

QCY
Avro
CF105
R-7-0554-5



TECHNICAL REPORT



AVRO AIRCRAFT LIMITED
MALTON - ONTARIO

TECHNICAL DEPARTMENT

REPORT NO. 710354/5

SHEET NO. 1

AIRCRAFT:

PREPARED BY

DATE

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0074/80

INTRODUCTION

CONFIDENTIAL

THIS REPORT DETERMINES THE STRINGER AND LONGERON END LOADS, PLUS THE SKIN SHEARS DUE TO BENDING, ALONG THE CENTRE FUSELAGE FROM STA. 255 TO 485 FOR CERTAIN AIRCRAFT LOADING CASES. THESE CASES HAVE BEEN SELECTED AS ENVELOPES FOR ALL OTHERS, COVERING UP AND DOWN BENDING AT ROOM & ELEVATED TEMPERATURE FOR SYMMETRIC CASES, AND LOCAL INVESTIGATION OF TWO ASYMMETRIC CONDITIONS.

SYMMETRIC BENDING:

CASE 71-0 STN 255 - STN 353 ROOM TEMP.

CASE 21-0 " 352 - 469 "

CASE 81-0 STN 255 - 485 ELEV. TEMP.

SUDDEN LOAD APPLICATION:

STN 255 - STN 485 ROOM TEMP.

CASE 9-30 STN 255 - STN 353 ELEV. TEMP.

SUDDEN ELEVATOR APPLICATION STN 353 ELEV. TEMP.

ASYMMETRIC

Rolling Pullout STN 268 - STN 353

Ground Case 7-1 STN. 353.



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REPORT NO. 7/0554/5

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INTRODUCTION - CONT

NOTE:

CALCULATIONS OF END LOAD AND
SHEAR AT STN 350 IN THIS REPORT ARE
BASED ON ESTIMATES OF WING LOAD APPLIED
AT STA 350 [FROM REPORT 7-0550-4]. THESE
WILL BE SUPERCEDED WHEN ACCURATE WING
LOADS ARE AVAILABLE, AND MUST BE USED
WITH THIS IN MIND.

ALL END LOADS AND SKIN STRESS
IN THIS REPORT ARE ULTIMATE



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TABLE OF CONTENTS

- SECTION 1 STRINGER & LONGERON AREAS
- SECTION 2 DIFFUSION -245-315
- SECTION 3 CASE 71-a STN 255-359
- SECTION 4 CASE 21-a STN 392-469
- SECTION 5 CASE 81-a STN 255-485
- SECTION 6 SUDDEN ELEVATOR APPLICATION SEA LEVEL
ROOM TEMP. STN 255-485
- SECTION 7 CASE 93a STN 255-359
- SECTION 8 SUDDEN ELEVATOR APPLICATION ELEVATED
TEMP. STN 359
- SECTION 9 Rounda Pullout STN 268-359
- SECTION 10 GROUND CASE 71, STN 359
- SECTION 11 SUMMARY - SYMMETRIC BEADING
STN 255 → 359.

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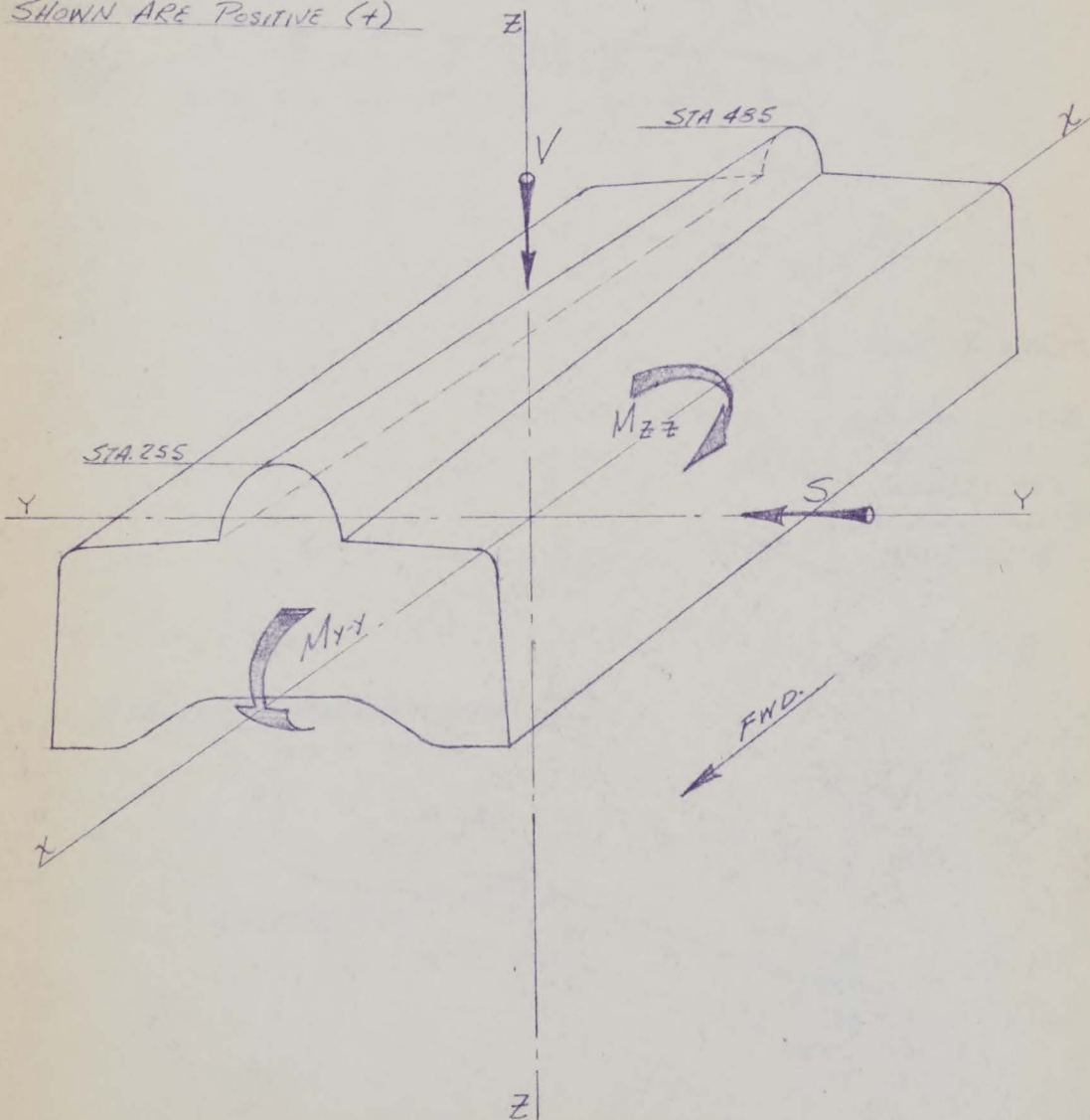
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AIRCRAFT C-105

SHL
FEB 16, 1955

CENTRE FUSELAGE SECTIONS

SIGN CONVENTION
LOADS & MOMENTS
SHOWN ARE POSITIVE (+)



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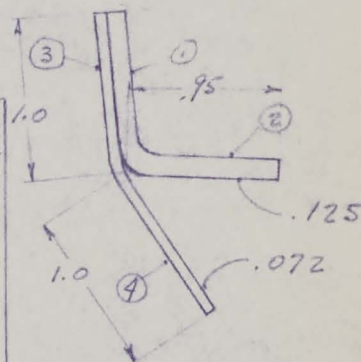
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CENTRE FUSELAGE SECTION
UPPER INNER LONGERON

Item	x	y	A
1	.125	.932	.116
2	.125	.882	.110
3	.072	1.000	.072
4	.072	1.000	.072

$$\Sigma = .370$$



$$\text{BUTT STRAP} = 3.1 \times .040 = .124 \text{ IN}^2$$

$$\text{DORSAL FIN ATT. } \angle = (2.25 + .75) \cdot .032 = .096 \text{ IN}^2$$

$$\begin{aligned} \text{EFFECTIVE SKIN (COMPRESSION)} &= .30T = 30(.040)^2 = .048 \text{ IN}^2 \\ &= 10T = 10(.032)^2 = .009 \text{ IN}^2 \end{aligned}$$

$$\text{TOTAL TENSION AREA} = .37 + .124 + .096 = .490 \text{ IN}^2$$

$$\text{TOTAL COMPRESSION AREA} = .37 + .048 + .009 = .427 \text{ IN}^2$$

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CENTRE FUSELAGE SECTION

UPPER INNER LONGERON

AREA WITHOUT EFFECTIVE SKIN AREA

STA	Reqd A.	Prov. A.
245	2.84	
255	1.25	
268	.812	
281	.630	.660
292	.560	.620
303.5	.520	.600
315	.500	.540

$$\text{EFFECTIVE SKIN AREA} = .6 \times .051 \times 4.5 = .138 \text{ IN}^2$$

$$A_E = .6 \times (.051 \times 2.25 + .040 \times 2.25) = .123 \text{ IN}^2$$

STA 255

$$A_{U1} = .60 (4.5 \times .051) + 1.25 = 1.388 \text{ IN}^2$$

$$A_{ST2} = .60 (4.5 + 2.25 \times .051) + .0501 = .257 \text{ IN}^2$$

$$A_{ST3} = .138 + .0501 = .188 \text{ IN}^2$$

$$A_{ST4} = .123 + .0501 = .173 \text{ IN}^2$$

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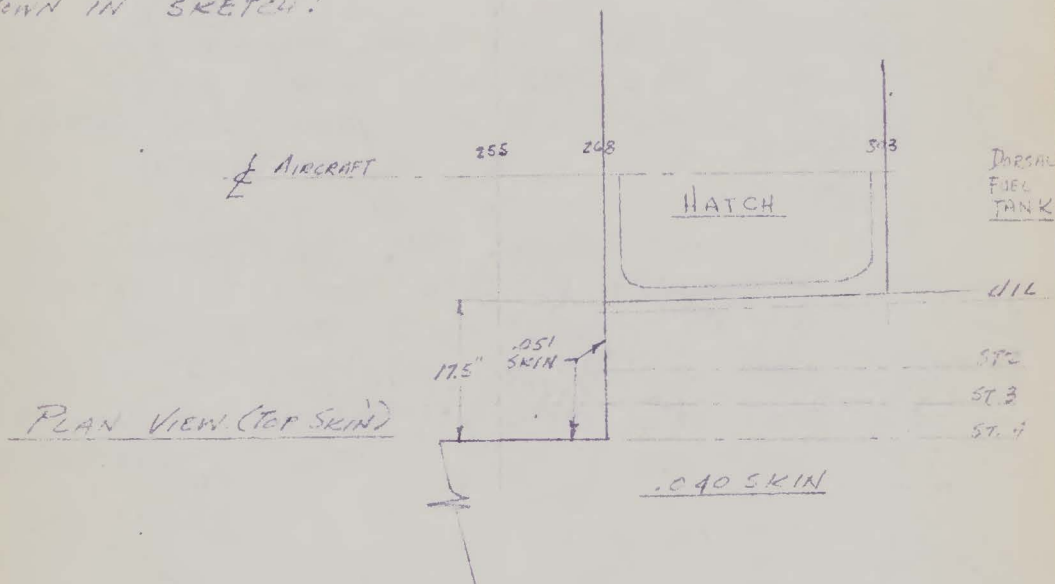
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CENTRE FUSELAGE SECTION
SECTIONAL CONSTANTS

THE SKIN FWD OF DORSAL FIN HATCH IS ASSUMED TO BE .051 GA. EXTENDING FROM STA. 255 TO STA. 303. & INBOARD OF STRINGER No. 4 AS SHOWN IN SKETCH.



EFFECTIVE WIDTH OF SKIN IS REASONABLY ASSUMED THE PORTION FWD DIL & STR. 4 = 17.5"

$$\text{EFFECTIVE AREA} = W \cdot t = 17.5 \times .051 = .89 \text{ IN}^2$$

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CENTRE FUSELAGE SECTION

SIDE SKIN

STRINGERS NOS. 11, 12, 13 & 14 ARE INTER-COSTAL MEMBERS FROM STA. 255 TO STA 281 AND SHALL BE CONSIDERED AS BEING NOT EFFECTIVE AT STA 255 & STA 268. (PER R. WADE)

STRINGERS NOS 12 & 13 ARE INTER-COSTAL MEMBERS FROM STA 281 TO STA 315 AND THEREFORE SHALL BE CONSIDERED AS BEING NOT EFFECTIVE AT STA. 292. (PER R. WADE)

IT HAS ALSO BEEN ASSUMED THE SMALLER SKIN GAUGE AT THE SKIN SPLICE AT STA 292. THE CALCULATIONS WILL BE REASONABLY CONSERVATIVE SINCE THE DIFFERENCE BEING ONE GAUGE (FROM .040 FWD TO .051 AFT.) PRODUCING MAXIMUM SHEARS ON THE .040 FWD. SKIN PANELS.

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AIRCRAFT

C 105

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CENTRE FUSELAGE

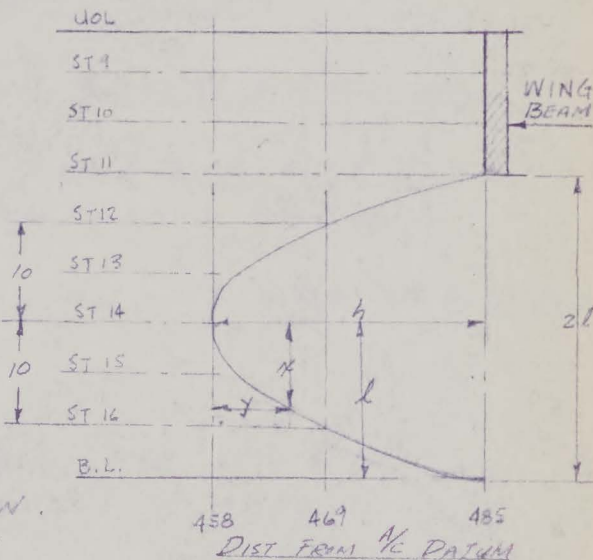
SKIN EFFICIENCY

STA 469 - STA 485

SIDE SKIN EFFICIENCY

STR Nos 9, 10 & 11 ARE
RIGIDLY FIXED TO THE
WING BEAM & SKIN
SHALL BE CONSIDERED
BEING FULLY EFFECTIVE IN
THIS AREA.

SKIN AT STR. NOS. 12, 13
14, 15, & 16 ARE ASSUMED
A PARABOLIC DISTRIBUTION.
EFFICIENCY, ALL STRINGERS
BEING FULLY EFFECTIVE AT STA 458 AS SHOWN IN ABOVE
SKETCH.



$$h = 485 - 458 = 27"$$

$$2l = 30"; \quad l = 15"$$

TO FIND IF STR NOS 12 & 16 ARE EFFECTIVE @ STA 469:
LET $x = 10"$ (SINCE STR. PITCH = $5"$)

PARABOLA:

$$y = \frac{h x^2}{l^2} = \frac{27 (10)^2}{(15)^2}$$

$$y = 12 \text{ INS.}$$

$$\therefore \text{DIST. FROM A/C DATUM} = 458 + 12 = 470 \text{ IN.}$$

$$\text{LET } y = 469 - 458 = 11"$$

$$\therefore x = \sqrt{\frac{l^2 y}{h}} = \sqrt{\frac{(15)^2 (11)}{27}} = 9.76"$$

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1-13

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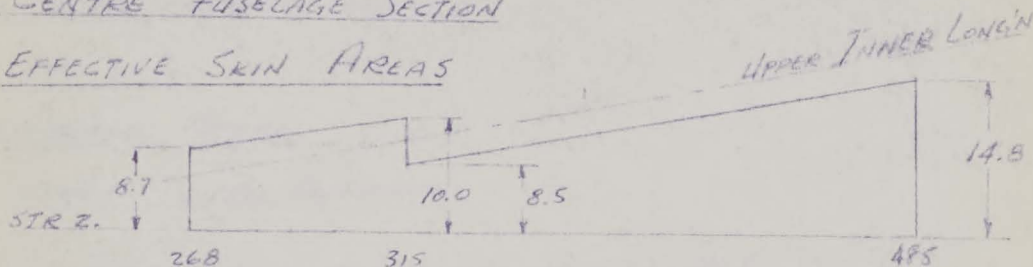
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CENTRE FUSELAGE SECTION

EFFECTIVE SKIN AREAS



$$A_{268} = 8.7 \times .040 = .348 \text{ IN}^2$$

$$A_{315} = 10.0 \times .040 = .400 \text{ IN}^2$$

$$A_{315} = 8.5 \times .040 = .340 \text{ IN}^2$$

$$A_{485} = 14.8 \times .040 = .590 \text{ IN}^2$$

$$A_{359} = .340 + (.590 - .340)(359 - 315) / (485 - 315) = .405 \text{ IN}^2$$

$$A_{469} = .340 + (.25)(469 - 315) / 170 = .566 \text{ IN}^2$$

$$A_{414} = .340 + (.25)(414 - 315) / 170 = .485 \text{ IN}^2$$

TOTAL AREAS WITH SKIN*

STA	414	STR 2	STR 3-8	4.0 L	STR 9-16	* B.L.
T	—	—	—	.2456	.2531	.978
255 C	—	—	—	.1896	.1011	.473
T	.660	.3131	.2331	.420	.2531	1.553
315 C	.475	.1011	.1011	.384	.1011	1.548
T	.692	.3451	.2331	.968	.2531	2.093
359 C	.475	.1011	.1011	.912	.1011	1.992
T	.732	.3851	.2331	1.620	.2531	2.641
414 C	.475	.1011	.1011	1.564	.1011	2.636
T	.773	.4261	.2331	2.021	.2531	3.272
469 C	.475	.1011	.1011	1.965	.1011	3.267

INCLUDING EFF. WIDTH OF 2.5" TEN IN BOTT SKIN

* FOR TOTAL EFF. AREA SEE P. 15

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AIRCRAFT

C105

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CENTRE FUSELAGE SECTION

STA. 359

EFFECTIVE AREAS

UPPER INNER LONGERON

$$\begin{aligned}\text{EFFECTIVE WIDTH OF SKIN} &= 30T \\ &= 30(.040) = 1.20 \text{ IN}\end{aligned}$$

$$A_c = 1.20 \times .040 = .0480 \text{ IN}^2$$

$$A_T = 4.5 \times .040 = .1800 \text{ IN}^2$$

$$A_b = 5.0 \times .040 = .2000 \text{ IN}^2$$

STRINGER SKIN AREA

$$\text{EFFECTIVE WIDTH OF SKIN} = 30T = 30(.040) = 1.20$$

$$A_c = 1.20 \times .040 = .048 \text{ IN}^2$$

$$A_T = 4.5 \times .040 = .180 \text{ IN}^2$$

$$A_b = 5.0 \times .040 = .200 \text{ IN}^2$$

UPPER OUTER LONGERON

$$\text{EFFECTIVE WIDTH OF SKIN} = 3(30T) = 3.60$$

$$A_c = 3.60 \times .040 = .144 \text{ IN}^2$$

$$A_T = 5.00 \times .040 = .200 \text{ IN}^2$$

BOTTOM LONGERON

$$\begin{aligned}\text{EFFECTIVE WIDTH OF SKIN} &= 30(.040) = 1.20 \text{ IN.} \\ &= 30(.032) = .96 \text{ IN.}\end{aligned}$$

$$A_c = 1.20 \times .040 + .96 \times .032 = .079 \text{ IN}^2$$

$$A_T = (2.5 \times .040) + 2.5 \times .032 = .180 \text{ IN}^2$$

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CENTRE FUSELAGE SECTION

TOTAL EFFECTIVE AREAS
SUMMARY OF AREAS

TOTAL EFFECTIVE AREAS = BASIC AREA + EFFECTIVE SKIN AREA.

EFFECTIVE SKIN AREA = .6 SKIN AREA

STA.	U/L	STR 2	STR 3-8	406	STR 9-16	B.L	STR 17*
T	—	—	.158	.158	.170	.848	.428*
255 C	—	—	.082	.103	.082	.845	.299
T	.592	.152	.158	.328	.170	1.398	.428
315 C	.456	.082	.082	.278	.082	1.420	.299
T	.611	.171	.158	.838	.170	1.922	.428
359 C	.456	.082	.082	.854	.082	1.961	.299
T	.626	.186	.158	1.194	.170	2.234	.428
392 C	.456	.082	.082	1.237	.082	2.288	.299
T	.635	.195	.158	1.464	.170	2.455	.428
414 C	.456	.082	.082	1.535	.082	2.509	.299
T	.660	.220	.158	1.815	.170	3.077	.428
467 C	.456	.082	.082	1.936	.082	3.140	.299

* ASSUMING 5" OF BOTTOM SKIN EFFECTIVE IN TENSION.

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1-18

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EFFECTIVE SKIN WIDTHS

COMPRESSION

$$\frac{W}{b} = \sqrt[3]{\frac{F_{cr}}{f_{ST}}} \quad (\text{BRUHN EQ B4.10})$$

TOP SHEET

.040 GA.

$$F_{cr} = 3.6 E \left(\frac{t}{b} \right)^2 \quad (\text{BRUHN EQ B4.2})$$

$$F_{cr} = 3.6 (6 \times 10^6) \left(\frac{.040}{4.5} \right)^2 = 1710 \text{ psi.}$$

$$A_e = A_{STR} + b \cdot t \cdot .6 \sqrt[3]{\frac{F_{cr}}{F_{ST}}}$$

$$= A_{STR} + 4.5 (.040) \cdot .6 \sqrt[3]{\frac{1710}{F_{ST}}}$$

$$= A_{STR} + .108 \left(\frac{11.76}{\sqrt[3]{F_{ST}}} \right) = A_{STR} + \frac{1.29}{\sqrt[3]{F_{ST}}}$$

.051 GA.

$$F_{cr} = 3.6 (6 \times 10^6) \left(\frac{.051}{4.5} \right)^2 = 2780 \text{ psi}$$

$$A_e = A_{STR} + 4.5 (.051) \cdot .6 \sqrt[3]{\frac{2780}{F_{ST}}}$$

$$= A_{STR} + .138 \left(\frac{14.6}{\sqrt[3]{F_{ST}}} \right) = A_{STR} + \frac{2.02}{\sqrt[3]{F_{ST}}}$$

SIDE SHEET

.040 GA

$$F_{cr} = 3.6 (6 \times 10^6) \left(\frac{.040}{5.00} \right)^2 = 1382 \text{ psi}$$

$$A_e = A_{STR} + 5.0 (.040) \cdot .6 \sqrt[3]{\frac{1382}{F_{ST}}}$$

$$= A_{STR} + .12 \left(\frac{11.14}{\sqrt[3]{F_{ST}}} \right) = A_{STR} + \frac{1.34}{\sqrt[3]{F_{ST}}}$$

.051 GA.

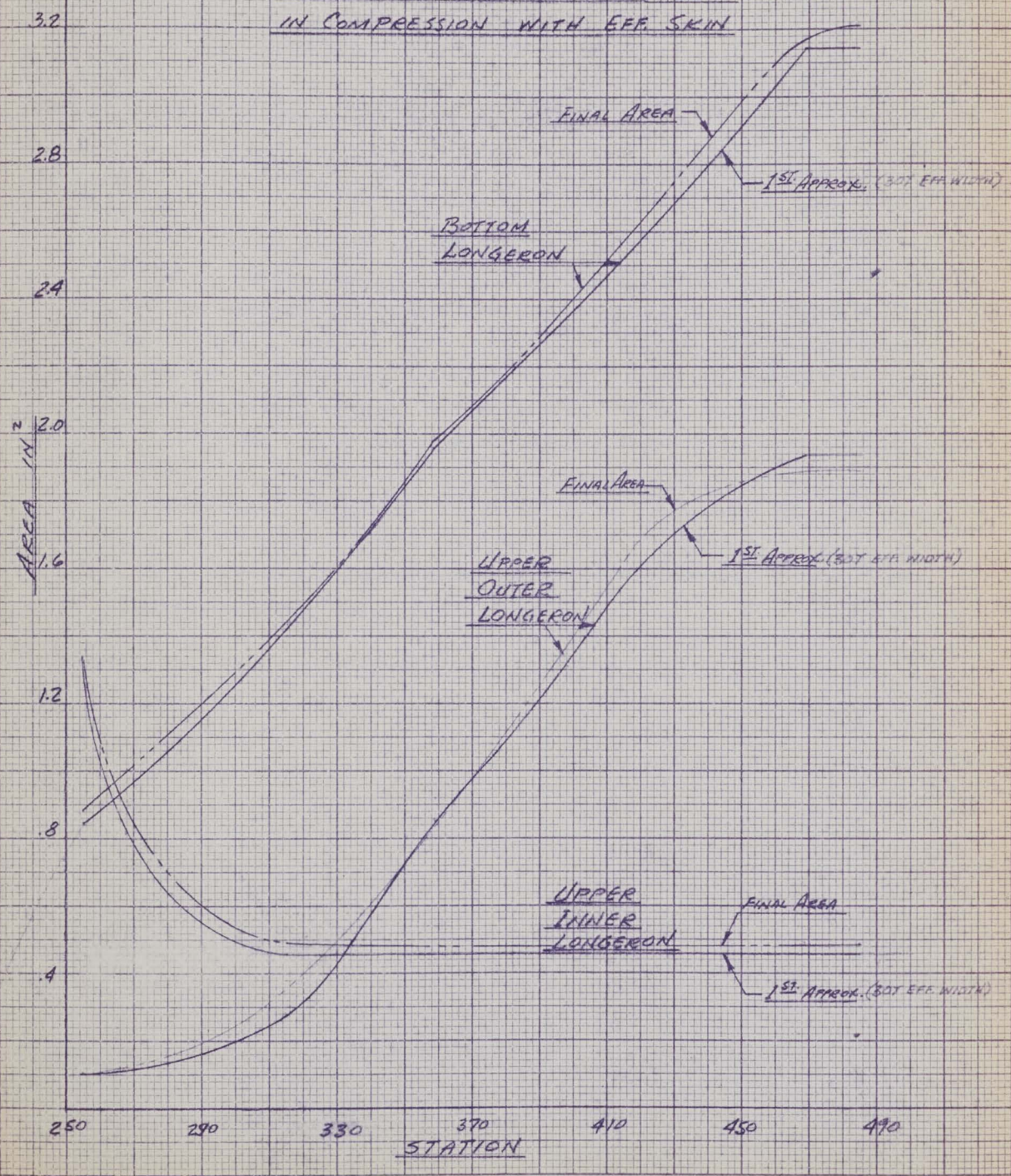
$$F_{cr} = 3.6 (6 \times 10^6) \left(\frac{.051}{5.0} \right)^2 = 2245 \text{ psi}$$

$$A_e = A_{STR} + 5.0 (.051) \cdot .6 \sqrt[3]{\frac{2245}{F_{ST}}}$$

$$= A_{STR} + .153 \left(\frac{13.1}{\sqrt[3]{F_{ST}}} \right) = A_{STR} + \frac{2.00}{\sqrt[3]{F_{ST}}}$$

710541
1-13

C-105 AIRCRAFT CENTRE SECTION
TOTAL EFFECTIVE LONGERON AREAS
IN COMPRESSION WITH EFF. SKIN





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REPORT NO.

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2-1

AIRCRAFT:

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OCT 3 / 56

SECTION 2

DIFFUSION - 245 - 315.

FROM ASSUMPTIONS MADE ON
BENDING OF AIRCRAFT FORWARD OF 255
IT IS NECESSARY TO DIFFUSE THE LOAD
FROM THE NOSE FUSELAGE LONGERON
[WHICH BECOMES THE UPPER INNER LONGERON AFT
OF 255] INTO THE CONTINUOUS STRINGERS
ON THE UPPER SURFACE OF THE FUSELAGE,
CONTINUITY BEGINNING AT STA 245.

THE INITIAL ESTIMATE OF UPPER LONGERON
LOAD ON WHICH THIS DIFFUSION IS BASED
IS FROM REPT 7/0555/13 "LOAD DIFFUSION
STA 214 TO STA 255.

THE DIFFUSION IS ASSUMED TO BE
COMPLETE BY STA 315.

T C105

COMPONENT

SHEET No.

2-5

REPORT No.

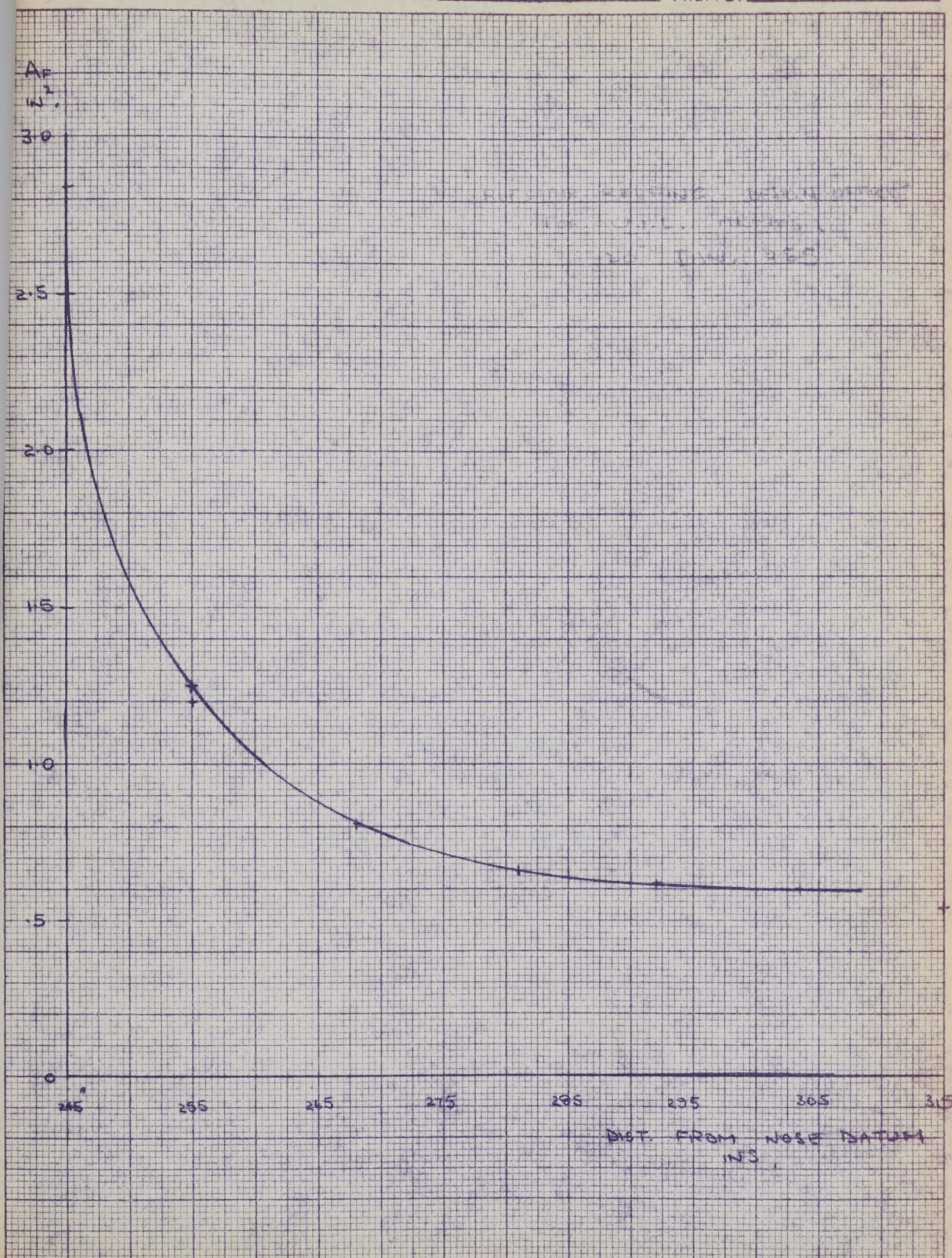
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REPORT No. 710554/S
SHEET No. 2-9

AIRCRAFT:

C105

INNER TOP
LONGERON
245 → 315 "

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DIFFUSION OF END LOAD

X FORCES

SHEARS/IN.

FROM TR 739

$$q_{n-1} = X_{n-1} \frac{K_n}{\tanh K_n L_n} - X_n \frac{K_n}{\sinh K_n L_n}$$

$$\& \quad q_n = X_{n-1} \frac{K_n}{\sinh K_n L_n} - X_n \frac{K_n}{\tanh K_n L_n}$$

$$q_0 = .341 P \times .1023 - .251 P \times .0385 = \underline{.0102 P}$$

$$q_1 = .251 P \times .0812 - .165 P \times .0750 = \underline{.0080 P}$$

$$q_2 = .165 P \times .0509 - .0819 P \times .0372 = \underline{.0053 P}$$

$$q_3 = .0819 P \times .0530 - .0602 P \times .0388 = \underline{.0020 P}$$

$$q_4 = .0619 P \times .0388 - .0602 P \times .0530 = 0.$$

SHEARS/IN ARE DUE TO X FORCES &

ALONGSIDE UPPER INNER LONGERON.

FT C105

COMPONENT

INNER
TOP LONK N
245-315

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2-10

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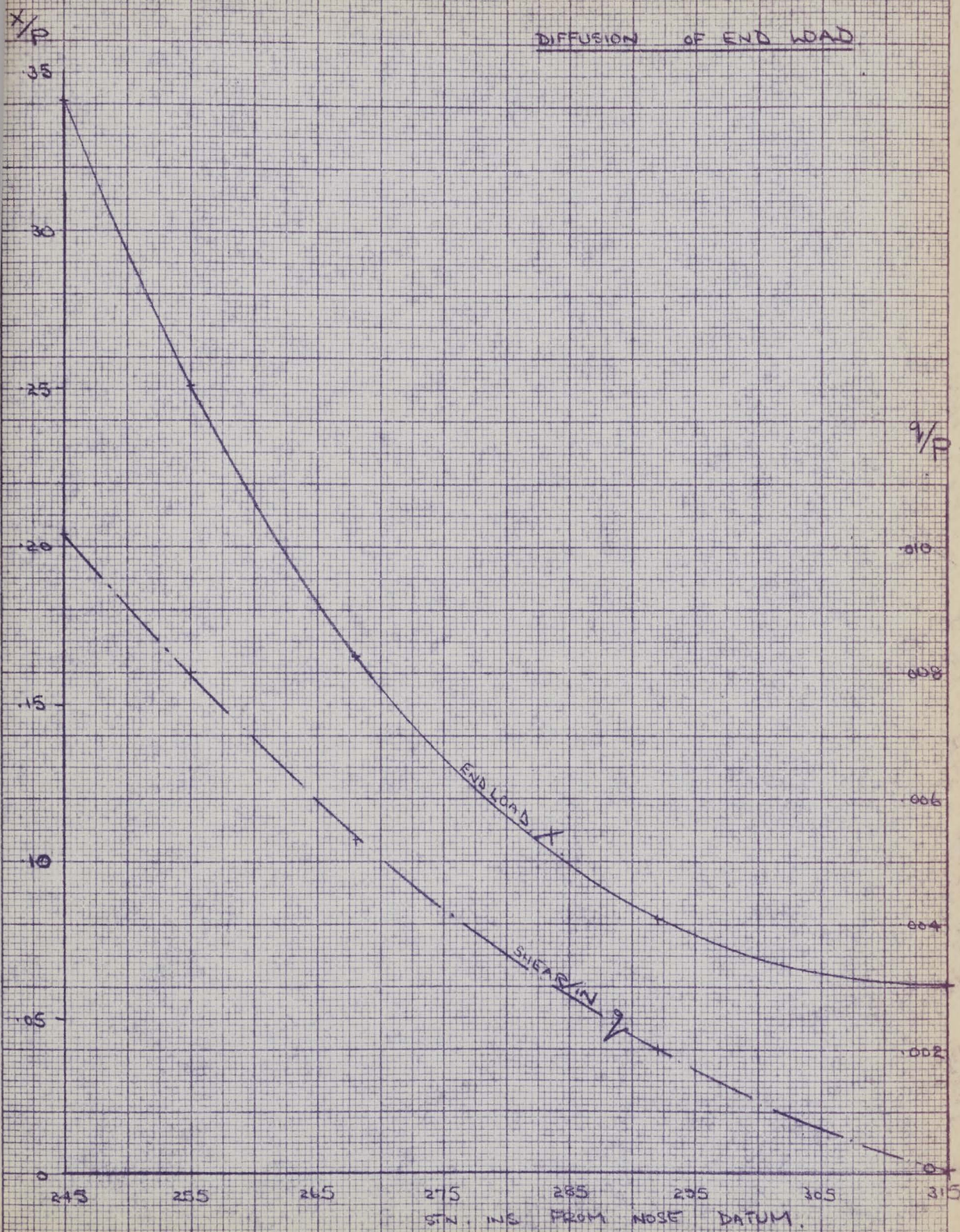
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DIFFUSION OF END LOAD



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AIRCRAFT:

C105

INNER TOP
LONGERON
245" → 315"

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DIFFUSION OF END LOAD

'X' FORCES.

SPANWISE DISTRIBUTION OF STRESS ACROSS
FUSELAGE

NACA TR 739 STATES THAT THE TRANSVERSE
DISTRIBUTION OF STRESS FOLLOWS A COSH
LAW AND A GRAPH OF THIS IS GIVEN
OVERLEAF

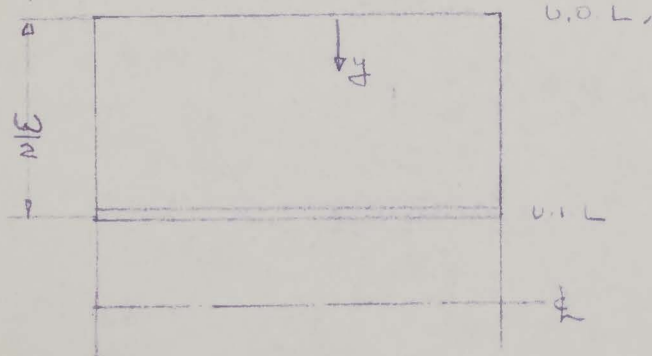
FOR SELF-EQUILIBRATING FORCES

$$\frac{\sigma_{ST \text{ AVERAGE}}}{\sigma_{U.L.}} = \frac{-X/A_S}{X/A_F} = -\frac{A_F}{A_S}$$

FROM WHENCE $\frac{1}{2} Y_W$ CAN BE FOUND
FROM GRAPH

$$\text{THEN } \frac{\sigma_{U.O.L.}}{\sigma_{U.L.}} = \frac{1}{2 - \cosh \frac{1}{2} Y_W}$$

$$\& \frac{\sigma_y}{\sigma_{U.L.}} = \frac{\sigma_{U.O.L.}}{\sigma_{U.L.}} (2 - \cosh \frac{Y_y}{2}) = \frac{2 - \cosh \frac{Y_y}{2}}{2 - \cosh \frac{1}{2} Y_W}$$





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REPORT NO. 710550-11SHEET NO. 2

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C-105

CENTER
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DOWN BENDING (TEN IN TOP) R.T.SECTIONAL CONSTANTS ARE CALCULATED USING
THE FOLLOWING SHEARS & B. M.CASE 7.1a (R.T.)

STA.	SHEAR [±]	B.M. ^{1#}
255	38 050 43 850	4 950 000
268	43 850 50 050	5 383, 980
292	54 500 72 400	6 639 050
315	78 500 80 300	8 364 118
337	81 300 82 400	10 023 458
359	76 150	11 764 600
392		
414		
469		
485		

REF. SYM. FLIGHT CASES, REP. 7-0550-4

STN. 255

CASE 7.1a ROOM TEMPERATURE

$$M_y = 4,950,000 \text{ IN-LBS.}$$

+V.E. B.M. (TENSION IN TOP)

$V = 38050 \text{ LBS.}$

43850 LBS (AFT.)

[illegible]

✓ = 38050 LBS. ✓ 43850 LBS (AFT.)

6	7	8	9	10	11	12	13	14	15	16	17	18	19
f_{ST}	Z_1	A_1	$A_1 Z_1$	$A_1 Z_1^2$	$Z_1 - \bar{Z}_1$	f_{ST}	Z_2	A_2	$A_2 Z_2$	$A_2 Z_2^2$	$Z_2 - \bar{Z}_2$	f_{ST}	$A_2(Z_2 - \bar{Z}_2)$
770	34.7	1.388	48.163	1864	15.1	14900	34.7	1.388	48.163	1671	16.33	14650	22.61
-	↑	↑	↑	↑	-	-	↑	↑	↑	↑	↑	↑	↑
-	①	②	③	④	-	-	①	②	③	④	-	-	-
-	↑	↑	↑	↑	-	-	↑	↑	↑	↑	↑	↑	↑
-	①	②	③	④	-	-	①	②	③	④	-	-	-
-	↑	↑	↑	↑	-	-	↑	↑	↑	↑	↑	↑	↑
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MALTON, ONTARIO
ENGINEERING DIVISION - AIRCRAFT

136
210554/5

3-4

AUG. 1955

C 105

47 000 LBS

PREPARED BY

[illegible]

SECTIONAL CONSTANTS

STN. 268

CASE 7.1(a) ROOM TEMPERATURE

$M_y = 5383,980 \text{ N-LBS}$

+V.E. B.M. (TENSION IN TOP)

$V = 43850 \text{ LBS (FWD)}; V = 50050$

	1	2	3	4	5	6	7	8	9	10	11
ITEM	FIRST APPROXIMATION						SECOND APPROXIMATION				
	Z	A	AZ	AZ^2	$Z - \bar{Z}$	f_{ST}	Z_1	A_1	AZ_1	$A_1 Z_1^2$	$Z_1 - \bar{Z}_1$
UPPER INNER LONG'N	34.7	.914	31.7	1100							
STR 2	34.4	.132	4.54	156							
3	34.2	.158	5.40	185							
4	33.9	.158	5.36	182							
5	33.6	.158	5.31	179							
6	33.4	.158	5.28	176							
7	33.1	.158	5.23	173							
8	32.5	.158	5.14	167							
UPPER OUTER LONG'N	30.5	.273	8.33	254							
STR 9	27.0	.170	4.59	124							
10	22.0	.170	3.74	82							
11											
12											
13											
14											
15	-3.0	.082	-.25	1	19.54	21899		.101	-.303	1	-19.309
16	-8.0	.082	-.65	5	24.54	27500		.095	-.760	5	-24.309
BOTTOM LONG'N	-13.0	.970	-12.60	164	29.54	33106		.964	-12.53	163	-29.309
STR 17	-14.4	.299	-4.30	62	30.94	34670		.309	-4.45	64	-30.709
		1455	1.7								
	16.54	4.040	66.82	3010			16.309	4.076	66.477	3012	
	$I = 3010 - 4.040(16.54)^2 = 1905 \times 2 = 3810 \text{ IN}^4$						$I = 3012 - 4.076(16.309)^2 = 1928$				
	1105						$I = 1928 \times 2 = 3856 \text{ IN}^4$				

MALTON, ONTARIO
ENGINEERING DIVISION - AIRCRAFT

C-105

47000 LB

AIRCRAFT	C-105
WEIGHT	47000 LB
C. G. POSITION	

LBS (AFT.)

[illegible]

A. V. ROE CANADA LIMITED

MALTON, ONTARIO
ENGINEERING DIVISION - AIRCRAFT

AIRCRAFT

WEIGHT

C. G. POSITION

REPORT NO

SHEET

DATE _____

PREPARED BY

18	19	20	21	22	23	24	25	26	27	28	29
		V = 43850		V = 50050		ENGINEERING CORRECTION DEFINITION END LOAD P	STA 268		TOTAL END LOAD P		
ST	$A_2(\bar{z}_2 - \bar{z}_1)$	$A_2(\bar{z}_2 - \bar{z}_1)$	$\bar{z}$								
710	16.85	16.85	190	220	23530	+ 7147					30647
8300	2.39	19.24	217	252	334	- 43					+ 3297
8000	2.83	22.07	250	289	3150	- 347					3693
570	2.78	24.85	281	325	3880	- 606					3274
1150	2.74	27.59	312	361	3820	- 730					3636
8870	2.70	30.29	342	396	3771	- 910					2961
460	2.66	32.95	372	431	3007	- 936					2711
2620	2.56	35.51	401	465	3574	- 1040					2534
830	2.88	39.39	444	515	5414	- 2225					2989
950	1.82	41.21	465	540	2580						2530
970	1.97	42.18	476	552	1360						1360
900	- 1.77	40.21	455	526	- 2210						- 2210
880	- 2.32	37.83	428	495	- 2740						- 2780
850	28.23	9.60	108	126	- 39630						- 39630
800	- 9.48	0			- 12800						- 12800

SECTIONAL CONSTANTS

STN. 292

CASE 7.1(a) ROOM TEMPERATURE

$M_y = 6,639,050$ IN-LB.

+VE. B.M. (TENSION IN TOP)

$V = 54,500$ (FWD.)

$V = 72400$ (AFT)

	1	2	3	4	5	6	7	8	9	10	11
								$.0531 + \frac{2.88}{(I_{ST})^3}$			
	FIRST APPROXIMATION						SECOND APPROXIMATION				
ITEM	$\bar{z}$	A	$A\bar{z}$	$A\bar{z}^2$	$\bar{z} - \bar{\bar{z}}$	I_{ST}	$\bar{z}_1$	A_1	$A_1\bar{z}_1$	$A_1\bar{z}_1^2$	$\bar{z}_1 - \bar{\bar{z}}$
UPPER INNER LONG'N	36.1	.584	21.1	762	21.7	33700	36.1	.584	21.1	762	23.0
STR 2	35.3	.147	5.2	184	↑	↑	↑	↑	↑	↑	↑
3	34.7	.158	5.48	190							
4	34.4	.158	5.44	187				②	③	④	
5	33.9	.158	5.35	181							
6	33.5	.158	5.30	177			①	COL	COL	COL	
7	33.1	.158	5.22	173							
8	32.7	.158	5.16	169				AS	AS	AS	
UPPER OUTER LONG'N	31.2	.330	10.30	321			COL				
STR 9	27.0	.170	4.60	124				SAME	SAME	SAME	
10	22.0	.170	3.74	82			AS				
11	17.0	.170	2.89	49	↓	↓					
12	12.0	.170	2.04	25	-2.4	3730	SAME	.170			↓
13	7.0	.082	.57	4	-7.4	11500		.170	1.19	8	6.1
14	2.0	.082	.16	0	-12.4	19300		.161	.52	1	11.1
15	-3.0	.082	-.25	1	-17.4	27000		.149	-.45	1	16.1
16	-8.0	.082	-.66	5	-22.4	34800		.141	-1.13	9	21.1
BOTTOM LONG'N	-13.0	1.133	-14.70	191	-27.4	42600	↓	1.167	-15.19	197	26.1
STR 17	-9.6	.299	-2.87	28	-24.0	37300	-9.6	.354	-3.40	33	22.7
$\Sigma =$	14.4	4.449	64.08	2853			13.1	4.831	63.17	2873	
	$I = 2853 - 4.449(14.4)^2 = 1931$						$I = 2873 - 4.831(13.1)^2 = 2043$				
	$I_{TOTAL} = 3862$ IN ⁴						$I_{TOTAL} = 4086$ IN ⁴				

= 54,500 (Fwd.)

$$V = 72400 \text{ (AFT)}$$

	6	7	8	9	10	11	12	13	14	15	16	17	18	19		
			$.0531 + \frac{2.88}{(f_{ST})^3}$						$.0531 + \frac{2.88}{(f_{ST})^3}$							
		SECOND APPROXIMATION						FINAL PROPERTIES								
ST		Z_1	A_1	AZ_1	AZ_1^2	$Z_1 - \bar{Z}_1$	f_{ST}	Z_2	A_2	AZ_2	AZ_2^2	$Z_2 - \bar{Z}_2$	f_{ST}	$A_2(Z_2 - \bar{Z}_2)$	I	
00		36.1	.584	21.1	762	23.0	33800	36.1	.584	21.1	762	23.1	37300	13.50		
		↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	22.3	36000	3.28		
												21.7	35000	3.42		
			②	③	④				⑥	⑦	⑩	21.4	34600	3.38		
			COL	COL	COL				COL	COL	COL	20.9	33800	5.30		
		①						⑤				20.5	33100	3.24		
		COL	AS	AS	AS			COL	AS	AS	AS	20.1	32500	2.8		
		AS	SAME	SAME	SAME			AS	SAME	SAME	SAME	19.7	31800	3.1		
												18.2	29400	6.40		
												14.0	22600	2.38		
												9.0	14500	1.53		
			↓									4.0	6470	.68		
30		SAME	.170					SAME				-1.0	-1616	-.17		
00			.170	1.19	8	6.1	9000		.170			-6.0	-9700	-1.02		
000			.161	.52	1	11.1	16300		.168	.33		-11.0	-17800	-1.95		
000			.149	-.45	1	16.1	23700		.153	-.46	1	-16.0	-25900	-2.44		
800			.141	-1.13	9	21.1	31000		.145	-1.16	9	-21.0	-33900	-3.44		
600		↑	1.167	-15.19	197	26.1	38400	↑	1.170	-15.20	198	-26.0	-42000	-30.40		
300		-9.6	.354	-3.40	33	22.7	33400	-9.6	.357	-3.42	33	-22.6	-36500	-8.46		
		13.1	4.831	63.17	2873			13.0	4.853	63.11	2874					
		$I = 2873 - 4.831(13.1)^2 = 2043$						$I = 2874 - 4.853(13)^2 = 2054$								
		$I_{TOTAL} = 4086 \text{ IN}^4$						$I_{TOTAL} = 4108 \text{ IN}^4$								

A. V. ROE CANADA LIMITED

MALTON, ONTARIO
ENGINEERING DIVISION - AIRCRAFT

AIRCRAFT C-105
WEIGHT 47000 LB.
C. G. POSITION

REPORT NO. 740554-5

SHEET 3-C

DATE 1 AUGUST 1955

PREPARED BY *SM*

17	18	19	20	21	22	23	24	25	26	27	28	29
PROPERTIES				$V = 54,500$	$V = 72,400$	ENGINEERING BENDING END LOAD	DIFFUSION CORRECTION LOAD $P' = 43510$				STA 29.2	
$\bar{z}_2 - \bar{z}_1$	$\int_{ST}$	$A_2(\bar{z}_2 - \bar{z}_1)$	$\int A_2(\bar{z}_2 - \bar{z}_1)$	$\bar{z}$		P'					Sept TOTAL END LOAD P	
23.1	37,300	13.50	0	0	0	2760	+ 3527					25227
22.3	36,000	3.28	13.50	179	238	5297	+ 134					5426
21.7	35,000	3.42	16.78	223	296	5550	- 156					5374
21.4	34,600	3.38	20.20	268	356	5747	- 296					5177
20.9	33,800	5.30	23.58	313	415	5840	- 398					4942
20.5	33,100	3.24	26.88	357	474	5830	- 472					4758
20.1	32,500	3.8	30.12	400	531	5735	- 550					4585
19.7	31,800	3.1	33.30	442	586	5624	- 574					4470
18.2	29,400	6.40	36.41	482	642	9702	- 7260					8442
14.0	22,600	2.38	42.41	560	746	3840						3840
9.0	14,500	1.53	44.79	595	790	2470						2470
4.0	6,470	.48	46.32	615	815	1155						1100
-1.0	-1,616	-.17	47.00	624	828	-275						-275
-6.0	-9700	-1.02	46.93	621	825	-1650						-1650
-11.0	-17800	-1.15	45.81	608	806	-3000						-3000
-16.0	-25300	-2.44	43.96	584	775	-3360						-3360
-21.0	-33300	-3.44	41.52	551	731	-4920						-4920
-26.0	-42,000	-30.40	38.48	510	648	-49140						-49,140
-22.6	-36,500	-8.06	8.08	107	142	-13000						-13,000
			0	0	0							

SECTIONAL CONSTANTS

STN. 315

CASE 7.12 @ ROOM TEMPERATURE

$M_y = +8,364,118$ IN. LB.

+VE B.M. (TENSION ON TOP)

$V = 78500$ LB (FWD) & $V = 803$

	1	2	3	4	5	6	7	8	9	10	11
	1ST. APPROXIMATION						2ND APPROXIMATION				
ITEM	Z	A	AZ	AZ ²	Z - $\bar{Z}$	f_{ST}	Z _i	A _i	AZ _i	A _i Z _i ²	Z _i - $\bar{Z}$
UPPER INNER LONG'N	36.1	.610	22.0	795	23.2		36.1	.610	22.0	795	
STR 2	35.3	.170	6.0	212	22.4						
3	34.7	.158	5.48	190	21.8						
4	34.4	.158	5.44	187	21.5		SAME	SAME	SAME	SAME	
5	33.9	.158	5.26	181	21.0						
6	33.5	.158	5.23	177	20.6		AS	AS	AS	AS	
7	33.1	.158	5.23	173	20.2						
8	32.7	.158	5.17	169	19.8		(1)	(2)	(3)	(4)	
UPPER OUTER LONG'N	31.2	.328	10.22	319	18.3						
STR 9	27.0	.203	5.48	148	14.1						
10	22.0	.203	4.47	98	9.1						
11	17.0	.203	3.46	59	4.1			V	V	V	
12	12.0	.203	2.44	29	-0.9	-1470		.203	2.44	29	-1.0
13	7.0	.100	.70	5	-5.9	-9120		.146	1.02	7	-5.0
14	2.0	.100	.20	0	-10.9	-17890		.130	.26	1	-10.0
15	-3.0	.100	-.30	1	-15.9	-25950		.121	-.36	1	-15.0
16	-8.0	.100	-.80	6	-20.9	-34100		.114	-.91	7	-20.0
BOTTOM LONG'N	-13.0	1.430	-18.45	240	-25.9	-42300	V	1.430	-18.60	242	-25.0
STR 17	-9.6	.206	-2.94	28	-22.5	-36700	-9.6	.388	-3.72	38	-21.0
Σ	12.9	4.774	64.45	3017			12.3	5.197	63.77	3033	
	$I = 3017 - 4.774 \times 12.9^2 = 2185$						$I = 3033 - 5.197 (12.3)^2 = 2248$				
	$I_{TOTAL} = 4370$ IN ⁴						$I_{TOTAL} = 4496$ IN ⁴				

$$V = 78500 \text{ LB (FWR)} \quad \& \quad V = 80300 \text{ LB (AFT.)}$$

[illegible]

SECTIONAL CONSTANTS

STN. 337

CASE 7.1 (a) @ ROOM TEMPERATURE

$M_y = 10,023,458$ IN-LBS

+VE (TENSION IN TOP) $V = 81,300$ # (FND); $V = 82400$ # (AFT)

B.L. = 1.6

	1	2	3	4	5	6	7	8	9	10	11
	1 ST APPROXIMATION						2 ND APPROXIMATION				
ITEM	Z	A	AZ	AZ ²	Z-Z	f _{ST}	Z ₁	A ₁	AZ ₁	AZ ₁ ²	Z ₁ -Z
UPPER INNER LONG'N	36.6	.601	21.99	804.8	—	—	36.6	.601	21.99	804.8	—
STR 2	35.3	.242	8.54	301.5	—	—	↑	↑	↑	↑	—
3	34.8	.158	5.50	191.4	—	—	↑	↑	↑	↑	—
4	34.4	.158	5.44	187.1	—	—	↑	↑	↑	↑	—
5	34.0	.158	5.37	182.6	—	—	↑	↑	↑	↑	—
6	33.6	.158	5.31	178.4	—	—	↑	↑	↑	↑	—
7	33.2	.158	5.24	174.0	—	—	↑	↑	↑	↑	—
8	32.8	.158	5.18	170.0	—	—	↑	↑	↑	↑	—
UPPER OUTER LONG'N	31.2	.583	18.19	567.5	—	—	↑	↑	↑	↑	—
STR 9	26.9	.170	4.57	122.9	—	—	↑	↑	↑	↑	—
10	21.9	.170	3.72	81.5	—	—	↑	↑	↑	↑	—
11	16.9	.170	2.87	48.5	—	—	↑	↑	↑	↑	—
12	11.9	.170	2.02	24.0	-.96	-1590	↑	↑	↑	↑	—
13	7.0	.082	.59	4.0	-5.86	-9720	↑	↑	↑	↑	—
14	2.1	.082	.17	.4	-10.76	-17900	↑	↑	↑	↑	—
15	-2.9	.082	-.23	.7	-15.76	-26100	↑	↑	↑	↑	—
16	-7.9	.082	-.65	5.1	-20.76	-34400	↑	↑	↑	↑	—
BOTTOM LONG'N	-13.0	1.680	-21.84	283.9	-25.86	-43000	↑	↑	↑	↑	—
STR 17	-10.2	.299	-3.05	31.1	-23.06	-38300	↑	↑	↑	↑	—
	12.86	5.361	68.934	3359.3			12.4	5.558	68.93	3369	
	$I = 3359.3 - 5.361(12.86)^3$						$I = 3369 - 5.558(12.4)^3$				
	$I_{total} = 2472.7 \text{ in}^4$						$I_{total} = 5$				
	$I_{total} = 4945.4$										

4.709
25.775

A. V. ROE CANADA LIMITED

MALTON, ONTARIO
ENGINEERING DIVISION - AIRCRAFT

C-105

47-000 #

7/2554/5

3-8

AUGUST 1955

Am. Mus.

17	18	19	20	21	22	23	24	25	26	27	28	29
											STA.	337
PROPERTIES												END
												LOAD
												P
$z - \bar{z}$	f_{ST}	$A_z(z - \bar{z})$	$\int A_z(z - \bar{z})$	$V =$ 81300	$V =$ 82400							
4.2	48100	14.54	0	0	0							28900
2.9	45500	5.54	14.54	234	258							11000
2.4	44500	3.54	20.08	324	329							7030
2.0	43700	3.48	23.62	384	387							6900
1.6	43000	3.41	26.10	420	428							6800
1.2	42100	3.35	29.51	475	484							6660
0.8	41400	3.29	32.86	530	539							6540
0.4	40600	3.22	36.15	582	593							6410
0.0	39700	3.15	39.37	634	645							6280
-0.4	38800	3.07	42.54	684	695							6150
-0.8	37900	2.99	45.67	735	746							6020
-1.2	36900	2.90	48.69	785	796							5890
-1.6	35900	2.81	51.67	835	846							5760
-2.0	34900	2.71	54.61	885	896							5630
-2.4	33900	2.61	57.51	935	946							5500
-2.8	32900	2.51	60.37	985	996							5370
-3.2	31900	2.41	63.19	1035	1046							5240
-3.6	30900	2.30	65.97	1085	1096							5110
-4.0	29900	2.19	68.71	1135	1146							4980
-4.4	28900	2.08	71.41	1185	1196							4850
-4.8	27900	1.96	74.07	1235	1246							4720
-5.2	26900	1.84	76.69	1285	1296							4590
-5.6	25900	1.71	79.27	1335	1346							4460
-6.0	24900	1.59	81.81	1385	1396							4330
-6.4	23900	1.46	84.31	1435	1446							4200
-6.8	22900	1.33	86.77	1485	1496							4070
-7.2	21900	1.19	89.19	1535	1546							3940
-7.6	20900	1.06	91.57	1585	1596							3810
-8.0	19900	0.92	93.91	1635	1646							3680
-8.4	18900	0.79	96.21	1685	1696							3550
-8.8	17900	0.65	98.47	1735	1746							3420
-9.2	16900	0.51	100.69	1785	1796							3290
-9.6	15900	0.37	102.87	1835	1846							3160
-10.0	14900	0.23	105.01	1885	1896							3030
-10.4	13900	0.09	107.11	1935	1946							2900
-10.8	12900	-0.06	109.17	1985	1996							2770
-11.2	11900	-0.20	111.19	2035	2046							2640
-11.6	10900	-0.34	113.17	2085	2096							2510
-12.0	9900	-0.47	115.11	2135	2146							2380
-12.4	8900	-0.60	117.01	2185	2196							2250
-12.8	7900	-0.73	118.87	2235	2246							2120
-13.2	6900	-0.86	120.69	2285	2296							1990
-13.6	5900	-0.98	122.47	2335	2346							1860
-14.0	4900	-1.10	124.21	2385	2396							1730
-14.4	3900	-1.22	125.91	2435	2446							1600
-14.8	2900	-1.34	127.57	2485	2496							1470
-15.2	1900	-1.46	129.19	2535	2546							1340
-15.6	900	-1.58	130.77	2585	2596							1210
-16.0	0	-1.70	132.31	2635	2646							1080
-16.4		-1.82	133.81	2685	2696							950
-16.8		-1.94	135.27	2735	2746							820
-17.2		-2.06	136.69	2785	2796							690
-17.6		-2.18	138.07	2835	2846							560
-18.0		-2.30	139.41	2885	2896							430
-18.4		-2.42	140.71	2935	2946							300
-18.8		-2.54	142.01	2985	2996							170
-19.2		-2.66	143.27	3035	3046							40
-19.6		-2.78	144.51	3085	3096							
-20.0		-2.90	145.71	3135	3146							
-20.4		-3.02	146.87	3185	3196							
-20.8		-3.14	148.01	3235	3246							
-21.2		-3.26	149.11	3285	3296							
-21.6		-3.38	150.17	3335	3346							
-22.0		-3.50	151.21	3385	3396							
-22.4		-3.62	152.21	3435	3446							
-22.8		-3.74	153.17	3485	3496							
-23.2		-3.86	154.11	3535	3546							
-23.6		-3.98	155.01	3585	3596							
-24.0		-4.10	155.87	3635	3646							
-24.4		-4.22	156.69	3685	3696							
-24.8		-4.34	157.47	3735	3746							
-25.2		-4.46	158.21	3785	3796							
-25.6		-4.58	158.91	3835	3846							
-26.0		-4.70	159.57	3885	3896							
-26.4		-4.82	160.19	3935	3946							
-26.8		-4.94	160.77	3985	3996							
-27.2		-5.06	161.31	4035	4046							
-27.6		-5.18	161.81	4085	4096							
-28.0		-5.30	162.27	4135	4146							
-28.4		-5.42	162.69	4185	4196							
-28.8		-5.54	163.07	4235	4246							
-29.2		-5.66	163.41	4285	4296							
-29.6		-5.78	163.71	4335	4346							
-30.0		-5.90	164.01	4385	4396							
-30.4		-6.02	164.27	4435	4446							
-30.8		-6.14	164.51	4485	4496							
-31.2		-6.26	164.71	4535	4546							
-31.6		-6.38	164.87	4585	4596							
-32.0		-6.50	164.99	4635	4646							
-32.4		-6.62	165.07	4685	4696							
-32.8		-6.74	165.11	4735	4746							
-33.2		-6.86	165.11	4785	4796							
-33.6		-6.98	165.07	4835	4846							
-34.0		-7.10	164.99	4885	4896							
-34.4		-7.22	164.87	4935	4946							
-34.8		-7.34	164.71	4985	4996							
-35.2		-7.46	164.51	5035	5046							
-35.6		-7.58	164.27	5085	5096							
-36.0		-7.70	164.01	5135	5146							
-36.4		-7.82	163.71	5185	5196							
-36.8		-7.94	163.37	5235	5246							
-37.2		-8.06	163.01	5285	5296							
-37.6		-8.18	162.61	5335	5346							
-38.0		-8.30	162.17	5385	5396							
-38.4		-8.42	161.71	5435	5446							
-38.8		-8.54	161.21	5485	5496							
-39.2		-8.66	160.69	5535	5546							
-39.6		-8.78	160.11	5585	5596							
-40.0		-8.90	159.51	5635	5646							
-40.4		-9.02	158.87	5685	5696							
-40.8		-9.14	158.21	5735	5746							
-41.2		-9.26	157.51	5785	5796							
-41.6		-9.38	156.77	5835	5846							
-42.0		-9.50	156.01	5885	5896							
-42.4		-9.62	155.21	5935	5946							
-42.8		-9.74	154.37	5985	5996							
-43.2		-9.86	153.51	6035	6046							
-43.6		-9.98	152.61	6085	6096							
-44.0		-10.10	151.67	6135	6146							
-44.4		-10.22	150.71	6185	6196							
-44.8		-10.34	149.71	6235	6246							
-45.2		-10.46	148.69	6285	6296							
-45.6		-10.58	147.61	6335	6346							
-46.0		-10.70	146.51	6385	6396							
-46.4		-10.82	145.37	6435	6446							
-46.8		-10.94	144.21	6485	6496							
-47.2		-11.06	143.01	6535	6546							
-47.6		-11.18	141.77	6585	6596							
-48.0		-11.30	140.51	6635	6646							
-48.4		-11.42	139.21	6685	6696							
-48.8		-11.54	137.87	6735	6746							
-49.2		-11.66	136.51	6785	6796							
-49.6		-11.78	135.11	6835	6846							
-50.0		-11.90	133.69	6885	6896							
-50.4		-12.02	132.21	6935	6946							
-50.8		-12.14	130.71	6985	6996							
-51.2		-12.26	129.17	7035	7046							
-51.6		-12.38	127.61	7085	7096							
-52.0		-12.50	126.01	7135	7146							
-52.4		-12.62	124.37	7185	7196							

76.150 LBS (il. 1a)

[illegible]

A. V. ROE CANADA LIMITED

MALTON, ONTARIO
ENGINEERING DIVISION - AIRCRAFT

REPORT NO.

71554/5

SHEET

3-3

DATE

AUGUST 1955

AIRCRAFT

C-105

WEIGHT

47000 LBS

C. G. POSITION

PREPARED BY

Miller

18	19	20	21	22	23	24	25	26	27	28	29
			V = 76,150 FWD	V = 60,650 AFT							
IES				ASSUMED MAX. ONE H. 2.0							END LOAD P
f _{ST}	A ₂ (z ₂ -z ₂)	A ₂ (z ₂ -z ₂)	8								
53,000	15.42	15.42	213	170							32,900
49,200	4.24	19.66	276	216							9,050
48,300	3.58	23.24	321	256							7,620
47,500	3.51	26.72	370	294							7,500
46,600	3.45	30.20	417	332							7,360
45,750	3.39	33.59	464	370							7,230
44,900	3.32	36.91	510	406							7,100
44,000	3.26	40.17	555	441							6,950
40,600	16.12	56.29	778	620							34,400
36,500	2.50	58.79	812	646							5,360
20,800	1.65	60.44	835	664							3,540
10,100	.80	61.24	846	674							1,720
-576	-.05	61.19	845	673							-98
-11,000	.61	60.58	837	666							-1,300
-21,700	-1.07	59.51	822	655							-2,280
-32,400	-1.49	58.12	803	640							-3,180
-43,100	-1.90	56.12	776	618							-4,050
-53,700	-49.28	6.42	95	76							-105,150
-47,800	6.89	0	0	0							-14,720

A.V.ROE CANADA LIMITED
MALTON - ONTARIO

TECHNICAL DEPARTMENT (Aircraft)

REPORT NO. 710554/5

SHEET NO. 4-2

PREPARED BY:

DATE:

CHECKED BY:

DATE:

AIRCRAFT C-105

CENTRE FUSELAGE SECTIONS

EFFECTIVE SHEET WIDTHS

STA 392 CASE 21 a RT.

2ND APP

$$A_{13} = .0531 + \frac{1.34}{(9215)^{\frac{1}{3}}} = .117 \text{ in}^2$$

$$A_{14} = .0531 + \frac{1.34}{(17950)^{\frac{1}{3}}} = .104 \text{ in}^2$$

$$A_{15} = .0531 + \frac{1.34}{(26500)^{\frac{1}{3}}} = .098 \text{ in}^2$$

$$A_{16} = .0531 + \frac{1.34}{(35234)^{\frac{1}{3}}} = .094 \text{ in}^2$$

$$A_{BL} = 2.25 + \frac{1.34}{(44100)^{\frac{1}{3}}} = 2.288 \text{ in}^2$$

$$A_{17} = .268 + \frac{1.34}{(39251)^{\frac{1}{3}}} = .307 \text{ in}^2$$

FINAL PROPERTIES

$$A_{13} = .0531 + \frac{1.34}{(8876)^{\frac{1}{3}}} = .118 \text{ in}^2$$

$$A_{14} = .0531 + \frac{1.34}{(17600)^{\frac{1}{3}}} = .105 \text{ in}^2$$

$$A_{15} = .0531 + \frac{1.34}{(26200)^{\frac{1}{3}}} = .098 \text{ in}^2$$

$$A_{16} = .0531 + \frac{1.34}{(34750)^{\frac{1}{3}}} = .094 \text{ in}^2$$

$$A_{BL} = 2.250 + \frac{1.34}{(43600)^{\frac{1}{3}}} = 2.288 \text{ in}^2$$

$$A_{17} = .268 + \frac{1.34}{(38750)^{\frac{1}{3}}} = .308 \text{ in}^2$$

SECTIONAL CONSTANTS

STN. 392

CASE: 2.1(a) ROOM TEMPERATURE

$M_y = 10,750,000$ IN-LBS

+VE B.M. (TENSION IN TOP); $V = 43,000$ LBS.

	1	2	3	4	5	6	7	8	9	10	
	FIRST APPROXIMATION						SECOND APPROXIMATION				
ITEM	Z	A	AZ	AZ ²	Z - $\bar{Z}$	I _{ST}	Z ₁	A ₁	AZ ₁	A ₁ Z ₁ ²	Z ₁ -
UPPER INNER LONG'N	36.0	.626	22.54	811			1	1	1	1	
STR 2	35.2	.189	6.65	234							
3	34.8	.158	5.50	191							
4	34.4	.158	5.43	187				(2)	(3)	(4)	
5	34.0	.158	5.37	183			(5)				
6	33.6	.158	5.31	178				COL	COL	COL	
7	33.2	.158	5.25	174				AS	AS	AS	
8	32.8	.158	5.18	170				AS	AS	AS	
UPPER OUTER LONG'N	31.2	1.280	39.94	1246							
STR 9	26.9	.170	4.57	123							
10	21.9	.170	3.72	81							
11	16.9	.170	2.87	49							
12	11.9	.170	2.02	24							
13	7.0	.082	.57	4	-5.277	9215		.117	.82	6	-5.1
14	2.1	.082	.17	0	-10.277	17950		.104	.22	0	-10.1
15	-2.9	.082	-.24	1	-15.177	26500		.098	-.28	1	-15.0
16	-7.9	.082	-.65	5	-20.177	35234		.094	-.74	6	-20.1
BOTTOM LONG'N	-13.0	2.287	-29.73	386	-25.277	44100		2.288	-2.74	386	-25.1
STR 17	-10.2	.297	-3.03	31	-22.477	39251		.307	-3.13	32	-22.1
		2.912	32.91					3.100	-3.85		
	12.277	6.635	81.46	4078			12.111	6.731	81.52	4082	
	$I = 4078 - 6.635(12.277)^2 = 3078$						$I = 4082 - 6.731(12.111)^2 = 3095$				
	$I_{tot} = 6156 \text{ IN}^4$						$I = 3095 \times 2 = 6190 \text{ IN}^4$				

115,705
33 LBS

of) ; $V = 43000$ LBS.

[illegible]

STN. 414

$$M_x = 12,000,000 \text{ in}^2 + \text{V.E. B.M.}$$

(TENSION IN TOP) ✓ 36000*

FORM 1544

MALTON, ONTARIO
ENGINEERING DIVISION - AIRCRAFT

REPORT NO

SHEET

DATE _____

PREPARED BY

AIRCRAFT

WEIGHT

C. G. POSITION

C-105

47 000 #

JAN. 1955

[illegible]

A. V. ROE CANADA LIMITED

MALTON, ONTARIO

ENGINEERING DIVISION - AIRCRAFT

AIRCRAFT

C-105

WEIGHT

47000 #

C. G. POSITION

REPORT NO.

21053415

SHEET

4-11

DATE _____

FEB 25, 1955

PREPARED BY

W. L. G.

[illegible]



AVRO AIRCRAFT LIMITED

TECHNICAL DEPARTMENT (Aircraft)

AIRCRAFT

C-105

CENTER
FUSELAGE

REPORT NO.

7-0550-415

SHEET NO.

5-2

PREPARED BY

DATE

CHECKED BY

DATE

JUNE 28, 1955

DOWN BENDING (TEN. IN TOP) ELEV. T. (250°F.)

SECTIONAL CONSTANTS ARE CALCULATED USING
THE FOLLOWING SHEARS & B.M.

CASE 8.1 a ELEVATED TEMP. 250°F.

STA.	SHEAR #	B.M. " #
255	40 350 41 218	4 100 000
268	41 218 46 370	5 264 000
292	43 239 57 750	6 250 000
315	62 020 63 300	7 695 000
337	62 022 62 800	9 068 000
359	55 403	10 390 000
392		
414		
469		
485		

REF. SYM. FLIGHT CASES, REP. 7-0550-4

SECTIONAL CONSTANTS

STN. 255

CASE 8.1 (a) ELEVATED TEMP 250°F

$M_1 = 4700000$ IN-LBS

+1/E 8M. (TENSION IN TOP)

$V = 40350$ LB (END) $V = 41218$ LB (A)

	1	2	3	4	5	6	7	8	9	10	11
ITEM	FIRST APPROXIMATION						SECOND APPROXIMATION				
	$\bar{z}$	A	$A\bar{z}$	$A\bar{z}^2$	$\bar{z} - \bar{\bar{z}}$	f_{ST}	$\bar{z}_1$	A	$A\bar{z}_1$	$A\bar{z}_1^2$	$\bar{z}_1 - \bar{\bar{z}}$
UPPER INNER LONG'N	34.7	1.388	48.10	1670	—	—	34.7	1.388	48.10	1670	—
STR 2	34.4	.257	8.84	304	—	—	↑	↑	↑	↑	—
3	34.2	.188	6.43	220	—	—	↑	↑	↑	↑	—
4	33.9	.173	5.86	199	—	—	①	②	③	④	—
5	33.6	.158	5.31	178	—	—	↑	↑	↑	↑	—
6	33.4	.158	5.28	176	—	—	↑	↑	↑	↑	—
7	33.1	.158	5.22	173	—	—	↑	↑	↑	↑	—
8	32.5	.158	5.14	167	—	—	↑	↑	↑	↑	—
UPPER OUTER LONG'N	30.5	.158	4.82	147	—	—	↓	↓	↓	↓	—
STR 9	27.0	.170	4.59	124	—	—	↓	↓	↓	↓	—
10	22.0	.170	3.74	82	—	—	↓	↓	↓	↓	—
11											
12											
13											
14											
15	-3.0	.082	-.24	1	-23.86	23100		.154	-.46	1.38	-22.5
16	-8.0	.082	-.64	5	-28.86	27900		.148	-1.18	9.45	-27.5
BOTTOM LONG'N	-13.0	.845	-10.99	143	-33.86	32700		.888	-71.53	150.00	-32.5
STR 17	-14.5	.299	-4.34	63	-35.36	34200	-14.5	.330	-4.78	69.20	-34.0
	20.86	4.444	92.72	3846			19.5	4.656	91.00	3864	
	$I = 3846 - 4.444(20.86)^2$						$I = 3864 - 4.656(19.5)^2$				
	$I = 1914; I_{total} = 3828 \text{ IN}^4$						$I = 2089; I_{total} = 4178 \text{ IN}^4$				

ANTS

TEMP 250°F

BS

Top) $V = 40350 \text{ LB (FWD)}$ $V = 41218 \text{ LB (AFT)}$

5	6	7	8	9	10	11	12	13	14	15	16	17	18
TION		SECOND APPROXIMATION						FINAL PROPERTIES					
$z - \bar{z}$	f_{ST}	z_1	A_1	$A_1 z_1$	$A_1 z_1^2$	$z_1 - \bar{z}_1$	f_{ST}	z_2	A_2	$A_2 z_2$	$A_2 z_2^2$	$z_2 - \bar{z}_2$	f_{ST}
—	—	34.7	1.388	48.10	1670	—	—	34.7	1.388	48.10	1670	16.5	18300
—	—	↑	↑	↑	↑	—	—	↑	↑	↑	↑	16.2	17950
—	—	↑	↑	↑	↑	—	—	①	②	③	④	16.0	17700
—	—	①	②	③	④	—	—	①	②	③	④	15.7	17400
—	—	↑	↑	↑	↑	—	—	↑	↑	↑	↑	15.4	17100
—	—	↑	↑	↑	↑	—	—	↑	↑	↑	↑	15.2	16800
—	—	↑	↑	↑	↑	—	—	↑	↑	↑	↑	14.9	16500
—	—	↑	↑	↑	↑	—	—	↑	↑	↑	↑	14.3	15800
—	—	↑	↑	↑	↑	—	—	↑	↑	↑	↑	12.3	13600
—	—	↑	↑	↑	↑	—	—	↑	↑	↑	↑	8.8	9750
—	—	22.0	.170	3.74	82	—	—	22.0	.170	3.74	82	3.8	4200
23.86	23100		.154	-4.46	1.38	-22.5	-19900		.157	-4.48	1.43	21.2	-23500
28.86	27900		.148	-1.18	9.45	-27.5	-24400		.152	-1.22	9.76	26.2	-29000
33.86	32700		.888	-11.53	150.00	-32.5	-28800		.892	-11.60	151.00	31.2	-34600
35.36	34200	-14.5	.330	-4.78	69.20	-34.0	-30100	-14.5	.332	-4.81	69.60	32.7	-36200
		19.5	4.656	91.20	3864			18.22	4.671	85.22	3672		
		$I = 3864 - 4.656(19.5)^2$						$I = 3672 - 4.671(18.22)^2$					
		$I = 2089; I_{total} = 4178 \text{ in}^4$						$I = 2126; I_{total} = 4242 \text{ in}^4$					

MALTON, ONTARIO
ENGINEERING DIVISION - AIRCRAFT

7/05/15

5-3

AUGUST 1955

C105

47000 LBS

PREPARED BY

17	18	19	20	21	22	23	24	25	26	27	28	29
												STA 255

SECTIONAL CONSTANTS

STN. 268

CASE 8.1 a. ELEVATED TEMPERATURE 250°F

$M_y = 5264 \times 100 \text{ IN-LBS.}$

V.E. B.M (TENSION IN TOP) $V = 41218 \text{ LBS (8.1a)} = 46370 \text{ LBS (8.1a)}$

	1	2	3	4	5	6	7	8	9	10	11
	FIRST APPROXIMATION						SECOND APPROXIMATION				
ITEM	Z	A	AZ	AZ ²	Z - $\bar{Z}$	f_{ST}	Z ₁	A ₁	A ₁ Z ₁	A ₁ Z ₁ ²	Z ₁ - $\bar{Z}_1$
UPPER INNER LONG'N	34.7	.914	31.70	1100	20.3	20700	34.7	.572	19.85	690	21.8
STR 2	34.4	.132	4.54	156	—	—	↑	↑	↑	↑	—
3	34.2	.158	5.40	185	—	—					—
4	33.9	.158	5.36	182	—	—					—
5	33.6	.158	5.31	179	—	—		(2)	(3)	(4)	—
6	33.4	.158	5.28	176	—	—					—
7	33.1	.158	5.23	173	—	—	(1)				—
8	32.5	.158	5.14	167	—	—					—
UPPER OUTER LONG'N	30.5	.273	8.33	254	—	—	COL	AS COL	AS COL	AS COL	—
STR 9	27.0	.170	4.59	124	—	—		SAME AS COL	SAME AS COL	SAME AS COL	—
10	23.0	.170	3.74	82	—	—	AS COL				—
11	17.0	.170	2.89	49	—	—	AS COL				—
12	12.0	.170	2.04	24	-3.94	-4280	SAME				—
13	7.0	.082	.57	4	-8.94	-9700		.170	1.19	8.32	-7.5
14	2.0	.082	.16	0	-13.94	-15200		.169	.54	.68	-12.5
15	-3.0	.082	-.25	1	-18.94	-20600		.158	-.474	1.42	-17.5
16	-8.0	.082	-.65	5	-23.94	-26000		.150	-1.200	9.60	-22.5
BOTTOM LONG'N	-13.0	.970	-12.60	164	-28.94	-31400	↑	1.013	-13.200	171.80	-27.5
STR 17	-14.4	.299	-4.30	62	-30.34	-33600	-14.4	.330	-4.75	68.40	-28.9
Σ =	15.94	4.544	72.46	3087			14.5	4.937	71.44	3111	
	$I = 3087 - 4.544(15.94)^2$						$I = 3111 - 4.937(14.5)^2$				
	$I = 1931, I_{total} = 3862 \text{ in}^4$						$I = 2071, I_{total} = 4142 \text{ in}^4$				

STANTS

D TEMPERATURE 250°F

B5.

V. 41215 LBS (E. 1m) 46370 LBS (E. 1m)

[illegible]

SECTIONAL CONSTANTS

STN. 292

CASE B.1 (a) @ ELEVATED TEMP. 250°F

$M_y = 6250,000$ IN-LBS

+ V.E. BM (TENSION IN TOP)

$V = 43.23$

	1	2	3	4	5	6	7	8	9	10	11
ITEM	Z	A	AZ	AZ ²	Z- $\bar{Z}$	f _{ST}	Z _i	A _i	AZ _i	AZ _i ²	Z _i - $\bar{Z}_i$
UPPER INNER LONG'N	36.1	.584	21.1	762	21.1	30800	36.1	.584	21.1	762	22.7
STR 2	35.3	.147	5.2	184	—	—	1	1	1	1	—
3	34.7	.158	5.48	190	—	—	1	AS COLUMN No 2	AS COLUMN No 3	AS COLUMN No 4	—
4	34.4	.158	5.44	187	—	—	1	AS COLUMN No 2	AS COLUMN No 3	AS COLUMN No 4	—
5	33.9	.158	5.35	181	—	—	1	AS COLUMN No 2	AS COLUMN No 3	AS COLUMN No 4	—
6	33.5	.158	5.30	177	—	—	1	AS COLUMN No 2	AS COLUMN No 3	AS COLUMN No 4	—
7	33.1	.158	5.22	173	—	—	1	AS COLUMN No 2	AS COLUMN No 3	AS COLUMN No 4	—
8	32.7	.158	5.16	169	—	—	1	AS COLUMN No 2	AS COLUMN No 3	AS COLUMN No 4	—
UPPER OUTER LONG'N	31.2	.330	10.30	321	—	—	1	AS COLUMN No 2	AS COLUMN No 3	AS COLUMN No 4	—
STR 9	27.0	.170	4.60	124	—	—	1	AS COLUMN No 2	AS COLUMN No 3	AS COLUMN No 4	—
10	22.0	.170	3.74	82	—	—	1	AS COLUMN No 2	AS COLUMN No 3	AS COLUMN No 4	—
11	17.0	.170	2.89	49	2.0	2920	AS	1	1	1	—
12	12.0	.170	2.04	25	-3.0	4370	AS	.170	2.04	25	-1.4
13	7.0	.082	.57	4	-8.0	11700	AS	.170	1.19	8	-6.4
14	2.0	.082	.16	0	-13.0	19000	AS	.161	.42	1	-11.4
15	-3.0	.082	-.25	1	-18.0	26200	AS	.150	-.45	1	-16.4
16	-8.0	.082	-.66	1	-23.0	33500	AS	.143	+1.14	9	-21.4
BOTTOM LONG'N	-13.0	1.133	-14.70	191	-28.0	40800	1	1.224	15.90	207	-26.4
STR 17	-9.6	.299	-2.87	28	-24.6	35800	-9.6	.329	-3.16	30	-23.0
Σ	15.0	4.279	-64.07	2749			13.4	4.696	-62.78	2780	
	$I = 2749 - 4.279(15.0)^2$						$I = 2780 - 4.696(13.4)^2$				
	$I_{total} = 3578$ IN ⁴						$I = 1940$; $I_{total} = 3880$ IN ⁴				
	$A_{BL} = 1.140$ IN ²										

IN TOP)

$$V = 43,239^{\text{ft}} (\text{FWD.}) \quad \& \quad V = 57,750^{\text{ft}} (\text{AFT.})$$

[illegible]

MALTON, ONTARIO
ENGINEERING DIVISION — AIRCRAFT

C 105

47000 LBS

REPORT NO.

71055415

SHEET

5-17

DATE _____

AUGUST 1955

PREPARED BY

1844

[illegible]

A.V.ROE CANADA LIMITED
MALTON - ONTARIO

TECHNICAL DEPARTMENT (Aircraft)

REPORT NO. 710554/5

SHEET NO. 5-3

AIRCRAFT

C105

SECTIONAL
CONSTANTS

PREPARED BY:

S. YOUNG

DATE:

JAN 14/55

CHECKED BY:

DATE:

STA 315

CASE 8.13

TENSION ON TOP

250°F

$$M_y = +6,200,000 \text{ " #}$$

$$V = 56000 \text{ #}$$

CONSIDER TENSION FROM UPPER INNER LONGERON
TO SIDE STRINGER 12.

THE MG. SKIN AREAS ARE REDUCED BY $\frac{c}{10}$ TO
GIVE AN EQUIVALENT EFFECTIVE AREA.

SKINS

STRINGER NOMINAL PITCH = 4.5 ON TOP - 040 MG
5.0 ON SIDE - 051 MG
5.0 ON BTM - SEE NOTE

ITEM	U.L.L.	2	3-8	U.O.L.	9-12	13-16	B.L.	17
SKIN A	.2	.2	.180	.2	.235	.078	.078	.063
$\frac{c}{10}$ SKIN A	.120	.120	.108	.120	.153	.047	.047	.038
BASIC A	.490	.0501	.0501	.208	.0501	.0531	1.373	268
A	.610	.170	.158	.328	.203	.100	1.420	306

NOTE:

THE BOTTOM SKIN IS 051 MG BETWEEN B.L. & #17
& 040 MG INB'D OF #17

$$\begin{aligned} \text{COMP SKIN AREA: } \#13-16 &= 30(.051)^2 = .078 \\ \text{BL} &= 30(.051)^2 = .078 \\ \#17 &= 15(.051)^2 + 15(.040)^2 = .063 \end{aligned}$$

A.V. ROE CANADA LIMITED
MALTON - ONTARIO

TECHNICAL DEPARTMENT (Aircraft)

REPORT NO. 71055415

SHEET NO. 5-9

AIRCRAFT

C105

SECTIONAL
CONSTANTS

PREPARED BY:

S. YOUNG

DATE:

JAN 14/55

CHECKED BY:

DATE:

STA 315

EFFECTIVE COMP. SKIN WIDTHS BRUHN EQ^N B4.10

$$\frac{w}{b} = \sqrt[3]{\frac{F_{CR}}{f_{ST}}}$$

SIDE SHEET 051 MG

$$A_{EQUIV.} = A_{STR.} + wt = A_{STR.} + \frac{6}{10} \times 0.51 \times 5.0 \sqrt[3]{\frac{F_{CR}}{f_{ST}}}$$

$$F_{CR} = 3.6 E \left(\frac{t}{b}\right)^2 \quad \text{BRUHN EQ^N B4.2}$$

$$= 3.6 \times 6 \times 10^6 \left(\frac{0.51}{5.0}\right)^2 = 2250 \text{ PSI}$$

$$A_{EQUIV} = A_{STR.} + .153 \sqrt[3]{\frac{2250}{f_{ST}}} = A_{STR.} + 2.0 \frac{1}{\sqrt[3]{f_{ST}}}$$

BOTTOM SHEET 040 MG

$$A_{EQUIV} = A_{STR.} + \frac{6}{10} \times 0.40 \times 5.0 \sqrt[3]{\frac{1}{f_{ST}} \times 3.6 \times 6 \times 10^6 \left(\frac{0.40}{5.0}\right)^2}$$

$$= A_{STR.} + 1.338 \frac{1}{\sqrt[3]{f_{ST}}}$$

A.V. ROE CANADA LIMITED
MALTON - ONTARIO

TECHNICAL DEPARTMENT (Aircraft)

AIRCRAFT

C 105

SECTION
CONSTANTS

REPORT NO.

710554/5

SHEET NO.

5-10

PREPARED BY:

S. YOUNG

DATE:

JAN 14/55

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DATE:

STA 315

COMP. SKIN AS PER 2ND APPROXIMATION

$$A_B = .053 + \frac{2.}{\sqrt[3]{8380}} = .053 + .098 = .151 \quad \square''$$

$$A_{14} = .053 + \frac{2.}{\sqrt[3]{15500}} = .053 + .080 = .133$$

$$A_{15} = .053 + \frac{2.}{\sqrt[3]{22550}} = .053 + .071 = .124$$

$$A_{16} = .053 + \frac{2.}{\sqrt[3]{29650}} = .053 + .065 = .118$$

$$A_{B.L.} = 1.373 + \frac{2.}{\sqrt[3]{38200}} = 1.373 + .059 = 1.432$$

$$A_{17} = .268 + \frac{1}{2} \frac{2.}{\sqrt[3]{31900}} + \frac{1}{2} \frac{1.338}{\sqrt[3]{31900}} = .268 + .031 + .021 = .320$$

CORRECTION FOR 3RD APPROXIMATION SIMILAR TO ABOVE

SECTIONAL CONSTANTS

STN. 315

CASE 8.18 ELEVATED TEMP. 250°F

$M_y = +7,695,000$ IN. LB.

$V = 62020$ LB. (FWD.)

+VE B.M. (TENSION ON TOP)

$V = 63300$ LB. (AFT.)

	1	2	3	4	5	6	7	8	9	10	11
	1ST APPROXIMATION						2ND APPROXIMATION				
ITEM	Z	A	AZ	AZ ²	Z - $\bar{Z}$	f _{ST}	Z ₁	A ₁	A ₁ Z ₁	A ₁ Z ₁ ²	Z ₁ - $\bar{Z}_1$
UPPER INNER LONG'N	36.1	.610	22.0	795	23.2	32700	36.1	.610	22.0	795	
STR 2	35.3	.170	6.0	212	22.4	31800	A	A	A	A	
3	34.7	.158	5.48	190	21.8	30950					
4	34.4	.158	5.44	187	21.5	30500					
5	33.9	.158	5.36	181	21.0	29800		SAME	SAME	SAME	
6	33.5	.158	5.29	177	20.6	29250					
7	33.1	.158	5.23	173	20.2	28700	SAME	AS	AS	AS	
8	32.7	.158	5.17	169	19.8	28100					
UPPER OUTER LONG'N	31.2	.328	10.22	319	18.3	25950	AS	(2)	(3)	(4)	
STR 9	27.0	.203	5.48	148	14.1	20000					
10	22.0	.203	4.47	98	9.1	12920	(1)				
11	17.0	.203	3.46	59	4.1	5820		Y	Y	Y	4.5
12	12.0	.203	2.44	29	-0.9	-1420		.203	2.44	29	-0.5
13	7.0	.100	.70	5	-5.9	-8380		.151	1.05	7	-5.5
14	2.0	.100	.20	0	-10.9	-15500		.133	.26	1	-10.5
15	-3.0	.100	-.30	1	-15.9	-22550		.124	-.37	1	-15.5
16	-8.0	.100	-.80	6	-20.9	-27650		.118	-.95	8	-20.5
BOTTOM LONG'N	-13.0	1.420	-18.45	240	-25.9	-38200	V	1.432	-18.60	242	-25.5
STR 17	-9.6	.306	-2.94	28	-22.5	-31900	-9.6	.520	-3.07	30	-22.1
Σ	12.9	4.994	64.45	3017			12.5	5.146	64.76	3026	
	$I = 3017 - 4.994 \times 12.9^2 = 2185$						$I = 3026 - 5.146 \times 12.5^2 = 2222$				
	$I_{TOTAL} = 4370 \text{ IN}^4$						$I_{TOTAL} = 4444$				

TEMP. 250°F

$V = 62020 \text{ LB. (FWD.)}$

$$V = 63300 \text{ LB. (AFT.)}$$

TOP)

6	7	8	9	10	11	12	13	14	15	16	17	18	19
2ND APPROXIMATION						FINAL PROPERTIES							
f_{ST}	z_1	A_1	$A_1 z_1$	$A_1 z_1^2$	$z_1 - \bar{z}_1$	f_{ST}	z_2	A_2	$A_2 z_2$	$A_2 z_2^2$	$z_2 - \bar{z}_2$	f_{ST}	$A_2 z_2^2$
32700	36.1	610	2210	795			36.1	610	2210	795	23.6	40900	15
31800	A	A	A	A			A	A	A	A	22.8	34500	3
30950											22.2	34400	3
30500											21.9	33000	4
29800		SAME	SAME	SAME							21.4	37000	3
29250							SAME	SAME	SAME	SAME	21.0	36400	3
28700	SAME	AS	AS	AS							20.6	35700	3
28100							AS	AS	AS	AS	20.2	35000	3
25950	AS	(2)	(3)	(4)							18.7	32400	6
20000							(1)	(2)	(3)	(4)	14.5	25100	2
12920	(1)										9.5	16450	1
5820		Y	Y	Y	4.5			.203	3.46	59	4.5	7800	
-1420		.203	2.44	29	-0.5	-700		.203	2.44	29	-0.5	-870	-
-8380		.151	1.05	7	-5.5	-7080		.157	1.10	8	-5.5	-19500	-
-15500		.133	.26	1	-10.5	-14680		.135	.27	0	-10.5	-18200	-
-22550		.124	.37	1	-15.5	-21650		.125	.37	1	-15.5	-26800	-
-29650		.118	.95	8	-20.5	-28650		.118	.95	8	-20.5	-35500	-
-38200	Y	1.432	1860	242	-25.5	-35600	Y	1.434	1865	242	-25.5	-44100	-3
-31900	-9.6	.520	3.07	30	-22.1	-30850	-9.6	.521	3.08	30	-22.1	-38300	-1
12.5						12.5							
5.146						5.158							
64.36						64.36							
3026						3028							
$I = 3026 - 5.146 \times 12.5^2 = 7222$						$I = 3028 - 5.158 \times 12.5^2 = 7222$							
$I_{TOTAL} = 4444$						$I_{TOTAL} = 4444 \text{ IN}^4$							

A. V. ROE CANADA LIMITED

MALTON, ONTARIO

ENGINEERING DIVISION — AIRCRAFT

AIRCRAFT

WEIGHT

C. G. POSITION

REPORT NO.

SHEET

DATE _____

PREPARED BY

[illegible]

STN. 359

$$M_y = +10,390,000 \text{ IN-LBS}$$

+ V.E. B.M (TENSION IN TOP)

$$V =$$

LBS. / 38,800

MALTON, ONTARIO
ENGINEERING DIVISION - AIRCRAFT

AIRCRAFT

C-105

WEIGHT

47000 #

C. G. POSITION

[illegible]

SECTIONAL CONSTANTS

STN. 414

CASE 8.1 (a) @ ELEVATED TEMP 250°F.

$M_x = 11,600,000$ IN-LBS

+VE B.M. (TENSION IN TOP)

$V = 38,000$ # CASE 11.

	1	2	3	4	5	6	7	8	9	10	11
	1 ST APPROXIMATION						2 ND APPROXIMATION				
ITEM	Z	A	AZ	AZ ²	Z - $\bar{Z}$	f _{ST}	Z _i	A _i	A _i Z _i	A _i Z _i ²	Z _i - $\bar{Z}$
UPPER INNER LONG'N	36.0	.635	22.8	820	24.0	42100	36.0	.635	22.8	820	24.6
STR 2	35.2	.195	6.86	242	-	-	↑	↑	↑	↑	-
3	34.8	.158	5.50	195	-	-	↓	↓	↓	↓	-
4	34.4	.158	5.44	187	-	-	↓	↓	↓	↓	-
5	34.0	.158	5.39	180	-	-	↓	↓	↓	↓	-
6	33.6	.158	5.31	178	-	-	↓	↓	↓	↓	-
7	33.2	.158	5.25	174	-	-	↓	↓	↓	↓	-
8	32.8	.158	5.19	170	-	-	↓	↓	↓	↓	-
UPPER OUTER LONG'N	31.2	1.464	45.70	1430	-	-	↓	↓	↓	↓	-
STR 9	26.9	.170	4.57	123	-	-	↓	↓	↓	↓	-
10	21.9	.170	3.72	81	-	-	↓	↓	↓	↓	-
11	16.9	.170	2.87	48	-	-	↓	↓	↓	↓	-
12	11.9	.170	2.02	24	-1	176	↓	.170	2.02	24	-
13	7.0	.082	.57	4	-5.0	8800	↓	.170	1.19	8	-4.4
14	2.1	.082	.17	1	-9.9	17400	↓	.164	.34	1	-9.3
15	-2.9	.082	-.24	1	-14.9	26100	↓	.150	-.43	1	-13.3
16	-7.9	.082	-.65	5	-19.9	35000	↓	.141	-1.11	8	-19.3
BOTTOM LONG'N	-13.0	2.509	-32.60	423	-25.0	43900	↓	2.535	-3.00	429	-24.4
STR 17	-10.2	.299	-3.05	31	-22.2	39000	-10.2	.326	-3.32	34	-21.6
$\bar{Z} =$	12.0	7.058	84.90	4317			11.38	7.408	4.37	4333	
	$I = 4317 - 7.058(12.0)^2 = 3302 \text{ IN}^4$						$I = 4333 - 7.408(11.38)^2$				
	$I_{total} = 6604 \text{ IN}^4$						$I_{total} = 6746 \text{ IN}^4$				
$A_{B.L.} =$	2.461 (AREA WITHOUT EFFECTIVE SKIN AREA)										

A. V. ROE CANADA LIMITED

MALTON, ONTARIO
ENGINEERING DIVISION - AIRCRAFT

AIRCRAFT

C105

WEIGHT

47000

C. G. POSITION

REPORT NO.

71053415

SHEET

5-15

DATE

JAN 1955

PREPARED BY

W. H. H.

17	18	19	20	21	22	23	24	25	26	27	28	29
PROPERTIES						Room Temperature (Base 11.12)						
$z_2 - \bar{z}_2$	f_{ST}	$A_2(z_2 - \bar{z}_2)$	$\int A_2(z_2 - \bar{z}_2)$	$\bar{z}$	ENDLOAD P							
24.54	42300	15.6	0	0	26900							
23.74	41000	4.6	15.6	88								
23.34	40200	3.7	20.2	104								
22.94	39500	3.6	23.9	135								
22.54	38800	3.6	27.5	155								
22.14	38200	3.5	31.1	175								
21.74	37400	3.4	34.6	195								
21.34	36800	3.4	38.0	214								
19.74	34000	29.0	41.4	234	49800							
15.44	26600	2.6	70.4	398								
10.44	18000	1.8	73.0	412								
5.44	9400	.9	74.8	422								
.44	760	.1	75.7	427								
-4.4	-7600	-.4	75.8	428								
-9.3	-16000	-1.2	75.4	425								
-13.3	-23000	-2.1	73.8	416								
-19.3	-33200	-2.7	71.7	405								
-24.4	-42000	-61.5	69.0	390	106000							
-21.6	-37200	-7.0	7.5	42								
			0	0								

IN 4

SECTIONAL CONSTANTS

STN. 469

CASE 8.1(a) @ ELEVATED TEMP. 250°F.

$M_y = 11,115,000$ IN-LBS

+V.E. B.M. (TENSION IN TOP)

$V = 28100$ LBS.

B.L.

	1	2	3	4	5	6	7	8	9	10	
	1 ST APPROXIMATION						2 ND APPROXIMATION				
ITEM	Z	A	AZ	AZ ²	Z- $\bar{Z}$	f _{ST}	Z _i	A _i	A _i Z _i	A _i Z _i ²	Z _i -
UPPER INNER LONG'N	36.0	.660	23.8	856	24.95	36100	36.0	.660	23.8	856	25.
STR 2	35.2	.220	7.75	273	-	-					-
3	34.8	.158	5.50	191	-	-					-
4	34.4	.158	5.44	187	-	-					-
5	34.0	.158	5.37	183	-	-					-
6	33.6	.158	5.30	178	-	-					-
7	33.2	.158	5.25	174	-	-					-
8	32.8	.158	5.18	170	-	-					-
UPPER OUTER LONG'N	31.2	1.815	56.60	1770	-	-					-
STR 9	26.9	.170	4.57	123	-	-					-
10	21.9	.170	3.72	82	-	-					-
11	16.9	.170	2.87	48	-	-					-
12	11.9	.170	2.02	24	+ .85	1230					-
13	7.0	.082	.57	4	-4.05	5860					-
14	2.1	.082	.17	0	-8.85	12300					-
15	-2.9	.082	-.24	1	-13.95	20200					-
16	-7.9	.082	-.65	5	-18.95	27400					-
BOTTOM LONG'N	-13.0	3.140	-40.80	530	-24.05	34800					-
STR 17	-10.2	.299	-3.05	31	-21.25	30800					-
$\Sigma =$	11.05	8.080	89.37	4830			10.44	8.472	88.506	4851	
	$I = 4830 - 8.080(11.05)^2$						$I = 4851 - 8.472(10.44)^2$				
	$I = 3843; I_{total} = 7686$ IN ⁴						$I = 3937; I_{total} = 7851$				

SECTIONAL CONSTANTS

STN. 485

CASE 8.2(a) ELEVATED TEMP 250°F.

$M_y = 14,215,000$ IN-LBS

TVE BM. (TENSION IN TOP)

TAKEN AS
 $V = 32,000$ LBS.

	1	2	3	4	5	6	7	8	9	10	11
	FIRST APPROXIMATION						SECOND APPROXIMATION				
ITEM	$\bar{z}$	A	A $\bar{z}$	A $\bar{z}^2$	$\bar{z} - \bar{\bar{z}}$	f_{st}	$\bar{z}_1$	A $_1$	A $\bar{z}_1$	A $\bar{z}_1^2$	$\bar{z}_1 - \bar{\bar{z}}$
UPPER INNER LONG'N	37.1	.660	24.5	909	24.82	42500	37.1	.660	24.5	909	25.6
STR 2	35.1	.220	7.7	270							
3	34.7	.158	5.48	190							
4	34.3	.158	5.42	186							
5	33.9	.158	5.36	182							
6	33.5	.158	5.29	177							
7	33.1	.158	5.23	173							
8	32.7	.158	5.17	169							
UPPER OUTER LONG'N	31.1	1.815	56.45	1755	13.82	30560	31.1	1.815	56.45	1755	19.6
STR 9											
10											
11											
12											
13											
14											
15											
16											
BOTTOM LONG'N	-13.0	3.20	39.0	507	-25.28	41000	13.0	3.21	41.7	542	24.5
STR 17											
	12.28	6.643	81.60	4518			11.5	6.853	78.90	4553	
	$I = 4518 - 6.643(12.28)^2$						$I = 4553 - 6.853(11.5)^2$				
	$I = 3516; I_{total} = 7032 \text{ in}^4$						$I = 3648; I_{total} = 7296 \text{ in}^4$				
	$A_E = 3.13 + .073 = 3.21$										

MALTON, ONTARIO
ENGINEERING DIVISION - AIRCRAFT

AIRCRAFT	-	-	C105
WEIGHT	-	-	47000 LBS
C. G. POSITION	-	-	

[illegible]

A. V. ROE CANADA LIMITED

MALTON, ONTARIO

ENGINEERING DIVISION - AIRCRAFT

AIRCRAFT

C105

WEIGHT

47000 LBS

C. G. POSITION

REPORT NO

710554/5

SHEET

5-18

DATE

FEB 2, 1955

PREPARED BY

ASW

17	18	19	20	21	22	23	24	25	26	27	28	29
PROPERTIES												END LOAD P
$z_2 - \bar{z}_2$	f_{ST}	$A_2(z_2 - \bar{z}_2)$	$A_2(z_2 - \bar{z}_2)$	g								
25.6	49880	16.9	0	0								32920
23.6	45980	5.19	16.9	74								
23.2	45200	3.66	22.09	97								
22.8	44420	3.60	25.75	113								
22.4	43640	3.54	29.35	129								
22.0	42860	3.47	32.89	144								
21.6	42080	3.41	36.36	160								
21.2	41300	3.35	39.77	175								
19.6	38190	35.60	49.12	189								69310
			78.72	346								
24.5	47730	78.60										153210

SUPERCEDED



AVRO AIRCRAFT LIMITED
TECHNICAL DEPARTMENT (Aircraft)

REPORT NO. 71088915

SHEET NO. 6-2

AIRCRAFT

C-105

CENTER
FUSELAGE

PREPARED BY

DATE

SHL

JUNE 28, 1955

CHECKED BY

DATE

UP BENDING (COMP IN TOP) R.T.

SECTIONAL CONSTANTS ARE CALCULATED USING THE
FOLLOWING SHEARS & B.M.

CASE: SUDDEN APPLICATION OF ELEVATOR @ SEA LEVEL (R.T.)

STA.	SHEAR ⁺	B.M. ^{##}
255	- 24 090 - 25 777	- 3 050 000
268	- 25 777 - 28 990	- 3 321 000
292	- 29 710 - 32 840	- 4 027 000
315	- 33 778 - 33 980	- 4 848 000
337	- 34 610 - 34 290	- 5 595 000
359	- 35 280	- 6 367 000
392		
414		
469		
485		

A.V.ROE CANADA LIMITED
MALTON - ONTARIO

TECHNICAL DEPARTMENT (Aircraft)

REPORT NO. 71055415

SHEET NO. 6-3

PREPARED BY:

DATE:

CHECKED BY:

DATE:

AIRCRAFT

C-105

FEB 14, 1955

CENTRE FUSELAGE SECTIONS

STN 255 34 BM RT CASE

EFFECTIVE AREAS

$$A_{u1L} = 1.25 + .051(30 \times .051 \times 2) = 1.340$$

$$A_{ST2} = .0531 + .051(30 \times .051) = .098$$

$$A_{ST3} = .0531 + .051(30 \times .051) = .098$$

$$A_{ST4} = .0531 + .051(30 \times .051) = .098$$

$$A_{ST5} = .0531 + .040(30 \times .040) = .082$$

$$A_{uOL} = .103$$

2ND APPROXIMATION

$$A_{u1L} = 1.25 + \frac{2.02}{(17000)^{\frac{1}{3}}} = 1.329$$

$$A_{ST2} = .0531 + \frac{2.02}{(16750)^{\frac{1}{3}}} = .132$$

$$A_{ST3} = .0531 + \frac{2.02}{(16600)^{\frac{1}{3}}} = .132$$

$$A_{ST4} = .0531 + \frac{2.02}{(16300)^{\frac{1}{3}}} = .133$$

$$A_{ST5} = .0531 + \frac{1.29}{(16100)^{\frac{1}{3}}} = .104$$

$$A_{ST6} = .0531 + \frac{1.29}{(15900)^{\frac{1}{3}}} = .104$$

$$A_{ST7} = .0531 + \frac{1.29}{(15600)^{\frac{1}{3}}} = .105$$

$$A_{ST8} = .0531 + \frac{1.29}{(15100)^{\frac{1}{3}}} = .105$$

$$A_{uOL} = .050 + \frac{1.29}{(12450)^{\frac{1}{3}}} = .106$$

A.V. ROE CANADA LIMITED
MALTON - ONTARIO

TECHNICAL DEPARTMENT (Aircraft)

REPORT NO. 71-231/5

SHEET NO. 6-2

PREPARED BY:

DATE:

CHECKED BY:

DATE:

AIRCRAFT

C-105

FEB 10, 1955

CENTRE FUSELAGE SECTION
STA 267 3/4 BM RT CASE

EFFECTIVE SHEET WIDTHS
2ND APPROX.

$$A_{u1L} = .427 + \frac{2.02}{(32700)^{\frac{1}{3}}} = .875 \text{ IN}^2$$

$$A_{ST2} = .0531 + \frac{2.02}{(32400)^{\frac{1}{3}}} = .117 \text{ IN}^2$$

$$A_{ST3} = .0531 + \frac{2.02}{(32100)^{\frac{1}{3}}} = .117 \text{ IN}^2$$

$$A_{ST4} = .0531 + \frac{2.02}{(31800)^{\frac{1}{3}}} = .117 \text{ IN}^2$$

$$A_{ST5} = .0531 + \frac{2.02}{(31400)^{\frac{1}{3}}} = .117 \text{ IN}^2$$

$$A_{ST6} = .0531 + \frac{2.02}{(31200)^{\frac{1}{3}}} = .117 \text{ IN}^2$$

$$A_{ST7} = .0531 + \frac{2.02}{(30800)^{\frac{1}{3}}} = .118 \text{ IN}^2$$

$$A_{ST8} = .0531 + \frac{2.02}{(30200)^{\frac{1}{3}}} = .118 \text{ IN}^2$$

$$A_{uOL} = .060 + \frac{2.02}{(27800)^{\frac{1}{3}}} = .127 \text{ IN}^2$$

$$A_{ST9} = .0531 + \frac{1.34}{(23800)^{\frac{1}{3}}} = .101 \text{ IN}^2$$

$$A_{ST10} = .0531 + \frac{1.34}{(17900)^{\frac{1}{3}}} = .104 \text{ IN}^2$$

A.V. ROE CANADA LIMITED
MALTON - ONTARIO

TECHNICAL DEPARTMENT (Aircraft)

AIRCRAFT

C-105

REPORT NO.

71059413

SHEET NO.

6-6

PREPARED BY:

S.M. G.

DATE:

FEB 10 1955

CHECKED BY:

DATE:

CENTRE FUSELAGE SECTIONS
STA 268 3/4 B.M. ST. CASE

EFFECTIVE SHEET WIDTHS
FINAL PROPERTIES

$$A_{412} = .812 + \frac{2.02}{(28400)^{\frac{1}{3}}} = .878 \text{ IN}^2$$

$$A_{ST2} = .0531 + \frac{2.02}{(28100)^{\frac{1}{3}}} = .119 \text{ IN}^2$$

$$A_{ST3} = .0531 + \frac{2.02}{(27700)^{\frac{1}{3}}} = .120 \text{ IN}^2$$

$$A_{ST4} = .0531 + \frac{2.02}{(27500)^{\frac{1}{3}}} = .120 \text{ IN}^2$$

$$A_{ST5} = .0531 + \frac{2.02}{(27200)^{\frac{1}{3}}} = .120 \text{ IN}^2$$

$$A_{ST6} = .0531 + \frac{2.02}{(27000)^{\frac{1}{3}}} = .120 \text{ IN}^2$$

$$A_{ST7} = .0531 + \frac{2.02}{(26600)^{\frac{1}{3}}} = .121 \text{ IN}^2$$

$$A_{ST8} = .0531 + \frac{2.02}{(26000)^{\frac{1}{3}}} = .121 \text{ IN}^2$$

$$A_{402} = .0531 + \frac{2.02}{(23800)^{\frac{1}{3}}} = .123 \text{ IN}^2$$

$$A_{ST9} = .0531 + \frac{1.34}{(21100)^{\frac{1}{3}}} = .102 \text{ IN}^2$$

$$A_{ST10} = .0531 + \frac{1.34}{(14500)^{\frac{1}{3}}} = .108 \text{ IN}^2$$

A.V. ROE CANADA LIMITED
MALTON - ONTARIO

TECHNICAL DEPARTMENT (Aircraft)

REPORT NO. 71055-15

SHEET NO. 6-7

AIRCRAFT

C-105

PREPARED BY:

DATE:

CHECKED BY:

DATE:

CENTRE FUSELAGE SECTIONS
STA 292 3/4 BM RT CASE

EFFECTIVE SHEET WIDTHS
2ND APPROXIMATION

$$A_{41L} = .560 + \frac{2.02}{(35,800)^{\frac{1}{3}}} = .621 \text{ IN}^2$$

$$A_{ST2} = .0531 + \frac{2.02}{(34,800)^{\frac{1}{3}}} = .115 \text{ IN}^2$$

$$A_{ST3} = .0531 + \frac{2.02}{(34,100)^{\frac{1}{3}}} = .115 \text{ IN}^2$$

$$A_{ST4} = .0531 + \frac{2.02}{(33,700)^{\frac{1}{3}}} = .116 \text{ IN}^2$$

$$A_{ST5} = .0531 + \frac{2.02}{(33,200)^{\frac{1}{3}}} = .116 \text{ IN}^2$$

$$A_{ST6} = .0531 + \frac{2.02}{(32,700)^{\frac{1}{3}}} = .116 \text{ IN}^2$$

$$A_{ST7} = .0531 + \frac{2.02}{(32,200)^{\frac{1}{3}}} = .117 \text{ IN}^2$$

$$A_{ST8} = .0531 + \frac{2.02}{(31,700)^{\frac{1}{3}}} = .117 \text{ IN}^2$$

$$A_{40L} = .170 + \frac{2.02}{(27,700)^{\frac{1}{3}}} = .235 \text{ IN}^2$$

$$A_{ST9} = .0531 + \frac{1.34}{(26,200)^{\frac{1}{3}}} = .098 \text{ IN}^2$$

$$A_{ST10} = .0531 + \frac{1.34}{(22,600)^{\frac{1}{3}}} = .100 \text{ IN}^2$$

$$A_{ST11} = .0531 + \frac{1.34}{(13,000)^{\frac{1}{3}}} = .110 \text{ IN}^2$$

A.V.ROE CANADA LIMITED
MALTON - ONTARIO

TECHNICAL DEPARTMENT (Aircraft)

REPORT NO.

SHEET NO.

PREPARED BY:

DATE:

CHECKED BY:

DATE:

AIRCRAFT

C-105

CENTRE FUSelage SECTIONS

STA. 292 3/4 B.M. RT CASE

EFFECTIVE SHEET WIDTHS

FINAL PROPERTIES

$$A_{s11} = .560 + \frac{2.02}{(27800)^{\frac{1}{3}}} = .625 \text{ IN}^2$$

$$A_{s12} = .0531 + \frac{2.02}{(28900)^{\frac{1}{3}}} = .118 \text{ IN}^2$$

$$A_{s13} = .0531 + \frac{2.02}{(28300)^{\frac{1}{3}}} = .119 \text{ IN}^2$$

$$A_{s14} = .0531 + \frac{2.02}{(28000)^{\frac{1}{3}}} = .119 \text{ IN}^2$$

$$A_{s15} = .0531 + \frac{2.02}{(27400)^{\frac{1}{3}}} = .120 \text{ IN}^2$$

$$A_{s16} = .0531 + \frac{2.02}{(27000)^{\frac{1}{3}}} = .120 \text{ IN}^2$$

$$A_{s17} = .0531 + \frac{2.02}{(26600)^{\frac{1}{3}}} = .121 \text{ IN}^2$$

$$A_{s18} = .0531 + \frac{2.02}{(26200)^{\frac{1}{3}}} = .121 \text{ IN}^2$$

$$A_{s19} = .170 + \frac{2.02}{(24600)^{\frac{1}{3}}} = .239 \text{ IN}^2$$

$$A_{s20} = .0531 + \frac{1.34}{(20100)^{\frac{1}{3}}} = .108 \text{ IN}^2$$

$$A_{s21} = .0531 + \frac{1.34}{(14750)^{\frac{1}{3}}} = .108 \text{ IN}^2$$

$$A_{s22} = .0531 + \frac{1.34}{(9400)^{\frac{1}{3}}} = .113 \text{ IN}^2$$

A.V.ROE CANADA LIMITED
MALTON - ONTARIO

TECHNICAL DEPARTMENT (Aircraft)

REPORT NO.

710554/5

SHEET NO.

6-14

PREPARED BY:

DATE:

CHECKED BY:

DATE:

AIRCRAFT

C 105

FEB 4, 1955

CENTRE FUSELAGE

STA. 359

EFFECTIVE SHEET WIDTHS

$$A_{ST8} = .0531 + \frac{2.15}{\sqrt[3]{38400}} = .117 \text{ IN}^2$$

STA 359 SIDE (E.T.)

$$A_{UOL} = .768 + \frac{2.15}{\sqrt[3]{36200}} = .833 \text{ IN}^2$$

$$A_{ST9} = .0531 + \frac{2.88}{\sqrt[3]{28800}} = .147 \text{ IN}^2$$

$$A_{ST10} = .0531 + \frac{2.88}{\sqrt[3]{23400}} = .154 \text{ IN}^2$$

$$A_{ST11} = .0531 + \frac{2.88}{\sqrt[3]{16100}} = .167 \text{ IN}^2$$

$$A_{ST12} = .0531 + \frac{2.88}{\sqrt[3]{9050}} = .170 \text{ IN}^2$$

FINAL PROPERTIES

$$A_{N1L} = .427 + \frac{2.15}{\sqrt[3]{38100}} = .491 \text{ IN}^2$$

$$A_{ST2} = .0531 + \frac{2.15}{\sqrt[3]{37000}} = .118 \text{ IN}^2$$

$$A_{ST3} = .0531 + \frac{2.15}{\sqrt[3]{35200}} = .119 \text{ IN}^2$$

$$A_{ST4} = .0531 + \frac{2.15}{\sqrt[3]{34800}} = .119$$

$$A_{ST5} = .0531 + \frac{2.15}{\sqrt[3]{34200}} = .119$$

STN. 255

NA - 3050 000 IN LBS

-VGB.M (Camp in Top)

$$V = 24\,090 \text{ (FWD.)}; \quad V = 25\,77$$

435

$$V = 24\,090 \text{ (FWD.)}; \quad V = 25\,777 \text{ (AFT)}$$

5	6	7	8	9	10	11	12	13	14	15	16	17	18
VARIATION		SECOND APPROXIMATION						FINAL PROPERTIES					
$z - \bar{z}$	f_{ST}	z_1	A_1	$A_1 z_1$	$A_1^2 z_1^2$	$z_1 - \bar{z}_1$	f_{ST}	z_2	A_2	$A_2 z_2$	$A_2^2 z_2^2$	$z_2 - \bar{z}_2$	f_{ST}
19.45	17000	34.7	1.329	46.10	1600	18.2	15600	34.7	1.331	46.30	1610	18.2	-144
19.15	16750	↑	.132	4.54	156	18.0	15300	↑	.134	4.61	159	17.9	-1420
18.95	16600	①	.132	4.51	154	17.8	15200	②	.134	4.59	157	17.7	-1410
18.65	16300	③	.133	4.51	153	17.5	14900	③	.135	4.57	155	17.4	-1380
18.35	16100	④	.104	3.50	118	17.2	14600	④	.106	3.56	120	17.1	-1360
18.15	15900	⑤	.104	3.48	116	17.0	14500	⑤	.106	3.54	118	16.9	-1340
17.85	15600	⑥	.105	3.48	115	16.7	14200	⑥	.106	3.50	116	16.6	-1320
17.25	15100	⑦	.105	3.41	111	16.1	13700	⑦	.107	3.48	113	16.0	-1270
14.25	12450	⑧	.106	3.23	98	14.1	12000	⑧	.107	3.26	100	14.0	-1110
11.75	10300	⑨	.112	3.02	81	10.6	9000	⑨	.115	3.10	84	10.5	-830
6.75	5900	22.0	.124	2.73	60	5.6	4800	22.0	.122	2.68	59	5.5	-440
-	-	-3.0	.170	-1.51	2	-	-	-3.0	.170	-1.51	2	-19.5	1550
-	-	-8.0	.170	-1.36	11	-	-	-8.0	.170	-1.36	11	-24.5	195
-	-	-13.0	.245	-10.98	143	-	-	-13.0	.245	-10.98	143	-29.5	234
-	-	-14.5	.299	-4.34	63	-	-	-14.5	.299	-4.34	63	-31.0	2460
16.40				3.970	65.32	2981	16.5				3.988	66.02	3010
$I = 2981 - 3.970(16.40)^2$							$I = 3010 - 3.988(16.5)^2$						
$= 1911 \times 2 = 3822 \text{ in}^4$							$= 1920 \times 2 = 3840 \text{ in}^4$						

MALTON, ONTARIO
ENGINEERING DIVISION - AIRCRAFT

SHEET

DATE _____

AIRCRAFT

WEIGHT

C. G. POSITION

PREPARED BY

17	18	19	20	21	22	23	24	25	26	27	28	29
			Y = 24090 [#]		Y = 25777 [#]		STA 255					
ERTIES												
$z - \bar{z}_2$	f_{ST}	$A_2(z - \bar{z}_2)$	$(A_2(z - \bar{z}_2))$	g	g	END LOAD P						
8.2	-14400	24.2	0	0	0							
7.9	-14200	24.0	24.2	152	162							
7.7	-14100	2.37	26.6	167	179							
7.4	-13800	2.35	28.97	182	194							
7.1	-13600	1.81	31.32	196	210							
6.9	-13400	1.79	33.13	208	222							
6.6	-13200	1.74	34.92	219	234							
6.0	-12700	1.71	36.68	230	246							
4.0	-11100	1.50	38.37	241	258							
10.5	-8300	1.21	39.89	250	268							
5.5	-4400	.67	41.10	258	276							
			41.77	262	280							
19.5	15500	3.32	38.45	242	258	2640						
24.5	19500	4.16	34.29	215	230	3320						
29.5	23400	24.90	7.37	57	63	19800						
31.0	24600	9.26				7360						

EFFECTIVE WIDTH OF

MALTON, ONTARIO
ENGINEERING DIVISION - AIRCRAFT

AIRCRAFT

C 105

WEIGHT

47000 LB

C. G. POSITION

PTH OF BOT. SKIN = 41.0 in.

11	12	13	14	15	16	17	18	19	20	21	22	23	24
									V = 33 778*	V = 33 980*			
VARIATION		FINAL PROPERTIES											
$z_1 - \bar{z}_1$	f_{ST}	z_2	A_z	$A_z z_2$	$A_z z_2^2$	$z_2 - \bar{z}_2$	f_{ST}	$A_z(z_2 - \bar{z}_2)$	$A_z(z_2 - \bar{z}_2)^2$	$\bar{x}$	$\bar{y}$		
29.99	37500	36.1	.487	17.60	635	29.8	-32800	14.5	0	0	0		
29.19	36500		.114	4.03	142	29.0	-32800	3.30	14.5	114	115		
28.59	35800	⊙	.114	3.96	137	28.4	-32200	5.24	17.80	140	141		
28.29	35400		.115	3.96	136	28.1	-31800	3.23	21.04	166	167		
27.79	34800	⊙	.115	3.90	132	27.6	-31200	3.17	24.27	191	193		
27.39	34200		.115	3.85	129	27.2	-30800	3.13	27.44	216	218		
26.99	33800	⊙	.116	3.84	127	26.8	-30400	3.11	30.57	241	243		
26.59	33300		.116	3.80	124	26.4	-29900	3.06	33.68	266	268		
25.09	31400	⊙	.284	8.85	276	24.9	-28200	7.07	36.74	290	292		
20.89	26200	⊙	.094	2.54	69	20.7	-23400	1.94	43.81	346	349		
15.89	19900	⊙	.103	2.26	50	15.7	-19800	1.62	45.75	361	363		
10.89	13600	⊙	.109	1.85	31	10.7	-12100	1.17	47.57	373	376		
5.89	7370	12.0	.122	1.46	18	5.7	-6460	.70	48.54	383	385		
.89	1110	7.0	.170	1.19	8	.7	-794	.12	49.24	388	391		
						-4.3	4870	-.73	49.36	389	392		
						-9.3	10500	-1.57	48.63	384	386		
						-14.3	16200	-2.43	47.65	371	374		
						-19.3	21900	-27.00	44.62	352	354		
						-15.9	18000	-6.80	17.62	139	140		
						-17.5	19900	-2.10	10.82	85	86		
						-14.4	16300	-1.38	8.72	69	69		
						-14.3	16200	-2.74	7.34	58	58		
						-13.7	15500	-2.63	4.60	36	37		
						-10.4	11800	-2.00	1.97	16	16		
									0	0	0		
			6.30	5.305	33.40	2349							
			$I = 2349 - 5.305(6.30)^2 = 2139 \times 2 = 4278 \text{ IN}^4$										

SECTIONAL CONSTANTS

STN. 337

CASE SUDDEN APPLICATION OF ELEVATOR @ SEA LEVEL (R.T.)

$M_y = 5,595,000$ IN-LBS $V_{END} = 34610$; $V_{AFT} = 34290$

-VE BM (COMP IN TOP)

EFFECTIVE WIDTH OF BOT

	1	2	3	4	5	6	7	8	9	10	11
	FIRST APPROXIMATION						SECOND APPROXIMATION				
ITEM	Z	A	AZ	AZ ²	Z - $\bar{Z}$	f _{ST}	Z ₁	A ₁	AZ ₁	AZ ₁ ²	Z ₁ - $\bar{Z}_1$
UPPER INNER LONG'N	36.6	.456	16.70	611	31.05	41100	36.6	.483	17.70	646	30.4
STR 2	35.3	.082	2.90	106	29.75	40000		.109	3.95	136	29.1
3	34.8	.082	2.85	99	29.25	39500		.110	3.83	133	28.6
4	34.4	.082	2.82	97	28.85	38700		.110	3.78	130	28.2
5	34.0	.082	2.79	95	28.45	37800		.110	3.74	127	27.8
6	33.6	.082	2.75	92	28.05	36900		.111	3.73	125	27.4
7	33.2	.082	2.72	90	27.65	35640		.111	3.68	122	27.0
8	32.8	.082	2.69	88	27.25	41500		.111	3.64	119	26.6
UPPER OUTER LONG'N	31.2	.644	20.10	627	25.65	38700		.590	17.80	555	25.0
STR 9	26.9	.082	2.20	59	21.35	31200		.096	2.58	70	20.7
10	21.9	.082	1.79	39	16.35	22400		.101	2.21	48	15.7
11	16.9	.082	1.39	24	11.35	13700		.109	1.84	31	10.7
12	11.9	.082	.98	12	6.35	4900		.132	1.57	19	5.7
13	7.0	.170	1.19	8							
14	2.1	.170	.36	1							
15	-2.9	.170	-.49	1							
16	-7.9	.170	-1.34	1							
BOTTOM 4" SKIN LONG'N	-13.0	1.660	-21.6	-280							
4" SKIN STR 17	-10.2	.428	-4.37	45							
5" OF SKIN 1	-11.2	.120	-1.34	15							
2	-8.1	.096	-.78	6							
3	-8.0	.192	-1.54	12							
4	-7.4	.192	-1.42	11							
5	-4.1	.192	-.59	2							
6" OF SKIN 6	-.4	.144	-.06	0							
			9.94	252							
	5.55	5.524	30.7	2421			6.20	5.967	36.97	2643	
	$I = 2421 - 5.524(5.55)^2 = 2252 \times 2 = 4504 \text{ IN}^4$						$I = 2643 - 5.967(6.20)^2 = 2414 \times 2 = 4818 \text{ IN}^4$				

MALTON, ONTARIO
ENGINEERING DIVISION - AIR

2102

4700

10	11	12	13	14	15	16	17	18	19	20	21	22	23
APPROXIMATION			FINAL PROPERTIES										
$A_1 Z_1$	$Z_1 - \bar{Z}_1$	f_{ST}	Z_2	A_2	$A_2 Z_2$	$A_2 Z_2^2$	$Z_2 - \bar{Z}_2$	f_{ST}	$A_2(Z_2 - \bar{Z}_2)$	$\int A_2(Z_2 - \bar{Z}_2)$	δ		
670	29.7	38100	37.0	.491	18.20	674	29.5	-34100	14.5	0	0		
142	28.9	37000		.118	4.15	146	28.7	-33200	3.38	14.50	93		
139	27.5	35200		.119	4.14	144	27.3	-31500	3.25	17.88	115		
136	27.1	34800		.119	4.10	141	26.9	-31100	3.20	21.13	135		
134	26.7	34200		.119	4.05	138	26.5	-30600	3.15	24.33	156		
131	26.3	33700		.120	4.03	136	26.1	-30200	3.13	27.48	176		
128	25.9	33200		.120	3.98	132	25.7	-29700	3.08	30.61	196		
126	25.5	32700	②	.120	3.94	129	25.3	-29200	3.04	33.69	216		
811	23.9	30600	②	.837	26.10	815	23.7	-27400	19.85	36.73	235		
107	19.7	25200	②	.151	4.08	110	19.5	-22500	2.84	56.58	362		
75	14.7	18900	②	.161	3.54	78	14.5	-16750	2.33	59.52	381		
48	9.7	12400	②	.170	2.89	49	9.5	-11000	1.61	61.85	396		
24	4.7	6020	②	.170	2.04	24	4.5	-5200	.76	63.46	406		
8			②							64.22	411		
			②							64.13	411		
			②							63.20	405		
			②							61.42	393		
			②							58.79	376		
			②							19.87	124		
			②							12.24	79		
			②							10.49	67		
			②							9.29	60		
			②							6.89	44		
			②							4.58	29		
			②							2.78	18		
			②							1.56	10		
			②							0	0		
092		5456	7.46	6.868	51.20	3136							
$6.822(7.303)^2 = 2728 \text{ IN}^4$													
$I = 3136 - 6.868(7.46)^2 = 2754 \times 2 = 5508$													

SECTIONAL CONSTANTS

STN. 414

CASE $\frac{3}{4}$ +VE. B.M. ROOM TEMP.

$MY = -8,800,000$ IN-LBS

-V.E. BM (COMP. ON TOP)

EFFECTIVE WIDTH OF BOTTOM

	1	2	3	4	5	6	7	8	9	10	11	
	FIRST APPROXIMATION						SECOND APPROXIMATION					
ITEM	Z	A	AZ	AZ ²	Z - $\bar{Z}$	f _{ST}	Z ₁	A ₁	A ₁ Z ₁	A ₁ Z ₁ ²	Z ₁ - $\bar{Z}_1$	
UPPER INNER LONG'N	37.0	.456	16.87	624	30.1	-43200	37.0	.517	19.1	706	29.3	
STR 2	35.2	.082	2.89	102	28.3	-40600	↑	.116	4.08	144	27.5	
3	34.8	.082	2.85	99	27.9	-40000		.116	4.04	141	27.1	
4	34.4	.082	2.82	97	27.5	-39500		.116	3.99	137	26.7	
5	34.0	.082	2.79	95	27.1	-39000		.116	3.94	134	26.3	
6	33.6	.082	2.75	92	26.7	-38700		.117	3.93	132	25.9	
7	33.2	.082	2.72	90	26.3	-37800		.117	3.88	129	25.5	
8	32.8	.082	2.69	88	25.9	-37200		.117	3.84	126	25.1	
UPPER OUTER LONG'N	21.2	1.535	47.90	1495	24.3	-34900	⊙	1.601	50.00	1560	23.5	
STR 9	27.0	.082	2.21	60	20.1	-28800		.147	3.97	107	19.3	
10	22.0	.082	1.80	40	15.1	-21700	Col	.156	3.43	75	14.3	
11	17.0	.082	1.39	24	10.1	-14500	Col	.170	2.89	49	9.3	
12	12.0	.082	.98	12	5.1	-7300	Col	.170	2.04	34	4.3	
13	7.0	.082	.57	4	.1	-144	Col	.170	1.19	8	-.7	
14	2.0	.170	.34	1			SAME AS	↑	↑	↑		
15	-3.0	.170	-.51	2				Ⓢ	Ⓢ	Ⓢ		
16	-8.0	.170	-1.36	11				Ⓢ	Ⓢ	Ⓢ		
BOTTOM LONG'N	-13.0	2.455	-31.90	415				AS Col (4.112)	AS Col (4.112)	AS Col (4.112)		
STR 17	-9.1	.422	-3.89	35				AS Col (4.112)	AS Col (4.112)	AS Col (4.112)		
SKIN 1	-11.2	.096	-1.07	12				AS Col (4.112)	AS Col (4.112)	AS Col (4.112)		
2	-8.1	.077	-.62	5				AS Col (4.112)	AS Col (4.112)	AS Col (4.112)		
3	-8.0	.155	-1.24	10				AS Col (4.112)	AS Col (4.112)	AS Col (4.112)		
4	-7.4	.155	-1.15	9				AS Col (4.112)	AS Col (4.112)	AS Col (4.112)		
5	-4.1	.155	-.64	3			↓	↓	↓	↓		
6	-.4	.081	.03	0	-7.3	10500	-.4	.081	.03	0	-8.1	
Σ =	6.937	7.087	49.16	3425			8.54	7.858	67.07	3976		
I =	3425	-7.087	(6.937) ²	3065	2	6130 IN ⁴	I = 3976	-7.858	(8.54) ²	3403	2	6

MALTON, ONTARIO
ENGINEERING DIVISION — AIRCRAFT

C-105

47000 155

REPORT NO

SHEET

DATE _____

PREPARED BY

17	18	19	20	21	22	23	24	25	26	27	28	29
PROPERTIES												END LOAD
$\bar{z}_2 - \bar{z}_1$	f_{st}	$A_2(\bar{z}_2 - \bar{z}_1)$	$\int A_2(\bar{z}_2 - \bar{z}_1)$	$\bar{z}$								P
28.2	-36400											19000
26.4	-34000											
25.9	-33400											
25.5	-32900											
25.2	-32500											
24.7	-31800											
24.4	-31500											
23.9	-31800											
22.4	-28900											46300
18.2	-23400											
13.2	-17000											
8.2	-10600											
3.2	-4100											
-1.8	2320											
-6.8	8760											
-11.8	15200											
-16.8	21600											
-21.8	28100											69000
-17.9	23100											
-20.0	25800											
-16.9	21800											
-16.8	21600											
-16.2	20900											
-12.9	16600											
-9.2	11900											
414x2 = 1828.4												

A.V.ROE CANADA LIMITED
MALTON - ONTARIO

TECHNICAL DEPARTMENT (Aircraft)

REPORT NO.

710554/S

SHEET NO.

6-26

AIRCRAFT

C-105

PREPARED BY:

SMG

DATE:

FEB 8, 1965

CHECKED BY:

DATE:

CENTRE FUSELAGE SECTIONS

STN 469 3/4 BM RT CASE

EFFECTIVE SHEET WIDTHS

FINAL PROPERTIES

$$A_{41L} = .427 + \frac{2.02}{(38500)^{\frac{1}{3}}} = .487 \text{ IN}^2$$

$$A_{ST2} = .0531 + \frac{2.02}{(37400)^{\frac{1}{3}}} = .113 \text{ IN}^2$$

$$A_{ST3} = .0531 + \frac{2.02}{(36800)^{\frac{1}{3}}} = .114 \text{ IN}^2$$

$$A_{ST4} = .0531 + \frac{2.02}{(36200)^{\frac{1}{3}}} = .114 \text{ IN}^2$$

$$A_{ST5} = .0531 + \frac{2.02}{(35600)^{\frac{1}{3}}} = .115 \text{ IN}^2$$

$$A_{ST6} = .0531 + \frac{2.02}{(35000)^{\frac{1}{3}}} = .115 \text{ IN}^2$$

$$A_{ST7} = .0531 + \frac{2.02}{(34400)^{\frac{1}{3}}} = .115 \text{ IN}^2$$

$$A_{ST8} = .0531 + \frac{2.02}{(33800)^{\frac{1}{3}}} = .116 \text{ IN}^2$$

$$A_{40L} = 1.821 + \frac{2.02}{(31400)^{\frac{1}{3}}} = 1.885 \text{ IN}^2$$

$$A_{ST9} = .0531 + \frac{1.34}{(25200)^{\frac{1}{3}}} = .099 \text{ IN}^2$$

$$A_{ST10} = .0531 + \frac{1.34}{(17800)^{\frac{1}{3}}} = .104 \text{ IN}^2$$

$$A_{ST11} = .0531 + \frac{1.34}{(10500)^{\frac{1}{3}}} = .114 \text{ IN}^2$$

SECTIONAL CONSTANTS

STN. 469

CASE $\frac{3}{4}$ BM ROOM TEMP

$M_y = 10,100,000$ IN-LBS

-VE BM (COMP IN TOP)

EFFECTIVE WIDTH OF BOTT SKIN = 11

	1	2	3	4	5	6	7	8	9	10	11
	FIRST APPROXIMATION						SECOND APPROXIMATION				
ITEM	Z	A	AZ	AZ ²	Z - $\bar{Z}$	f _{ST}	Z ₁	A ₁	AZ ₁	A ₁ Z ₁ ²	Z ₁ - $\bar{Z}_1$
UPPER INNER LONG'N	36.0	.456	16.40	590	27.05	-41900	36.0	.485	17.45	628	26.20
STR 2	35.2	.082	2.88	101	26.25	-40600		.112	3.94	139	25.46
3	34.8	.082	2.85	99	25.85	-40000		.112	3.90	136	25.06
4	34.4	.082	2.82	97	25.45	-39400		.112	3.85	132	24.66
5	34.0	.082	2.79	95	25.05	-38800		.113	3.81	131	24.20
6	33.6	.082	2.76	93	24.65	-38100		.113	3.80	128	23.84
7	33.2	.082	2.72	90	24.25	-37500		.113	3.75	125	23.46
8	32.8	.082	2.69	88	23.85	-36900		.114	3.74	123	23.06
UPPER OUTER LONG'N	31.2	1.936	60.45	1887	22.25	-34400		1.883	58.90	1840	21.46
STR 9	26.9	.082	2.21	59	17.95	-27800		.097	2.61	70	17.16
10	21.9	.082	1.80	39	13.95	-20000		.102	2.32	51	12.16
11	16.9	.082	1.38	23	7.95	-12300		.111	1.87	32	7.16
12	11.9	.073	.87	10	2.95	4560		.073	.87	10	2.16
13											
14											
15											
16	-7.9	.116	-9.2	7	-16.85	26100		.116	-9.2	7	-17.64
BOTTOM LONG'N	-13.0	3.077	40.00	520	-21.95	33900		3.077	40.00	520	-22.74
STR 17											
SKIN 1	-11.2	.210	-2.35	26	-20.15	31200		.210	-2.35	26	-20.94
Σ	8.95	6.654	59.55	3798			9.74	6.937	67.57	4098	
	$I = 3798 - 6.654(8.95)^2 = 3264 \text{ IN}^4$						$I = 4098 - 6.937(9.74)^2 = 3440 \text{ IN}^4$				
	$I_{total} = 6528 \text{ IN}^4$						$I_{total} = 6380 \text{ IN}^4$				

A.V. ROE CANADA LIMITED
MALTON - ONTARIO

TECHNICAL DEPARTMENT (Aircraft)

REPORT NO. 210554/5

SHEET NO. 6-25

PREPARED BY: M. L. H.

DATE:

CHECKED BY:

DATE:

AIRCRAFT

C105

CENTRE FUSELAGE SECTIONS

STA 485 3/4 B.M. R.T. CASE

EFFECTIVE SHEET WIDTHS.

2ND APPROX.

$$A_{UL} = .427 + \frac{2.02}{(43400)^{\frac{1}{3}}} = .484$$

$$A_{STR 2} = .0531 + \frac{2.02}{(40300)^{\frac{1}{3}}} = .112$$

$$A_{STR 3} = .0531 + \frac{2.02}{(39600)^{\frac{1}{3}}} = .112$$

$$A_{STR 4} = .0531 + \frac{2.02}{(39000)^{\frac{1}{3}}} = .112$$

$$A_{STR 5} = .0531 + \frac{2.02}{(38400)^{\frac{1}{3}}} = .113$$

$$A_{STR 6} = .0531 + \frac{2.02}{(37700)^{\frac{1}{3}}} = .113$$

$$A_{STR 7} = .0531 + \frac{2.02}{(37100)^{\frac{1}{3}}} = .114$$

$$A_{STR 8} = .0531 + \frac{2.02}{(36400)^{\frac{1}{3}}} = .114$$

$$A_{UL} = 1.821 + \frac{2.02}{(33700)^{\frac{1}{3}}} = 1.883$$

$$A_{STR 9} = .0531 + \frac{1.34}{(27200)^{\frac{1}{3}}} = .098$$

$$A_{STR 10} = .0531 + \frac{1.34}{(19400)^{\frac{1}{3}}} = .103$$

$$A_{STR 11} = .0531 + \frac{1.34}{(11,400)^{\frac{1}{3}}} = .113$$

A.V.ROE CANADA LIMITED
MALTON - ONTARIO

TECHNICAL DEPARTMENT (Aircraft)

AIRCRAFT

C 105

REPORT NO.

710554/5

SHEET NO.

6-29

PREPARED BY:

S.M. Goss

DATE:

FEB 7, 1955

CHECKED BY:

DATE:

CENTRE FUSELAGE SECTION

STA 485 3/4 B.M. RT. CASE

EFFECTIVE SKIN WIDTHS

FINAL PROPERTIES

$$A_{416} = .427 + \frac{2.02}{(41600)^{\frac{1}{3}}} = .485$$

$$A_{512} = .0531 + \frac{2.02}{(38600)^{\frac{1}{3}}} = .113$$

$$A_{513} = .0531 + \frac{2.02}{(38000)^{\frac{1}{3}}} = .113$$

$$A_{514} = .0531 + \frac{2.02}{(37300)^{\frac{1}{3}}} = .113$$

$$A_{515} = .0531 + \frac{2.02}{(36700)^{\frac{1}{3}}} = .114$$

$$A_{516} = .0531 + \frac{2.02}{(36000)^{\frac{1}{3}}} = .114$$

$$A_{517} = .0531 + \frac{2.02}{(35200)^{\frac{1}{3}}} = .115$$

$$A_{518} = .0531 + \frac{2.02}{(34800)^{\frac{1}{3}}} = .115$$

$$A_{400} = 1.821 + \frac{2.02}{(32200)^{\frac{1}{3}}} = 1.885$$

$$A_{519} = .0531 + \frac{1.34}{(25600)^{\frac{1}{3}}} = .098$$

$$A_{5110} = .0531 + \frac{1.34}{(17700)^{\frac{1}{3}}} = .105$$

$$A_{5111} = .0531 + \frac{1.34}{(9800)^{\frac{1}{3}}} = .116$$

SECTIONAL CONSTANTS

STN. 485

CASE 3/4 B.M. ROOM TEMP

$M_y = 10,500,000$ IN-LBS.

-VE B.M. (COMP IN TOP)

	1	2	3	4	5	6	7	8	9	10	
	FIRST APPROXIMATION						SECOND APPROXIMATION				
ITEM	Z	A	AZ	AZ ²	Z - $\bar{Z}$	f_{ST}	Z ₁	A ₁	A ₁ Z ₁	A ₁ Z ₁ ²	Z ₁ -
UPPER INNER LONG'N	37.1	.456	16.9	626	27.4	-43400	37.1	.484	18.0	666	26
STR 2	35.1	.082	2.88	101	25.4	-40300		.112	3.93	138	24
3	34.7	.082	2.84	98	25.0	-39600	⊙	.112	3.88	135	24
4	34.3	.082	2.81	96	24.6	-39000		.112	3.84	132	23
5	33.9	.082	2.78	94	24.2	-38400		.112	3.83	130	22
6	33.5	.082	2.75	92	23.8	-37700		.112	3.78	127	22
7	33.1	.082	2.72	90	23.4	-37100		.114	3.77	125	22
8	32.7	.082	2.68	87	23.0	-36400		.114	3.72	122	22
UPPER OUTER LONG'N	31.1	1.936	60.10	1870	21.4	-33900		1.888	58.60	1822	20
STR 9	26.9	.082	2.25	61	17.2	-27200		.098	2.64	71	16
10	21.9	.082	1.80	39	12.2	-19400		.103	2.22	50	11
11	16.9	.082	1.39	23	7.2	-11400	16.9	.113	1.71	32	6
12											
13											
14											
15											
16											
BOTTOM LONG'N	-13.0	3.077	-40.00	520	-22.7	36000	-13.0	3.077	-40.00	520	-23
STR 17											
$\Sigma =$	7.7	6.229	60.9	3898			10.7	6.548	70.16	4010	
$I = 3898 - 6.229(7.7)^2 = 3301 \text{ IN}^4$							$I = 4010 - 6.548(10.7)^2 = 3320$				
$I_{total} = 6614 \text{ IN}^4$							$I_{total} = 6640 \text{ IN}^4$				

TANTS

TEMP

N-LESS

5	6	7	8	9	10	11	12	13	14	15	16	17	18
ACTION		SECOND APPROXIMATION						FINAL PROPERTIES					
$z - \bar{z}$	f_{ST}	z_1	A_1	$A_1 z_1$	$A_1 z_1^2$	$z_1 - \bar{z}_1$	f_{ST}	z_2	A_2	$A_2 z_2$	$A_2 z_2^2$	$z_2 - \bar{z}_2$	f_{ST}
27.4	-43400	37.1	.484	18.0	666	26.4	-41600	37.1	.485	18.10	667	26.37	-41500
25.4	-40300		.112	3.93	138	24.4	-38600		.113	3.97	139	24.37	-38400
25.0	-39600	⊙	.112	3.88	135	24.0	-38000	⊙	.113	3.92	136	23.97	-37800
24.6	-39000		.112	3.84	132	23.6	-37300		.113	3.88	133	23.57	-37100
24.2	-38400		.113	3.83	130	23.2	-36700		.114	3.86	131	23.17	-36500
23.8	-37700		.113	3.78	127	22.8	-36000		.114	3.82	128	22.77	-35900
23.4	-37100		.114	3.77	125	22.3	-35200		.115	3.81	126	22.27	-35100
23.0	-36400		.114	3.72	122	22.0	-34800		.115	3.76	123	21.97	-34600
21.4	-33900		1.883	58.60	1822	20.4	-32200		1.885	58.60	1826	20.37	-32100
17.2	-27200		.098	2.64	71	16.2	-25600		.098	2.64	71	16.17	-25500
12.2	-19400		.103	2.26	50	11.2	-17700		.105	2.30	50	11.17	-17600
7.2	-11400	16.9	.113	1.91	32	6.2	-9800	16.9	.116	1.96	33	6.17	-97300
-22.7	36000	-13.0	3.077	-40.00	520	-23.7	37400	-13.0	3.077	-40.00	520	-23.73	37400
		10.7	6.542	70.16	4010			10.73	6.563	70.52	4083		
		$I = 4070 - 6.542(10.7)^2 = 3320$						$I = 4083 - 6.563(10.73)^2 = 3327$					
		$I_{total} = 6640 \text{ in}^4$						$I_{total} = 6654 \text{ in}^4$					

MALTON, ONTARIO
ENGINEERING DIVISION - AIRCRAFT

C105

47000 LBS

REPORT NO.

SHEET

DATE _____

PREPARED BY

[illegible]



AVRO AIRCRAFT LIMITED

TECHNICAL DEPARTMENT (Aircraft)

REPORT NO. 71055415

SHEET NO. 7-2

AIRCRAFT:

C-105

CENTER
FUSELAGE

PREPARED BY

DATE

CHECKED BY

DATE

UP BENDING (COMP. IN TOP) ELEV. TEMP. 250°FSECTIONAL CONSTANTS ARE CALCULATED USING
THE FOLLOWING SHEARS & B.M.CASE 9.3a 250°F

STA.	SHEAR [#]	B. M. ^{##}
255	- 12 102 - 11 769	- 950 000
268	- 11 769 - 14 346	- 1 170 271
292	- 13 514 - 20 815	- 1 501 087
315	- 21 283 - 21 956	- 1 963 963
337	- 21 265 - 21 707	- 2 437 953
359	- 19 563	- 2 891 865
392		
414		
469		
485		

REF. SYM. FLIGHT CASES REF. 7-0550-4

SIGN CONVENTION: TEN. (+); COMP (-)

4	5	6	7	8	9	10	11	12	13	14	15	16	17
<u>FIRST APPROXIMATION</u>			<u>SECOND APPROXIMATION</u>						<u>FINAL PROPERTIES</u>				
Az^2	$z - \bar{z}$	f_{ST}	z_1	A_1	$A_1 z_1$	$A_1 z_1^2$	$z_1 - \bar{z}_1$	f_{ST}	z_2	A_2	$A_2 z_2$	$A_2 z_2^2$	$z_2 - \bar{z}_2$
									34.7	1.331	46.30	1610	18.2
									34.4	.134	4.61	159	17.9
									34.2	.134	4.59	157	17.7
									33.9	.135	4.57	155	17.4
									33.6	.106	3.56	120	17.1
									33.4	.106	3.54	118	16.9
									33.1	.106	3.50	116	16.6
									32.5	.107	3.48	113	16.0
									30.5	.107	3.26	100	14.0
									27.0	.115	3.10	84	10.5
									22.0	.122	2.68	59	5.5
									-3.0	.170	-.51	2	-19.5
									-8.0	.170	-1.36	11	-24.5
									-13.0	.845	-10.98	143	-29.5
									-14.5	.299	-4.34	63	-31.0
									16.5	3.988	66.02	3010	

$$I = 2 \left[3010 - 3.988 (16.5)^2 \right] = 3840 \text{ IN}^4$$

A. V. ROE CANADA LIMITED

MALTON, ONTARIO
ENGINEERING DIVISION - AIRCRAFT

REPORT NO

SHEET

DATE

PREPARED BY

AIRCRAFT

WEIGHT

C. G. POSITION

C-105

47000

28% MAC

AUGUST 1955

J.M. Lee

17	18	19	20	21	22	23	24	25	26	27	28	29
PROPERTIES			$V = -12102^*$		$V = -11769$		STA. 255					
$\bar{z}_2 - \bar{z}_2$	f_{ST}	$A_2(\bar{z}_2 - \bar{z}_2)$	$\int A_2(\bar{z}_2 - \bar{z}_2)$	$\bar{z}$	$\bar{z}$	END LOAD						$P^{\#}$
18.2	-45.00	24.2	24.2	76	74							-6000
17.9	-44.20	2.4	26.6	84	81							-592
17.7	-43.70	2.37	28.97	91	89							-585
17.4	-43.00	2.35	31.32	99	96							-580
17.1	-42.20	1.81	33.13	105	101							-447
16.9	-41.70	1.79	34.92	110	107							-442
16.6	-41.00	1.76	36.68	116	112							-435
16.0	-39.50	1.71	38.39	121	117							-423
14.0	-34.60	1.50	39.89	126	122							-370
10.8	-26.00	1.21	41.10	130	126							-300
5.5	-13.60	.67	41.77	132	128							-166
-19.5	4820	3.32	38.45	121	118							820
-24.5	6050	4.16	34.29	108	105							1030
-29.5	7300	24.90	9.39	30	29							6150
-31.0	7660	9.26										229

40 IN⁴

STN. 268

CASE 9.3 a ELEV. TEMP. 250°F

$$M_y = -1170.271 \text{ N-LB.}$$

$V = -11\,769 \text{ LB. (FWP), } V = -14\,346 \text{ LB. (AFT.)}$

SIGN CONY

[illegible]

MALTON, ONTARIO
ENGINEERING DIVISION - AIR

C-101

47000

287.

[illegible]

$$I = 2 \left[2534 - 5.917 (11.3)^3 \right] = 4040 \text{ IN}^4$$

MALTON, ONTARIO
ENGINEERING DIVISION - AIRCRAFT

SHEET

DATE _____

AIRCRAFT

WEIGHT

C. G. POSITION

C-105

47000 LB.

287. M.A.C.

PREPARED BY -

$$[1.3]^2] = 4040 \text{ IN}^4$$

SECTIONAL CONSTANTS

STN. 292

CASE 7.3 a ELEV. TEMP. 250°F

$M_y = -1501.087$ IN-LBS

$V = -13514$ LB(FWD), $V = -20815$ LB(AFT.)

SIGN CONV

	1	2	3	4	5	6	7	8	9	10
	FIRST APPROXIMATION						SECOND APPROXIMATION			
ITEM	Z	A	AZ	AZ ²	Z-Z	f _{ST}	Z ₁	A ₁	AZ ₁	AZ ₁ ²
UPPER INNER LONG'N										
STR. 2										
3										
4										
5										
6										
7										
8										
UPPER OUTER LONG'N										
STR. 9										
10										
11										
12										
13										
14										
15										
16										
BOTTOM 4" SKIN LONG'N										
4" SKIN STR. 17										
5" SKIN 1										
4" SKIN 2										
8" SKIN 3										
7 1/2" SKIN 4										
Σ										

CONSTANTS

TEMP. 250°F

IN. LBS

$V = -20.815 \text{ LB(AFT.)}$

SIGN CONVEN: TEN(+), COMP. (-)

4	5	6	7	8	9	10	11	12	13	14	15	16	17
FIRST APPROXIMATION			SECOND APPROXIMATION						FINAL PROPERTY				
$A\bar{z}^2$	$\bar{z} - \bar{z}_1$	f_{ST}	$\bar{z}_1$	A_1	$A_1\bar{z}_1$	$A_1\bar{z}_1^2$	$\bar{z}_1 - \bar{z}_2$	f_{ST}	$\bar{z}_2$	A_2	$A_2\bar{z}_2$	$A_2\bar{z}_2^2$	$\bar{z}_2 - \bar{z}_3$
									36.1	.625	22.60	815	27.7
									35.3	.118	4.17	147	26.9
									34.7	.119	4.13	143	26.3
									34.4	.119	4.10	141	26.0
									33.9	.120	4.06	138	25.5
									33.5	.120	4.02	135	25.1
									33.1	.121	4.00	132	24.7
									32.7	.121	3.96	129	24.3
									31.2	.239	7.46	233	22.8
									27.0	.102	2.75	74	18.6
									22.0	.108	2.38	52	13.6
									17.0	.116	1.97	33	8.6
									2.0	.170	.34	1	-6.4
									-3.0	.170	-.51	2	-11.4
									-8.0	.170	-1.36	11	-16.4
									-13.0	1.170	-15.20	97	-21.4
									-9.6	.428	-4.10	40	-18.0
									-11.6	.120	-1.39	16	-20.0
									-8.1	.096	-.78	6	-16.5
									-8.0	.192	-1.54	12	-16.4
									-7.4	.180	-1.33	10	-15.8
									8.40	4.718	39.73	2467	
									$I = 2[2467 - 4.718(8.40)^2]$				

A. V. ROE CANADA LIMITED

MALTON, ONTARIO
ENGINEERING DIVISION - AIRCRAFT

REPORT NO

SHEET

DATE _____

AIRCRAFT

WEIGHT

C. G. POSITION

C-105

47000 LB

28% MAC

PREPARED BY

17	18	19	20	21	22	23	24	25	26	27	28	29
												STA 292
PROPERTIES			$V = -13.514$		$V = -20.815$							
$\bar{z}_2 - \bar{z}_c$	f_{ST}	$A_2(\bar{z}_2 - \bar{z}_c)$	$\int A_2(\bar{z}_2 - \bar{z}_c)$	$\bar{x}$	$\bar{y}$	END LOAD P						
27.7	-9750	17.3	0	0	0							
26.9	-9480	3.17	17.3	55	85							
26.3	-9260	3.13	20.47	65	100							
26.0	-9150	3.10	23.60	75	115							
25.5	-9000	3.06	26.70	85	131							
25.1	-8850	3.03	29.76	94	145							
24.7	-8700	2.99	32.78	104	160							
24.3	-8560	2.94	35.77	113	175							
22.8	-8040	5.45	38.71	123	189							
18.6	-6550	1.90	44.16	140	216							
13.6	-4800	1.47	46.96	146	226							
8.6	-3030	1.00	47.53	151	232							
			48.53	154	237							
-6.4	2260	1.07	47.44	150	232	384						
-11.4	4020	1.94	45.50	144	222	684						
-16.4	5780	2.79	42.71	135	209	983						
-21.4	7540	25.00	17.71	56	87	8810						
-18.0	6340	7.70	10.01	32	49	2720						
-20.0	7030	2.40	7.61	24	37	8460						
-16.5	5810	1.58	6.03	19	30	558						
-16.4	5780	3.15	2.88	9	14	1110						
-15.8	5560	2.94	0	0	0	1000						
$(8.40)^2 = 4266 \text{ IN}^4$												

STN. 315

$$M_y = -1,963,963 \text{ in lbs}$$
$$V = -21283^{\circ} (\text{FWD}) \quad V = -21956^{\circ} (\text{AFT})$$

SIGN LONVEN

FORM 1545

SECTIONAL CONSTANTS

STN. 337

AGE 3300 Elev Temp 250°F

$M_y = 2,437,953$ in lb

$V = -21,625$ lb (FWD) $V = 21,707$ lb (AFT)

SIGN CONVEN

	1	2	3	4	5	6	7	8	9	10	
	FIRST APPROXIMATION						SECOND APPROXIMATION				
ITEM	$\bar{z}$	A	$A\bar{z}$	$A\bar{z}^2$	$\bar{z} - \bar{\bar{z}}$	f_{ST}	$\bar{z}_1$	A_1	$A_1\bar{z}_1$	$A_1\bar{z}_1^2$	$\bar{z}_1$
UPPER INNER LONG N											
STR 2											
3											
4											
5											
6											
7											
8											
UPPER OUTER LONG N											
STR 9											
10											
11											
12											
13											
14											
15											
16											
BOTTOM 4" SKIN LONG N											
4" SKIN STR 17											
5" OF SKIN 1											
4" 1 2											
8" 3											
8" 4											
8" 1 5											
6" OF SKIN 6											
Σ											

CONSTANTS

TEMP 250°F

lb

21707 lb. (AFT)

SIGN CONVEN TEN (+) COMPR (-)

4	5	6	7	8	9	10	11	12	13	14	15	16	17
FIRST APPROXIMATION			SECOND APPROXIMATION						FINAL PROPERTIES				
Az^2	$z - \bar{z}$	f_{ST}	z_1	A_1	Az_1	Az_1^2	$z_1 - \bar{z}_1$	f_{ST}	z_2	A_2	Az_2	Az_2^2	$z_2 - \bar{z}_2$
									36.6	48.9	17.70	64.9	30.2
									35.3	111	3.92	138	28.9
									34.8	112	3.90	136	28.4
									34.4	112	3.95	132	28.0
									34.0	112	3.81	130	27.6
									33.6	113	3.80	128	27.2
									33.2	113	3.75	125	26.8
									32.8	113	3.71	122	26.4
									31.2	572	17.80	555	24.8
									26.9	1097	2.61	70	20.5
									21.9	102	2.23	49	15.5
									16.9	112	1.88	31	10.5
									11.9	138	1.61	20	5.5
									7.0	170	1.19	8	.6
									2.1	170	.36	1	-4.3
									-2.9	170	-.49	1	-9.3
									-7.9	170	-1.34	1	-14.3
									-13.0	1660	-21.6	-280	-19.1
									-10.2	428	-4.37	45	-16.6
									-11.2	120	-1.34	15	-17.6
									-8.1	1096	-.78	6	-14.5
									-8.0	192	-1.54	12	-14.4
									-7.4	152	-1.42	11	-13.8
									-4.1	192	-.59	2	-10.5
									-4	144	-.06	0	-6.3
									6.40	5.995	38.44	266.8	
									$I = 2 [266.8 - 5.995 (6.40)^2] = 4844 in^4$				

A. V. ROE CANADA LIMITED

MALTON, ONTARIO
ENGINEERING DIVISION - AIRCRAFT

REPORT NO.

SHEET

DATE

PREPARED BY

AIRCRAFT

WEIGHT

C. G. POSITION

C105

47000 lbs

28% MAC

AUGUST 1955

STA 337

PROPERTIES

17	18	19	20	21	22	23	24	25	26	27	28	29
				$V = -21,625"$	$V = -21,707"$							
$\bar{x}_2 - \bar{z}_2$	f_{ST}	$A_2(\bar{x}_2 - \bar{z}_2)$	$A_2(\bar{x}_2 - \bar{z}_2)$	$\bar{x}$	$\bar{y}$							END LOAD P
30.2	-15,200	14.67	14.67	65	65							-7,360
28.0	-14,545	3.71	17.38	78	78							-1,614
28.4	-14,290	3.18	21.01	94	94							-1,600
28.0	-14,100	3.14	24.15	108	108							-1,580
27.6	-13,900	3.09	27.24	122	122							-1,560
27.2	-13,700	3.07	30.31	135	136							-1,550
26.8	-13,490	3.05	33.34	149	149							-1,520
26.4	-13,290	3.03	36.37	162	163							-1,500
24.8	-12,480	14.19	50.51	225	226							-7,140
20.5	-10,320	1.39	52.50	234	235							-1,000
15.5	-7,800	1.58	54.08	241	242							-795
10.5	-5,280	1.18	55.26	247	248							-590
5.5	-2,770	.76	56.02	250	251							-382
.6	-301	.10	56.72	251	251							-50
-4.3	2,164	-7.3	53.39	238	239							370
-9.3	4,680	-1.58	53.81	240	241							796
-14.3	7,200	-2.43	51.38	229	230							1,274
-19.4	9,770	-3.20	19.18	86	86							16,220
-16.6	8,350	-7.10	12.08	54	54							3,570
-17.6	8,860	-2.11	9.97	45	45							1,060
-14.5	7,300	-1.39	8.60	38	38							700
-14.4	7,250	-2.76	5.94	27	27							1,390
-13.8	6,050	-2.65	3.19	14	14							1,330
-10.5	5,280	-2.02	1.17	5	5							1,010
-6.8	3,422	-.98	0	0	0							490

4844 in

MALTON, ONTARIO
ENGINEERING DIVISION - AIRCRAFT

SHEET

DATE _____

PREPARED BY

AIRCRAFT

WEIGHT

C. G. POSITION

C 105

47 000 Ave

28% MAC

[illegible]

A.V. ROE CANADA LIMITED
MALTON - ONTARIO

TECHNICAL DEPARTMENT (Aircraft)

REPORT NO.

7103415

SHEET NO.

7-2

AIRCRAFT

C105

PREPARED BY:

CHECKED BY:

DATE:

Feb 7, 1955

CENTRE FUSELAGE

STA. 359 CASE 1/4 RM (E.T.)

EFFECTIVE SHEET WIDTHS

2ND APPROX.

$$A_{UL} = .427 + \frac{2.15}{(38000)^{\frac{1}{3}}} = .491 \text{ IN}^2$$

$$A_{ST2} = .0531 + \frac{2.15}{(35900)^{\frac{1}{3}}} = .118 \text{ IN}^2$$

$$A_{ST3} = .0531 + \frac{2.15}{(35400)^{\frac{1}{3}}} = .119 \text{ IN}^2$$

$$A_{ST4} = .0531 + \frac{2.15}{(34900)^{\frac{1}{3}}} = .119 \text{ IN}^2$$

$$A_{ST5} = .0531 + \frac{2.15}{(34400)^{\frac{1}{3}}} = .119 \text{ IN}^2$$

$$A_{ST6} = .0531 + \frac{2.15}{(34000)^{\frac{1}{3}}} = .119 \text{ IN}^2$$

$$A_{ST7} = .0531 + \frac{2.15}{(33500)^{\frac{1}{3}}} = .120 \text{ IN}^2$$

$$A_{ST8} = .0531 + \frac{2.15}{(33000)^{\frac{1}{3}}} = .120 \text{ IN}^2$$

$$A_{UOL} = .768 + \frac{2.15}{(31000)^{\frac{1}{3}}} = .836 \text{ IN}^2$$

$$A_{ST9} = .0531 + \frac{2.88}{(24800)^{\frac{1}{3}}} = .152 \text{ IN}^2$$

$$A_{ST10} = .0531 + \frac{2.88}{(19900)^{\frac{1}{3}}} = .159 \text{ IN}^2$$

$$A_{ST11} = .0531 + \frac{2.88}{(13800)^{\frac{1}{3}}} = .170 \text{ IN}^2$$

$$A_{ST12} = .0531 + \frac{2.88}{(7800)^{\frac{1}{3}}} = .170 \text{ IN}^2$$

$$A_{ST13} = .0531 + \frac{2.88}{(1700)^{\frac{1}{3}}} = .170 \text{ IN}^2$$

SECTIONAL CONSTANTS

STN. 359

CASE 3/4 +VE B.M. ELEVATED TEMP.

$M_y = 6,000,000$ IN-LBS

-V.E. B.M. (COMP. IN TOP)

	1	2	3	4	5	6	7	8	9	10
ITEM	FIRST APPROXIMATION						SECOND APPROXIMATION			
	Z	A	AZ	AZ ²	Z - $\bar{Z}$	f_{ST}	Z ₁	A ₁	A ₁ Z ₁	A ₁ Z ₁ ²
UPPER INNER LONG'N	37.0	.456	16.87	624	31.4	38,000	37.0	.491	18.20	674
STR. 2	35.2	.082	2.89	102	29.6	35,900		.118	4.15	146
3	34.8	.082	2.85	99	29.2	35,400		.119	4.14	144
4	34.4	.082	2.82	97	28.8	34,900		.119	4.10	141
5	34.0	.082	2.79	95	28.4	34,400		.119	4.05	138
6	33.6	.082	2.75	92	28.0	34,000		.119	4.00	134
7	33.2	.082	2.72	90	27.6	33,500		.120	3.98	132
8	32.8	.082	2.69	88	27.2	33,000	①	.120	3.94	129
UPPER OUTER LONG'N	31.2	.854	26.64	831	25.6	31,000		.836	26.10	814
STR. 9	27.0	.082	2.21	60	20.4	24,800	②	.152	4.10	111
10	22.0	.082	1.80	40	16.4	19,900	③	.159	3.50	77
11	17.0	.082	1.39	24	11.4	13,800	④	.170	2.89	49
12	12.0	.082	.98	12	6.4	7,800	⑤	.170	2.04	24
13	7.0	.082	.57	4	1.4	1,700	⑥	.170	1.19	8
14	2.0	.170	.34	1			⑦			
15	-3.0	.170	-.51	2			⑧			
16	-8.0	.170	-1.36	11			⑨			
BOTTOM LONG'N	-13.0	1.722	-24.99	325						
STR. 17	-7.1	.428	-3.89	35						
SKIN 1	-11.2	.096	-1.07	12						
2	-8.1	.077	-.62	5						
3	-8.0	.155	-1.24	10						
4	-7.4	.155	-1.15	9						
5	-4.1	.155	-.64	3						
6	-.4	.155	-.06	0						
SKIN 7	0	.230	0	0						
Σ	5.63	6.177	34.78	2671			8.93	6.958	61.29	3134
	$I = 2671 - 6.177(5.63)^2 = 2475 \times 2 = 4950$ IN ⁴						$I = 3134 - 6.958(8.93)^2 = 25$			

CONSTANTS

ELEVATED TEMP.

0 IN - LBS

0 IN TOP

4	5	6	7	8	9	10	11	12	13	14	15	16	17
FIRST APPROXIMATION			SECOND APPROXIMATION					FINAL			PROPER		
Az^2	$z - \bar{z}$	f_{ST}	z_1	A_1	$A_1 z_1$	$A_1 z_1^2$	$z_1 - \bar{z}_1$	f_{ST}	z_2	A_2	$A_2 z_2$	$A_2 z_2^2$	$z_2 - \bar{z}_2$
624	31.4	38000	37.0	.491	18.20	674	28.1	32600	37.0	.494	18.3	677	29.3
102	29.6	35900		.118	4.15	146	26.3	30500		.122	4.3	151	27.5
99	29.2	35400		.119	4.14	144	25.9	30000		.122	4.24	148	27.1
97	28.8	34900		.119	4.10	141	25.5	29600		.122	4.20	143	26.7
95	28.4	34400		.119	4.05	138	25.1	29100		.123	4.17	142	26.3
92	28.0	34000		.119	4.00	134	24.7	28600	①	.124	4.16	140	25.9
90	27.6	33500		.120	3.98	132	24.3	28200		.126	4.06	135	25.5
88	27.2	33000	①	.120	3.94	129	23.9	27700	COL	.131	4.30	141	25.1
831	25.6	31000		.836	26.10	814	22.3	25900	COL	.855	26.70	834	23.5
60	20.4	24800	COL	.152	4.10	111	18.1	21000		.170	4.59	124	19.3
40	16.4	19900	COL	.159	3.50	77	13.1	15200	AS	.170	3.74	82	15.3
24	11.4	13800	AS	.170	2.89	49	8.1	9400					9.3
12	6.4	7800	AS	.170	2.04	24	3.1	3600					4.3
4	1.4	1700		.170	1.19	8	-1.9		SAME	②	③	④	-0.7
1			SAME						SAME	COL	COL	COL	-5.7
2										COL	COL	COL	-10.7
11				⑤	⑥	⑦				AS	AS	AS	-15.7
325				COL	COL	COL				AS	AS	AS	-20.7
35										SAME	SAME	SAME	-16.8
12				AS	AS	AS				SAME	SAME	SAME	-18.9
5													-15.8
10				SAME	SAME	SAME							-15.7
7													-15.1
3													-11.8
0													-8.1
0	-	-	0	.230	0	0	-	-	0	.230	0	0	-7.7
2671			7.73	6.952	61.29	3134			7.73	6.952	53.79	3211	

$$I^3 = 2475 \times 2 = 4950 \text{ IN}^4$$

$$I = 3134 - 6.952(7.73)^2 = 2588 \times 2 = 5176 \text{ IN}^4$$

$$I = 3211 - 6.952(7.73)^2 = 2795 \times 2 =$$

SECTIONAL CONSTANTS

CASE: ROLLING PULLOUT

SIDE APPLIED LOAD ALONG $\frac{A}{C}$ DATUM

SECOND APPROXIMATION

	1	2	3	4	5	6	7	8	9	10
ITEM	y	z	A	Ay	Ay ²	Az	Az ²	y - $\bar{y}$	z - $\bar{z}$	Ay(z - $\bar{z}$)
UPPER INNER LONG'N	16.3	34.7	.914	14.90	242.9	31.70	1100	15.7	19.9	236
STR 2	24.0	34.8	↑	↑	↑	↑	↑	23.4	19.6	60
3	28.5	34.2	↑	↑	↑	↑	↑	27.9	19.4	86
4	33.0	33.9	↑	↑	↑	↑	↑	32.3	19.1	97
5	37.5	33.6	↑	↑	↑	↑	↑	36.9	18.8	107
6	42.0	33.4	↑	↑	↑	↑	↑	41.4	18.6	122
7	46.5	33.1	↑	↑	↑	↑	↑	45.9	18.3	133
8	51.0	32.5	↑	↑	↑	↑	↑	50.4	17.7	141
UPPER OUTER LONG'N	55.6	30.5	↑	↑	↑	↑	↑	55.0	15.7	236
STR 9	56.6	27.0	↑	↑	↑	↑	↑	56.0	12.2	116
10	56.8	22.0	.170	9.66	549	3.74	82	56.2	7.2	69
11										
12										
13										
14										
15	57.9	-3.0	.145	8.40	486	-4.35	1.3	57.3	-17.8	-148
16	58.0	-8.0	.128	7.43	431	-1.00	8.2	57.4	-22.8	-168
17	47.8	-13.0	.332	15.40	760	-4.31	56.0	47.2	-27.8	-436
DOVT. LONG'N	57.8	-14.5	.986	57.00	3300	-14.30	207.0	57.2	-29.3	-1650
$\Sigma =$			4.198	177.95	8587	60.66	2950			-949

CONSTANTS

PULLOUT

PLIED LOAD ALONG $\frac{1}{2}$ DATUM

APPROXIMATION

STA 263

$M_y = 2,843,275$ IN-LBS; $M_z = 1,991,000$ IN-LBS

$V = 24,300$ LBS FWD $S = 18580$ LBS

$V = 28,000$ LBS. AFT $S = 18910$ LBS

TENSION ON TOP + STR^B SIDES.

4	5	6	7	8	9	10	11	12	13	14	15	16	17
y	Ay^2	Az	Az^2	$y - \bar{y}$	$z - \bar{z}$	$A(y - \bar{y})(z - \bar{z})$	$A(y - \bar{y})$	y	z	A	Ay	Ay^2	Az
90	242.9	31.70	1100	15.7	19.9	286	14.4	16.3	34.7	.914	14.90	242.9	31.70
				23.4	19.6	60	3.1						
				27.9	19.4	86	4.4						
				32.3	19.1	97	5.1						
				36.9	18.8	107	5.8						
				41.4	18.6	122	6.5						
				45.9	18.3	133	7.2						
				50.4	17.7	141	8.0						
				55.0	15.7	236	15.0						
				56.0	12.2	116	9.5						
56	549	3.74	82	56.2	7.2	69	9.6	56.8	22.0	.170	9.66	549	3.74
40	486	-4.35	1.3	57.3	-17.8	-148	8.3	57.9	-3.0	.109	6.30	365	3.18
43	431	-1.00	8.2	57.4	-22.8	-168	7.3	58.0	-8.0	.106	6.15	356	85
90	760	-4.31	56.0	47.2	-22.8	-436	15.7	47.8	-13.0	.319	15.20	726	4.15
00	3300	-14.30	207.0	57.2	-29.3	-1650	56.4	57.8	-14.5	.971	56.10	3245	14.10
73	447	23.16	772.6										
95	8587	60.66	2950			-949				4.112	172.97	8301	62.34
										$S_{ST} = - \left((6.81 \times 1591) + (37.2 \times 2800) \right) y - \left((257 \times 2349) + (3721 \times 14.10) \right) z$ $= (1256 + 77.5) y - (7322 + 5442) z$ $= 2031 y - 7864 z$			

A.V.ROE CANADA LIMITED
MALTON - ONTARIO

TECHNICAL DEPARTMENT (Aircraft)

REPORT NO.

71054/5

SHEET NO.

2-2

PREPARED BY:

DATE:

CHECKED BY:

DATE:

AIRCRAFT

STA 268 R.P.O. CENTRE SECTION

ITEM	1	2	3	4	5	6	7	8
	$2 \times 1 \text{ (1)}$				$9 =$		9	$161.1 =$
	$SA(1-2) \times 4$	$2A_n m_1$	0×2	$\frac{S_y}{I_{xx}} \times 1$	6×4	$SA(2-3)$	$\frac{S_y}{I_{xx}} \times 3$	15×7
UPPER INNER LONG'N	14.4	259	3730	15.3	74.7	18.2	104	179
STR 2	17.5	150	2620	18.6	71.4	20.8	119	190
3	21.4	145	3180	23.3	66.7	23.1	132	199
4	27.0	140	3780	28.7	61.7	26.1	150	212
5	32.8	140	4600	34.9	55.1	29.1	167	222
6	39.3	140	5500	41.9	48.1	32.0	183	231
7	46.5	120	5580	49.5	40.5	34.9	200	241
8	54.5	165	9000	58.0	32.0	37.7	216	248
UPPER OUTER LONG'N	69.5	165	11500	74.0	16.0	42.0	240	256
STR 9	79.0	280	22100	84.0	6.0	44.1	252	258
10	88.6	1424	126200	94.2	-4.2	45.3	259	255
11								
12								
13								
14								
15	96.4	290	28100	103	-13	43.6	250	237
16	104.2	156	16240	111	-21	46.0	235	214
PORT LONG'N	165.6	220	25400	171	-81	39.1	218	137
STR 17	176.3	124	21850	188	-98	3.2	53	-35

$$\Sigma = 3918 \quad 330580$$

$$\frac{S}{I_{xx}} = \frac{17970}{16885} = 1.064$$

$$\frac{V}{I_{yy}} = \frac{23300}{4074} = 5.72$$

$$\phi = \frac{330580}{3918} (1.064) = 90^\circ/\text{IN.}$$

SECTIONAL CONSTANTS

CASE: ROLLING PULLOUT

SIDE APPLIED LOAD ALONG A/C DATUM

FIRST APPROXIMATION

ST.

M_y

V_{FWD}

V_{AFT}

	1	2	3	4	5	6	7	8	9	10
ITEM	y	z	A	A_y	Ay^2	A_z	Az^2	$y - \bar{y}$	$z - \bar{z}$	$A(y - \bar{y})(z - \bar{z})$
UPPER INNER LONG'N	16.3	34.7	.584	9.52	155	20.26	703	13.67	21.5	
STR 2	24.0	34.4	.147	3.53	85	5.05	174	21.37	21.2	
3	28.5	34.2	.158	4.50	128	5.40	185	25.87	21.0	
4	33.0	33.9	.158	5.21	172	5.36	182	30.37	20.7	
5	37.5	33.6	.158	5.92	222	5.31	178	34.87	20.4	
6	42.0	33.4	.158	6.64	279	5.28	176	39.37	20.2	
7	46.5	33.1	.158	7.35	342	5.23	173	43.87	19.9	
8	51.0	32.5	.158	8.06	411	5.14	167	48.37	19.3	
UPPER OUTER LONG'N	55.6	30.5	.330	18.35	1020	10.06	307	52.97	17.3	
STR 9	56.6	29.0	.170	7.62	544	4.59	124	53.97	12.8	
10	56.8	22.0	.170	9.66	549	3.71	82	54.17	8.8	
11	57.0	17.0	.170	9.69	552	2.89	49	54.87	3.9	
12	57.3	12.0	.170	9.74	558	2.01	24	54.67	-1.8	
13	57.5	7.0	.170	9.78	562	1.19	8	54.27	-6.8	
14	57.8	2.0	.170	9.83	568	.34	1	55.17	-11.8	
15	57.9	-3.0	.082	4.75	275	-1.25	1	55.27	-16.8	
16	58.0	-8.0	.082	4.76	276	-4.66	5	55.37	-21.8	
17	47.8	-12.0	.299	14.29	683	-3.99	51	45.17	-26.8	
TOTT. LONG'N	57.8	-14.5	1.133	65.19	3785	-16.43	238	55.17	-27.5	
Σ			4.625	217.70	11.166	60.65	2828			

CONSTANTS

NG PULLOUT

APPLIED LOAD ALONG A/C DATUM

APPROXIMATION

STA. 292

$M_y = 3120000$ IN-LBS ; $M_z = 2151000$ IN-LBS

$V_{FWD} = 29200$ LBS. $S_{FWD} = 19040$ LBS.

$V_{AFT} = 40300$ LBS. $S_{AFT} = 20040$ LBS.

4	5	6	7	8	9	10	11	12	13	14	15	16	17
A_y	A_y^2	A_z	A_z^2	$y - \bar{y}$	$z - \bar{z}$	$A_y(x - \bar{x})$	y	z	A	A_y	A_y^2	A_z	A_z^2
9.52	155	20.26	703	13.67	21.5		16.3	34.7	.584	9.52	155	20.26	
3.53	85	5.05	174	21.37	21.2		24.0	34.4	.147				
4.50	128	5.40	185	25.17	21.0		28.5	34.2	.157				
5.21	172	5.36	182	30.37	20.7		33.0	33.9	.156	(A)	(B)	(C)	
5.92	222	5.31	178	34.27	20.4		37.5	33.6	.158				
6.64	279	5.28	176	39.37	20.2		42.0	33.4	.158	AS	AS	AS	
7.35	342	5.23	173	43.87	19.9		46.5	33.1	.158				
8.06	411	5.14	167	48.37	19.3		51.0	32.5	.158	SHANE	SHANE	SHANE	
18.35	1020	10.06	307	52.97	17.3		55.6	30.5	.330				
9.62	544	4.59	124	53.97	13.8		56.6	27.0	.170				
9.66	549	3.74	82	54.17	8.8		56.8	22.0	.082	4.66	264	1.80	
9.69	552	2.89	49	54.87	3.8		57.0	17.0	.082	4.67	266	1.39	
9.74	558	2.01	24	54.67	-1.8		57.3	12.0	.102	4.70	269	.98	
9.78	562	1.19	8	54.27	-6.8		57.5	7.0	.102	4.71	271	.57	
9.83	568	.34	1	55.17	-11.8		57.8	2.0	.102	4.74	274	.16	
4.75	275	-.125	1	55.27	-16.8		57.9	-2.0	.102	4.75	275	-.25	
4.76	276	-.166	5	55.37	-21.8		58.0	-8.0	.102	4.76	276	-.66	
14.29	683	-3.89	51	45.17	-26.8		47.8	-13.0	.299				
65.49	3785	-16.43	238	55.17	-27.5		57.8	-14.5	1.133	65.49	3785	-16.43	
217.70	11166	60.65	2828						4.185	19148	9921	55.33	

A. V. ROE CANADA LIMITED

MALTON, ONTARIO
ENGINEERING DIVISION - AIRCRAFT

REPORT NO

710554/5

SHEET

3-4

DATE

AIRCRAFT

C-105

WEIGHT

47000 LBS.

C. G. POSITION

PREPARED BY

LBS.

SS.

BS.

17	18	19	20	21	22	23	24	25	26	27	28	29
						$\uparrow$ T _{ST}						
A_z	A_z^2	$y + \bar{y}$	$z - \bar{z}$	$A(y + \bar{y})(z - \bar{z})$	X +VE	X -VE						
20.26	703	18.93	21.5		18010	14380	$\bar{y} = \frac{2372}{8.81} = 263 \text{ IN}$					
		20.63	21.2		18610	14215						
		31.13	21.0		18870	14030	$\bar{z} = \frac{116}{8.81} = 13.18 \text{ IN}$					
		35.63	20.7		19130	13860						
		40.13	20.4		19300	13600	$I_{yy} = 5572 - 8.81(13.18)^2 = 4042 \text{ IN}^4$					
		44.63	20.2		19660	13520						
		49.13	19.9		19940	13350	$I_{zz} = 20887 - 8.81(2.63)^2 = 20827 \text{ IN}^4$					
		53.63	19.3		19890	12910						
		58.13	19.3		18860	11620	$\bar{x}_{+VE} = \frac{3120000}{4042} = 251600 \text{ IN}$					
		59.13	13.8		16260	9280						
1.80	40	59.43	8.8		12390	5890						
1.39	24	59.63	3.8		8540	2540						
.98	12	59.73	-1.8		4260	-1576						
.57	4	60.13	-6.8		410	-5950						
.16	0	60.43	-11.8		-3400	-10320						
-.25	1	60.53	-16.8		-7290	-14730						
-.66	5	60.63	-21.8		-11090	-19050						
		60.43	-26.8		-16040	-23460						
5	-16.43	238	60.43	-27.5	-15500	-24040						
55.35	2744											

SUPERCEDED

SECTIONAL CONSTANTS

CASE: ROLLING PULLOUT

SIDE APPLIED LOAD ALONG $\frac{A}{C}$ DATUM

SECOND APPROXIMATION

	1	2	3	4	5	6	7	8	9	10
ITEM	^{15.56} y	z	A	A _y	A _y ²	A _z	A _z ²	y - $\bar{y}$	z - $\bar{z}$	A(y - $\bar{y}$)(z - $\bar{z}$)
UPPER INNER LONG'N	16.3	34.7	.584	5.65	92	20.25	704	15.85	23.37	216.3
STR 2	24.0	34.4	.147	3.52	85	5.06	174	23.55	23.07	79.9
3	28.5	34.2	.158	4.50	128	5.40	185	28.05	22.87	101.35
4	33.0	33.9	.158	5.21	172	5.36	182	32.55	22.57	116.07
5	37.5	33.6	.158	5.93	222	5.31	178	37.05	22.27	130.37
6	42.0	33.4	.158	6.64	279	5.28	176	41.95	22.07	144.88
7	46.5	33.1	.158	7.35	342	5.23	173	46.05	21.77	158.39
8	51.0	32.5	.158	8.06	411	5.14	167	50.55	21.17	169.08
UPPER OUTER LONG'N	55.6	30.5	.330	18.32	1032	10.08	307	55.15	19.17	348.89
STR 9	56.6	27.0	.170	9.62	544	4.59	124	56.15	15.67	149.58
10	56.8	22.0	.170	9.66	549	3.74	82	56.35	10.67	102.21
11	57.0	17.0	.170	9.69	552	2.89	49	56.55	5.67	54.51
12	57.3	12.0	.170	9.74	558	2.04	24	56.85	.67	6.47
13	57.5	7.0	.170	9.78	562	1.19	8	57.05	-4.33	-41.99
14	57.8	2.0	.142	8.21	475	.28	1	57.35	-9.33	-76.00
15	57.9	-3.0	.122	7.07	410	-.36	1	57.45	-14.33	-100.44
16	58.0	-8.0	.112	6.50	377	-.70	7	57.55	-19.33	-124.59
17	47.8	-13.0	.321	15.40	734	-4.16	54	47.35	-24.33	-369.80
Bottom LONG'N	57.8	-14.5	1.404	81.20	4690	-20.40	295	57.35	-25.33	-2079.82
$\Sigma =$			4.960	236.96	12267	56.00	2890			-1017

IN-LBS
LBS
LBS

A. V. ROE CANADA LIMITED

MALTON, ONTARIO
ENGINEERING DIVISION - AIRCRAFT

REPORT NO.

71055915

SHEET

2-5

DATE

OCTOBER 1955

AIRCRAFT

C-105

WEIGHT

47000 LBS.

C. G. POSITION

PREPARED BY

J.M. Lee

17	18	19	20	21	22	23	24	25	26	27	28	29
A_z	A_z^2	$y + \bar{y}$	$z - \bar{z}$	$A(y + \bar{y})(z - \bar{z})$	x +VE	x -VE						
		16.75	23.37	229	22140	17000						
		24.45	23.07	83	23185	15350						
		28.95	22.87	105	24390	14500						
		33.45	22.57	119	24910	13500						
		37.95	22.27	134	25420	12400						
		42.45	22.07	148	26020	11500						
		46.95	21.77	161	26535	10500						
		51.45	21.47	172	26730	9210						
		56.05	19.17	355	25810	6800						
		57.05	15.67	152	23070	3600						
		57.25	12.67	104	18950	-700						
		57.45	5.67	55	14630	-5000						
2.02	24.2	57.75	.67	6	10430	-9300						
.89	6.2	57.95	-4.33	-32	6220	-13580						
.23	.5	58.25	-9.33	-62	7000	-17800						
-.32	1.0	58.55	-14.33	-90	2230	-22155						
-.83	6.6	58.85	-19.33	-116	-6500	-26420						
-4.10	53.2	48.25	24.33	-370	-12450	-28930						
-20.20	293.0	58.25	25.83	-2100	-12000	-31920						
55.26	2885			-947								
							$A = 4.960 + 4.851 = 9.811 \text{ in}^4$ $\bar{y} = \frac{236.96 - 232.55}{9.811}$ $\bar{y} = \frac{4.41}{9.811} = .45 \text{ in}$ $\bar{z} = \frac{56.00 + 55.26}{9.811} = 11.33 \text{ in}$ $I_{yy} = 2890 + 2485 - 9.811(11.33)^2$ $I_{yy} = 4559 \text{ in}^4$ $I_{zz} = 12267 + 11905 - 9.811(.45)^2$ $I_{zz} = 24170 \text{ in}^4$ $I_{stx\text{ave}} = \frac{-3120000}{(4559)^2} + \frac{2181000}{24170}$ $I_{ye} = -1017 - 947 = -1964 \text{ in}^4$ $\tan 2\theta = \frac{-(1964)2}{24170 - 4559} = .1601478$ $\theta = 2^\circ - 50'$ $K_1 = \frac{I_{yz}}{I_y I_z - I_{yz}^2} = .0000184707$ $K_2 = \frac{I_z}{I_y I_z - I_{yz}^2} = .00022731$ $K_3 = \frac{I_y}{I_y I_z - I_{yz}^2} = .0000428757$ $106,330,000$ $f_{st} = -(K_3 M_z - K_1 M_y) y - (K_2 M_y - K_1 M_z) z$					
							$471(3.542) y - (227.31(3.542) - (18.471(2.457) z$ $5.13 + 45.33) z = 170.77 y - 850.51 z$					

A.V. ROE CANADA LIMITED
MALTON - ONTARIO

TECHNICAL DEPARTMENT (Aircraft)

AIRCRAFT C-105

REPORT NO. 710554/5

SHEET NO. 2-6

PREPARED BY: J.M. Lee

DATE:

CHECKED BY:

FEB 13, 1955

DATE:

CENTRE FUSELAGE SECTIONS
EFFECTIVE SHEET WIDTHS IN COMP
STA 292 R.P.O. @ 5000 FT ALT. CASE

X + VE

$$A_{ST 14} = .0531 + \frac{1.34}{(3400)^{\frac{1}{3}}} = .142$$

$$A_{ST 15} = .0531 + \frac{1.34}{(7290)^{\frac{1}{3}}} = .122$$

$$A_{ST 16} = .0531 + \frac{1.34}{(11090)^{\frac{1}{3}}} = .112$$

$$A_{ST 17} = .268 + \frac{1.34}{(16040)^{\frac{1}{3}}} = .321$$

$$A_{B.L.} = 1.350 + \frac{1.34}{(15500)^{\frac{1}{3}}} = 1.404$$

X - VE

$$A_{ST 12} = .0531 + \frac{1.34}{(1576)^{\frac{1}{3}}} = .168$$

$$A_{ST 13} = .0531 + \frac{1.34}{(5950)^{\frac{1}{3}}} = .127$$

$$A_{ST 14} = .0531 + \frac{1.34}{(10320)^{\frac{1}{3}}} = .115$$

$$A_{ST 15} = .0531 + \frac{1.34}{(14730)^{\frac{1}{3}}} = .108$$

$$A_{ST 16} = .0531 + \frac{1.34}{(19050)^{\frac{1}{3}}} = .103$$

$$A_{ST 17} = .268 + \frac{1.34}{(23460)^{\frac{1}{3}}} = .315$$

$$A_{B.L.} = 1.350 + \frac{1.34}{(24040)^{\frac{1}{3}}} = 1.396$$

SECTIONAL CONSTANTS

CASE: ROLLING PULLOUT

SIDE APPLIED LOAD ALONG $\frac{A}{C}$ DATUM
FIRST APPROXIMATION

	1	2	3	4	5	6	7	8	9	10
ITEM	y	z	A	Ay	Ay^2	Az	Az^2	$y - \bar{y}$	$z - \bar{z}$	$A(y - \bar{y})(z - \bar{z})$
UPPER INNER LONG'N	14.3	36.1	.610	8.71	125	22.0	795	13.8	22.5	189
STR 2	24.0	35.3	.170	4.08	98	6.0	212	23.5	21.7	87
3	28.5	34.7	.158	4.50	128	5.5	191	28.0	21.1	93
4	33.0	34.4	.158	5.21	172	5.4	187	32.5	20.8	107
5	37.5	33.9	.158	5.92	222	5.4	181	37.0	20.3	119
6	42.0	33.5	.158	6.64	279	5.3	178	41.5	19.9	130
7	46.5	33.1	.158	7.35	342	5.2	173	46.0	19.5	142
8	51.0	32.7	.158	8.05	410	5.2	169	50.5	19.1	152
UPPER OUTER LONG'N	55.6	31.2	.328	18.20	1010	10.2	318	55.1	17.6	318
STR 9	56.6	27.0	.203	11.50	650	5.5	148	56.1	13.4	152
10	56.8	22.0	.203	11.52	655	4.5	98	56.3	9.4	96
11	57.0	17.0	.203	9.70	553	3.45	59	56.5	3.4	39
12	57.3	12.0	.203	11.6	665	2.44	29	56.8	-1.6	-18
13	57.5	7.0	.203	11.7	674	1.42	9	57.0	-6.6	-76
14	57.8	2.0	.100	5.8	335	.20	0	57.3	-11.6	-66
15	57.9	-3.0	.100	5.8	336	-.30	1	57.4	-16.6	-95
16	58.0	-8.0	.100	5.8	336	-.80	6	57.5	-21.6	-124
17	47.8	-13.0	.306	14.6	700	-3.98	52	47.3	-26.6	-385
TOTT. LONG'N	57.8	-9.6	1.420	82.1	4750	-13.62	131	57.3	-23.2	-1890
			5.097	247.76	12040	69.1	2937			-1030

STANTS

OUT

LOAD ALONG $\frac{A}{C}$ DATUM

OXIMATION

STA. 315

$M_y = 4120000$ IN-LBS; $M_z = 2473000$ IN-LBS.

$V_{FWD} = 44300$ LBS; $S_{FWD} = 20730$ LBS.

$V_{AFT} = 45600$ LBS; $S_{AFT} = 20770$ LBS.

	6	7	8	9	10	11	12	13	14	15	16	17	18	
y^2	A_z	A_z^2	$y - \bar{y}$	$z - \bar{z}$	$A(y - \bar{y})(z - \bar{z})$	y	z	A	A_y	A_y^2	A_z	A_z^2	y	
5	22.0	795	13.8	22.5	189	14.3	36.1	-.610	8.71	125	22.0	795	14	
8	6.0	212	23.5	21.7	87	24.0	35.3	.170	1	1	1	1	24	
8	5.5	191	28.0	21.1	93	28.5	34.7	.158					28	
2	5.4	187	36.5	20.8	107	33.0	34.4	.158	(4)	(5)	(6)	(7)	33	
22	5.4	181	37.0	20.3	119	37.5	33.9	.158					37	
9	5.3	178	41.5	19.9	130	42.0	33.5	.158	COL	COL	COL	COL	42	
2	5.2	173	46.0	19.5	142	46.5	33.1	.158	AS	AS	AS	AS	46	
0	5.2	169	50.5	19.1	152	51.0	32.7	.158	AS	AS	AS	AS	51	
0	10.2	318	55.1	17.6	318	55.6	31.2	.328	SAME	SAME	SAME	SAME	55	
50	5.5	148	56.1	13.4	152	56.6	27.0	.203	SAME	SAME	SAME	SAME	56	
5	4.5	98	56.3	8.4	96	56.8	22.0	.203	1	1	1	1	56	
53	3.45	59	56.5	3.4	37	57.0	17.0	.203	1	1	1	1	57	
5	2.44	29	56.8	-1.6	-18	57.3	12.0	.100	5.7	328	1.20	14.4	57	
4	1.43	9	57.0	-6.6	-76	57.5	7.0	.100	5.7	328	.70	4.9	57	
5	.20	0	57.3	-11.6	-66	57.8	2.0	.100	1	1	1	1	57	
6	-.30	1	57.4	-16.6	-95	57.9	-3.0	.100	(4)	(5)	(6)	(7)	57	
5	-.80	6	57.5	-21.6	-124	58.0	-8.0	.100	AS	AS	AS	AS	57	
2	-3.98	52	47.3	-26.6	-385	47.8	-13.0	.306	1	1	1	1	47	
0	-13.62	131	57.3	-23.2	-1890	57.8	-9.6	1.420	82.1	4750	-13.62	131	57	
0	67.1	2937			-1030			4.891	23588	11357	67.1	2718		

MALTON, ONTARIO
ENGINEERING DIVISION - AIRCRAFT

SHEET

DATE _____

PREPARED BY

AIRCRAFT

WEIGHT

C. G. POSITION

C-105

47000 LBS.

At

COPIED

[illegible]

A.V. ROE CANADA LIMITED
MALTON - ONTARIO

TECHNICAL DEPARTMENT (Aircraft)

REPORT NO.

710554/5

SHEET NO.

2-0

PREPARED BY:

Shirley

DATE:

FEB 23, 1955

CHECKED BY:

DATE:

AIRCRAFT

C 105

CENTRE FUSELAGE SECTIONS

EFFECTIVE SHEET WIDTHS

STA 315 X + VE 2ND. APPROXIMATION

$$A_{14} = .0531 + \frac{2.00}{(1880)^{\frac{1}{3}}} = .2157 \text{ IN}^2$$

$$A_{15} = .0531 + \frac{2.00}{(6900)^{\frac{1}{3}}} = .158$$

$$A_{16} = .0531 + \frac{2.00}{(11990)^{\frac{1}{3}}} = .140$$

$$A_{BL} = 1.370 + \frac{2.00}{(13620)^{\frac{1}{3}}} = 1.454$$

$$A_{17} = .268 + \frac{2.00}{(18870)^{\frac{1}{3}}} = .343$$

X - VE

$$A_{10} = .0531 + \frac{2.00}{(1480)^{\frac{1}{3}}} = .2297 \text{ IN}^2$$

$$A_{11} = .0531 + \frac{2.00}{(6620)^{\frac{1}{3}}} = .160$$

$$A_{12} = .0531 + \frac{2.00}{(11820)^{\frac{1}{3}}} = .141$$

$$A_{13} = .0531 + \frac{2.00}{(17960)^{\frac{1}{3}}} = .129$$

$$A_{14} = .0531 + \frac{2.00}{(22150)^{\frac{1}{3}}} = .124$$

$$A_{15} = .0531 + \frac{2.00}{(27270)^{\frac{1}{3}}} = .120$$

$$A_{16} = .0531 + \frac{2.00}{(32390)^{\frac{1}{3}}} = .116$$

$$A_{17} = .268 + \frac{2.00}{(35700)^{\frac{1}{3}}} = .329$$

$$A_{BL} = 1.370 + \frac{2.00}{(33750)^{\frac{1}{3}}} = 1.432$$

ST

My

$$V_{FV}$$
 V_A

1992

DE APPLIED LOAD ALONG $\frac{A}{C}$ DATUM
COND APPROXIMATION.

$$V_{AFT} = 46800 \text{ LBS.} ; S_{AFT} = 21130 \text{ LBS.}$$
[illegible]

MALTON, ONTARIO
ENGINEERING DIVISION - AIRCRAFT

AIRCRAFT

C-105

WEIGHT

47000 LBS.

C. G. POSITION

REPORT NO.

7/0554/5

SHEET

2-10

DATE _____

MARCH 1, 1955

PREPARED BY

1866

17	18	19	20	21	22	23	24	25	26	27	28	29
					$\frac{N}{I_{ST}}$							
A_z	A_{z^2}	$y + \bar{y}$	$z - \bar{z}$	$A(y+\bar{y})(z-\bar{z})$	$\sum X$ +VE	$\sum X$ -VE	$A(y-\bar{y})$					
22.02	795	16.25	21.63	214	31680	23400	9.9	$A = 10.382$				
		25.95	20.85	92	33130	20000	4.4	$\bar{y} = \frac{255.18 - 235.68}{10.382} = 1.955 \text{ IN}$				
		30.45	20.25	97	33510	18000	4.8					
(16)	(17)	34.95	19.93	110	34260	16480	5.5	$\bar{z} = \frac{75.88 + 74.4}{10.382} = 14.475 \text{ IN}$				
		39.45	19.43	121	34780	14700	6.2	$I_{zz} = 13408 + 12245 - 10.382(1.95)^2$				
AS	AS	43.95	19.03	132	35415	13050	6.9	$I_{zz} = 25613 \text{ IN}^4$				
		48.45	18.63	143	36055	11400	7.6	$I_{zz} = -1312 - 1432 = -2804 \text{ IN}^4$				
SAME	SAME	52.95	18.23	153	36600	9800	8.4	$I_{yy} = 3201 + 3168 - 10.382(14.47)^2$				
		57.55	17.13	323	36465	7600	18.9	$I_{yy} = 4149 \text{ IN}^4$				
		58.55	12.53	149	30860	1060	11.9					
		58.75	7.53	90	24540	-5400	11.9	$\theta = \frac{1}{2} \tan^{-1} \frac{I_{xy}}{I_x - I_y} = \frac{2804}{25613 - 4149}$				
2.72	46	58.95	2.53	24	18220	-11780	9.4					
1.69	20	59.25	-2.41	-21	11940	-18225	8.4					
.90	6	59.45	-7.47	-57	5600	-24640	7.7	$\theta = 7^\circ - 26'$				
.24	0	59.75	-12.47	-92	-680	-31080	7.4	$U_y = \frac{2804}{4149} = -.677$				
-.36	1	59.85	-17.47	-125	-7000	-37480	7.2					
-.93	7	59.95	-22.47	-156	-13400	-43870	6.9	$U_z = \frac{2804}{25613} = .1096$				
4.28	56	49.75	-27.47	-450	-22400	-37660	16.4					
13.75	132	59.75	-24.07	-2059	-15400	-35850	86.0					
							$M_{yy} = \frac{4120000 + .1096(2473000)}{1 - (.677 - .1096)}$					
14.4	3168						$M_{yy} = 4160000 \text{ IN}^4$					
$-(2015.4549) - (-286.2924) Z$							$K_1 = \frac{-2084}{\frac{(2015.4549) - (-286.2924)}{-5}} = -2.86 \times 10^{-4}$					
$+.6 + 53.3 Z$							$K_2 = \frac{25613}{58710} = 2.615 \times 10^{-4}$					
							$K_3 = \frac{4149}{9.8 \times 10^7} = 4.24 \times 10^{-5}$					
							$M_{zz} = \frac{2473000 + .677(4120000)}{.9258} = 342000$					
							$f_{ST} = -(K_3 M_z - M_y K_1) g / (K_1 M_y - K_2 M_z) z$					

SIDE APPLIED LOAD ALONG A/C DATUM

$$V_{27} =$$
FORM 1544

5152

2516

CONSTANTS

STA 359

NG PULLOUT

$M_y = 6,500,000$ IN LBS

$M_z = 2,730,000$ IN-

$V = 47,000$ LBS

$S = 21,000$ LBS

APPLIED LOAD ALONG $\frac{A}{C}$ DATUM

4	5	6	7	8	9	10	11	12	13	14	15	16	17	
R.H. SIDE							$P_{R.H.}$	L.H. SIDE						
A_y	A_y^2	A_z	A_z^2	$y - \bar{y}$	$z - \bar{z}$	$A_y(\bar{y} - \bar{z})$		y	z	A	A_y	A_y^2	A_z	
872	125	22.02	795	12.12	23.17	171	18450	14.3	36.1	.610	1	1	1	
4.08	98	6.00	212	21.82	22.37	83	4950	24.0	35.3	.170				
4.50	128	5.48	190	26.32	21.77	91	4480	28.5	34.7	.158	(D)	(5)	(6)	
5.21	172	5.44	187	30.82	21.47	104	4435	33.0	34.4	.158				
5.92	222	5.36	182	35.32	21.97	117	4210	37.5	33.9	.158				
6.64	279	5.29	177	39.82	20.57	129	4230	42.0	33.5	.158				
7.35	342	5.23	243	44.32	20.17	141	4150	46.5	33.1	.158				
8.05	410	5.17	169	48.82	19.77	152	4065	51.0	32.7	.158				
47.09	2618	26.43	825	53.42	18.27	827	20150	55.6	31.2	.847				
9.62	544	4.57	124	54.42	14.07	130	3120	56.6	27.0	.170				
9.66	547	3.74	82	54.62	9.07	84	2012	56.8	22.0	.082	4.66	265	1.80	
9.69	552	2.89	49	54.82	4.07	38	903	57.0	17.0	.082	4.67	266	1.39	
9.74	558	2.04	24	55.12	-.93	-9	-207	57.3	12.0	.082	4.70	269	.98	
9.78	562	1.19	8	55.32	-5.93	-56	-1315	57.5	7.0	.082	4.71	271	.57	
9.83	568	.34	1	55.62	-10.93	-103	-2430	57.8	2.0	.082	4.74	274	.16	
4.75	275	-.25	1	55.72	-15.93	-73	-3540	57.9	-3.0	.082				
4.76	276	-.66	5	55.82	-20.93	-96	-4650	58.0	-8.0	.082				
4.29	683	-3.89	51	45.62	-25.93	-354	-10100	47.8	-13.0	.299				
13.52	4561	-18.85	181	55.62	-32.53	-2461	-57800	57.8	-9.6	1.964				
93.18	15522	77.56	3506				-1085	-4.07	+2.18	+12.93	5.572	267.96	14.078	72.24
							3152							
							2316							

0 IN-LBS

ENGINEERING DIVISION - AIRCRAFT

C-105

47000 LBS.

REPORT NO

SHEET

DATE _____

PREPARED BY

17	18	19	20	21	22	23	24	25	26	27	28	29
A_z	A_z^2	$y + \bar{y}$	$z - \bar{z}$	$A(y + \bar{y})(z - \bar{z})$	$\frac{L.H.}{X}$ +VE	$\frac{R.H.}{X}$ -VE	$P_{L.H.}$					
1	1	16.48	25.17	233	30274	30217	18500					
6	36	26.18	22.37	100	29243	29191	4980	$A = 6.012 + 5.572 = 11.584 \text{ in}^2$				
		30.68	21.77	106	28453	28391	4490	$\bar{y} = 293.18 + 267.96 / 11.584 = 2.177 \text{ in}$				
		35.18	21.47	119	28112	28042	4440					
		39.68	20.97	131	27461	26641	4340	$\bar{z} = 77.56 + 72.26 / 11.584 = 12.933 \text{ in}$				
		44.18	20.57	144	26880	26794	4250					
		48.68	20.17	155	26389	26292	4160	$I_y = 3506 + 3422 - 11.584(12.933)^2$				
		53.18	19.77	166	25898	25792	4090	$I_y = 4990 \text{ in}^4$				
		57.68	18.27	189	23907	23791	20220	$I_z = 15922 + 14078 - 11.584(2.177)^2$				
		58.78	14.07	141	18509	18391	3142	$I_z = 29545 \text{ in}^4$				
1.80	40	58.98	9.07	44	11760	11840	980	$\tan 2\theta = \frac{2(2142)}{29545 - 4990} = \frac{4284}{24555} = .17445$				
1.39	24	59.18	4.07	20	5420	5302	445	$2\theta = 9^\circ 54' \text{ or } \theta = 4^\circ 57'$				
.98	12	59.48	-.93	-5	-1097	-1218	-900	$I_{yz} = -1085 - 1057 = -2142 \text{ in}^4$				
.57	6	59.68	-5.93	-29	-7639	-7758	-625					
.16	0	59.98	-10.93	-54	-14188	-14508	-1155					
		60.08	-15.93	-78	-20688	-20808	-1697	$K_1 = \frac{-2142}{(4990 - 29545) + (2142)^2} = .00001505$				
		60.18	-20.93	-103	-27228	-27348	-2235					
		49.98	-25.93	-387	-33709	-33829	-10100	$K_2 = \frac{29545}{142400000} = .0002075$				
		59.98	-22.53	-2654	-29288	-29408	-57500	$K_3 = \frac{4990}{142400000} = .0000350$				
72.26	3422			-1057			-175	$f_{1st} = (K_3 M_z - K_1 M_y) y - (K_2 M_y - K_1 M_z) z$				
								$f_{1st} = -(35 \times 2.73 - 15 \times 4.5) y -$				
								$- (207 \times 6.5 - 16 \times 2.73) z$				
								$f_{1st} = 24 y - 1306 z$				

CONSTANTS

UND CASE

METRICAL BRAKING)

FACTORS: $n_z = 1.365 \downarrow$; $n_x = .449$ (FWD); DRAG STRUT REACTION @ STA 176.95; $\frac{1}{4}$ C REACTION @ STA

STA. 359

ULT. NET LOADS & MOMENTS

$M_y = 71,000''\#$; $M_z = 320,000''\#$; $M_x = 1,460,000''\#$

$V = 13,500\#$; $S_{\frac{1}{4}} = 10,820\#$; $S_{\frac{3}{4}} = 11\#$

4	5	6	7	8	9	10	11	12	13	14	15	16	17
A_y	A_y^2	A_z	A_z^2	$y - \bar{y}$	$z - \bar{z}$	$A(y - \bar{y})(z - \bar{z})$	$A(y - \bar{y})$	y	z	A	A_y	A_y^2	A_z
8.72	125	22.02	795	13.01	23.15	184	7.95	14.3	36.1	.610	8.72	125	22.02
4.08	98	6.00	212	22.71	22.35	86	3.86	$\uparrow$	$\uparrow$	.170	4.08	$\uparrow$	$\uparrow$
4.50	128	5.48	190	27.21	21.75	94	4.30	(1)	(2)	.158	4.50		
5.21	172	5.44	187	31.71	21.45	107	5.01	No	No	.158	5.21	(5)	(6)
5.92	222	5.36	182	36.21	20.95	119	5.71	No	No	.158	5.92		
6.64	279	5.29	177	40.71	20.55	132	6.44	COLUMN	COLUMN	.158	6.64	A	A
7.35	342	5.23	243	45.21	20.15	144	7.14	COLUMN	COLUMN	.158	7.35	A	A
8.05	410	5.17	169	49.71	19.75	155	7.85	COLUMN	COLUMN	.158	8.05	SAME	SAME
9.09	2618	26.43	825	54.31	18.25	839	46.00	COLUMN	COLUMN	.847	47.09	SAME	SAME
9.62	544	4.59	124	55.31	14.05	132	9.40			.170	9.62		
9.66	549	3.74	82	55.51	9.05	85	9.45	A	A	.170	9.66		
9.69	552	2.89	49	55.71	4.05	38	9.46	A	A	.170	9.69	$\downarrow$	$\downarrow$
9.74	558	2.04	24	56.01	-.95	-9	9.54			.082	4.70	269	-.98
9.78	562	1.19	8	56.21	-5.95	-57	9.55	SAME	SAME	.082	4.71	271	-.57
9.83	568	.34	1	56.51	-10.95	-106	9.61	SAME	SAME	.082	4.74	274	-.16
4.75	275	-.25	1	56.61	-15.95	-74	4.65			.082	4.75	$\uparrow$	$\uparrow$
4.76	276	-.66	5	56.71	-20.95	-97	4.66			.082	4.76	(5)	(6)
4.29	683	-3.89	51	46.51	-25.95	-361	13.90	$\downarrow$	$\downarrow$	.299	14.29	$\downarrow$	$\downarrow$
3.52	6561	-18.85	181	56.51	-22.55	-2503	111.00	57.8	-9.6	1.964	113.52	6561	-18.85
13.18	15522	77.56	3506			1091		1.29	12.96	5.748	277.98	14248	74.70



AVRO AIRCRAFT LIMITED
MALTON - ONTARIO

TECHNICAL DEPARTMENT

REPORT NO. 710889/5

SHEET NO. 11-1

AIRCRAFT:

PREPARED BY

DATE

CHECKED BY

DATE

SECTION II

SUMMARY - SYMMETRIC BENDING

255 - 359

TECHNICAL DEPT. (AIRFRAME)

AIRCRAFT

WEIGHT

C. G. POSITION

REPORT NO.

SHEET

DATE _____

PREPARED BY -

[illegible]

SNAP-LOCK BINDER, 1½ inch capacity

NO. 4872-W

MANUFACTURED IN CANADA BY
THE CHAS. CHAPMAN CO. LIMITED
London - Canada

