	1161	16280						
				3-2	10.0	1047	10470						
				2-1	8.7	1216	10580						
				1-1	14.5	1348	19550						
				3-3	62.5	856	-53500						
				7-7	183.5	765	-140500						
				10-10	211	463	-97700						
				F-F	174	-74	+14350						

TECHNICAL DEPARTMENT (Aircraft)

REPORT NO. 710583/17

SHEET NO. 5-1

DATE _____

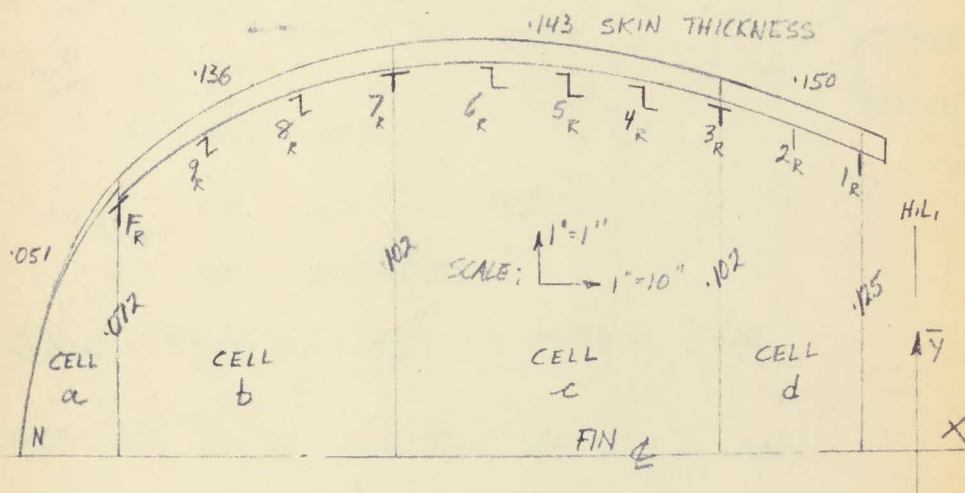
SEPT. 13/55

DATE 7/1/54

C105

FIN

FIN STA 9225 SECTION PROPERTIES ARE GIVEN
IN REPORT 7/0583/14, SECTION 2. ALL REFERENCES
TO A, Y, X, ETC. ARE FROM THAT REPORT.



THE LOADING CURVES ARE GIVEN IN REPORT
7/0583/3B, PG 3-14, FOR FIN C.P. AFT CASE AND
INCLUDES FIN-RUDDER INDUCED HINGE LOADS.

ULTIMATE SHEAR OUTL'D 92 = 18250 #

SHEAR IND'D 72 = 22 000 #

B. M. = 975,000 ¹¹ ~~11~~

H.L. TORQUE CUTS D 92 = 150,000 "H"

H.L. TORQUE INBD 92 = 186,000 " #

A. V. ROE CANADA LIMITED
MALTON - ONTARIO

TECHNICAL DEPARTMENT (Aircraft)

AIRCRAFT:

C105

FIN

REPORT NO.

7/0583/17

SHEET NO.

5-2

PREPARED BY

DATE

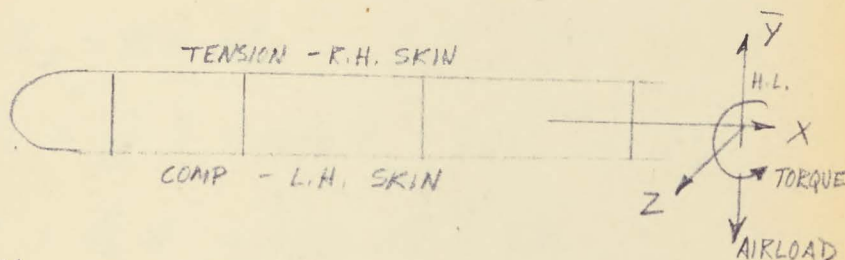
S. YOUNG

SEPT. 13/55

CHECKED BY

DATE

NOTATION:



X +VE AFT

Y +VE L.H. TO R.H.

Z +VE OUTBOARD

X, Y, Z RELATED BY R.H. SCREW RULE.

LOADS +VE IF IN DIRECTION OF X, Y, Z AXES.

MOMENTS +VE IF R.H. SCREW RULE GIVES PROGRESSION
IN X, Y, Z AXES.

NOTE: CAP STRESSES ARE +ve $\frac{1}{2}$ -ve FOR TENSION
& COMP.

CAP LOADS ARE +VE IN DIRECTION OF
X, Y, Z AXES.

SKIN SHEAR FLOWS WHICH PRODUCE $+M_x$ ABOUT H.L. ARE +VE,
WEB SHEAR FLOWS WHICH ACT IN $+Y$ DIRECTION ARE +VE.

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

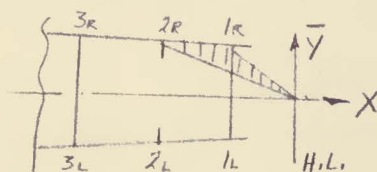
REPORT NO. 7/0583/17
SHEET NO. 5-8

AIRCRAFT: <u>C105</u>	<u>FIN</u>	PREPARED BY <u>S. YOUNG</u>	DATE <u>SEPT. 13/55</u>
		CHECKED BY	DATE

BAY 92-112

DETERMINE MID-BAY PROPERTIES BY AVERAGING THE X, Y VALUES AT STA'S 92-112.

CALCULATE THE SKIN AREA BETWEEN ITEMS ABOUT THE HINGE LINE



$$A_{1-2} = X_1 \bar{Y}_2 - X_2 \bar{Y}_1$$

CELL AREA CALCULATIONS

$$A_d = 2 \left[A_{1-2} + A_{2-3} - \frac{1}{2} X_3 \bar{Y}_3 + \frac{1}{2} X_1 \bar{Y}_1 \right]$$

$$= 2A_{1-2} + 2A_{2-3} - X_3 \bar{Y}_3 + X_1 \bar{Y}_1$$

$$= 7.8 + 9.3 + 13.0 \times 2.2 - 3.5 \times 18.8 = \underline{39.1} \text{ } \square''$$

$$A_c = 2A_{3-4} + 2A_{4-5} + 2A_{5-6} + 2A_{6-7} - X_7 \bar{Y}_7 + X_3 \bar{Y}_3 \quad \square''$$

$$= 9.3 + 10.0 + 11.5 + 20.0 + 34.6 \times 2.31 - 13.0 \times 2.20 = 102.2$$

$$A_b = 2A_{7-8} + 2A_{8-9} + 2A_{9-F} - X_F \bar{Y}_F + X_7 \bar{Y}_7 \quad \square''$$

$$= 18.0 + 24.2 + 22.6 + 49.8 \times 1.57 - 34.6 \times 2.31 = \underline{63.1}$$

STA 112 $A_a = 14.0$

PG

STA 92 $A_a = 16.2$

PG 1-11

7/0583/3B

$A_a = 15.1 \text{ } \square''$

A. V. ROE CANADA LIMITED
MALTON - ONTARIO

TECHNICAL DEPARTMENT (Aircraft)

REPORT NO.

7/0583/17

SHEET NO.

5-9

AIRCRAFT:

C105

FIN

PREPARED BY

DATE

S. YOUNG

SEPT. 13/55

CHECKED BY

DATE

BAY 92-112

CALCULATE LENGTH TO THICKNESS RATIO FOR SKIN

& WEB ELEMENTS.

$$r = \frac{L}{t}$$

$$\text{SKIN } L = |X_i - X_{i+1}|$$

$$\text{WEB } L = 2t_i$$

NOTE NOSE F-N-FR = 13.0 " STA 112

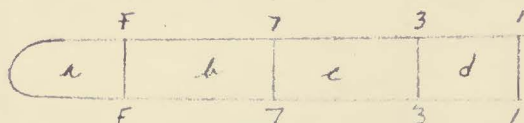
PG 1-13 7/0583/38

$$\frac{14.0}{13.5} \text{ " AVGIE}$$

STA 92

PG 1-11

DETERMINE CELL "r" VALUES.



DETERMINE THE DISTRIBUTION FACTORS.

$$d_{a-b} = \frac{r_{F-F}}{r_a} = \frac{45.8}{319.8} = .1435$$

$$d_{b-a} = \frac{r_{F-F}}{r_b} = \frac{45.8}{358.5} = .1278$$

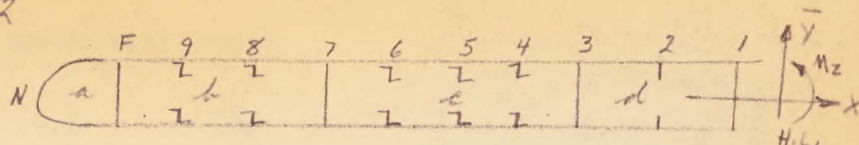
$$d_{b-c} = \frac{r_{7-7}}{r_b} = \frac{47.5}{358.5} = .1325$$

$$d_{c-b} = \frac{r_{7-7}}{r_c} = \frac{47.5}{394.6} = .1205$$

$$d_{c-d} = \frac{r_{3-3}}{r_c} = \frac{44.7}{394.6} = .1132$$

$$d_{d-c} = \frac{r_{3-3}}{r_d} = \frac{44.7}{213.1} = .210$$

BAY 92-112



$$2A = X_i \bar{Y}_{i+1} - X_{i+1} \bar{Y}_i$$

A. V. ROE

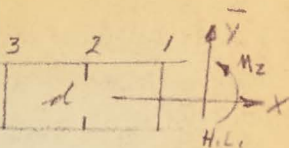
MA
TECHN

AIRCRAFT

WEIGHT

C. G. POSITION

ITEM	1	2	3	4	5	6	7	8	9	10	11
	STA 112		STA 92		MID BAY						
	X	$\bar{Y}$	X	$\bar{Y}$	X	$\bar{Y}$		$X_i \bar{Y}_{i+1}$	$X_{i+1} \bar{Y}_i$	ITEM	2A
1	-3.5	1.81	-3.5	1.95	-3.5	1.88		-7.25	15.05	1-2	7.8
2	-8.0	1.99	-8.0	2.14	-8.0	2.07		-17.6	26.9	2-3	9.3
3	-13.0	2.12	-13.0	2.28	-13.0	2.20		-30.3	39.6	3-4	9.3
4	-18.0	2.26	-18.0	2.44	-18.0	2.33		-43.6	53.6	4-5	10.0
5	-23.0	2.32	-23.0	2.52	-23.0	2.42		-56.3	67.8	5-6	11.5
6	-28.0	2.33	-28.0	2.57	-28.0	2.45		-64.7	84.7	6-7	20.0
7	-34.62	2.20	-34.62	2.42	-34.6	2.31		-75.8	93.8	7-8	18.0
8	-40.62	1.98	-40.62	2.39	-40.6	2.19		-78.3	102.5	8-9	24.2
9	(-46.6)	(1.74)	-46.6	2.11	-46.8	1.93		-73.5	96.4	9-F	22.6
F	-47.0	1.50	-52.6	1.65	-49.8	1.57		-0	88.2		
N	-53.3	0	-57.1	0	-56.2	0					
NOTE (X, $\bar{Y}$) FOR ITEM 9, STA 112											
ARE ASSUMED VALUES,											



A. V. ROE CANADA LIMITED

MALTON, ONTARIO
TECHNICAL DEPT. (AIRFRAME)

AIRCRAFT C105
WEIGHT
C. G. POSITION

REPORT NO. 7/0583/17
SHEET 5-10
DATE SEPT. 13/55
PREPARED BY S. YOUNG

7	8	9	10	11	12	13	14	15	16	17	18	19
	X_{i+1}	X_{i+1}	ITEM	2A		ITEM	L	t	$\frac{r}{4}$		CELL	r
	-725	1505	1-2	7.8		1-2	4.5	.147	30.6		a	308.6
	-176	264	2-3	9.3		2-3	5.	.147	34.0		b	406.6
	-30.3	396	3-4	9.3		3-4	5.	.140	35.7		c	397.0
	-43.6	536	4-5	10.0		4-5	5.	.140	35.7		d	202.4
	-56.3	678	5-6	11.5		5-6	5.	.140	35.7			
	-64.7	847	6-7	20.0		6-7	6.6	.140	47.2			
	-75.8	938	7-8	18.0		7-8	6.0	.133	45.2		CELL	A
	-78.3	1025	8-9	24.2		8-9	6.2	.133	46.6		a	15.1
	-73.5	964	9-F	22.6		9-F	3.	.133	22.6		b	63.1
	-0	882			13.0-112 14.0-92	F-N-F	13.5	.051	26.5		c	102.2
						1-1	3.76	.125	30.1		d	39.1
						3-3	4.40	.102	43.1			
						7-7	4.62	.102	45.3			
						F-F	3.14	.072	43.6			

A. V. ROE CANADA LIMITED
MALTON - ONTARIO

TECHNICAL DEPARTMENT (Aircraft)

AIRCRAFT:

C105

F1N

REPORT NO. 7/0583/17

SHEET NO. 5-11

PREPARED BY

DATE

S. YOUNG

SEPT 13/55

CHECKED BY

DATE

LOADING - STA 112

7/0583/38

3-14
C.P. AFT

ULTIMATE

SHEAR OUTB'D = 12250 #

SHEAR INB'D = 18250 #

BM = 625000 ##

H.L. TORQUE OUTB'D = 100000 ##

H.L. TORQUE INB'D = 150000 ##

$$\frac{P}{b} = \frac{625000}{70.77} \quad \bar{Y} = 8840 \quad \bar{Y}$$

$$P = 8840 \text{ A}\bar{Y}$$

ITEM	$\bar{Y}$	$A\bar{Y}$	$f \cdot B$	$P \cdot LB.$
1	1.81	1.183	16000	10430
2	1.99	1.584	17580	14000
3	2.12	2.320	18700	20510
4	2.26	1.835	19950	16200
5	2.32	1.886	20500	16650
6	2.33	2.145	20600	18950
7	2.20	2.678	19400	23650
8	1.98	1.840	17490	16250
F	1.50	1.400	13250	12380

A. V. ROE CANADA LIMITED
MALTON - ONTARIO

TECHNICAL DEPARTMENT (Aircraft)

REPORT NO. 7/0583/17

SHEET NO. 5-12

AIRCRAFT:

C105

FIN

PREPARED BY

DATE

S. YOUNG

SEPT. 14/55

CHECKED BY

DATE

RAY 92-112

CAP SLOPE SHEAR

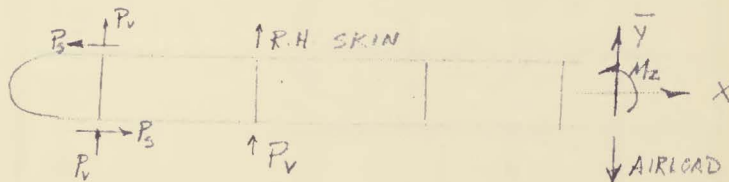
$$P_v = \frac{Y_{12} - Y_{12}}{\Delta L} P_{CAP}$$

$$\Delta L = 112 - 92 = 20''$$

SIMILARLY

FRONT SPAR SWEEPBACK SHEAR LOAD,

$$P_s = \frac{X_{92} - X_{112}}{\Delta L} P_{CAP}$$



$$2 \text{ SKINS } \sum P_v = 2(2422) = 4844 \#$$

$$2 \text{ SKINS } \sum P_v X = 2(74635) = -149,270 \# \text{ } \overline{M}_z \text{ DIRECTION}$$

$$\text{FRONT SPAR } \sum P_s Y = 2(11750) = +23,500 \#$$

BAY 92-112

SLOPE & SWEEPBACK SHEAR

A. V

AIR

WE

C.

	1	2	3	4	5	6	7	8	9	10
ITEM	$\bar{Y}_{92}$	$\bar{Y}_{112}$	$\bar{Y}_{92} - \bar{Y}_{112}$	P_{CAP} STA 92	P_V STA 92	X	$P_V \cdot X$		$X_{92} - X_{112}$	P_S STA 92
1	1.95	1.81	.14	13200	93	-3.5	-325			
2	2.14	1.99	.15	17450	132	-8.0	-1060			
3	2.28	2.12	.16	25950	208	-13.0	-2710			
4	2.44	2.26	.18	20650	186	-12.0	-22350			
5	2.52	2.32	.20	21350	214	-23.0	-4920			
6	2.57	2.33	.24	24600	295	-28.0	-8280			
7	2.42	2.20	.22	31750	350	-34.6	-12100			
8	2.39	1.98	.41	22450	460	-40.6	-18650			
9	2.11	(1.74)	.37	19900	368	-46.6	-17150			
F	1.65	1.50	.15	15450	116	-52.6	-6100			
Σ					2422		-74,035			

TECHNICAL DEPARTMENT (Aircraft)

REPORT NO. 7/0583/17

SHEET NO. 5-14

AIRCRAFT:

C105

FIN

PREPARED BY

DATE

S. YOUNG

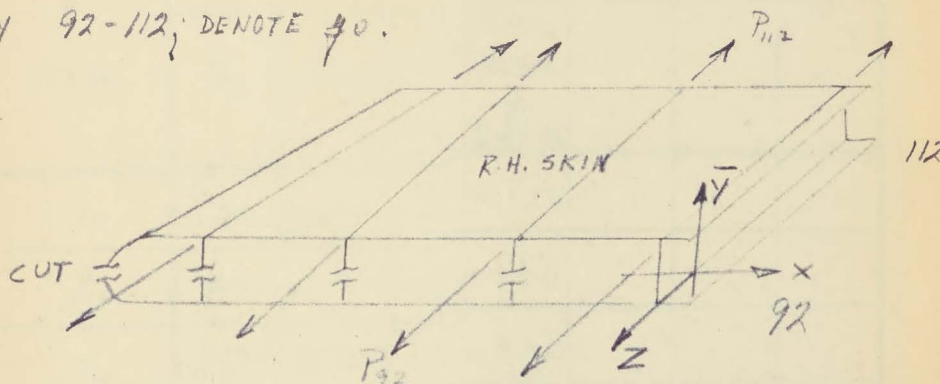
SEPT 14/55

CHECKED BY

DATE

BAY 92-112

COMPUTE ASSUMED BENDING SHEAR FLOW FOR
BAY 92-112; DENOTE q_0 .



$$q_0 = \frac{P_{112} - P_{92}}{92-112} \quad \text{SUMMED IN ROTATION NOSE, F, G, S, T, ETC}$$

CALCULATE $2q_0$ & $2Aq_0$ FOR ALL ITEMS.

AREAS ABOUT H.L.

$$2A \text{ FOR } F_L - N - F_R = 2A \text{ OF CELL 'a' - } X_F \cdot Y_R - F_L$$



$$= 2 \times 15.1 + 49.8 \times (2.157) = 30.2 + 107.4 = 137.6 \quad \text{in}^2$$

$$2A \text{ FOR } F_R - F_L = (2.157) 49.8 = 107.4$$

$$7_R - 7_L = (2.231) 34.6 = 77.2$$

$$3_R - 3_L = (2.220) 13.0 = 28.9$$

$$1_R - 1_L = (2 \times 1.88) 3.5 = 13.2$$

[illegible]

TECH

C. G. POSITIO

FORM 1543

393 20

TECHNICAL DEPARTMENT (Aircraft)

REPORT NO. 7/0583/17

SHEET NO. 5-16

AIRCRAFT:

C105

FIN

PREPARED BY

DATE

S. YOUNG

SEPT. 14/55

CHECKED BY

DATE

BAY 92-112

FOR A SHEAR LOAD ONLY, SOLVE THE MULTI-CELL SECTION BY AN ITERATION METHOD GIVEN IN

J. R. AE Soc. FEB 1954 SHEAR DISTRIBUTION FOR MULTI-CELL BEAMS

$$\sum a = 308.6$$

$$\sum b = 406.6$$

$$\sum c = 397.0$$

$$\sum d = 202.4$$

1ST APPROXIMATION q' FOR EACH CELL

$$q'_s = \frac{\sum a q_0}{\sum a}$$

$$\sum a q_0 = 0$$

$$\sum b q_0 = 2(3410 + 53400 + 65700) = 245,020$$

$$\sum c q_0 = 2(87800 + 76500 + 85000 + 92900) = 684,400$$

$$\sum d q_0 = 2(97800 + 93500) + 96200 = 478,800$$

$$q'_{sa} = \frac{0}{308.6} = 0$$

$$q'_{sb} = \frac{245,020}{406.6} = 603$$

$$q'_{sc} = \frac{684,400}{397.0} = 1721$$

$$q'_{sd} = \frac{478,800}{202.4} = 2370$$

TECHNICAL DEPARTMENT (Aircraft)

REPORT NO. 7/0583/17

SHEET NO. 5-17

AIRCRAFT:

C105

FIN

PREPARED BY

DATE

S. YOUNG

SEPT 14/55

CHECKED BY

DATE

BAY 92-112

a	b	c	d
---	---	---	---

d	.1435	.1278	.1325	.1205	.1132	.210
d TRANSPOSE	.1278	.1435	.1205	.1325	.210	.1132

q_s 1 ST APPROX	0	603.	1721.	2370.
2 ND "	86.64	0	228.	72.7
3 RD "	32.7	11.1	452	27.4
4 TH "	8.1	4.2	9.1	6.8
5 TH "	1.9	1	2.0	1.6
Σq_s	129.3	902.7	2148.6	2820.5
ITERATE	129.5	165	285.	108.8
+ q_s 1 ST APPROX	0	603	1721	2370.
q_s	129.5	904.5	2148.8	2822.
ITERATE	130.	166	285	109
+ q_s 1 ST APPROX	0	603	1721	2370
q_s	130	904.6	2150	2822

BY INSPECTION, THE q VALUES MUST BE
NEGATIVE TO BALANCE THE SECTION.

$$q_a = -130$$

$$q_c = -2150$$

$$q_b = -905$$

$$q_d = -2822$$

TECHNICAL DEPARTMENT (Aircraft)

AIRCRAFT:

C105

FIN

REPORT NO.

7/0583/17

SHEET NO.

5-18

PREPARED BY

DATE

S. YOUNG

SEPT. 14/55.

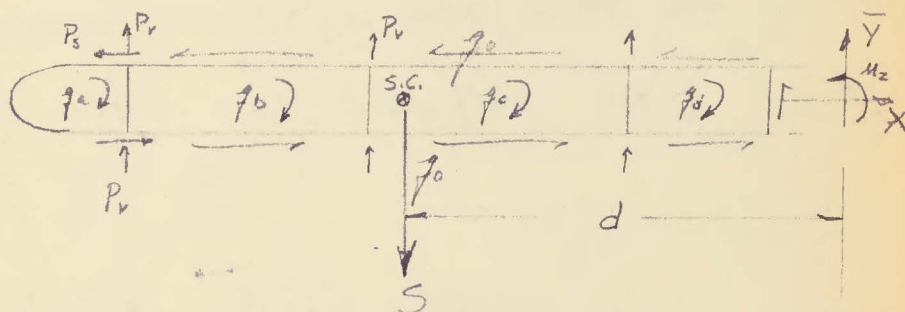
CHECKED BY

DATE

BAY 92-112

DETERMINE THE POSITION OF THE SHEAR CENTRE
BY TAKING MOMENTS ABOUT THE A.L.

BAY 92-112 SHEAR = 18250 #



$$\sum M_z = +18250 d + \sum 2A f_0 + 2A_a f_a + 2A_b f_b + 2A_c f_c + 2A_d f_d + \sum 2P_v \cdot X + \sum 2P_h \cdot Y = 0$$

$$18250 d + 393,200 - 2 \cdot 151,130 - 2 \cdot 631 \cdot 905 - 2 \cdot 1022 \cdot 2150 - 2 \cdot 391 \cdot 2822 - 149,270 + 23,500 = 0$$

$$18250 d + 393,200 - 39,300 - 1,141,000 - 449,000 - 220,500 - 149,270 + 23,500 = 0$$

$$d = \frac{511,100}{18250} = 280''$$

ADD THE ASSUMED BENDING f_0 SHEAR FLOWS TO THE
CELL CLOSING f_a, f_b, f_c, f_d SHEAR FLOWS TO OBTAIN
THE SHEAR FLOW PICTURE FOR THE APPLIED SHEAR
ACTING AT THE SHEAR CENTRE.

TECHNICAL DEPARTMENT (Aircraft)

AIRCRAFT:

C105

FIN

REPORT NO.

7/2583/17

SHEET NO.

5-19

PREPARED BY

DATE

S. YOUNG

SEPT. 14/55

CHECKED BY

DATE

BAY 92-112

COMPUTE THE SHEAR FLOWS IN THE SECTION FOR A TORQUE ACTING AT THE SHEAR CENTRE.

METHOD FROM J. Ae. Soc. AUG 1946 NUMERICAL TRANSFORMATION PROCEDURES FOR SHEAR FLOW CALCULATION

THE INITIAL CELL ESTIMATES ARE

$$q'_T = \frac{2A}{\sum r}$$

$$q'_{Ta} = \frac{2A_a}{\sum r_a} = \frac{2 \times 15.1}{308.6} = .0979$$

$$q'_{Tb} = \frac{2A_b}{\sum r_b} = \frac{2 \times 63.1}{406.6} = .310$$

$$q'_{Tc} = \frac{2A_c}{\sum r_c} = \frac{2 \times 102.2}{397.0} = .515$$

$$q'_{Td} = \frac{2A_d}{\sum r_d} = \frac{2 \times 39.1}{202.4} = .387$$

A. V. ROE CANADA LIMITED
MALTON, ONTARIO

TECHNICAL DEPARTMENT (Aircraft)

AIRCRAFT:

C105

FIN

REPORT NO. 7/0583/17

SHEET NO. 5-21

PREPARED BY

DATE

S. YOUNG

SEPT. 14/55

CHECKED BY

DATE

BAY 92-112

BY INSPECTION, THE TORQUE q 's ARE +VE.

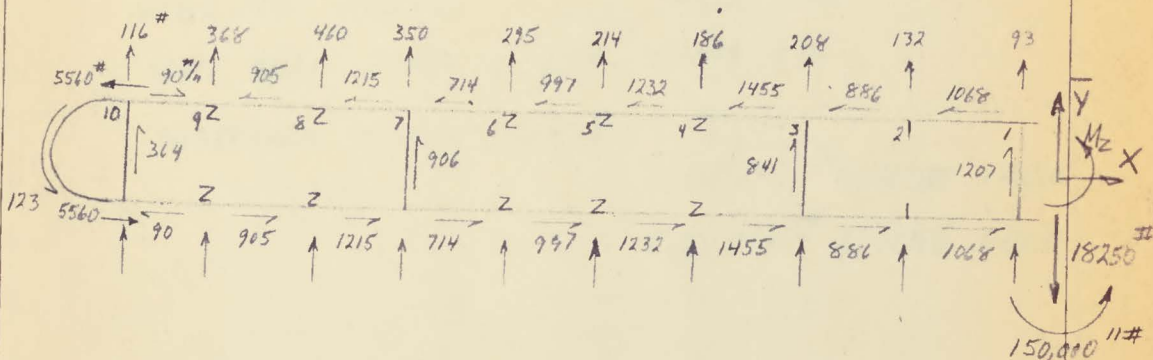
$$q_A = .1571 \times 1610 = 253$$

$$q_C = .6233 \times 1610 = 1003$$

$$q_B = .4125 \times 1610 = 664$$

$$q_D = .518 \times 1610 = 834$$

THE FINAL SECTION q 's ARE SUM OF THE
ASSUMED BENDING q_c , SHEAR CORRECTION q_s , AND
TORQUE CORRECTION q_t .



FINAL SHEAR FLOWS

BAY 92-112

C.P. AFT CASE

TECHNICAL DEPARTMENT (Aircraft)

REPORT NO. 7/0583/17
SHEET No. 5-22

AIRCRAFT:

C105

FIN

PREPARED BY.

DATE

S. YOUNG

SEPT. 14/55

CHECKED BY

DATE

BAY 92-112

CHECK THE VERTICAL SHEAR BALANCE.

$$\text{SKIN SHEAR} = 2 \times +199 = 398$$

$$\text{WEB \& NOSE SHEAR} = 13176$$

$$\text{SLOPE SHEAR } 2 \Sigma P_v = 4844$$

$$+18418^{\#} \text{ REACTIVE SHEAR}$$

$$\& -18250^{\#} \text{ APPLIED SHEAR}$$

CHECK H.L. TORQUE BALANCE.

$$\text{SKIN TORQUE} = 2 \times 107935 = +217,870$$

$$\text{WEB \& NOSE TORQUE} = -242,600$$

$$\text{SLOPE SHEAR TORQUE} = 2 \Sigma P_v \cdot X = -149,270$$

$$\text{SWEEPBACK TORQUE} = 2 \Sigma P_v \cdot Y = +23,500$$

$$-148,500^{\#} \text{ REACTIVE TORQUE}$$

$$+150,000^{\#} \text{ APPLIED TORQUE}$$

BAY 92-112

SHEAR & TORQUE BALANCE CHECK

A. V.

AIRCRAFT

WEIGHT

C. G.

	1	2	3	4	5	6	7	8	9	10
ITEM	MID BAY 7	ITEM	ΔY	ΔZ	SHEAR					ITEM
F	1.57	F-N-F	3.14	123	-386					F-N-F
8	1.93	F-9	.36	-90	+32					F-9
8	2.19	9-8	.26	905	-235					9-8
7	2.31	8-7	.12	1215	-146	$\frac{1}{2} \Sigma$ SKIN SHEAR = +199				8-7
6	2.45	7-6	.14	714	-100	Σ WEB NOSE SHEAR = +13176				7-6
5	2.42	6-5	-.03	997	+30					6-5
4	2.33	5-4	-.09	1232	+111					5-4
3	2.20	4-3	-.13	1455	+189					4-3
2	2.07	3-2	-.13	886	+115					3-2
1	1.88	2-1	-.19	1068	+203					2-1
		1-1	3.76	1207	+4540					1-1
		3-3	4.40	841	+3700					3-3
		7-7	4.62	906	+4180					7-7
		F-F	3.14	364	+1142					F-F

A. V. ROE CANADA LIMITED
MALTON, ONTARIO

TECHNICAL DEPARTMENT (Aircraft)

AIRCRAFT:

C105

FIN

REPORT No.

7/0582/17

SHEET No.

6-4

PREPARED BY

DATE

S. J. DUNN

SEPT 22/55

CHECKED BY

DATE

BAY 112-137 SECTION PROPERTIES

DETERMINE BAY PROPERTIES BY AVERAGING
STA. 112 & 137 (SIMILAR TO BAY 92-112)

CELL AREAS

$$A_d = 2(A_{1,2} + A_{2,3} - \frac{1}{2}X_2\bar{Y}_3 + X_1\bar{Y}_1) = 2A_{1,2} + 2A_{2,3} - X_2\bar{Y}_3 + X_1\bar{Y}_1$$

$$= 7.5 + 8.2 + 130.201 - 3.5 \times 1.64 = 35.5 \text{ sq"}$$

$$A_c = A_{3,4} + A_{4,5} + A_{5,6} + A_{6,7} - X_7\bar{Y}_1 + X_1\bar{Y}_7$$

$$= 8.5 + 9.9 + 11.6 + 17.2 + 346.196 - 130.201 = 90.9 \text{ sq"}$$

$$A_b = A_{7,8} + A_{8,9} - X_9\bar{Y}_7 + X_7\bar{Y}_9$$

$$= 21.7 + 15.8 + 440.142 - 34.6 \times 1.76 = 32.2 \text{ sq"}$$

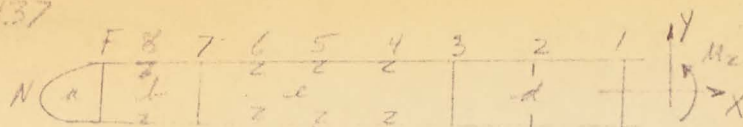
$$A_a = 14.0 \text{ sq"} \quad \text{STA 112}$$

$$A_a = 10.8 \text{ sq"} \quad \text{STA 137}$$

7/0582/35 1-15

$$A_a = 12.4 \text{ sq"} \quad \text{STA 112}$$

BAY 112-137



$$2A = X_i Y_{i+1} - X_{i+1} Y_i$$

A. V. ROE

MA
TECHN

AIRCRAFT

WEIGHT

C. G. POSITION

	1	2	3	4	5	6	7	8	9	10	11
	STA 137		STA 112		MID	BAY					
ITEM	X	Y	X	Y	X	Y		$X_i \bar{Y}_{i+1}$	$-X_{i+1} Y_i$	ITEM	2A
1	-3.5	1.56	-3.5	1.81	-3.5	1.64		-5.55	13.1	1-2	7.5
2	-8.	1.75	-8.	1.99	-8.	1.87		-16.1	24.5	2-3	8.2
3	-13.	1.90	-13.	2.12	-13.	2.01		-27.7	36.2	3-4	8.5
4	-18.	2.00	-18.	2.26	-18.	2.13		-39.1	47.0	4-5	9.9
5	-23.	2.02	-23.	2.32	-23.	2.17		-49.2	60.4	5-6	11.6
6	-28.	1.95	-28.	2.33	-28.	2.14		-55.0	74.5	6-7	17.2
7	-34.6	1.72	-34.6	2.20	-34.6	1.96		-57.8	79.5	7-8	21.7
8	(-40.6)	(1.35)	-40.6	1.98	-40.6	1.67		-57.7	73.6	8-F	15.8
F	-41.	1.33	-47.0	1.50	-44.0	1.42					
N	-46.5	0	-53.3	0	-49.9	0					
NOTE : ITEM 8 VALUES, STA 137											
ARE ASSUMED,											

A. V. ROE CANADA LIMITED

MALTON, ONTARIO

TECHNICAL DEPT. (AIRFRAME)

REPORT NO.

7/0583/17

SHEET

6-5

DATE

SEP 22/55

PREPARED BY

S. YOUNG

AIRCRAFT

C105

WEIGHT

C. G. POSITION

	7	8	9	10	11	12	13	14	15	16	17	18	19
		X 7.11	-X 7.11	ITEM	2A		ITEM	L	t	1/2		CELL	15
		-585	13	1-2	7.5		1-2	4.5	137	32.4		a	280.4
		-161	24	2-3	8.2		2-3	5	137	36.0		b	320.2
		-277	36	3-4	8.5		3-4	5	132	37.9		c	405.2
		-39.1	41	4-5	9.9		4-5	5	132	37.9		d	202.4
		-49.2	60	5-6	11.6		5-6	5	132	37.9			
		-53.0	74	6-7	17.2		6-7	6.6	132	50.0			
		-57.8	79	7-8	21.7		7-8	6.0	125	40.0		CELL	A
		-57.7	73	8-F	15.8		8-F	3.4	125	27.2		a	12.4
						13-0-102 116-1257	F-N-F	12.3	1051	24.1		b	32.2
							1-1	3.28	125	26.2		c	90.9
							3-3	4.02	102	39.4		d	35.5
							7-7	3.92	102	38.4			
							F-F	2.84	172	38.4			

BAY 112-137

SLOPE $\frac{1}{7}$ SWEEPBACK SHEAR

A. V. ROE

M
TECH

AIRCRAFT

WEIGHT

C. G. POSITION

ITEM	1	2	3	4	5	6	7	8	9	10	11
	$\bar{Y}_{112}$	$\bar{Y}_{137}$	ΔY	P_{CAP} STA 112	P_v	X	$P_v X$		X_{112} K_{137}	$\bar{P}_3$	$\bar{X}$
1	1.81	1.56	.25	10430	104	-3.5	-364				
2	1.99	1.75	.24	14000	134	-8.	-1073				
3	2.12	1.90	.22	20500	180	-13.	-2340				
4	2.26	2.00	.26	16200	169	-18.	-3045				
5	2.32	2.02	.30	16250	200	-23.	-4600				
6	2.33	1.95	.38	18950	288	-28.	-8060				
7	2.20	1.72	.48	23650	454	-34.6	-15700				
8	1.98	1.35	.63	16250	409	-40.6	-16600				
F	1.50	1.33	.17	12380	84	-47.0	-3950		-6	2970	1.50
Σ					+2022		-55732				
1											

A. V. ROE CANADA LIMITED
MALTON - ONTARIO

TECHNICAL DEPARTMENT (Aircraft)

REPORT NO. 7/0583/17

SHEET NO. 6-10

AIRCRAFT:

C105

FIN

PREPARED BY

DATE

S. YOUNG

SEPT. 22/55

CHECKED BY

DATE

BAY 112-137

COMPUTE THE BENDING SHEAR FLOW q_c , CORRECTIVE
SHEAR q_s , AND CORRECTIVE TORQUE q_t IN MANNER
SIMILAR TO BAY 92-112.

ITEM AREAS ABOUT H.L.

$$\begin{aligned} F-N-F \quad 2A &= 2A_s - 2x_f \bar{y}_f = 2 \cdot 12.4 - 2 \cdot 44.0 \times 1.42 \\ &= 24.8 + 125. = 149.8 \end{aligned}$$

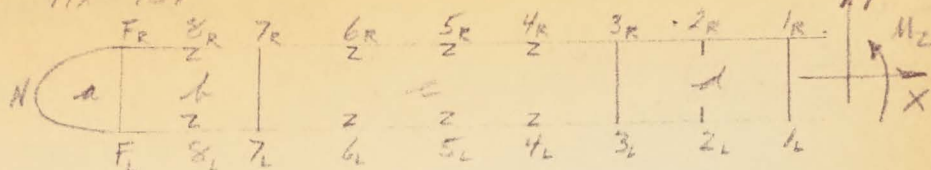
$$1-1 \quad 2A = 2x_f \bar{y}_f = 2 \cdot 3.5 \times 1.64 = 11.5$$

$$3-3 \quad 2A = 2x_s \bar{y}_s = 2 \cdot 13.2 \times 1.01 = 52.3$$

$$7-7 \quad 2A = 2 \cdot 34.6 \times 1.96 = 135.5$$

$$F-F \quad 2A = 2 \cdot 44.0 \times 1.42 = 125.$$

BAY 117-137



A. V. RO

AIRCRAFT

WEIGHT

C. G. POSI

	1	2	3	4	5	6	7	8	9	10	11
ITEM	P_{112}	$-P_{137}$	$P_{112}-P_{137}$ ΔP	$\frac{P_{112}-P_{137}}{112-137}$ $\Delta P/25$		ITEM	ΔP	ΔP	ΔP	$2A$	$2A$
1 _R	10430	-1780	2650	-106		F_N-F_R	0	241	0	1498	0
2 _R	14440	-9220	4780	-191		F_R-8_R	111	272	300	158	175
3 _R	20520	-15750	4750	-190		8_R-7_R	761	480	3610	217	165
4 _R	16200	-12300	3900	-156		7_R-6_R	1055	500	5200	192	202
5 _R	16650	-12380	4270	-171		6_R-5_R	1270	37.9	4480	11.6	147
6 _R	18750	-13590	5360	-215		5_R-4_R	1441	37.9	5460	9.9	142
7 _R	23650	-16300	7350	-294		4_R-3_R	1597	37.9	6050	8.5	135
8 _R	16250	0	16250	-650		3_R-2_R	1787	36.0	6430	8.2	146
F_R	12380	-9600	2780	-111		2_R-1_R	1978	32.4	6400	7.5	140
						1_L-1_R	2084	26.2	5400	11.5	-24
						3_L-3_R	0	39.4	0	523	0
						7_L-7_R	0	38.4	0	135	0
						$F-F_R$	0	39.4	0	175	0
						Σ					

E CHECK

A. V. ROE CANADA LIMITED

MALTON, ONTARIO
TECHNICAL DEPT. (AIRFRAME)

REPORT NO.

7/0583/17

SHEET

6-19

DATE

SEPT 23/55

PREPARED BY

S. YOUNG

AIRCRAFT

C105

WEIGHT

C. G. POSITION

6	7	8	9	10	11	12	13	14	15	16	17	18	19
					ITEM	2A	f	2A _g					
					F-N-F	149.8	106	16150					
					F-8	15.8	53	837					
					8-7	21.7	703	15250					
					7-6	19.2	459	8830					
					Σ SKIN SHEAR = +275	6-5	11.6	674	7820	1/2 Σ SKIN TORQUE = +60,207			
					WEB & NOSE SHEAR = +7525	5-4	9.9	845	8380	Σ WEB & NOSE TORQUE = -118,420			
						4-3	8.5	1001	8500				
						3-2	8.2	583	4780				
						2-1	7.5	774	5810				
						1-1	11.5	880	-10120				
						3-3	523	588	-36800				
						7-7	135.5	538	-72900				
						F-F	125	166	-20750				

AIRCRAFT
U. W.

C105

COMPONENT

FIN

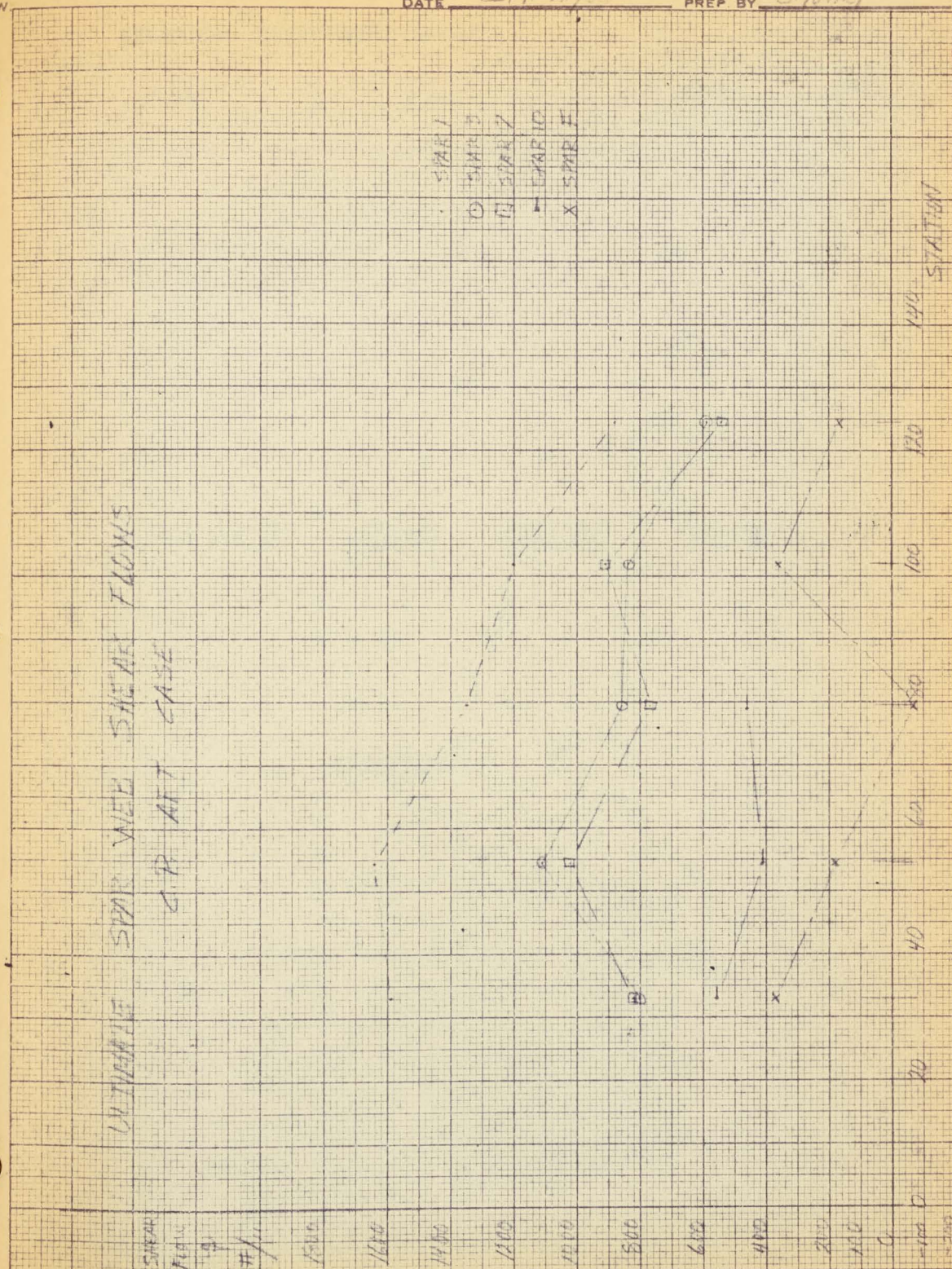
SHEET No. 7-2
DATE SEP 21/55

REPORT No. 210532/17
PREP BY S. JONES

WINGMAN SPAR WHEEL SHEAR FACTORS
C.P. ATT CASE

START
START
START
START
START

STATION



AIRCRAFT *C105*
A. U. W.

COMPONENT *FIN*

SHEET No. *8-2*
DATE *SEPT 27/55*

REPORT No. *7/1548/117*
PREP BY *S. H. G. N.*

ULTIMATE SKIN SHEAR FLOWS
C.P. AFT CASE

