AVRO AIRCRAFT

TECHNICAL REPORT

L. Thurston

ANALYZED

A. V. ROE CANADA LIMITED

MALTON · ONTARIO

TECHNICAL DEPARTMENT (Aircraft)

AIRCRAFT: C-105

REPORT NO. 7/0510/10

FILE NO.

NO. OF SHEETS:

TITLE: FIN ANALYSIS

Classification cancelled / Changed to UNCLASS
By authority of AVRS
Date 30 Sept 96
Signature [signature]
Unit / Rank / Appointment AVRS8

~~CONFIDENTIAL~~

PREPARED BY C. Burrell DATE July '55

CHECKED BY DATE

SUPERVISED BY DATE

APPROVED BY DATE

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

FORM 1316A

A. V. ROE CANADA LIMITED MALTON - ONTARIO **TECHNICAL DEPARTMENT (Aircraft)**		REPORT No. 7/0510/10 SHEET No.	
AIRCRAFT: C 105	FIN	PREPARED BY G. Grandeson	DATE APR 56
		CHECKED BY	DATE

LIST OF REFERENCES

DRAWINGS

G.A. FIN STRUCT. & GEOM. (SCHEME) 7-0183-37 ISS. 7

AUX SPARS & RIBS 7-0183-39 ISS. 4

TEXTS

STRENGTH OF METAL A/C ELEMENTS ANC-5

THEORY OF ELASTISITY "TIMOSHENKO"

REPORTS

AVRO STRESS REPORT GEN/1090/376

AVRO STRESS REPORT 7/0510/9

FORM 1319 A

AVRO AIRCRAFT LIMITED
MALTON - ONTARIO
TECHNICAL DEPARTMENT

AIRCRAFT:		REPORT NO. 7/ 0510/ 10	
		SHEET NO.	
		PREPARED BY	DATE
C 105	Fin	G.E. Burrell	April '56
		CHECKED BY	DATE

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INTRODUCTION

This report contains an overall analysis of the C 105 Fin for normal loads. The structure considered extends over the entire fin with its foundation.

Stresses and deflections due to unit loads are predicted from a strain energy analysis basad on a method developed in Avro Stress Report Gen/1090/336 which permits the handling of large scale problems.

SPECIAL FEATURES

In all, sixty three loads are considered acting normal to the component. These represent air and inertia loads acting on the fin, and rudder hinge loads resulting from air and inertia loads on the rudder.

In this solution thr redundancies total seventy-five. Since it is economically impossible, even uaing the present method, to solve a problem of this magnitude by desk calculator, as much use as possible has been made of computor facilities. An attempt was made to partition the structure ,following the technique of Avro Stress Report 7/0510/9, to facilitate the use of the company's C. P. C. type digital computors. However, in order to hasten the completion date, it was necessary to programme the calculations to solve for all redundancies at the one time.

In order to save time of personnel, soae additonal work beyond the normal programme was performed on the Company's C. P. C. computors.

AVRO AIRCRAFT LIMITED
MALTON · ONTARIO
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		CHECKED BY	DATE

This consisted of calculations in conjunction with the establishment of the K^*_{1p} and with checking the K^*_{1p} and T^*_{1a} matrices.

Much of the data was checked before initial release to the Computing Group. In any event, befoer the main computation programme was started, members of the Stress Office had checked the matrices concerned either by desk calculator or by checks designed for the C. P. C. computor.

For the first time, these computations include stresses in webs of spars and ribs. Because of lack of flatness of the various skin panels it has been necessary to approximate these stresses to the extent of two to three percent. Because of thes slight diccrepency and because the basic method is based on the Theory of Plates, the strain energy of the webs has been neglected. A measure of the difference may be obtained by comparison of the Z_{ab} and $Z^{\dagger}_{AB}$ matrices. This indicates a difference of percent.

REPRESENTATION OF SRRUCTURE

A close representation of the structure has been possible with spars and ribs located almost exactly on the actual fin lines.

In order to reduce the the uncertainties due to buckling and ither effects, the leading edge skin has been neglected in shear.

Onl

Only minor relocation of spar and rib positions to permit intersection has been introduced. Where webs are ommitted on the actual fin they have been ommitted on the strees model. Lightning holes and possible b buckling has been catered for by a reduced Shear Moduli.

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A skin panel has been estimated for every area between each pair of rib and spar lines. to uniform thickness throughout each area has been assumed.

The axial stress points have been estimated by considering a lumping of qrea from spar and rib booms, from spar and rib webs, and from skin panels.

The base rib has been neglected due to the difficulty of predicting stresses in an oblique rib.

The foundation has been estimated from the best data available at this time.

In calculating web stresses it should be remembered that:

$$\tau_{x\phi} = \tau_m \frac{h_L \cdot h_1}{h^2}$$

Where;

τ_m = shear stress quoted

$\tau_{x\phi}$ = shear stress at point where height is "h"

h_1 = height at one end

h_2 = height at other end

M 1319A

DATA OBTAINED

Stresses are obtained for two hundred and seventy seven stress points in kips per square inch for sixty three unit loads of one kip each applied normal to tye structure.

USING THE RESULTS

These results are intended for use in detail analysis and in wiight s saving work on the fin.

For this, stresses due to actual loading cases can be quickly established. It is only necessary to establish a Q_m^a matrix expressing the quantity of each unit load required for each loading case.

This is done by distributung air and inertia loads to the init load points.

Then the S_{ia}, S^*_{ia}, and Z_{ab} matrices are post multiplied by the Q_m^m matrix to obtain stresses and deflections due to the loading cases.

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

REPORT NO. 7/0510/10
SHEET NO. 3-1

AIRCRAFT:		PREPARED BY	DATE
C105	FIN	L Gunderson	
		CHECKED BY	DATE
			Dec

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SECTION 3 GEOMETRY

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

REPORT NO.	2/2510/10
SHEET NO.	3-4
PREPARED BY	DATE
[illegible signature]	SEPT. 55
CHECKED BY	DATE
[illegible initials]	JAN '56

AIRCRAFT: C105 — FIN

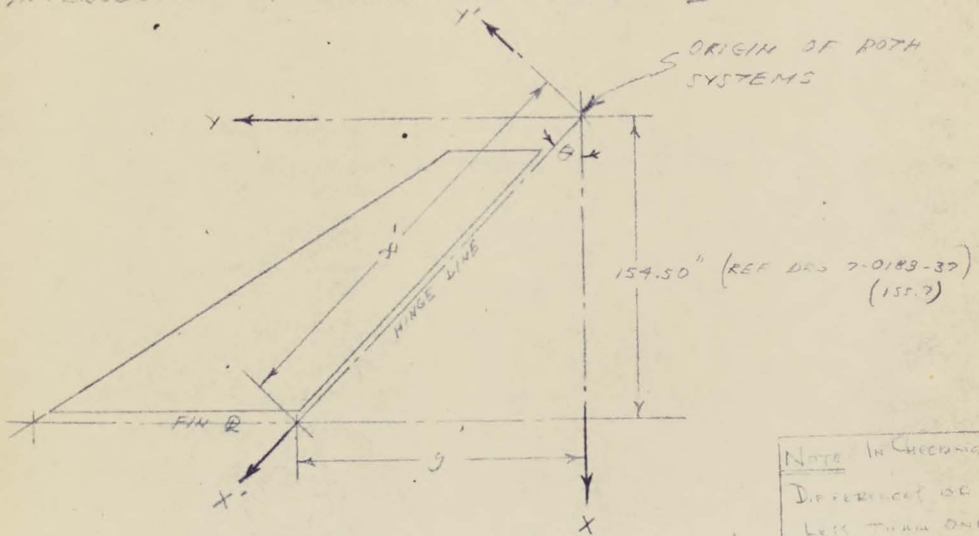
FIN GEOMETRY

SPAR AND RIB INTERSECTION CO-ORDINATES

THE ACTUAL STRUCTURE HAS BEEN MODIFIED SLIGHTLY, TO SIMPLIFY CALCULATION, AS SHOWN ON SHEET 3-2.

THE CO-ORDINATE POINTS IN TERMS OF THE X' Y' AXIS WERE FIRST DETERMINED (EXCEPT POINTS ON THE FRONT SPAR) AND THEN WERE TRANSFORMED TO THE X, Y SYSTEM. IN THE CASE OF POINTS ON THE FRONT SPAR IT WAS MORE CONVENIENT TO DETERMINE THE X, Y CO-ORDINATES AND THEN TRANSFORM THESE TO THE X', Y' SYSTEM. FINALLY ALL THE POINTS WERE SUMMARIZED IN A TABLE (REF SHT 3-61)

INTERSECTION OF HINGE LINE AND FIN ℄.



$\tan\theta = 0.96212858$ (REF DRG 7-0183-37 155.7)

$\therefore y = 154.500000 \times .96212858 = 148.6488656$

$\therefore x' = (154.50^2 + 148.6488656^2)^{\frac{1}{2}} = 214.398544$

NOTE IN CHECKING, DIFFERENCES OF LESS THAN ONE IN THE SEVENTH SIGNIFICANT FIGURE ARE IGNORED

A. V. ROE CANADA LIMITED MALTON - ONTARIO **TECHNICAL DEPARTMENT (Aircraft)**		REPORT NO. 7/0510/10 SHEET NO. 3 - 5	
AIRCRAFT:		PREPARED BY	DATE
C105	FIN	C. Gradner	SEPT 55
		CHECKED BY	DATE
		[illegible]	JAN '56

FIN GEOMETRY

CALC. OF TRIG FUNCTIONS

$$\sin\theta = \frac{148.6488656}{214.398544} = 0.69332964$$

$$\cos\theta = \frac{154.500000}{214.398544} = 0.720620565$$

TRANSFORMATION FROM THE X' Y' SYSTEM TO THE X Y SYSTEM WILL TAKE THE FORM :

$$x = x'\cos\theta - y'\sin\theta$$

$$y = x'\sin\theta + y'\cos\theta$$

TRANSFORMATION FROM THE X Y SYSTEM TO THE X' Y' SYSTEM WILL TAKE THE FORM :

$$x' = x\cos\theta + y\sin\theta$$

$$y' = y\cos\theta - x\sin\theta$$

FORM 1319A

A. V. ROE CANADA LIMITED · MALTON · ONTARIO **TECHNICAL DEPARTMENT (Aircraft)**		REPORT No. 7/0510/110 SHEET No. 3-6	
AIRCRAFT:		PREPARED BY	DATE
C105	FIN	C. Gundesen	SEPT 55
		CHECKED BY	DATE
		[signature]	JAN 56

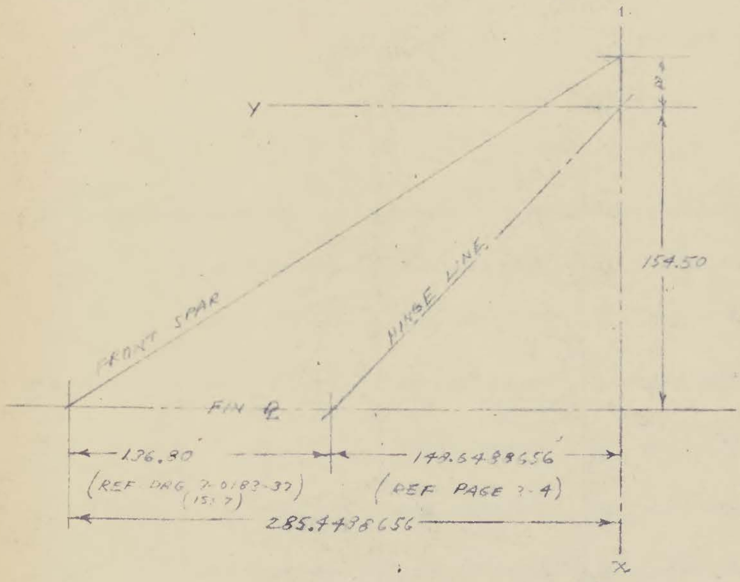
FIN GEOMETRY

FRONT SPAR AND RIB CO-ORDINATES

METHOD :

THE EQUATION OF THE FRONT SPAR AND OF EACH RIB WILL BE CALCULATED IN TERMS OF X AND Y ORDINATES, THE EQUATIONS WILL THEN BE SOLVED TO YIELD X AND Y CO-ORDINATES. THESE CO-ORDINATES WILL BE TRANSFORMED TO X′ Y′ BY MEANS OF THE TRANSFORM EQUATIONS.

CALCULATION OF FRONT SPAR EQUATION



$$\tan\theta = 1.58753700 \quad \text{AND} \quad \frac{1}{1.5875370} = 0.629906578$$

$$\therefore a = \frac{285.4488656}{1.58753700} - 154.500000 = 25.3061183$$

$\therefore$ EQUATION OF F.S. IS :

$$x + 25.3061183 - 0.629906578\,y = 0$$

A. V. ROE CANADA LIMITED MALTON · ONTARIO **TECHNICAL DEPARTMENT (Aircraft)**		REPORT NO. 7/0510/12 SHEET NO. 3-8	
AIRCRAFT:		PREPARED BY	DATE
C105	FIN	L. Gundersen	SEPT. 55
		CHECKED BY	DATE
		T.B.	JAN '56

FIN GEOMETRY

FRONT SPAR AND RIB CO-ORDINATES

SOLUTION OF EQUATIONS:

FROM. FRONT SPAR EQUATION (REF PAGE 3-6)

$$y = \frac{25.3361183 + x}{.629906578} = 40.1743991 + 1.5875370\,x$$

SUBST IN EQU RIB #1

$$x = \frac{330.742693 - .96212858 \times 40.174399 \; (38.6529376)}{1.0 + 1.5875370 \times .96212858 \; (1.52741472)} = \frac{292.089755}{2.52741472} = 115.568589$$

SUBST IN F.S. EQU

$$y = 40.1743991 + 1.5875370 \times 115.568589 \; (183.469411) = 223.643810$$

SUBST IN EQU RIB #2

$$x = \frac{289.193170 - 38.6529376}{2.52741472} = \frac{250.540232}{2.52741472} = 99.1290546$$

SUBST IN F.S. EQU.

$$y = 40.1743991 + 1.5875370 \times 99.1290546 \; (157.371042) = 197.545441$$

SUBST IN EQU RIB #3

$$x = \frac{264.214698 - 38.6529376}{2.52741472} = \frac{225.561760}{2.52741472} = 89.2460419$$

$$y = 40.1743991 + 1.5875370 \times 89.2460419 \; (141.681394) = 181.855793$$

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

REPORT No.	7/0510/10
SHEET No.	3-9
PREPARED BY	DATE
G. Gundersen	SEPT 55
CHECKED BY	DATE
[illegible initials]	JAN 56

AIRCRAFT:	
C105	FIN

FIN GEOMETRY

SUBST IN EQU RIB # 4

$$x = \frac{239.236227 - 38.6529376 \;(200.583287)}{2.52741472} = 79.3630295$$

SUBST IN F.S. EQU

$$y = 40.1743991 + 1.5875370 \times 79.3630295 \;(125.991746) = 166.166145$$

SUBST IN EQU RIB # 5

$$x = \frac{204.543906 - 38.6529376 \;(165.890968)}{2.52741472} = 65.6366233$$

SUBST IN F.S. EQU

$$y = 40.1743991 + 1.5875370 \times 65.6366232 \;(104.200568) = 144.374967$$

SUBST IN EQU RIB # 6

$$x = \frac{170.267892 - 38.6529376 \;(131.614954)}{2.52741472} = 52.0749337$$

SUBST IN F.S. EQU

$$y = 40.1743991 + 1.5875370 \times 52.0749337 \;(82.670884) = 122.845283$$

SUBST IN EQU RIB # 7

$$x = \frac{142.514035 - 38.6529376 \;(103.861077)}{2.52741472} = 41.0938086$$

$$y = 40.1743991 + 1.5875370 \times 41.0938086 \;(65.237942) = 105.412341$$

RM 1319A

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

REPORT NO. 7/0510/110	
SHEET NO. 3-10	
PREPARED BY	DATE
C. Gunderson	SEPT 55
CHECKED BY	DATE
C.B.	JAN 56

AIRCRAFT: C105 — FIN

FIN GEOMETRY

SUBST IN EQU RIB #8

$$x = \frac{103.936174 - 38.652938}{2.52741472} = 25.8300450$$

(65283236)

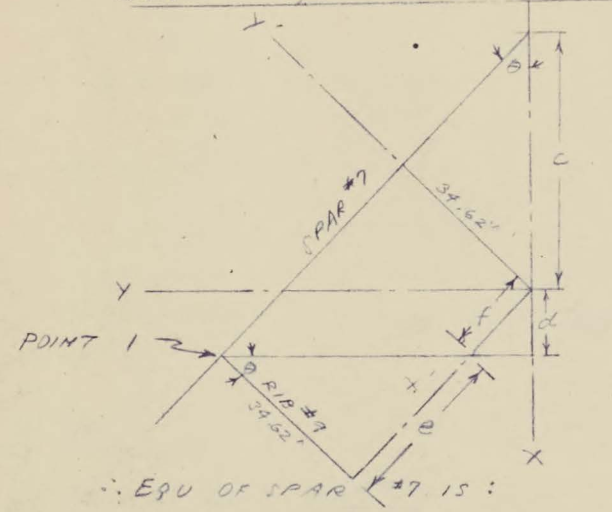
$$y = 40.1743991 + 1.5875370 \times 25.830045 = 81.1805512$$

(41.0061521)

LOCATION OF RIB #9

RIB #9 IS CONCURRENT WITH THE FRONT SPAR AND SPAR #7

CALC OF EQUATION OF SPAR #7



SIN θ = 0.69332964 (REF PAGE 3-5)

$$c = \frac{34.62}{.69332964} = 49.9329582$$

TAN θ = .96212858 (REF PAGE 3-4)

SLOPE = COT θ = 1.03936211

∴ EQU OF SPAR #7 IS :

$$x + 49.9329582 - 1.03936211\,y = 0$$

CALC OF X Y CO-ORDINATES OF POINT 1

SUBTR FS. FROM #7 $-x - 25.3061183 + .629706578\,y = 0$

$$24.6268399 - .409455553\,y = 0$$

$$y = 60.145335$$ (OVER)

RM 1319 A

A. V. ROE CANADA LIMITED MALTON · ONTARIO **TECHNICAL DEPARTMENT (Aircraft)**		REPORT No. 7/0510/10 SHEET No. 3-11	
AIRCRAFT: C105	FIN	PREPARED BY C. Gunderson	DATE SEPT 55
		CHECKED BY [illegible]	DATE JAN '56

FIN GEOMETRY

SUBST IN FS EQU

$$x = 25.3061183 - .62999657 8 \times 60.145335 = 0 \quad (-37.8859421)$$

$$x = 12.5798238$$

POINT WHERE RIB #9 INTERSECTS X' AXIS

SEE DIAGRAM: PREVIOUS SHT

$$d = 12.5798238''$$

$$\therefore f = \frac{12.5798238}{.72062056 \leftarrow \cos\theta} = 17.4569315$$

$$e = 34.62 \times 0.96212858 \; (\leftarrow \tan\theta) = 33.308891$$

$$\therefore X'_{RIB\,\#9} = 17.4569315 + 33.308891 = \underline{50.7658225}$$

y' POINT 1 $= 34.62''$ (REF DRG 7-0183-37) (155. 7)

SUBST IN EQU RIB #0

$$x = \frac{382.821382 - 38.6529376}{2.52741472} = \frac{344.168444}{2.52741472} = 136.1741075$$

$$y = 40.1743991 + 1.5875377 \times 136.1741075 = 256.3558332 \quad (216.1814341)$$

FORM 1319 A

A. V. ROE CANADA LIMITED
MALTON ONTARIO

TECHNICAL DEPARTMENT (Aircraft)

AIRCRAFT:		REPORT NO. 7/0510/10	
		SHEET No. 3-12	
		PREPARED BY	DATE
C105	FIN	E. Gunderson	SEPT 55
		CHECKED BY	DATE
		[illegible]	JAN 57

FIN GEOMETRY

FRONT SPAR AND RIB INTERSECTION CO-ORDINATES

$x' = .72062056\,x + .69332964\,y \qquad y' = .72062056\,y - .69332964\,x$

	1	2	3	4	5	6	7	8
POINT	x REF SHT 3-8, 3-9, 3-10	Y REF SHT 3-8, 3-9, 3-10	.72062056 x	.69332964 Y	.72062056 Y	.69332964 x	CHECK SHT x' (3) + (4)	Y' (5) − (6)
57	147.749623 (SHT 13)	274.732392	106.471416	190.480110	197.977810	102.439193	296.951526	95.538617
53	115.568589	223.643810	83.281101	155.058882	161.162376	80.127128	238.339983	81.035248
48	99.129546	197.545441	71.434348	136.964109	142.355306	68.7291117	208.398544	73.626194
42	89.246419	181.855793	64.3125327	126.086011	131.049023	61.876926	190.398544	69.172097
35	79.3630295	166.166145	57.1906308	115.207913	119.742740	55.024741	172.398544	64.717999
28	65.6366233	149.374967	47.2991002	100.099444	104.039570	45.507816	147.398544	58.531754
22	52.0749337	122.843283	37.5262679	85.172276	88.524837	36.105095	122.698544	52.419742
16	41.0938086	105.412341	29.6130434	73.085500	75.962300	28.4915555	102.698543	47.470745
10	25.8300450	81.1805512	18.6136615	56.284882	58.500374	17.9087358	74.898544	40.591638
56	136.174108	256.355833	98.129862	177.739797	184.735284	94.413545	275.869659	90.321739
5	SEE SHT 3-16							

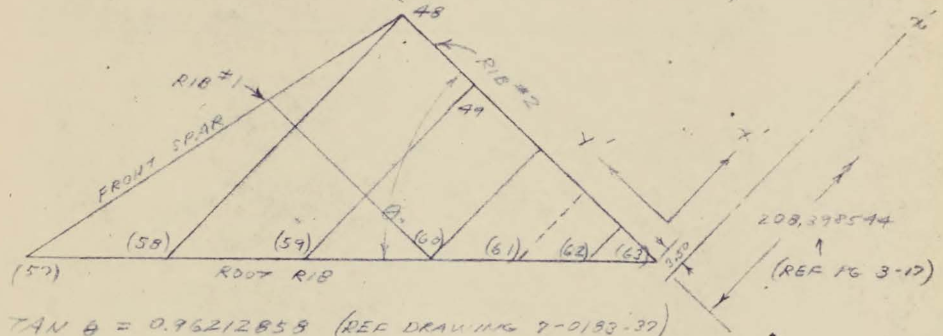
THESE CALCULATIONS HAVE BEEN CHECKED BY TRANSFORMING COL (7) AND (8) BACK TO COL (1) AND (2). ERRORS ARE NEGLIGIBLE IN MOST CASES. POINT 53 IS IN ERROR BY ABOUT 7 IN THE 8TH DIGIT.

FORM 1319A

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

REPORT NO. 7/0510/10	SHEET NO. 3-13	
AIRCRAFT: C105	FIN	
PREPARED BY: G. Gundersen	DATE: SEPT 55	
CHECKED BY: [illegible]	DATE: JAN 56	

LOCATION OF INTERSECTION CO-ORDINATE POINTS ALONG ROOT RIB, (X' Y' CO-ORDINATES)



TAN θ = 0.96212858 (REF DRAWING 7-0183-37 155.7)

∴ X' = 208.398544 + (Y'-3.50)(0.96212858)

POINT	Y' - 3.50	(Y' - 3.50)(.96212858)	X'
62	9.5000000	9.1402215	217.538766
61	19.5000000	18.7615073	227.160051
60	31.120000	29.9414414	238.339985
59	(48.919742) 52.419742 - 3.50	47.0670819	255.465626
58	(70.126194) 73.626194 - 3.50	67.470415	275.868959

NOTE: DIMENSION (Y' - 3.50) IS TAKEN DIRECTLY FROM DRAWING 7-0183-37 FOR POINTS 62 61, AND 60

(Y' - 3.50) IS LOCATED FROM POINT 49 (REF SH 21) FOR POINT 59

(Y' - 3.50) IS LOCATED FROM POINT 48 (REF SH 12) FOR POINT 58

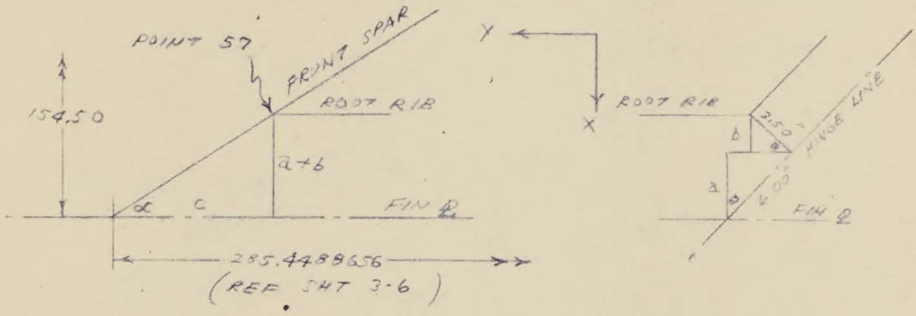
FORM 1319A

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

AIRCRAFT:		REPORT NO. 7/5510/10	
C 105	FIN	SHEET NO. 3-14	
		PREPARED BY	DATE
		C. Gunderson	SEPT 55
		CHECKED BY	DATE
		[signature]	JAN '56

FIN GEOMETRY

LOCATION OF POINT 57 (X AND Y CO-ORDINATES)



TAN θ = 0.96212858 COT α = 1.587537
SIN θ = 0.69332964
COS θ = 0.72062056

BY TRIG :

a = 6.00 × .72062056 = 4.32372336

b = 3.50 × .69332964 = 2.4266536

∴ a + b = 6.7503770

c = (a + b) TAN α = 6.7503770 × 1.587537 = 10.7164732

∴ Y = 285.4488656 − 10.7164732 = 274.7323924

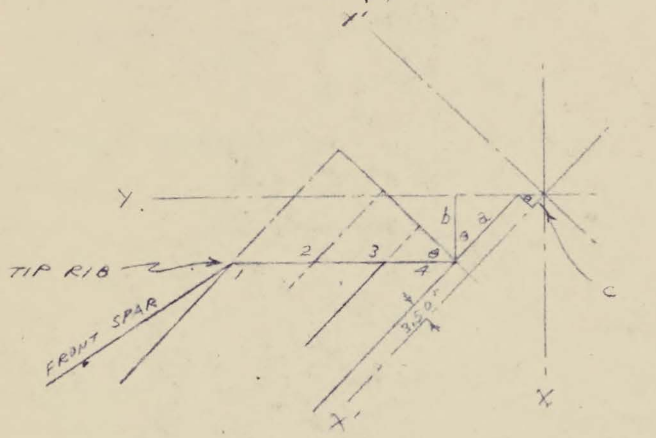
∴ X = 154.500000 − 6.7503770 = 147.749623

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

REPORT NO. 7/0513/10	SHEET NO. 3-15	
PREPARED BY: b Gunderson	DATE: SEPT 55	
CHECKED BY: [illegible]	DATE: JAN 56	
AIRCRAFT: C105	FIN	

FIN GEOMETRY

LOCATION OF POINTS 2, 3, 4 (x' ORDINATE)



TAN θ = .96212858
SIN θ = .69332964
COS θ = .72062056

NOTE: FOR OTHER CO-ORDINATES SEE SHT 3-17, 3-18, 3-19

$c = 3.50 \times 0.96212858 = 3.36745003$

$b = 12.5798238$ SHT 3-11

$a = \frac{12.5798238}{.72062056} = 17.4569304$

$a + c = 20.8243804$

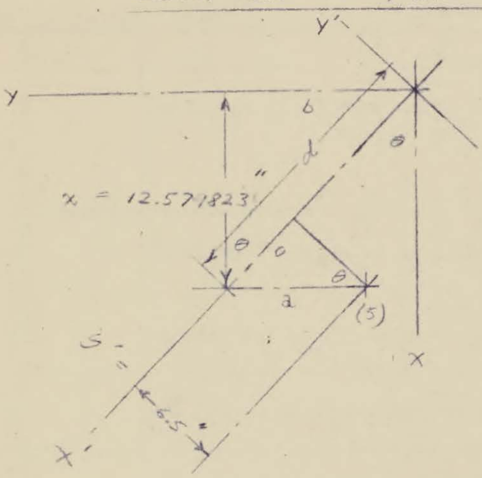
$x' = 20.8243804 + (y' - 3.50)(.96212858)$

POINT	y' - 3.50	(y' - 3.50)(.96212858)	x'
4	0		20.8243804
3	9.50	9.1402215	29.9646019
2	19.50	18.7615073	39.5858877

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

REPORT NO. 0510/10			
SHEET NO. 3-16			
AIRCRAFT: C105	FIN	PREPARED BY: L. Gunderson	DATE: NOV 55
		CHECKED BY: [illegible]	DATE: JAN 56

LOCATION OF POINT (5)



$TAN\ \theta = 0.96212858$

$COS\ \theta = 0.72062056$

$b = 0.96212858 \times 12.579823 = 12.103407240$

* $c = 0.96212825 \times 6.5 = 6.25383577$

$d = 12.579823 \div 0.72062056 = 17.45693045$

$a = 6.5 \div 0.72062056 = 9.020003536$

$\underline{y} = b - a = 3.08340370$

$\underline{x'} = d - c = 11.20309468$

* ON CHECKING THIS NUMBER RECALCULATES TO 6.253834
ORIGINAL NUMBER IS USED

FORM 1319A

A. V. ROE CANADA LIMITED MALTON - ONTARIO **TECHNICAL DEPARTMENT (Aircraft)**		REPORT NO. 7/0510/10 SHEET NO. 3-.8	
AIRCRAFT: C105.	FIN	PREPARED BY [signature]	DATE SEPT 55
		CHECKED BY [signature]	DATE JAN '56

FIN GEOMETRY

SPAR AND RIB INTERSECTION CO-ORDINATES

$x = .72062056\,x' - .69332964\,y'$ $\qquad$ $y = .69332964\,x' + .72062056\,y'$

	1	2	3	4	5	6	7	8
POINT	x' = 24.398544 - STA 200	y'	.72062056 x'	.69332964 y'	.69332964 x'	.72062056 y'	x (3) − (4)	y (5) + (6)
62	217.578766 (SHT 13)	13.0	156.762907	9.0132853	150.826074	9.3680673	147.749621	160.194141
52	208.398544		150.176275		144.488887		141.162990	153.856954
46	190.398544		137.205105		132.008954		128.191820	141.377021
39	172.398544		124.233935		119.529020		115.220650	128.897087
32	147.398544		106.218421		102.195779		97.205136	111.563846
25	122.698544		88.419093		85.070537		79.405808	94.438604
19	102.698544		74.006682		71.203944		64.993397	80.572011
13	74.898544	↓	53.973431	↓	51.929381	↓	44.960146	61.297448
7	50.765822	13.0	36.582895	9.0132853	35.197449	9.3680673	27.569610	44.565516
3	29.964602	13.0	21.593108	9.0132853	20.775347	9.3680673	12.579823 CHECK 54	30.143414

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

REPORT No. 7/0510/10
SHEET No. V-23

AIRCRAFT:		PREPARED BY	DATE
C105	FIN ANALYSIS	G.B.	OCT '55
		CHECKED BY	DATE
		E. Gardner	DEC 55

LENGTHS OF INDIVIDUAL ELEMENTS

SHEAR PANELS AFFECTED	X_1'	X_2'	X'_{NET}
135, 136	50.765 822	39.585 888	11.179 934
136, 137	50.765 822	29.964 602	20.801 220
137	50.765 822	20.824 380	29.941 442
138, 139, 140 141	74.898 544	50.765 822	24.132 722
142, 143, 144, 145	102.698 543	74.898 544	27.799 999
146, 147, 148, 149	122.698 544	102.698 543	20.000 001
150, 151, 152, 153, 154	147.398 544	122.698 544	24.700 000
155, 156, 157, 158, 159	172.398 544	147.398 544	25.000 000
160, 161, 162, 163, 164,	190.398 544	172.398 544	18.000 000
165, 166, 167, 168, 169	208.398 544	190.398 544	18.000 000
170, 171, 172, 173	238.339 983	208.398 544	29.941 439
173, 174	227.160 051	208.398 544	18.761 507
174, 175	217.538 766	208.398 544	9.140 222
176, 177	275.868 959	238.339 983	37.528 976
177, 178	255.465 626	238.339 983	17.125 643
179	296.951 526	275.868 959	21.082 567

FORM 1319A

A. V. ROE CANADA LIMITED MALTON - ONTARIO **TECHNICAL DEPARTMENT (Aircraft)**		REPORT NO. 7/0510/10 SHEET NO. 3-25	
AIRCRAFT: C105	Fin Analysis	PREPARED BY CB	DATE Oct 55
		CHECKED BY CRG	DATE DEC 55

LENGTHS OF DIAGONALS.

WEB AFFECTED	X'	Y'	$X'^2 + Y'^2$	$\sqrt{X'^2 + Y'^2}$
180	11.179 934	11.62	260.015 324 244	16.124 991
181	20.901 220 11.179 934	10.00	192.569 144 294	13.876 928
182	27.941 442 20.901 220	9.50	173.793 658 207	13.183 082
183	24.132 722	5.971 635	618.248 731 532	24.860 586
196	27.999 999	12.850 745 5.971 638	820.162 113 117	28.638 473
204	20.000 001	17.779 742 12.850 745	424.492 611 306	20.603 218
212	24.700 000	6.112 012	647.446 690 688	25.444 974
221	25.000 000	12.278 257 6.112 012	663.269 627 200	25.754 022
232	15.000 000	16.752 355 12.278 257	343.838 980 974	18.542 896
242	18.000 000	21.206 452 16.752 355	343.838 980 085	18.542 896
252	29.941 439	7.409 054	951.383 850 566	30.844 511
260	37.528 976	16.695 545 7.409 054	1494.662 954 702	38.660 871
264	21.082 567	21.712 423 16.695 545	471.690 447 376	21.718 436
265	21.082 567	21.712 423	924.628 913 040	30.407 711
266	31.528 976 17.125 643	21.206 452	866.009 603 937	29.428 041
267	17.125 643	17.779 742	610.118 463 430	24.700 576
268	27.941 439 18.761 507	11.62	260.015 279 525	16.124 987
269	18.761 507 9.140 222	10.00	192.569 125 051	13.876 928
270	9.140 222	9.50	173.793 658 209	13.183 082

A. V. ROE CANADA LIMITED
MALTON · ONTARIO

TECHNICAL DEPARTMENT (Aircraft)

REPORT No.	7/0510/10
SHEET No.	3 - 24
AIRCRAFT:	C105
	FIN ANALYSIS
PREPARED BY	C.B.
DATE	OCT '55
CHECKED BY	[illegible]
DATE	DEC 55

LENGTHS OF INDIVIDUAL [illegible]

SHEAR PANELS AFFECTED	Y′MAX	Y′MIN	Y′NET
179	95.[illegible] 617	73.626 194	21.912 423
177, 176	90.321 739	73.626 194	16.695 545
176, 170	91.[illegible] 248	73.626 194	7.409 054
171, 171, 165	73.626 194	52.419 742	[illegible] 452
165, 160	69.172 097	52.419 742	16.752 355
160, 155	64.717 999	52.419 742	12.298 257
155, 150	58.531 754	52.419 742	6.112 012
173, 172, 166, 161, 156, 151, 146	52.419 742	34.62	17.799 742
146, 142	47.470 745	34.62	12.850 745
142, 138	40.591 638	34.62	5.971 638
173, 167, 162, 157, 152, 147, 143, 139, 135	34.62	23.00	11.62
174, 168, 163, 158, 153, 148, 144, 140, 136	23.00	13.00	10.00
175, 169, 164, 159, 154, 149, 145, 141, 137	13.00	5.50	7.50

A. V. ROE CANADA LIMITED MALTON · ONTARIO **TECHNICAL DEPARTMENT (Aircraft)**		REPORT NO 7/0510/10 SHEET NO 3-26	
AIRCRAFT:		PREPARED BY	DATE
C105	FIN	S. Gunderson	NOV 55
		CHECKED BY	DATE

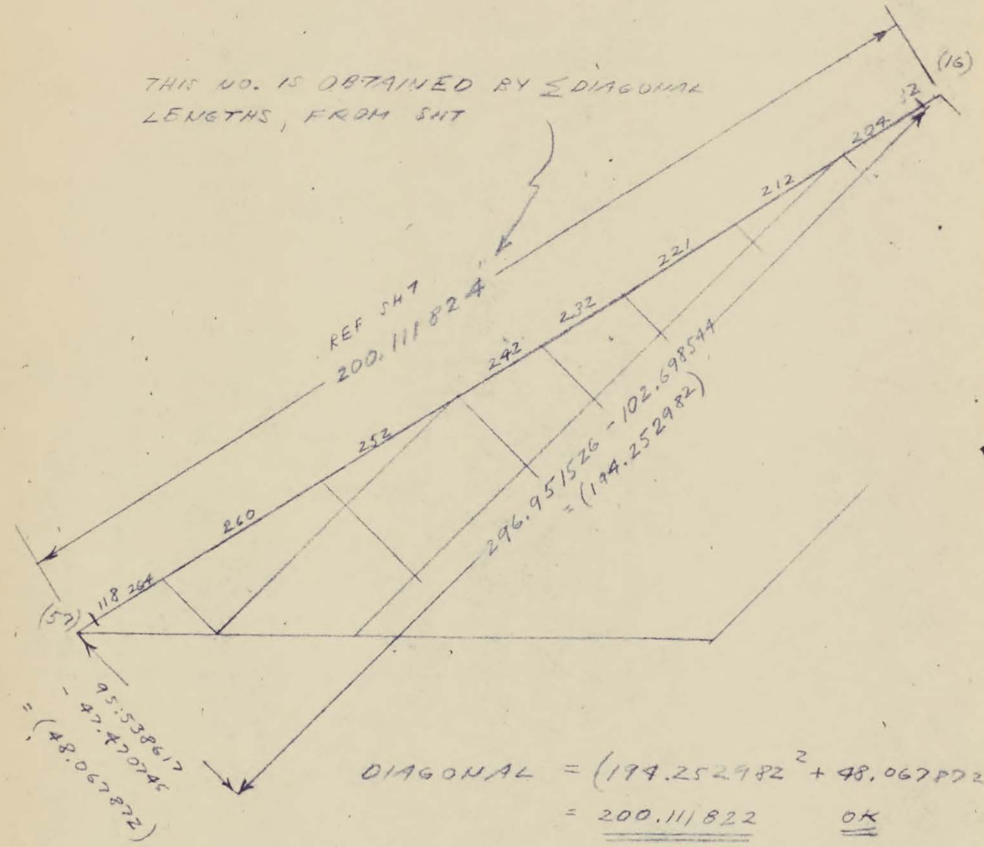
CHECK OF DIAGONAL LENGTHS, WEBS 180, 181, 182

$y_{LP(1)} - y_{LP(4)} = \Sigma$ LENGTH 180, 181, 182

60.145 335 − 16.960 332 = 16.124 991 + 13.876 928 + 13.183 082

43.185 003 = 43.185 001 OK

CHECK OF PANELS 204, 212, 221, 232, 242, 252, 260, 264



$$\text{DIAGONAL} = (194.252982^2 + 48.067872^2)^{\frac{1}{2}}$$
$$= 200.111822 \quad \text{OK}$$

CHECK OF PANELS 188 & 196

$$28.638\,473 + 24.860\,586 = \left[(102.698\,544 - 50.765\,822)^2 + (47.470\,745 - 34.62)^2\right]^{\frac{1}{2}}$$

53.499 059 = 53.499 0585 OK

CHECK OF PANELS 265, 266, 267, 268, 269, 270

274.732 392 − 147.011 059 = 30.407 711 + 29.428 041 + 24.700 576 + 16.124 989 + 13.876 928 + 13.183 082

127.721 333 = 127.721 327 OK

FORM 1319A

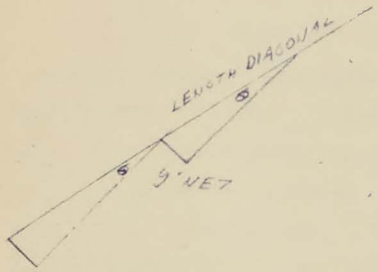
A. V. ROE CANADA LIMITED
MALTON · ONTARIO
TECHNICAL DEPARTMENT (Aircraft)

REPORT NO. 7/0510/10
SHEET NO. 3·27

AIRCRAFT:		PREPARED BY	DATE
C105	FIN	L. Gundersen	
		CHECKED BY	DATE

CHECK OF DIAGONAL LENGTHS

CHECK OF SLOPE OF FRONT SPAR



COS θ SHOULD BE CONSTANT FOR ALL PANELS.

WEB AFFECTED	X'	L	SLOPE X'/L
204	SEE 2	SEE 2	.9707222
212	SHT	SHT	.9707221
221	PREVIOUS	PREVIOUS	.9707221
232			.9707221
242			.9707221
252			.9707222
260			.9707225
264			.9707221

HM 1319A

AVRO AIRCRAFT LIMITED
MALTON - ONTARIO
TECHNICAL DEPARTMENT

AIRCRAFT:		REPORT NO. 7/0510/10	
		SHEET NO. 3-28	
		PREPARED BY	DATE
C 105	FIN	E. Gundersen	OCT 55
		CHECKED BY	DATE

FIN GEOMETRY

FIN HALF THICKNESS (TO OUTSIDE SKIN) AT LOAD POINTS

METHOD:

THE FIN ½ THICKNESS, AT INTERVALS OF A FEW INCHES APART ALONG THE SPARS, CAN BE OBTAINED FROM CHART 61 FROM THE LOFT. WE CAN THEN INTERPOLATE BETWEEN THESE POINTS, ASSUMING THE SPAR IS STRAIGHT, TO OBTAIN THE FIN THICKNESS AT THE LOAD POINTS. THIS METHOD WAS SUFFICIENTLY ACCURATE FOR ALL BUT A FEW POINTS WHICH REQUIRED INTERPOLATION BY MEANS OF A CURVED LINE EQUATION THROUGH THREE POINTS.

POINTS ON FRONT SPAR

SINCE THE FRONT SPAR IS LINEAR WE CAN INTERPOLATE BETWEEN POINTS WHICH ARE FAR APART. IT WILL SIMPLIFY CALCULATION TO ALWAYS INTERPOLATE BETWEEN THE SAME TWO POINTS.

REFERENCE POINTS

① INTERSECTION OF SPAR 7 AND F.S.
② " " RIB X_R 6 " F.S.

NOTE:

IT WILL BE MORE CONVENIENT TO USE RUDDER STATIONS, WITH THE ORIGIN AT THE FIN ℄ INSTEAD OF ABOVE THE FIN, IN ORDER TO BE CONSISTENT WITH CHART 61.

A. V. ROE

MA

TECHNI

AIRCRAFT -

WEIGHT -

C. G. POSITION

FIN GEOMETRY

FIN HALF THICKNESS AT LOAD POINTS

LOAD POINT	1	2	3	4	5	6	7	8	9	10	11
	z_1 AT STA COL (2)	x_1 RUD STA	z_2 AT STA COL (4)	x_2 RUD STA	x_3 RUD STA AT POINT	$z_1 - z_2$ (1) − (3)	$x_2 - x_1$ (4) − (2)	$x_2 - x_3$ (4) − (5)	$\frac{x_1 - x_3}{x_1 - x_2}$ $\frac{(8)}{(7)}$	(6) × (9)	z (10) + (3)
1 SPAR 7	1.230289	163.63272									1.2303
2 SPAR 5	1.639859	172.89698	1.599626	175.36165	174.81266	.040233	2.46467	.54899	.222744	.008962	1.6086
3 SPAR 3	1.572762	182.311229	1.534090	185.673552	184.433942	.038672	3.362323	1.23961	.368677	.014257	1.5483
4 SPAR 1	1.258226	191.745526	1.229103	194.906729	193.574164	.029123	3.160204	1.33256	.42167	.012280	1.2414
6 SPAR 5	1.80916	162.15304	1.76595	164.98119	163.632722	.04321	2.82815	1.34847	.47680	.020603	1.7866
7 SPAR 3	1.788470	162.672558	1.741915	167.028621	↓	.046555	4.35306	3.39590	.78018	.036318	1.7782
8 SPAR 1	1.525200	161.616667	1.501491	164.320099	163.632722	.023709	2.7033	0.68736	.25427	.006028	1.5075
10 F.S.	2.573798	6.0000	1230289	163.632722	139.5	1.343509	157.63272	24.1327	.153094	.205683	1.4360
11 SPAR 7	1.887725	137.939194	1.831605	140.587201	↓	.05632	2.6480	1.0872	.41057	.023123	1.8547
12 SPAR 5	2.13363	139.10256	2.08449	142.79318		.049140	3.69062	3.29318	.89231	.043849	2.1283
13 SPAR 3	2.057436	136.632755	1.996841	142.498285	↓	.060595	5.86552	2.9828	.508531	.030814	2.0277
14 SPAR 1	1.741300	137.0	1.662293	146.0	139.5	.079007	9.00	6.50	.72222	.057060	1.7194
16 F.S.	2.573798	6.00	1.230289	163.632722	111.7	1.343509	157.63272	51.9322	.329450	.442619	1.6729
17 SPAR 7	2.403274	110.113706	2.344946	113.613091	↓	.058328	3.49932	1.91309	.54670	.031888	2.3768
18 SPAR 5	2.51434	108.30957	2.45527	113.32699	↓	.059070	5.01742	1.62699	.32427	.019155	2.4744

FORM 1543

O. R. L.

FIN GEOMETRY

FIN HALF THICKNESS AT LOAD POINTS

A. V. ROE C

MALT

TECHNICA

AIRCRAFT

WEIGHT

C. G. POSITION

LOAD POINT	1 y_1	2 x_1	3 y_2	4 x_2	5 x_3	6 $y_1 - y_2$ (1) − (3)	7 $x_1 - x_2$ (4) − (2)	8 $x_2 - x_3$ (4) − (5)	9 $\frac{(8)}{(7)}$	10 (6) × (9)	11 y (10) + (3)
19 SPAR 3	2.326655	108.97364	2.254418	116.4934	111.7	.072237	7.51962	4.7933	.62092	.04853	2.2993
20 SPAR 1	2.134139	92.25	1.908092	118.0	111.7	.226047	25.750	6.30	.24426	.055305	1.9634
22 F.S.	2.573798	6.0000	1.230289	163.63272	91.7	1.343509	157.63272	71.93272	.456331	.61308	1.8434
23 SPAR 7	2.708938	92.697257	2.646085	94.859529		.062853	4.162272	3.15953	.75909	.047711	2.6938
24 SPAR 5	2.70361	91.700									2.703[illegible]
25 SPAR 3	2.490021	91.452635	2.447053	96.044128		.042968	4.5869	4.39413	.947[illegible]	.040698	2.4877
26 SPAR 1	2.153891	90.00	2.134139	92.25	91.7	.019752	2.25	.5500	.24444	.004828	2.1390
28 F.S.	2.573798	6.0000	1.230289	163.63272	67.0	1.343509	157.63272	96.63272	.613024	.82360	2.0539
29 SPAR 10	2.578720	64.418584	2.491381	68.235059		.087340	3.81647	1.23505	.32361	.02826	2.5193
30 SPAR 7	3.110222	62.132475	3.040013	67.372420		.070209	5.23994	.37242	.071078	.00499	3.0450
31 SPAR 5	2.99121	65.08571	2.91486	72.29891		.076350	7.21320	5.29891	.73461	.05609	2.9709
32 SPAR 3	2.730544	65.42115	2.678615	71.087655		.051929	5.6665	4.087655	.721372	.03746	2.7161
33 SPAR 1	2.496254	51.00	2.325073	70.50	67.0	.171181	19.50	3.50	.17948	.030725	2.3558
35 F.S.	2.573798	6.0000	1.230289	163.63272	42	1.343509	157.63272	121.63272	.771621	1.03668	2.2670
36 SPAR 10	3.076135	41.141212	2.992794	45.360042	42	.083341	4.21883	3.3604	.7964	.06637	3.0592

FORM 1543

O. R. L.

A. V. ROE CANADA LIMITED
MALTON, ONTARIO
TECHNICAL DEPT. (AIRFRAME)

AIRCRAFT - ____________

WEIGHT - ____________

C. G. POSITION - ____________

REPORT NO. - 7/0510/12

SHEET - 3-31

DATE - OCT 55

PREPARED BY - C. Gundersen

	9	10	11	12	13	14	15	16	17	18	19
x_3			3								
(5)	$\frac{(8)}{(7)}$	(6) x (9)	(10) + (3)								
3	.62092	.044853	2.2993								
	.24416	.055305	1.9134								
72	.456331	.61308	1.8434								
53	.25904	.047711	2.6935								
			2.7036								
53	.947112	.040698	2.4877								
	.24414	.004828	2.1390								
72	.613224	.52360	2.0539								
05	.32361	.02826	2.5195								
42	.071078	.004790	3.0450								
11	.73461	.05609	2.9709								
55	.721372	.03746	2.7161								
	.17749	.030725	2.3558								
72	.771621	1.03668	2.2670								
4	.7964	.06637	3.0592								

A. V. ROE CA
MALTO
TECHNICAL

AIRCRAFT -
WEIGHT -
C. G. POSITION -

FIN GEOMETRY

FIN HALF THICKNESS AT LOAD POINTS

LOAD POINT	1	2	3	4	5	6	7	8	9	10	11	12
	y1	x1	y2	x2	x3	y1 − y2 (1) − (3)	(4) − (2)	(4) − (5)	(8)/(7)	(6)·(9)	(10) + (3)	
37 SPAR 9	3.408080	38.827154	3.330798	45.036126	42.0	.077282	6.20897	3.[illegible]126	.48[illegible]	.03[illegible]	3.3686	
38 SPAR [illegible]	3.24223	4[illegible]	3.15455	47.33495		.087680	7.62116	7.33495	.85[illegible]	.074[illegible]	3.2291	
39 SPAR 3	2.86[illegible]	39.947193	2.899845	46.7776[illegible]		.061581	6.83042	4.777615	.699[illegible]	.04[illegible]	2.9429	
40 SPAR 1	2.575261	42.00			42.0						2.5753	
42 F.S.	2.573798	6.0000	1.230289	163.63272	24.0	1.343509	157.63272	139.63272	.83580	1.14009	2.4274	
43 SPAR 10	3.413358	22.89792	3.328276	27.677033		.085112	4.7791	3.67703	.76[illegible]	.065485	3.3938	
44 SPAR 7	3.653390	18.412627	3.569197	25.536348		.084193	7.12372	1.57635	.2156[illegible]	.01815[illegible]	3.5874	
45 SPAR 5	3.45177	21.72866	3.33502	31.53064		.116750	9.80178	7.53064	.768[illegible]	.08976	3.4247	
46 SPAR 3	3.164283	17.26[illegible]843	3.093378	25.217972		.070905	[illegible]	1.21797	.153[illegible]	.01085	3.1042	
47 SPAR 1	2.871284	6.00	2.572816	40.00	24.0	.298471	34.00	16.00	.47[illegible]	.14046	2.7333	
48 F.S.	2.573798	6.0000	1.230289	163.63272	6.0	1.343509	157.63212	157.6322	1.0	1.3431	2.5734	
49 SPAR 11	3.761944	2.124343	3.673387	7.583248		.088557	5.45890	1.58325	.290[illegible]	.02568	3.6991.	
50 SPAR 7	3.530763	3.088[illegible]08	3.742273	10.938534		.089793	7.85067	4.93867	.629[illegible]	.05649	3.7968	
51 SPAR 5	3.643975	0	3.53463	11.24314		.109345	11.24314	5.2431	.466[illegible]	.05099	3.5956	
52 SPAR 3	3.317322	0	3.238830	8.868365	6.0	.078492	8.86837	2.868[illegible]	.32[illegible]	.02539	3.2642	

FORM 1543

FIN GEOMETRY

FIN HALF THICKNESS AT LOAD POINTS

A. V. ROE C[illegible]
MALT[illegible]
TECHNICA[illegible]

AIRCRAFT -
WEIGHT -
C. G. POSITION

	1	2	3	4	5	6	7	8	9	10	11
LOAD POINT	y_1	x_1	y_2	x_2	x_3	$y_1 - y_2$ (1) - (3)	(4) - (2)	(4) - (5)	(8)/(7)	(6) x (9)	(10) + (3)
53	2.573798	6.000	1.23029	163.63272	-23.94144	1.343509	157.63272	187.57416	1.18996	1.5987	2.8290
54 SPAR 14	SEE FOLLOWING SHT FOR CALC										3.4375
55 SPAR 10	4.223713	-29.278908	4.128436	-21.745149	[illegible]	.09527	[illegible]	2.[illegible]629	.356144	.0320	4.1604
56 F.S.	2.573798	6.0000	1.23029	163.63272	-61.47045	1.343509	157.63272	225.1031	1.42802	1.91856	3.1489
57 F.S.	2.573798	6.0000	1.23029	163.63272	-82.55298	1.343509	157.63272	246.1857	1.56176	2.09824	3.3285
58 14	SEE FOLLOWING SHT FOR CALC				-61.47045						4.2898
59 10	4.419436	-42.119941	4.320063	-35.065591	-41.067082	.098773	7.05443	6.00157	.85075	.08403	4.4047
60 7	4.223712	-32.715299	4.119525	-23.033558	-23.14441	.104192	9.68289	.90107	.093884	.009782	4.1293
61 5	3.88334	-25.11220	3.75964	-12.08578	-12.76150	.12370	13.02724	.675547	.051856	.0064146	3.7660
62 3	3.400113	-9.384575	3.317322	0	-3.14022	.082791	9.38457	3.14022	.33461	.027703	3.3450
63 1	2.891289	6.00			6.0						2.8913

FORM 1543

AVRO AIRCRAFT LIMITED

TECHNICAL DEPARTMENT (Aircraft)

AIRCRAFT		REPORT No 7/0510/10	
		SHEET No 3-34	
		PREPARED BY	DATE
C105	FIN	[illegible initials]	OCT 55
		CHECKED BY	DATE

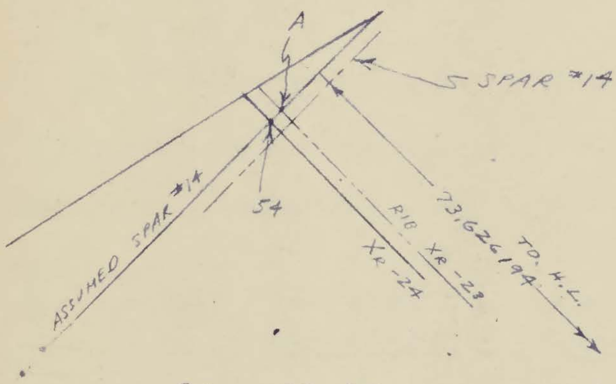
FIN GEOMETRY

LOCATION OF POINT 54

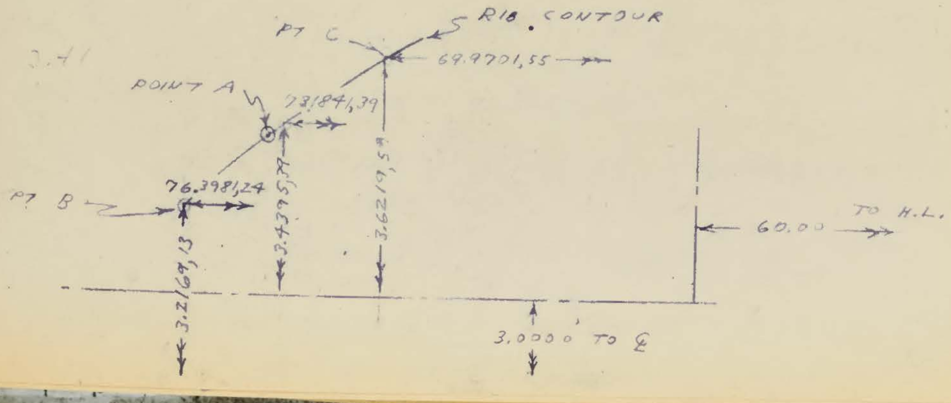
THE METHOD USED FOR THE CALCULATION OF THE OTHER POINTS WILL NO LONGER APPLY SINCE THIS POINT DOES NOT LIE ON EITHER A SPAR OR A RIB GIVEN ON CHART 51.

METHOD:

LOCATE A POINT ON THE ASSUMED SPAR #14 BY INTERPOLATION WITH A LINE EQUATION ALONG RIB STA -23. INTERPOLATE FROM THIS POINT TO OTHER KNOWN POINTS ALONG ASSUMED SPAR 14 TO OBTAIN THE REQ'D POINT.



CALC. OF HEIGHT AT POINT A



A. V. ROE CANADA LIMITED MALTON - ONTARIO **TECHNICAL DEPARTMENT (Aircraft)**		REPORT No. 7/0512/10 SHEET No. 2-37	
AIRCRAFT:		PREPARED BY	DATE
C105	FIN	G.B.	OCT 55
		CHECKED BY	DATE

∴ EQUATION IS:

$$-.0003881574\,x^2 + .01187494\,x = z$$

(AT SPAR H) $x = 29.783177 - 28.297523 = 1.485654$

$$\therefore z = -.0008567506 + .025070322$$
$$= .0242135714$$

POINT "D"

∴ FIN THICKNESS AT SPAR 14 & REAL ROOT RIB

$$= .02421357 + 4.23616$$
$$= 4.26037$$

LOCATION OF POINT "D" IN YRUD SYSTEM.

$$Y_{RUD} = 1.05337771\,x - 8.058339$$

(// H.L)

$$-73.626194 = 1.05337771\,x - 8.058339$$

$$x = \frac{-73.626194 + 8.058339}{1.05337771} = 62.245341$$

(65.567855)

SINCE POINT 48 IS ON R.R STA 6.0

∴ D IS 68.245341 FROM PT 48

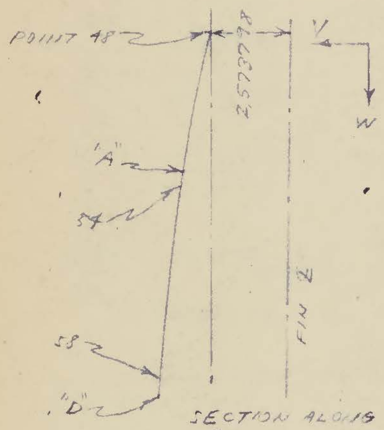
A. V. ROE CANADA LIMITED
MALTON · ONTARIO
TECHNICAL DEPARTMENT (Aircraft)

REPORT NO.	7/0510/10
SHEET NO	3-38

AIRCRAFT:		PREPARED BY	DATE
C105	F111	L. Gaulcen	OCT 55
		CHECKED BY	DATE

INTERPOLATION ALONG SPAR # 14

WE NOW HAVE DEFINED 3 POINTS ALONG SPAR 14. THEREFORE WE CAN DETERMINE THE FIN THICKNESS AT POINTS 54 & 58.



SECTION ALONG SPAR 14

ASSUMING THE ORIGIN AT PT 48

POINT	V	W	W^2
48	0	0	0
A	0.837505	28.941439	837.60689
54	?	29.941439	896.489769
58	?	67.470415	4552.25690
D	1.730907	68.245341	4657.42657

ASSUMING LINE EQU

$$aw^2 + bw + c = V$$

$$0 + 0 + c = 0 \qquad (1)$$
$$837.60689\,a + 28.941439\,b + c = .837505 \qquad (2)$$
$$4657.42657\,a + 68.245341\,b + c = 1.730907 \qquad (3)$$

MULT (2) BY $\frac{68.245341}{28.941439} = 2.358047$

$$1975.117618\,a + 68.24533\,b = 1.9748778$$
$$4657.42657\,a \quad 68.2453\,b = 1.730907$$

$$-2682.30895\,a = .2439708$$

$$a = -0.0000909551$$

SOLVING IN (2) $-.0761849619 + 28.941437\,b = .837505$

$$\therefore b = \frac{.91568996}{28.941439} = 0.03157030$$

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

AIRCRAFT: C105	FIN	REPORT NO 7/0510/10	SHEET NO 3-39
		PREPARED BY: BBG	DATE: OCT 55
		CHECKED BY	DATE

∴ EQU. 15 :

$$-.0000909555/ W^2 + .03157030\, W = V$$

FOR PT 54 $W = 29.941439$

$$-.081540684 + .945260211 = V$$

$$V = .86371953$$

∴ FIN THICKNESS AT 54 = 3.4375

FOR POINT 58 $W = 67.470415$

$$-.41405284 8 + 2.1300612 = V$$

$$V = 1.716008$$

∴ FIN THICKNESS AT 58 = 4.2898

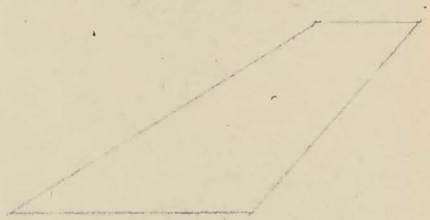
A. V. ROE CANADA LIMITED MALTON · ONTARIO **TECHNICAL DEPARTMENT (Aircraft)**		REPORT NO. 7/0510/10 SHEET NO. 3-41	
		PREPARED BY	DATE
AIRCRAFT: C105	FIN ANALYSIS	C.B.	OCT 55
		CHECKED BY	DATE

SKIN THICKNESS

REFERENCE DWG: 7/0183-45 SHT 1 ISS. 1.

x' COORDINATES OF REFERENCE LINE

SPAR EQNS



$3 \quad y' = 13.0$

$7 \quad y' = 34.68$

$10 \quad y' = 53.417742$

$14 \quad y' = 73.626194$

FRONT $\dfrac{95.539617 - 81.035248}{296.751520 - 238.339983} = \dfrac{95.539617 - y'}{296.751526 - x'} = \dfrac{14.503369}{58.611543}$

EQN OF WING - FIN DATUM

$X = 154.5$

& TRANSFERRING $X = 154.5 = x' \cdot 0.720620565 - y' \cdot 0.69332964$

NOW, COMPUTE THE INTERSECTIONS.

SPAR		
3	$x' = 226.906215$	CHECKS BY SCALING.
7	247.707455	
10	264.835076	
14	285.256409	

FRONT SPAR $\quad -58.611543y' = -1292.868202 - 14.503369x'$

$$14.503369x' - 58.611543y' + 1292.868202 = 0$$
$$.720620565x' - .693329644y' - 154.5 = 0$$

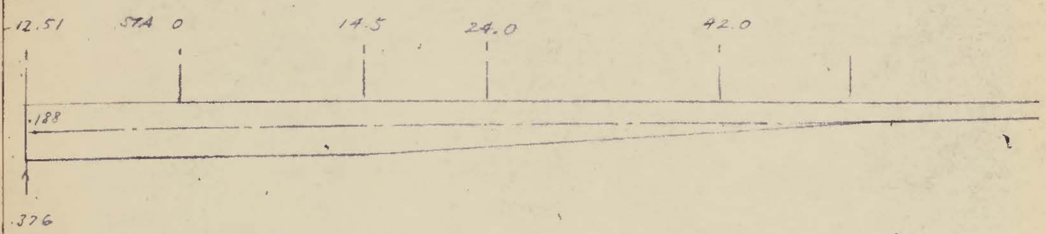
$$10.055615x' - 40.637120y' + 8,896.383845 = 0$$
$$42.236683x' - 40.637120y' - 9055.483394 = 0$$

$$-32.181068x' + 9,951.867239 = 0$$

$$x' = 309.246021$$

A. V. ROE CANADA LIMITED MALTON · ONTARIO **TECHNICAL DEPARTMENT (Aircraft)**		REPORT NO. 7/0510/10 SHEET NO. 3-43	
AIRCRAFT:		PREPARED BY	DATE
C105	FIN	C. Gunderson	OCT 55
		CHECKED BY	DATE

SKIN THICKNESS OF AFT PANEL



UP TO STA 14.5 $t = .376 + (STA - 226.776215)\ .00072$

ABOVE STA 52 P. $t = .188 + (STA - 226.776215)\ .00036$

THICKNESS AT STA 14.5 $= .376 - (27.01)\ .00072$

$= .35654$

THICKNESS AT STA 42.0 $= .2400$

THICKNESS AT STA 24.0 $= (.35654 - .24000)\ \frac{16}{25.5} + .2400$

$= .3131$

SPAR THICKNESS

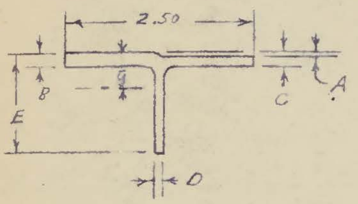
SPAR	THICKNESS
1	0.125
3	.091
5	.072
7	.091
10	.072
14	.064
F.S.	.064 ABOVE L.P. (22)
F.S	.072 BELOW L.P. (22)

A. V. ROE CANADA LIMITED MALTON - ONTARIO **TECHNICAL DEPARTMENT (Aircraft)**		REPORT NO. 7/0510/10 SHEET NO. 3 - 45	
AIRCRAFT: C105	FIN	PREPARED BY: G. Gundesen	DATE
		CHECKED BY	DATE

FIN GEOMETRY

DIMENSIONS OF SPARS AND RIBS

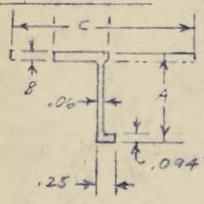
SPAR CAP BOOM



SPAR NO	A	B	C	D	E
3	—	.15 *	.15 *	.102	1.30
7	.0062	.15 *	.15 *	.102	1.30
10	.069	.15 *	.15 *	.081	1.30
14	.0096	.09	.09	.072	1.30
RIB STA 42					
RIB STA 92	—	.15	.15	.102	1.25

* NOTE: DIM B AND C BASIC DIM ABOUT FIN ℄) TAPERING .00029 /INCH

STRINGER



SPAR NO	A	B	C
4, 6, 8, 9	1.125	.094	.25
11, 12, 13, 15, 16	1.10	.064	.25
5	1.125	.094	2.50

RIB THICKNESS

RIB #2, 3, 4, 5 FROM SPAR 10 TO L.E. .051
RIB #7, 8 FROM SPAR #1 TO L.E. .064
RIB #6 FROM SPAR #7 TO L.E. .064
RIB #1 FROM SPAR #7 TO L.E. .072
RIB #4, 5 FROM SPAR #1 TO SPAR 10 .072
RIB #6 FROM SPAR #1 TO SPAR 7 .072
RIB 2, 3 FROM SPAR #1 TO SPAR #10 .081

RIB FLANGE WIDTH

RIB #1 1.00
RIB #2 FROM SPAR #1 TO SPAR #10 1.00
RIB 3, 4, 5 " " 1 " " #7 .85
RIB 6 " " 1 " " 7 .85
RIB 2, 3, 4, 5 " " 10 " L.E. .76
RIB #7, 8 " " 1 " L.E. .76
RIB #6 " " 7 " L.E.

A. V. ROE CANADA LIMITED MALTON - ONTARIO **TECHNICAL DEPARTMENT (Aircraft)**		REPORT No. 7/0510/110 SHEET No. 3-46	
		PREPARED BY	DATE
AIRCRAFT: C105	FIN	E. Gunnlaugson	
		CHECKED BY	DATE

CALCULATION OF SPAR CAP AREAS

BASIC AREA = 1.2 × .15 + 1.2 × .081 + 1.30 × .081 = .382 in^2

BASIC Ay = 1.3 × .072 × .65 + 0.04 × 2.4 × .115 = .072 in^3

BASIC $\bar{y} = \frac{.072}{.392} = 0.188$"

SPAR	STA	INCHES FROM BASE 265 − STA	CAP A .000695/IN	CAP y 0.150 − .000145/IN	CAP Ay	Σ Ay	Σ A	$\bar{y} = \frac{\Sigma Ay}{\Sigma A}$
10	122.7	142	−.099	−.129	−.013	.059	.283	.208
	147.4	118	−.082	−.133	−.011	.061	.300	.203
	172.4	93	−.064	−.135	−.009	.063	.319	.197
	190.4	75	−.052	−.142	−.007	.065	.330	.196
	208.4	57	−.040	−.144	−.006	.066	.342	.193
	238	27	−.019	.146	−.003	.069	.363	.190
10	255	10	−.007	.149	−.001	.071	.375	.191

SPAR # 14 AREA = .090 × 1.2 + .080 × 1.2 + .072 × 1.3
= 0.298 in^2

Ay = 1.30 × .65 × .072 + .085 × .042 × 2.4
= 0.069 in^3

$\bar{y} = \frac{.069}{.298} = 0.232$"

y = 0.40

STRINGER 4, 6, 8, 9 A = 1.00 × .094 + .06 × 0.937 = 0.150 in^2

11, 12, 13, 15, 16 A = 1.00 × .064 + .06 × 0.064 = 0.116 in^2

5 A = .362 in^2 y = 0.26"

CALCULATION OF EFFECTIVE SPANWISE BOOM AREAS

STRESS POINT	1 L_1 SKIN LENGTH	2 t_1 SKIN THICKNESS	3 A_1 SKIN AREA (1) × (2)	4 z_1 SKIN C.G. TO ℄ (2) − ½(2)	5 $A z$ (3) × (4)	6 L_2	7 t_2	8 A_2 (6) × (7)	9 z_2	10 $A z_2$ (8) × (9)	11 A_3 SPAR
5 SPAR 5	5.81	.113	.656	1.553	1.02	5.00	.113	.565	1.55	.875	.150
6 SPAR 3	5.00	.110	.550	1.49	.820	4.75	.112	.533	1.49	.826	.356
7 SPAR 1	4.75	.114	.541	1.293	.690	2.30	.114	.262	1.141	.298	.143
12 F.S.	1.50	.051	.076	1.204	.091	2.90	.110	.319	1.175	.375	.255
13 SPAR 7	—	—	—	—	—	2.90	.110	.319	1.175	.375	.349
14 SPAR 5	5.81	.117	.680	1.73	1.176	5.00	.117	.585	1.73	[illegible]	.150
15 SPAR 3	5.00	.117	.585	1.720	1.005	4.75	.125	.595	1.72	1.020	.369
16 SPAR 1	4.75	.125	.592	1.535	.909	2.30	.125	.287	1.403	.402	.141
22 F.S.	1.50	.051	.076	1.383	.105	2.98	.120	.358	1.35	.483	.255
23 SPAR 7	2.98	.120	.358	1.795	.643	5.81	.126	.732	1.795	1.312	.359
24 SPAR 5	5.81	.126	.732	2.065	1.510	5.00	.126	.630	2.065	1.31	.150
25 SPAR 3	5.00	.126	.630	1.965	1.24	4.75	.133	.630	1.965	1.24	.387
26 SPAR 1	4.75	.133	.630	1.742	1.10	2.30	.133	.306	1.61	.492	.141
32 F.S.	1.50	.051	.076	1.646	.125	6.425	.130	.725	1.50	1.48	.255
33 SPAR 7	6.425	.130	.835	2.311	1.93	5.81	.136	.790	2.311	1.830	.386

[illegible] AREAS

AVRO AIRCRA

MALTON, ON

ENGINEERING D

AIRCRAFT - -

WEIGHT - -

C. G. POSITION -

9	10	11	12	13	14	15	16	17	18	19	20	21	22
[illegible]	A_{22} (8) × (9)	A_3 SPAR	[illegible] SPAR	A_{33} SPAR	A_4 STRINGER	[illegible]	A_{44} STR (4) / (?)	[illegible]	[illegible] WEB	[illegible]	[illegible]	[illegible]	ΣA (3) + (8) + (?) + (14) + (20)
[illegible]	.875	[illegible]	1.077	.165	[illegible]	1.037	.155	—	—	—	—	1.61	1.521
[illegible]	.826	.356	1.16	.413	.135	.95	.128	.091	1.13	.044	.018	1.55	1.62
[illegible]	.298	.143	.529	.075	.071	.529	[illegible]	.125	.927	.037	.022	1.241	1.039
[illegible]	.375	.255	.930	.277	.075	.720	.074	.014	.825	.012	.008	1.230	.793
[illegible]	[illegible]	[illegible]	.344	.294	.075	.920	.054	[illegible]	.820	[illegible]	.011	1.230	.734
[illegible]	[illegible]	.150	1.62	.244	.150	1.10	.176	—	—	—	—	1.787	1.565
1.72	[illegible]	.367	1.40	.512	.145	1.27	.144	.091	1.35	.074	.024	1.378	[illegible]
[illegible]	.402	.141	0.80	.113	.071	.78	.056	.125	1.18	.069	[illegible]	1.508	1.121
[illegible]	.467	.255	1.579	.280	.075	.889	.0665	.064	[illegible]	.0252	.013	1.409	.777
[illegible]	1.312	.359	1.455	.522	.150	1.33	.200	.091	1.42	.087	.025	1.855	1.624
2.265	1.31	.150	1.96	.294	.150	[illegible]	.242	—	—	—	—	2.128	1.662
[illegible]	1.24	.387	1.64	.635	.145	1.51	.219	.091	1.59	.121	.029	2.028	1.821
1.41	.492	.141	1.00	.141	.071	1.00	.071	.125	1.38	.117	.038	[illegible]	1.186
1.60	.148	.255	1.352	.345	[illegible]	1.697	.24	.064	1.321	.149	.017	1.672	1.423
2.311	1.830	.386	1.983	.765	.225	1.840	.415	.091	1.92	.214	.038	2.377	2.274

CALCULATION OF SPANWISE BOOM AREAS

STRESS POINT	1 L_1 SKIN LENGTH	2 t_1 SKIN THICKNESS	3 A_1 SKIN AREA (1) × (2)	4 $\bar{z}_1$ SKIN C.G. TO FIN ℄ (21) − ½ (2)	5 $A_1\bar{z}_1$ (3) × (4)	6 L_2	7 t_2	8 A_2 (6) × (7)	9 $\bar{z}_2$	10 $A_2\bar{z}_2$ (8) × (9)	11 A_3 SPAR
34 SPAR 5	5.81	.136	.790	2.406	1.90	5.00	.136	.680	2.406	1.633	.150
35 SPAR 3	5.00	.136	.680	2.231	1.516	4.75	.143	.680	2.227	1.512	.477
36 SPAR 1	4.75	.143	.680	1.980	1.34	2.30	.143	.329	1.848	.607	.139
43 F.S.	1.50	.051	.076	1.817	.138	2.50	.137	.342	1.774	.606	.255
44 SPAR 10	—	—	—	—	—	6.40	.137	.876	1.774	1.55	—
45 SPAR 7	8.90	.137	1.22	2.626	3.20	5.81	.143	.830	2.626	2.18	.349
46 SPAR 5	5.81	.143	.830	2.632	2.18	5.00	.143	.715	2.652	1.87	.150
47 SPAR 3	5.00	.143	.715	2.422	1.73	4.75	.150	.712	2.422	1.726	.421
48 SPAR 1	4.75	.150	.712	2.153 *	1.53	2.30	.150	.345	2.021 *	.697	.138
55 F.S.	1.50	.051	.076	2.028	.154	3.06	.0754	.230	2.016	.463	.255
56 SPAR 10	3.056	.0754	.230	2.482	.57	5.90	.146	1.300	2.447	3.18	.300
57 SPAR 7	8.90	.146	1.300	2.972	3.86	5.81	.152	.883	2.969	2.62	.417
58 SPAR 5	5.81	.152	.883	2.895	2.56	5.00	.152	.760	2.895	2.20	.362
59 SPAR 3	5.00	.152	.760	2.642	2.01	4.75	.159	.755	2.633	1.99	.437
60 SPAR 1	4.75	.159	.755	2.365 *	1.78	2.30	.159	.366	2.233 *	.815	.137

FORM 1544

AVRO AIRCRAF[T]

MALTON, ON[T]

ENGINEERING D[EPT]

AIRCRAFT - -

WEIGHT - -

C. G. POSITION -

9	10	11	12	13	14	15	16	17	18	19.	20	21	22
$\bar{z}^2$	$A\bar{z}_2$ (8) × (9)	A_3 SPAR	z_3 SPAR (21)-(2)-$\bar{y}$	$A_3 z_3$ SPAR (11) × (12)	A_4 STRINGER	z_4 STR (21)-(2)-$\bar{y}$	$A_4 z_4$ STR (14) × (15)	t WEB	h WEB (21)-(2)-.2-(CAP t)	I WEB $\frac{(17)(18)^3}{3}$	A WEB AT OUTSIDE S. $= I/z^2$ $\frac{(19)}{(21)^2}$	z FIN ½ C TO O. SKIN	ΣA (3)+(8)+(11)+(14)+(20)
2.406	1.633	.150	1.935	.291	.150	1.935	.290	—	—	—	—	2.474	1.720
2.227	1.512	.400	1.907	.775	.144	1.763	.254	.091	1.83	.184	.035	2.299	1.946
1.848	.607	.139	1.241	.173	.069	1.24	.0855	.125	1.62	.177	.046	1.963	1.263
1.974	.606	.255	1.632	.409	.116	1.326	.152	.072	1.406	.069	.020	1.843	.809
1.774	1.55	—	—	—	.150	1.306	.196	—	—	—	—	1.843	1.026
2.626	2.18	.399	2.324	.925	.150	2.16	.324	.091	2.25	.346	.048	2.694	2.647
2.632	1.87	.150	2.161	.324	.150	2.161	.324	—	—	—	—	2.204	1.845
2.422	1.726	.421	2.10	.883	.144	1.94	.279	.091	2.05	.261	.042	2.494	2.023
2.021*	.677	.138	1.41	.195	.069	1.41	.098	.125	1.29	.242	.057	2.139	1.316
2.016	.463	.255	1.813	.462	.116	1.579	.183	.072	1.70	.118	.028	2.054	.705
2.447	2.18	.300	2.242	.673	.266	2.045	.544	.072	2.12	.230	.036	2.520	2.132
2.969	2.62	.417	2.644	1.101	.225	2.499	.562	.091	2.57	.513	.055	3.045	2.880
2.895	2.20	.362	2.559	.925	.150	2.419	.363	.072	2.49	.370	.042	2.971	2.197
2.638	1.99	.437	2.322	1.013	.144	2.166	.312	.091	2.24	.342	.046	2.718	2.155
2.233*	.815	.137	1.626	.223	.069	1.63	.112	.125	2.00	.333	.060	2.356	1.326

CALC. OF SPANWISE BOOM AREAS

STRESS POINT	1 L_1 SKIN LENGTH	2 t_1 SKIN THICKNESS	3 A_1 SKIN AREA (1) × (2)	4 $\bar{y}_1$ SKIN C.G. TO FIN ℄ (2.) − ½(2)	5 $A\bar{y}_1$ (3) × (4)	6 L_2 SKIN	7 t_2	8 A_2 (6) × (7)	9 $\bar{y}_2$	10 $A\bar{y}_2$ (9) · (8)	11 A_3 SPAR
67 F.S.	1.50	.051	.076	2.225	.169	6.15	.0844	.520	2.225	1.16	.225
68 SPAR 10	6.149	.0844	.519	3.017	1.565	8.90	.155	1.38	2.932	4.12	.319
69 SPAR 9	8.90	.155	1.38	3.292	4.54	5.81	.161	.935	3.2[illegible]	3.08	.433
70 SPAR 5	5.81	.161	.935	3.149	2.94	5.00	.161	.805	[illegible]	2.14	.150
71 SPAR 3	5.00	.161	.805	2.863	2.30	4.75	.240	1.14	2.8[illegible]	3.22	.455
72 SPAR 1	4.75	.240	1.14	2.544	2.90	2.30	.240	.552	[illegible]	1.40	.127
79 F.S.	1.50	.051	.076	2.394	.182	8.376	.091	.761	2.374	1.80	.255
80 SPAR 10	8.376	.091	.761	3.348	2.55	8.90	.161	1.43	3.314	4.78	.330
81 SPAR 9	8.90	.161	1.43	3.500	5.00	5.81	.167	.97	3.504	3.40	.446
82 SPAR 5	5.81	.167	.97	3.342	3.24	5.00	.167	.834	3.392	2.77	.15[illegible]
83 SPAR 3	5.00	.167	.834	3.021	2.52	4.75	.313	1.49	2.948	4.40	.367
84 SPAR 1	4.75	.313	1.49	2.666	3.97	2.30	.313	.720	2.554	1.82	.118
92 F.S.	1.50	.051	.076	2.547	.194	2.10	.0973	.204	2.524	.515	.255
93 SPAR 14	—	—	—	—	—	8.18	.091	.824	2.524	2.08	—
94 SPAR 13	10.603	.094	1.00	3.652	3.65	8.90	.168	1.50	[illegible]	5.43	.343

FORM 1544

CALC. OF SPANWISE BOOM AREAS

STRESS POINT	1	2	3	4	5	6	7	8	9	10	11
	L_1 SKIN LENGTH	t_1 SKIN THICKNESS	A_1 SKIN AREA (1) x (2)	$\bar{z}_1$ SKIN C.G. TO FIN ℄ (z1) - ½ (2)	$A\bar{z}_1$ (3) x (4)	L_2	t_2	A_2	$\bar{z}_2$	$A\bar{z}_2$ (8) x (9)	A_3 SPAR
95 SPAR 7	8.90	.168	1.494	3.713	5.54	5.81	.174	1.01	3.710	3.75	.458
96 SPAR 5	5.81	.174	1.01	3.499	3.54	5.00	.363	1.81	3.404	6.16	.150
97 SPAR 3	5.00	.363	1.81	3.082	5.58	4.75	.363	1.72	3.092	5.30	.480
98 SPAR 1	4.75	.363	1.72	2.709	4.65	2.30	.363	.885	2.709	2.40	.112
103 F.S.	1.50	.051	.076	2.803	.214	3.704	.099	.366	2.779	1.017	.255
104 SPAR 14	3.704	.099	.367	3.387	1.245	10.603	.108	1.147	3.383	3.88	.298
105 SPAR 10	10.603	.108	1.145	4.106	4.59	8.90	.178	1.583	4.071	6.45	.363
106 SPAR 7	8.90	.178	1.553	4.040	6.399	5.81	.185	1.075	4.037	4.34	.479
109 SPAR 5	5.81	.181	1.052	3.675	3.865	5.00	.370	1.850	3.581	6.81	.150
111 SPAR 3	5.00	.369	1.844	3.161	5.83	4.75	.369	1.75	3.161	5.50	.487
115 F.S.	1.50	.051	.0765	3.123	.239	8.348	.113	.942	3.012	2.91	.255
116 SPAR 14	8.348	.113	.942	4.233	3.99	10.603	.122	1.295	4.230	5.48	.298
117 SPAR 10	10.603	.114	1.21	4.348	5.26	8.900	.185	1.645	4.313	7.12	.375
118 F.S.	1.50	.051	.0765	3.302	.252	8.34	.121	1.010	3.267	3.30	.255

FORM 1544

A. V. ROE CAN

MALTON, O

ENGINEERING DIVISI

AIRCRAFT - -

WEIGHT - -

C. G. POSITION -

	9	10	11	12	13	14	15	16	17	18	19	20	21	22
	z_2	$A_2 z_2$ (8) × (9)	A_3 SPAR	z_3 SPAR	$A_3 z_3$ SPAR (11) × (12)	A_4 STR	z_4 STR	$A_4 z_4$ STR. (14) × (15)	t WEB	h WEB (21) - (2) ÷ 20 - (CAP 0)	I WEB	A_5 WEB AT 0. SKIN $\frac{(19)}{(21)^2}$	z FIN ½ t	Σ A (3)+(8)+ (11)+(14)+ (20)
	3.710	3.75	.458	3.387	1.550	.225	3.229	.726	.091	3.29	1.08	.075	3.797	3.262
	3.404	6.16	.150	3.012	.451	.150	3.012	.451	—	—	—	—	3.586	3.12
2	3.082	5.30	.480	2.655	1.28	.133	2.501	.333	.091	2.56	.509	.048	3.264	4.19
5	2.709	2.40	.112	2.060	.231	.056	2.040	.114	.125	2.33	.529	.063	2.891	2.84
6	2.779	1.017	.255	2.540	.648	.232	2.330	.540	.072	2.39	.328	.040	2.827	.969
7	3.383	3.88	.298	3.106	.925	.232	2.938	.681	.064	3.00	.576	.049	3.437	2.093
3	4.091	6.45	.363	3.862	1.40	.324	3.652	1.18	.072	3.71	1.22	.071	4.1604	3.49
5	4.037	4.34	.479	3.713	1.78	.225	3.551	.80	.091	3.60	1.42	.083	4.129	3.445
0	3.581	6.81	.150	3.185	.478	.150	3.185	.478	—	—	—	—	3.766	3.20
5	3.161	5.50	.487	2.772	1.35	.132	2.490	.329	.091	3.64	1.46	.130	3.345	4.34
2	3.012	2.90	.255	2.846	.726	.116	2.636	.306	.072	2.74	.492	.050	3.149	1.439
5	4.230	5.48	.298	3.936	1.172	.232	3.768	.871	.064	3.83	1.19	.065	4.290	2.832
5	4.313	7.12	.375	4.029	1.513	.324	3.891	1.26	.072	3.88	1.40	.072	4.405	3.626
0	3.267	3.30	.255	3.087	.789	.116	2.81	.326	.072	2.98	.635	.057	3.328	1.514

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

REPORT No. 7/0510/10
SHEET No. 3 - 53

AIRCRAFT:		PREPARED BY	DATE
C105	FIN	L. Gunderson	NOV 55
		CHECKED BY	DATE

BOOM AREAS

STRESS POINT 37

$$\text{BOOM AREA} = AREA_{43} + AREA_{44}$$
$$= 0.655 + .870$$
$$= 1.525 \text{ in}^2$$

STRESS POINT 85

$$\text{BOOM AREA} = AREA_{92} + AREA_{93}$$
$$= 0.620 + .887$$
$$= 1.507 \text{ in}^2$$

RM 1319 A

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

REPORT NO. 7/0251/10			
SHEET NO. 3-56			
AIRCRAFT: C105	FIN	PREPARED BY: L. Gundesen	DATE: OCT 55
		CHECKED BY	DATE

CALCULATION OF CHORDWISE BOOM AREAS

ASSUMPTIONS :

① THE RIB AREAS CAN BE NEGLECTED SINCE THEY ARE SMALL DISCONTINUOUS AREAS COMPARED TO THE SKIN AREAS.

② THE EFFECTIVE WIDTH OF SKIN WILL NOT BE MORE THAN 18.1% OF THE RIB, ON EACH SIDE. (REF. "JOUR. AERO. SC. JULY 53 PAGE 450") OR ½ RIB PITCH WHICHEVER IS LEAST.

CALC OF EFFECTIVE SKIN WIDTH

STRESS POINTS	RIB LENGTH	.181 × RIB ℓ	½ RIB PITCH	½ RIB PITCH	(BOTH SIDES) EFF WIDTH
1, 2, 3, 4	43.185	7.80			7.80
8, 9, 10, 11	31.120	5.63		12.8	11.26
17, 18, 19, 20, 21	37.092	6.71	12.8	14.0	13.42
27, 28, 29, 30, 31	43.971	7.95	14.0	10.0	15.90
38, 39, 40, 41, 42	48.920	8.84	10.0	12.2	17.68
49, 50, 51, 52, 53, 54	55.032	9.95	12.2	12.5	19.90
61, 62, 63, 64, 65, 66	61.218	11.08	12.5	9.000	20.08
73, 74, 75, 76, 77, 78	65.672	12.08	9.000	9.000	18.000
86, 87, 88, 89, 90, 91	70.126	12.90	9.000	15.000	21.90
99, 100, 101, 102	46.41	8.39			16.78
113, 114	16.69	3.02			6.04

RM 1319A

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

REPORT NO. 7/0510/10
SHEET NO. 7-59

AIRCRAFT: C105 | FIN

PREPARED BY	DATE
L. Gunderson	NOV 55
CHECKED BY	DATE

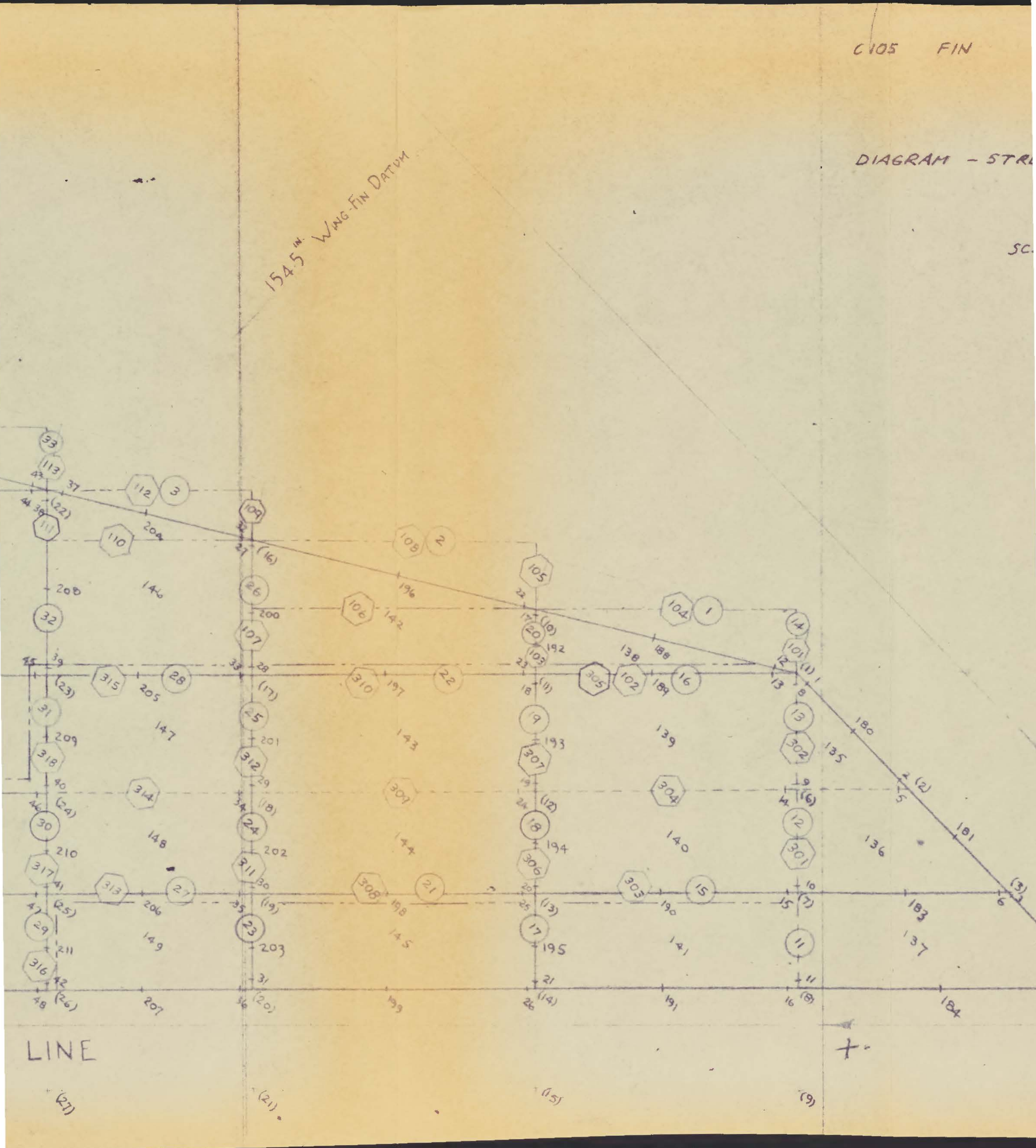
CALC OF CHORDWISE BOOM AREAS

	1	2	3	4	5	6
STRESS POINT	W SKIN WIDTH	t SKIN THICKNESS	$\bar{z}'$ SKIN C.G (5) − ½ (2)	A_1 ACTUAL BOOM AREA (1) × (2)	$\bar{z}'$ FIN ½ THICKNESS	A BOOM AREA $(4) \times (3)^2/(5)^2$
99	16.78	.0995	2.779	1.668	2.829	1.61
100	↓	.1038	3.385	1.740	3.437	1.69
101	↓	.143	4.114	2.40	4.186	2.32
102	16.78	.178	4.128	2.985	4.217	2.86
113	6.04	.113	3.092	.682	3.149	.655
114	6.04	.113	4.233	.682	4.290	.663

FORM 1319A

135	.113 356	160	.087 618	184	.125	208	.064	232	.072	256	.091
136	.113 356	161	.157 964	185		209	.072	233	.072	257	.072
137	.120 900	162	.164 129	186		210	.072	234	.091	258	.072
138	.114 859	163	.164 129	187		211	.072	235	.091	259	.072
139	.121 445	164	.276 550	188	.064	212	.072	236	.125	260	.072
140	.121 445	165	.094 078	189	.091	213	.072	237	.051	261	.064
141	.128 950	166	.164 444	190	.091	214	.091	238	.081	262	.072
142	.124 628	167	.170 609	191	.125	215	.072	239	.081	263	0
143	.130 793	168	.170 609	192	.064	216	.091	240	.081	264	.072
145	.138 250	169	.337 887	193	.064	217	.125	241	.081		
146	.133 232	170	.094 084	194	.064	218	.051	242	.072	144	.130 773
147	.139 397	171	.102 728	195	.054	219	.072	243	.072		
148	.139 397	172	.123 073	196	.064	220	.072	244	.091		
149	.146 850	173	.179 238	197	.091	221	.072	245	.091		
150	.070 932	174	.177 226	198	.091	222	.072	246	.125		
151	.141 278	175	.365 964	199	.125	223	.091	247	.051		
152	.147 443	176	.106 229	200	.064	224	.072	248	.081		
153	.147 443	177	.114 872	201	.064	225	.091	249	.081		
154	.154 950	178	.181 545	202	.064	226	.125	250	.081		
155	.079 878	179	.116 779	203	.064	227	.051	251	.081		
156	.150 224	180	.072	204	.064	228	.072	252	.072		
157	.156 389	181	.072	205	.091	229	.072	253	.064		
158	.156 389	182	.072	206	.091	230	.072	254	.072		
159	.199 700	183	.091	207	.125	231	.072	255	.091		

REPORT NO 7/0510/10
SHT NO 3-61
PREPARED BY B. Gundersen
CHECKED BY
DATE FEB 56

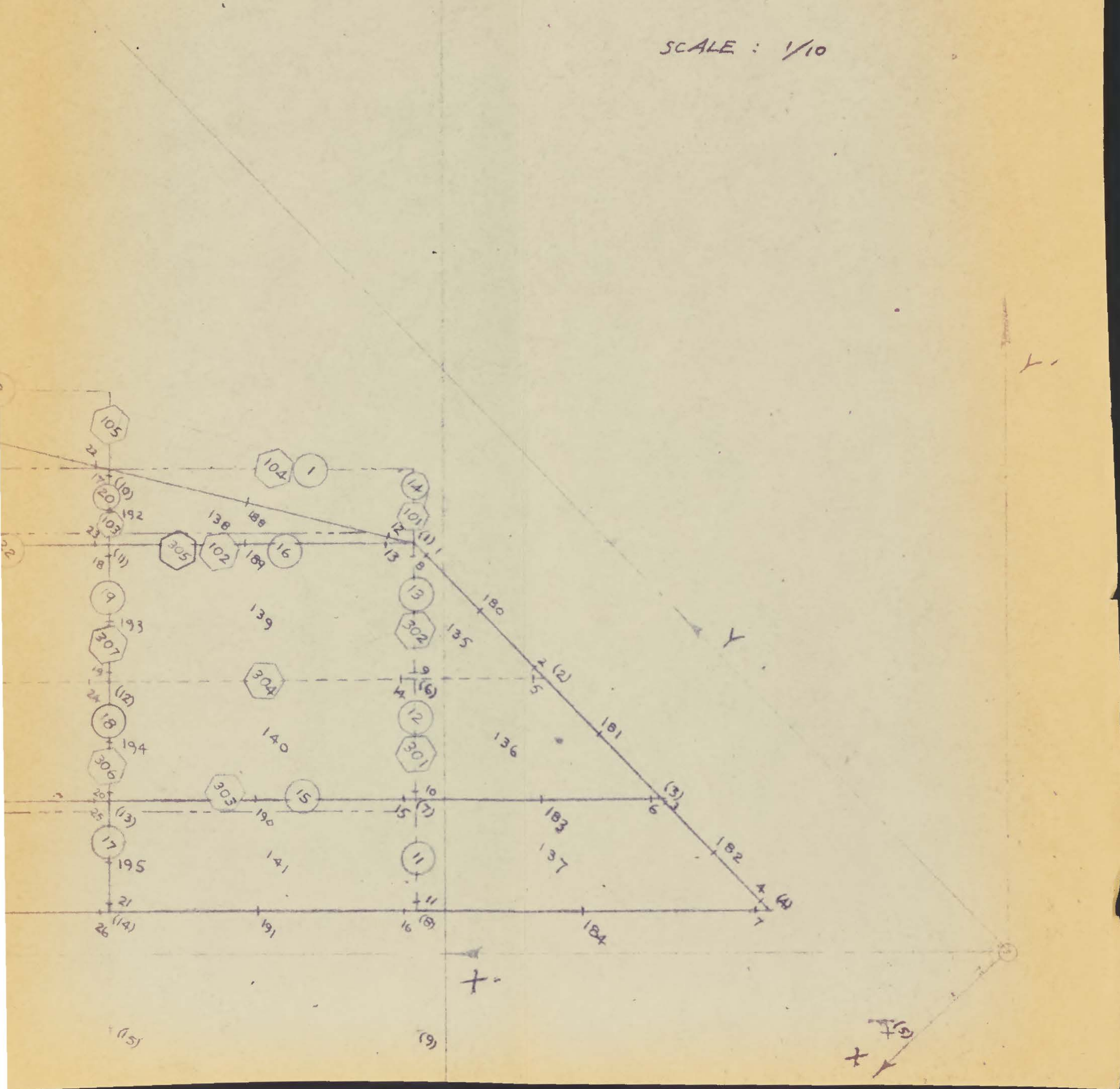

C105 FIN
DIAGRAM - STR
SC.
154.5 IN. WING-FIN DATUM
LINE

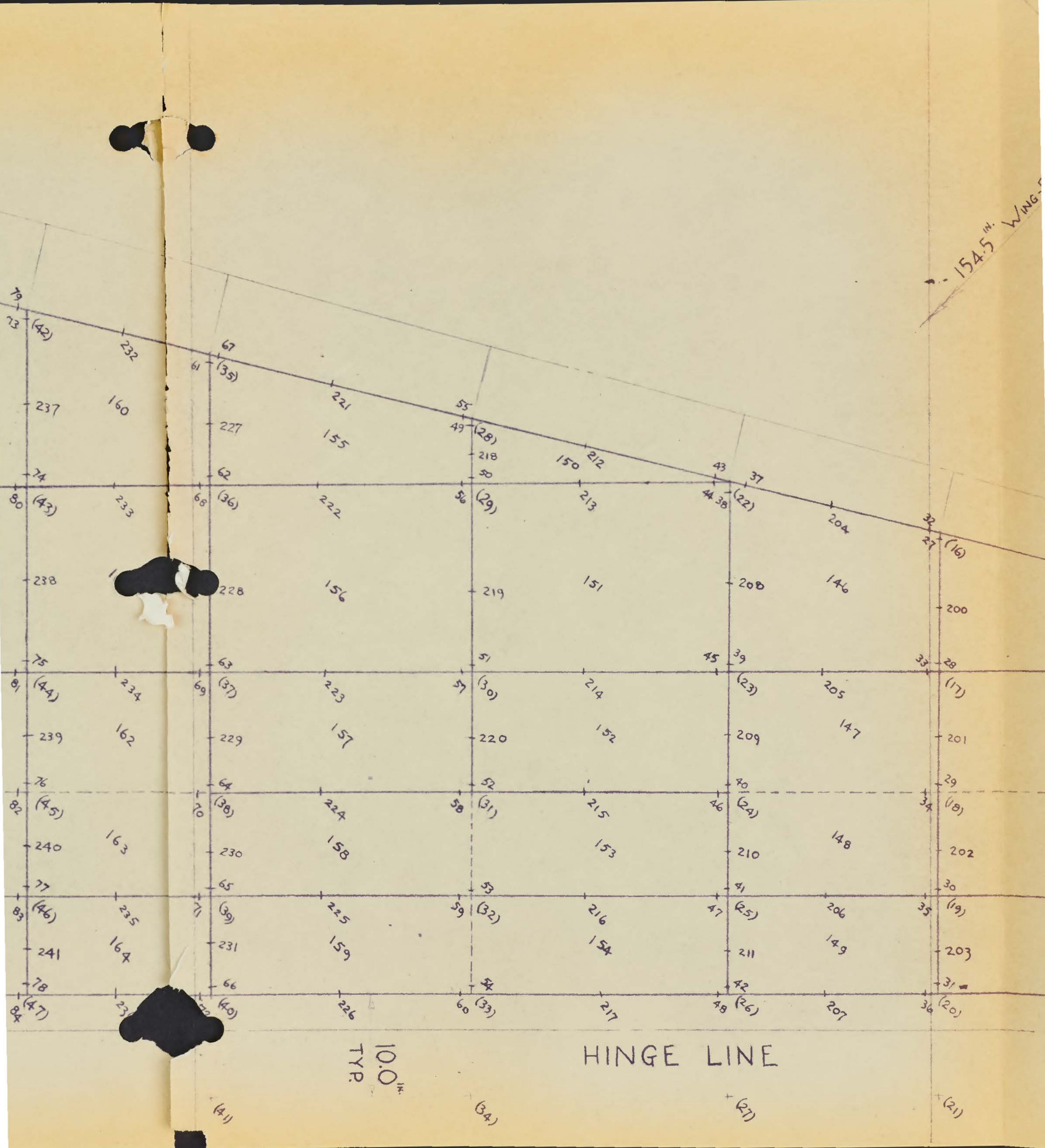
C105 FIN

REPORT NO 7/0510/10
SHT NO 3-62
PREPARED BY [illegible]

DIAGRAM – STRESS POINTS AND Kip REDUNDANT GROUPS

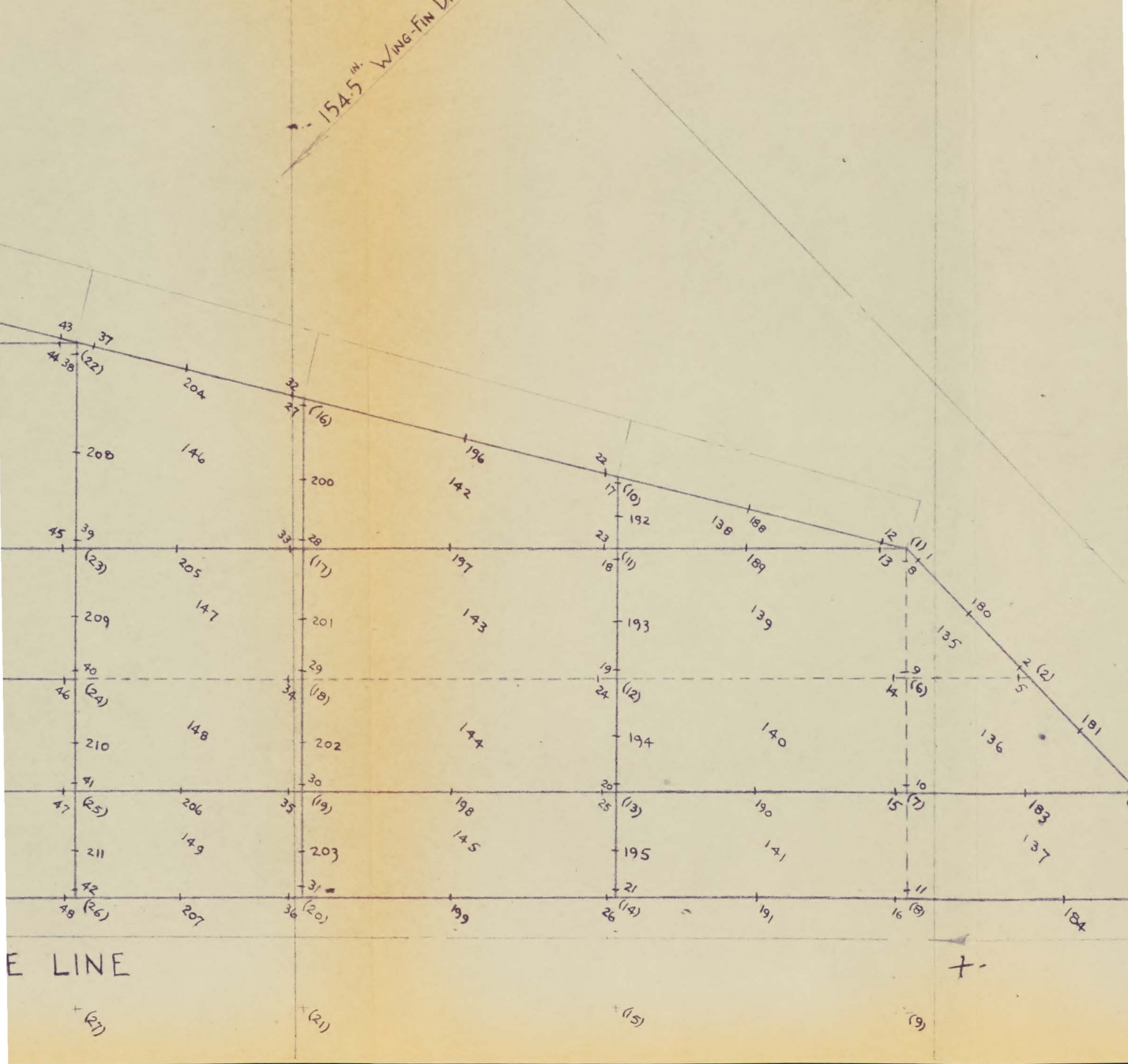
SCALE : 1/10




HINGE LINE
10.0" TYP.

C105 FIN

DIAGRAM --



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

REPORT NO. 7/0510/10
SHEET NO. 4-8

AIRCRAFT:		PREPARED BY	DATE
C105	FIN ANALYSIS		OCT 55
		CHECKED BY	DATE
		LBG	

SHEAR WEB ENERGY

WEB	LENGTH	½ HEIGHT (AV)	t	At/G.
253	27.741 437	3.0054	.064	.0014767
254	"	3.9298	.072	.00217226
255	"	3.9630	.091	.0027637
256	9.140 222	3.3046	.091	.0007048
257	7.407 054	3.1332	.072	.0006878 *
258	21.206 452	3.7990	.072	.0023871 *
259	17.799 742	4.1448	.072	.0021860 *
260	38.660 871	2.9889	.072	.0034238 *
261	37.528 976	3.8636	.064	.0023794
262	17.125 643	4.2826	.072	.0013540
263	16.695 545	3.7193	.051	.001303 *
264	21.718 436	3.2387	.072	.0012986
265	30.407 711	3.8091	.051	.0024309 *
266	29.428 541	4.3472	.051	.0026849 *
267	24.700 576	4.2670	.051	.0022120 *
268	16.124 987	3.9476	.051	.00133597 *
269	13.876 928	3.5555	.051	.0010355 *
270	13.183 092	3.1181	.051	.0008627 *

* A REDUCED "G" IS APPLIED TO RIBS TO ACCOUNT FOR LIGHTENING HOLES. "G" IS ASSUMED = 3900 × 0.625 ≈ 2430

A. V. ROE CA[illegible]

MALTO[illegible]

TECHNICAL [illegible]

AIRCRAFT -

WEIGHT -

C. G. POSITION -

Boom Energy

Ribs

Rib Stns 19 – 7[illegible]	1 Area	2 Length	3 Length	4 .75A1+.25A2	5 A1+A2	6 .25A1+.75A2	7 A1 A2 / A1+A2 · L · 25	8 A1 L1 + A2 L2 [illegible]	9	10 [illegible]	11 Area	12 Le[illegible]
86	2.060			2.23875				.001340		119		
		21.206432	7.0[illegible]817		4.93[illegible]		.000836					33.40
87	2.775			2.91125		2.596 25		.000654		120		
		17.799742	5.933247		6.235		.000[illegible]5					29.4[illegible]
88	3.260			3.552 50		3.16[illegible]		.003424		121		
		11.62	3.87333		7.010		.000670					24.7[illegible]
89	3.420			4.2[illegible]		3.4712[illegible]		.002257		[illegible]		
		10.00	3.33333		10.830		.000[illegible]					16.12[illegible]
90	7.010			6.1775		4.16500		.005265		[illegible]		
		9.5	3.1666[illegible]		10.570		.000741					12.[illegible]
91	3.800					4.33[illegible]		.000[illegible]		11[illegible]		
113	.672			.6570				.000363				13.13
		16.6[illegible].42	5.[illegible]1[illegible]1		1.318		.000186			112		
114	.662					.661[illegible]		.000310		72	1.590	
99	1.610			1.[illegible]				.000385				16.7[illegible]
		7.400[illegible]	2.46[illegible]		3.[illegible]		.000204			74	2.1[illegible]	
100	1.680			1.84[illegible]		1.[illegible]		.001515				17.7[illegible]
		21.206432	7.0[illegible]817		4.010		.000631			75	2.42[illegible]	
101	2.320			2.45[illegible]		2.16[illegible]		.003060				11.62
		17.799742	5.933247		5.18[illegible]		.000760			76	2.870	
102	2.967					2.72[illegible]		.001791				10.00
										77	3.[illegible]	
										78	4.9[illegible]	9.5

FORM 1543

[illegible] Energy

Rib [illegible]

A. V. ROE C[illegible]
MALTO[illegible]
TECHNICA[illegible]

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

	1	2	3	4	5	6	7	8	9	10	11	
Stress Point	Area	Length [illegible]	Length [illegible]	.75A + .25A	A + A	.25A + .75A	A·A/(A+A) · L/3E	A² [illegible]		Stress Point	Area	L[illegible]
61	1.620			1.798 75				.000 601		49	1.434	
		12.298 257	4.099 42		3.915		.000 389					6
62	2.295			2.476 25		2.126 [illegible]		.002 277		50	2.185	
		17.799 742	5.933 25		5.315		.000 714					17.
63	3.026			3.081 00		2.83875		.002 072		51	2.818	
		11.62	3.87333		6.090		.000 589					11.6
64	3.064			3.[illegible]550		3.0[illegible] 00		.002 158		62	2.810	
		10.00	3.33 333		6.814		.000 662					10
65	3.750			3.862 50		3.578 00		.002 463		53	2.920	
		9.5	3.166 66		7.950		.000 627					9
66	4.200					4.0[illegible]		.001 366		54	2.951	
38	2.240			2.265 75				.001 314		47	1.925	
		17.799 742	5.933 25		4.585		.000 679					12.
39	2.343			2.354 75		2.317 25		.002 309		28	1.99[illegible]	
		11.62	3.87333		4.733		.000 45[illegible]					11.6
40	2.390			2.403 00		2.378 25		.001 723		29	2.040	
		10.0	3.33333		4.83[illegible]		.000 402					10
41	2.442			2.446 50		2.429 90		.001 590		30	2.097	
		9.5	3.16666		4.902		.000 388					9
42	2.460					2.455 00		.000 781		31	2.113	
17	1.362			1.406 30				.000 262				
		5.831 638	1.9[illegible]		2.902		.000 144					
18	1.540			1.552 25		1.495 00		.000 907				
		11.62	3.87333		3.129		.000 30[illegible]					
19	1.583			1.593 25		1.576 75		.001 146				
		10.00	3.33333		3.219		.000 268					
20	1.630			1.636 00		1.619 75		.001 041				
		9.50	3.166 666		3.284		.000 260					
21	1.654					1.648 00		.000 526				

FORM 1543

A. V. ROE CA

MALTO

TECHNICAL

AIRCRAFT . . [illegible]

WEIGHT . .

C. G. POSITION .

Boom Entry [illegible]

Front Spar

	1	2	3	4	5	6	7	8	9	10	11
Station Point	Area	Length	Length/3	[illegible]	$A_1 + A_2$	[illegible]	[illegible]	[illegible]			
12	[illegible]			.5?75				.000417			
		24.960586	8.32086		1.11?		.000229				
22	.500			.7525		.5725		.000945			
		28.638473	9.546158		1.8??		.000382				
32	1.240			1.31125		1.0??5		.002168			
		[illegible]603218	6.[illegible]74		2.765		.000479				
37	1.525					1.45375		.001099			
43	.6??			.6??5				.00?71			
		[illegible].444974	8.48166		1.2??		.000262				
55	.585			.6525		.6?2?		.000432			
		25.[illegible]	8.[illegible]67		1.440		.000298				
67	.8?5			.7810		.7815		.001370			
		18.[illegible]	6.18096	[illegible]	2.099		.000288				
79	1.144			1.23475		1.07175		.001409			
		18.542[illegible]	6.18096		2.651		.000402				
85	1.507					1.41625		.000991			
92	.6??			.67??				.000597			
		30.844[illegible]	10.281504		1.44?		.000844				
103	.925			.94875		[illegible]		.001829			
		38.660[illegible]	12.886957		2.14?		.000654				
115	1.???			1.74???		1.19?2?		.00?818			
		21.718436	7.23948		2.720		.000492				
118	1.400					1.330		.001028			

FORM 1043

A. V. ROE CA[…]
MALTON
TECHNICAL D[…]

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

Boom Energy.

Spars # 10. & 14.

Spar 10 Stress Point	1 Area	2 Length	3 Length / 3.	4 .75A₁ + .25A₂	5 A₁ + A₂	6 .25A₁ + .75A₂	7 A₁·A₂ / A₁+A₂ · 1/3E	8 [illegible]	9	10 Spar 14 Stress Point.	11 Area	12 Len[…]
44	0.870			1.1275				.00553				
			8.333333		2.770		.000491					
56	1.900			2.005		1.6425		.003314				
			8.333333		4.210		.00 870					
68	2.320			2.410		2.215		.003365				
			6.000000		5.000		.000740					
80	2.680			2.765		2.590		.003222				
			6.000000		5.700		.000882					
94	3.020			3.0675		2.935		.004832		93	.887	
		29.941439	9.980 48		6.230		.001553					
105	3.210			3.2525		3.1625		.005060		104	[illegible]	
		17.125643	5.70855		6.590		.000940					37.5[…]
117	3.380					3.3375		.001954		116	[illegible]	

FORM 1543

A. V. ROE C[illegible]
MALT[illegible]
TECHNICA[illegible]

AIRCRAFT -
WEIGHT -
C. G. POSITION -

BOOM ENERGY

SPARS 1 & 3

E = 10,600 [illegible]

	1	2	3	4	5	6	7	8	9	10	11	12
STRESS POINT	AREA	LENGTH	LENGTH / 3	.75A + 1.25A	A + A	.25A + .75A	A A / A+A . L/3E	A^2 / (4) . L/3E	A [illegible]	(8)+(9) / 1	STRESS POINT	A[illegible]
16	.911			.930 75				.000 7173		.000 717	15	1.
		24.133 72[illegible]	8.044 24		1.901 00		.000 382					
26	.990			1.012 50		.970 25		.000 897		.001 710	25	1.
		27.199 999	9.066 666		2.070 00		.000 479					
36	1.090			1.092 50		1.067 50		.000 7118		.001 734	35	1.
		20.000 001	6.666 667		2.[illegible] 00		.000 368					
48	1.130			1.157 50		1.117 50				.001 670	47	1.
		24.700 00	8.233 333		2.370 00		.000 487					
60	1.240			1.385 00		1.212 50				.001 969	59	1.
		25.000 000	8.333 333		3.060 00		.000 615					
72	1.820			1.910 00		1.675 00				.002 688	71	2.
		18.000 0[illegible]	6.000 000		4.000 00		.000 595					
84	2.186			2.245 50		2.090 0[illegible]				.002 636	83	2
		18.000 000	6.000 000		4.610 00		.000 689					
98	2.430					2.367 50				.001 496	97	3.

FORM 1543

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

REPORT NO. 7/0510/10
SHEET NO. 4-18

AIRCRAFT: C 105 | FIN

PREPARED BY: CRG | DATE:
CHECKED BY: B | DATE: MAR 56

σ_{x_1}	$\sigma_{y'}$	PANEL 1	PANEL 2	PANEL 3	PANEL 4	$-\frac{mtA}{E}$
84	78	164	169			.000741
98	91	169	175			.000519
106	102	172	178			.000846
116	114	176	179			.000484

FORM 1319A

AVRO AIRCRAFT LIMITED
MALTON - ONTARIO
TECHNICAL DEPARTMENT

AIRCRAFT:		REPORT No. 7/0510/10	
C105	FIN.	SHEET No. 5-1	
		PREPARED BY	DATE
		C.B.	JAN '56
		CHECKED BY	DATE

: STRESSES DUE TO REDUNDANT GROUPS

INDEX

FORM 1319A

A. V. ROE CANADA LIMITED MALTON · ONTARIO **TECHNICAL DEPARTMENT (Aircraft)**		REPORT NO. 7/0510/10 SHEET NO. 5-2	
AIRCRAFT: C105	FIN	PREPARED BY C.B.	DATE Dec. '55
		CHECKED BY	DATE

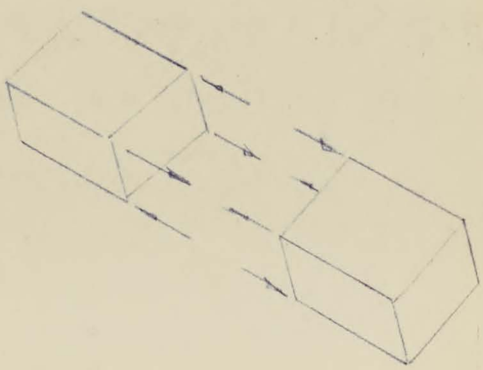
STRESSES DUE TO REDUNDANT GROUPS.

§§1. GENERAL REMARKS.

A set of self-equilibrated forces are applied to the structure & considered to act on a small portion of the total fin. This follows the technique successfully employed in the wing analysis & recorded in AVRO STRESS REPORT GEN/1090/336.

The typical group of forces is of the "MF" Type. With this group a set of force forces is considered as acting on two adjacent cells such that Bi-moments are produced.

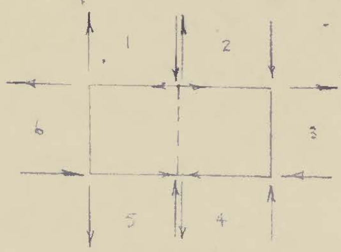
Reference:
Gen/1090/336
Pg 13.



A. V. ROE CANADA LIMITED MALTON · ONTARIO **TECHNICAL DEPARTMENT (Aircraft)**		REPORT No. 7/0510/10	
		SHEET No. 5-3	
AIRCRAFT: C105	FIN	PREPARED BY	DATE
		C.B	Dec '55
		CHECKED BY	DATE

STRESSES DUE TO REDUNDANT GROUPS

§§1: Certain webs have been cut away to cater to jacks, flying-controls, etc: The shear flow in these webs have been calculated due to the "F" groups acting on the adjacent cells. Then the "F" group acting across this web face will combine singularly with each of the other six Bimoments to produce zero shear flow.



The oblique edge conditions on the leading edge of the base rib are treated separately in Parts 1 and 2.

RM 1319 A

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

REPORT NO.	7/0510/10
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AIRCRAFT:

RECTANGULAR (XY) CELLS.

STRESSES DUE TO REDUNDANT GROUPS

§ 2

INDEX.

RM 1319A

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

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C.B.		Dec. '55
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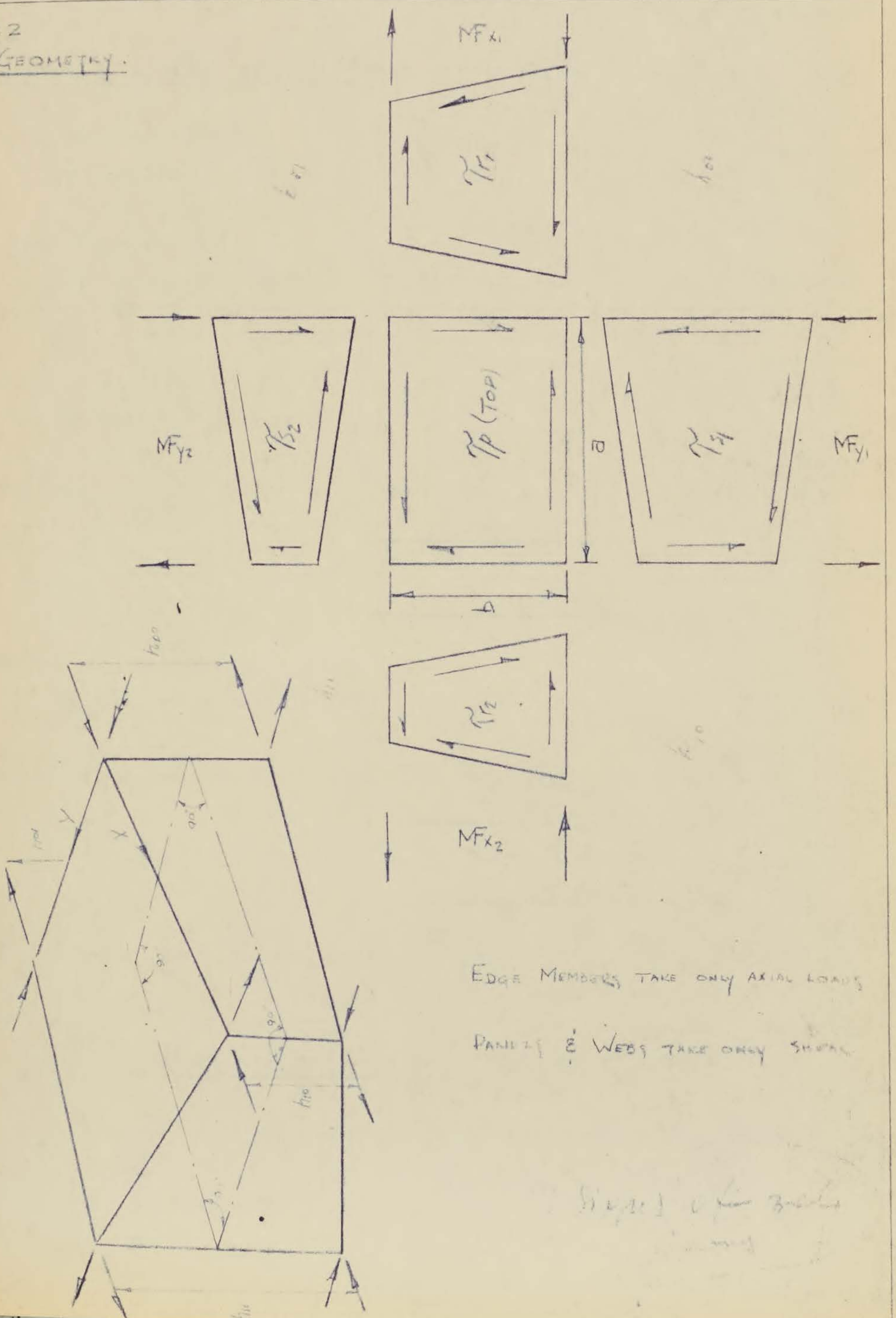
AIRCRAFT:

§§2
1. GEOMETRY.



EDGE MEMBERS TAKE ONLY AXIAL LOADS

PANELS & WEBS TAKE ONLY SHEAR

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TECHNICAL DEPARTMENT (Aircraft)

AIRCRAFT:	
REPORT NO.	7/0510/10
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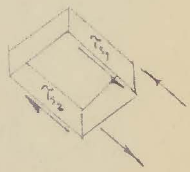
§ 2

3. CHECK NET FORCE IN DIRECTION OF MF GROUPS

$$\Sigma X = -\frac{MF_{X_1}}{(h_{01}+h_{10})}\cdot\frac{h_{10}}{h_{01}} + \frac{MF_{X_1}}{(h_{00}+h_{11})}\cdot\frac{h_{11}}{h_{00}} + \frac{MF_{X_1}}{h_{01}} - \frac{MF_{X_1}}{h_{00}}$$



BUT $(h_{01}+h_{10}) = (h_{00}+h_{11})$ Pg 3

& DERIVED $h_{11} = h_{01}+h_{10}-h_{00}$

REF.

SUBSTITUTE

$$\Sigma X = -\frac{MF_{X_1}}{(h_{01}+h_{10})}\left(\frac{h_{10}}{h_{01}} - \frac{h_{01}+h_{10}-h_{00}}{h_{00}}\right) + MF_{X_1}\left(\frac{1}{h_{01}} - \frac{1}{h_{00}}\right)$$

$$= -\frac{MF_{X_1}}{(h_{01}+h_{10})}\cdot\left(\frac{h_{10}h_{00} - h_{01}^2 - h_{10}h_{01} + h_{00}h_{01}}{h_{01}\cdot h_{00}}\right) + MF_{X_1}\left(\frac{h_{00}-h_{01}}{h_{01}\,h_{00}}\right)$$

$$= -MF_{X_1}\left[\frac{h_{10}h_{00} - h_{01}^2 - h_{10}h_{01} + h_{00}h_{01} - h_{00}h_{01} - h_{00}h_{10} + h_{01}^2 + h_{01}h_{10}}{h_{00}\cdot h_{01}(h_{01}+h_{10})}\right]$$

$$= 0 \qquad ; \qquad \text{O.K.}$$

4. CONSIDER EQUILIBRIUM ALONG UNLOADED BOOMS.

For a Trapezoidal Panel.

h_1 h_2

x_1 x_2

$$\tau_{x\phi} = \tau_{m}\cdot\frac{h_1 h_2}{h^2} = \tau_{m}\cdot\frac{x_1\,x_2}{x^2}$$

REF. GEN/1090/330/Pg 07

REF.

TOTAL FORCE T

$$T = \tau_m\cdot x_1\cdot x_2\int_{x_1}^{x_2}\frac{dx}{x^2} = -\tau_m\cdot x_1\cdot x_2\left[\frac{1}{x}\right]_{x_1}^{x_2} = \tau_m(x_2 - x_1)$$

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§§2

From $\Sigma X = \Sigma Y = \Sigma M = 0$ for Panel loaded only by shear

necessary that shear stress be constant.

Then Total load on Boom - Unloaded web Face

$= \tau_{r2} \cdot b - \tau_p \cdot b = 0$ (HORIZONTAL COMP'T)

$$\tau_p = + \tau_{r2} = \frac{MF_{x1}}{a(h_{00} + h_{11})}$$

Similarly - Total Load on Boom - Loaded Web Face

$= \tau_{r1} \cdot b + \tau_p \cdot b = 0$ (HORIZONTAL COMP'T)

$$\tau_{r1} = - \tau_p = \frac{MF_{x1}}{a(h_{00} + h_{11})}$$

5. CHECK NET FORCE TRANSVERSE TO MF GROUP CONSIDERED

$$\Sigma Y = \tau_{r1} \cdot b + \tau_{r2} \cdot b$$

$$= \frac{MF_{x1} \cdot b}{a(h_{00} + h_{11})} (1 - 1) = 0 \qquad \underline{OK}$$

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§§2

6. Consider Equilibrium at Loaded Corners

Load on Post at (0,1)

$$-\tilde{\tau}_{s2}\cdot\frac{h_{11}}{h_{01}}\cdot h_{01} + \tilde{\tau}_{r1}\cdot\frac{h_{00}}{h_{01}}\cdot h_{01} - \frac{MF_{x1}}{h_{01}}\cdot\frac{h_{01}-h_{11}}{a}.$$

$$= \frac{MF_{x1}}{a}\left[-\frac{h_{11}\cdot h_{10}}{(h_{00}+h_{11})h_{01}} + \frac{h_{00}}{(h_{00}+h_{11})} - \frac{(h_{01}-h_{11})}{h_{01}}\right]$$

$$= \frac{MF_{x1}}{a(h_{01})(h_{00}+h_{11})}\left[-h_{11}\cdot h_{10} + h_{00}h_{01} - h_{00}h_{01} + h_{01}h_{11} - h_{01}\cdot h_{00} + h_{11}^2\right]$$

$$= \frac{MF_{x1}}{a}\left[\frac{-h_{11}(h_{10}+h_{00}-h_{01}) + h_{00}h_{11} - h_{01}\cdot h_{00} + h_{11}^2}{h_{01}(h_{00}+h_{11})}\right]$$

$$= 0 \qquad \underline{\text{OK.}}$$

Load on Post at (0,0)

$$-\tilde{\tau}_{s1}\cdot\frac{h_{10}}{h_{00}}\cdot h_{00} - \tilde{\tau}_{r1}\cdot\frac{h_{01}}{h_{00}}\cdot h_{00} + \frac{MF_{x1}}{h_{00}}\cdot\frac{(h_{00}-h_{10})}{a}$$

$$= +\frac{MF_{x1}}{a(h_{00}+h_{11})}\left[\frac{h_{11}}{h_{00}}\cdot h_{10} - h_{01} + \frac{(h_{00}-h_{10})(h_{00}+h_{11})}{h_{00}}\right]$$

$$= \frac{MF_{x1}}{a(h_{00}+h_{11})h_{00}}\left[h_{11}h_{10} - h_{01}\cdot h_{00} + h_{00}^2 + h_{00}\cdot h_{11} - h_{10}\cdot h_{00} - h_{10}h_{11}\right]$$

$$= \frac{MF_{x1}}{a(h_{00}+h_{11})h_{00}}\cdot\left[-h_{00}^2 - h_{00}h_{11} + h_{00}h_{10} + h_{00}^2 + h_{00}h_{11} - h_{10}h_{00}\right]$$

$$= 0 \qquad \underline{\text{OK}}$$

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§§2

By comparison, the shears due to the other Bi-Moments may be evaluated.

9 SUMMARY

Bi-Moment / Shear Flow	MF_{x_1}	MF_{x_2}	MF_{y_1}	MF_{y_2}
τ_p	$-\frac{1}{a(h_{00}+h_{11})}$	$+\frac{1}{a(h_{00}+h_{11})}$	$-\frac{1}{b(h_{00}+h_{11})}$	$+\frac{1}{b(h_{00}+h_{11})}$
τ_{r_1}	$\frac{1}{a(h_{00}+h_{11})}$	$-\frac{1}{a(h_{00}+h_{11})}$	$-\frac{1}{b(h_{00}+h_{11})}\cdot\frac{h_{11}}{h_{00}}$	$+\frac{1}{b(h_{00}+h_{11})}\cdot\frac{h_{10}}{h_{01}}$
τ_{r_2}	$-\frac{1}{a(h_{00}+h_{11})}$	$+\frac{1}{a(h_{00}+h_{11})}$	$+\frac{1}{b(h_{00}+h_{11})}\cdot\frac{h_{01}}{h_{10}}$	$-\frac{1}{b(h_{00}+h_{11})}\cdot\frac{h_{00}}{h_{11}}$
$\tilde{\tau}_{s_1}$	$-\frac{1}{a(h_{00}+h_{11})}\cdot\frac{h_{11}}{h_{00}}$	$+\frac{1}{a(h_{00}+h_{11})}\cdot\frac{h_{01}}{h_{10}}$	$+\frac{1}{b(h_{00}+h_{11})}$	$-\frac{1}{b(h_{00}+h_{11})}$
$\tilde{\tau}_{s_2}$	$+\frac{1}{a(h_{00}+h_{11})}\cdot\frac{h_{10}}{h_{01}}$	$-\frac{1}{a(h_{00}+h_{11})}\cdot\frac{h_{00}}{h_{11}}$	$-\frac{1}{b(h_{00}+h_{11})}$	$+\frac{1}{b(h_{00}+h_{11})}$

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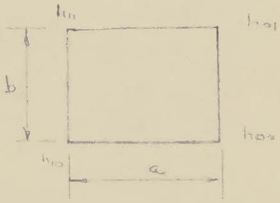
§3

10 CONSIDER PANELS THAT ARE NOT FLAT.

WHEN THE PANEL IS NOT FLAT SOME CORRECTION MUST BE INTRODUCED. IT IS PROPOSED TO MODIFY THE CELL TO OBTAIN FLAT PANELS. THIS CAN ONLY BE DONE WHERE THE DIFFERENCE TO A PLANE ARE SLIGHT.



THE NEW HEIGHTS WILL BE FOUND BY SETTING A PLANE IN SPACE SUCH THAT THE SUM OF THE SQUARES OF THE DIFFERENCE IN HEIGHT AT THE FOUR CORNERS IS A MINIMUM.

EQN OF PLANE $Z = Ax + By + C$.

$$E^2 = (h_{00} - C)^2 + (h_{10} - Aa - C)^2 + (h_{10} - Bb - C)^2 + (h_{11} - Aa - Bb - C)^2$$

	A	B	C	h_{00}	h_{01}	h_{10}	h_{11}
$\partial E^2/\partial A = 0 =$	$-2a^2$	$-ba$	$-2a$	—	—	a	a
$\partial E^2/\partial B = 0 =$	$-ab$	$-2b^2$	$-2b$	—	b	—	b
$\partial E^2/\partial B = 0 =$	$-2a$	$-2b$	-4	1.0	1.0	1.0	1.0

FROM WHICH

0 =	$-2a$	—	—	-1.0	-1.0	$+1.0$	$+1.0$
0 =	—	$2b$	—	-1.0	$+1.0$	-1.0	$+1.0$
0 =	—	—	4	-3.0	-1.0	-1.0	$+1.0$

M 1310A

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§8.3

Then substituting in Eqn of Plane, we obtain

$$Z_{00} = \frac{3h_{00} + h_{01} + h_{10} - h_{11}}{4} = h_{00} + \left[\frac{\frac{h_{01}+h_{10}}{2} - \frac{h_{00}+h_{11}}{2}}{2}\right]$$

$$Z_{10} = \frac{h_{00} - h_{01} + 3h_{10} + h_{11}}{4} = h_{10} - \left[\frac{\frac{h_{01}+h_{10}}{2} - \frac{h_{00}+h_{11}}{2}}{2}\right]$$

$$Z_{01} = \frac{h_{00} + 3h_{01} - h_{10} + h_{11}}{4} = h_{01} - \left[\frac{\frac{h_{01}+h_{10}}{2} - \frac{h_{00}+h_{11}}{2}}{2}\right]$$

$$Z_{11} = \frac{-h_{00} + h_{01} + h_{10} + 3h_{11}}{4} = h_{11} + \left[\frac{\frac{h_{01}+h_{10}}{2} - \frac{h_{00}+h_{11}}{2}}{2}\right]$$

Substitute these values in the Eq'ns of Pg 5-12 keeping the same subscripts. Ref.

$$Z_{00} + Z_{11} = \frac{h_{00} + h_{01} + h_{10} + h_{11}}{2}$$

⋮

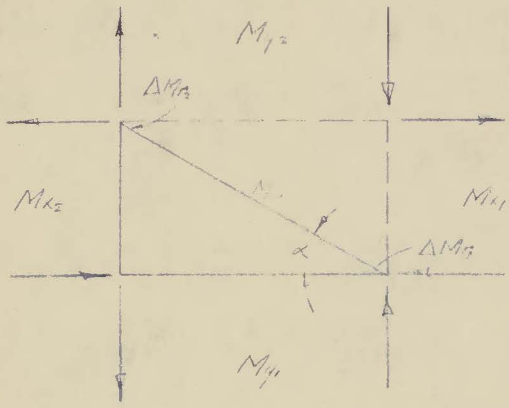
A. V. ROE CANADA LIMITED
MALTON - ONTARIO
TECHNICAL DEPARTMENT (Aircraft)

AIRCRAFT:		REPORT NO. [illegible]
C105	Fin	SHEET NO. 5.17

PREPARED BY	DATE
E.B.	Nov. 5[illegible]
CHECKED BY	DATE

3.4

LEADING EDGE.



$$\Delta M_{T_2} = \frac{1}{2}\left(M_{x_2}\cos\alpha - M_{y_2}\sin\alpha\right)$$

$\frac{1}{2}$ Taken to allow to effects of lumping.

$$\Delta M_{T_1} = \frac{1}{2}\left(M_{x_1}\cos\alpha - M_{y_1}\sin\alpha\right)$$

TORSION POSITIVE

$$M_T = -\frac{1}{2}\left(M_{y_2} + M_{y_1}\right)\sin\alpha + \frac{1}{2}\left(M_{x_2} + M_{x_1}\right)\cos\alpha \quad (1)$$

$$M_N = \frac{1}{2}\left(M_{y_2} + M_{y_1}\right)\cos\alpha + \frac{1}{2}\left(M_{x_2} + M_{x_1}\right)\sin\alpha = 0 \quad (2)$$

See 9041/1040/376 p. 34

Multiplying (1) by $\sin\alpha$ & (2) by $\cos\alpha$ & subtracting

(1) by $\cos\alpha$ & (2) by $\sin\alpha$ & adding

we obtain

$$M_T\sin\alpha = -\frac{1}{2}\left(M_{y_2} + M_{y_1}\right)\left(\sin^2\alpha + \cos^2\alpha\right) = -\frac{1}{2}\left(M_{y_2} + M_{y_1}\right)$$

$$M_T\cos\alpha = \frac{1}{2}\left(M_{x_2} + M_{x_1}\right)\left(\cos^2\alpha + \sin^2\alpha\right) = \frac{1}{2}\left(M_{x_2} + M_{x_1}\right)$$

Then a) $M_{y_2} = -M_{y_1} - 2M_T\sin\alpha$

$M_{x_1} = -M_{x_2} + 2M_T\cos\alpha$

If M_T [illegible] is

b) $M_{y_2} = -M_{y_1} - \left(M_{x_2} + M_{x_1}\right)\tan\alpha$

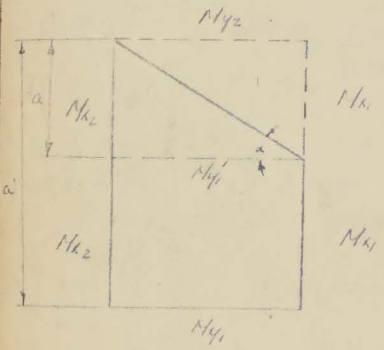
If M_{x_1} is known.

M 5319A

§§4

Now, Consider a Trapezoidal Cell:

set $a/a' = m$



$$\begin{cases} M_{y_1}' = m M_{y_1} + (1-m) M_{y_2} \\ M_{y_2} = -M_{y_1}' - (M_{x_2}+M_{x_1}) \tan\alpha \end{cases}$$

$$\begin{cases} M_{y_1}' - (1-m) M_{y_2} = m M_{y_1} \\ M_{y_1}' + M_{y_2} = -(M_{x_2}+M_{x_1}) \tan\alpha \end{cases}$$

$$(-2+m) M_{y_2} = m M_{y_1} + (M_{x_2}+M_{x_1}) \tan\alpha$$

$$\Delta M_{r_2} = \frac{1}{2}\left(M_{x_2}\cos\alpha - M_{y_2}\sin\alpha\right)$$

$$\Delta M_{r_1} = \frac{1}{2}\left(M_{x_1}\cos\alpha - M_{y_1}'\sin\alpha\right)$$

Substitute for M_{y_2}, M_{y_1}'

$$M_{y_2} = -\frac{m M_{y_1} + (M_{x_2}+M_{x_1})\tan\alpha}{(+2-m)}$$

$$M_{y_1}' = \frac{m M_{y_1} + (M_{x_2}+M_{x_1})\tan\alpha}{(+2-m)} - (M_{x_2}+M_{x_1})\tan\alpha$$

$$= \frac{m M_{y_1} - (1-m)(M_{x_2}+M_{x_1})\tan\alpha}{(2-m)}$$

$$\Delta M_{r_2} = \frac{1}{2}\left(M_{x_2}\cos\alpha + \left(\frac{m M_{y_1} + M_{x_2} + M_{x_1})\tan\alpha}{(2-m)}\right)\sin\alpha\right)$$

$$\Delta M_{r_1} = \frac{1}{2}\left(M_{x_1}\cos\alpha - \left(\frac{m M_{y_1} - (1-m)(M_{x_2}+M_{x_1})\tan\alpha}{2-m}\right)\sin\alpha\right)$$

A. V. ROE CANADA LIMITED
MALTON · ONTARIO
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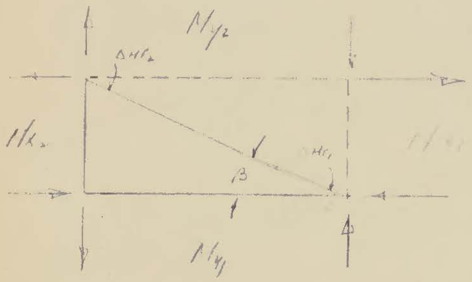
REPORT No. 71/0270/10	SHEET No. 5-18	
AIRCRAFT: C105	Fin.	
PREPARED BY: C.P.	DATE: Nov 57	
CHECKED BY:	DATE:	

§5.4

Foundation Effects.



following pg 5-17

$$\Delta_{T_1} = \frac{1}{2}\left(M_{x_1}\cos\beta - M_{y_1}\sin\beta\right)$$

$$\Delta_{T_2} = \frac{1}{2}\left(M_{x_2}\cos\beta - M_{y_2}\sin\beta\right)$$

$$M_T = \frac{1}{2}\left(M_{y_2}+M_{y_1}\right)\cos\beta + \frac{1}{2}\left(M_{x_2}+M_{x_1}\right)\sin\beta$$

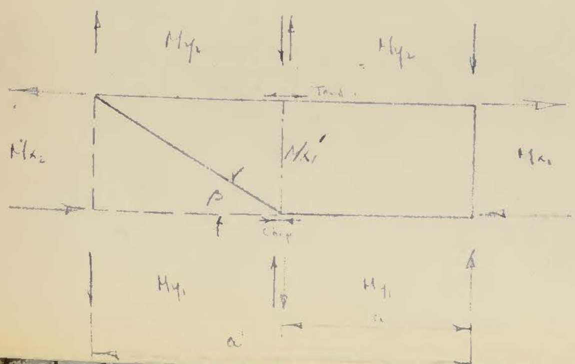
Now Reversing sign of considering top.

$$\Delta_{T_1} = -\frac{1}{2}\left(M_{x_1}\cos\beta - M_{y_1}\sin\beta\right)$$

$$\Delta_{T_2} = -\frac{1}{2}\left(M_{x_2}\cos\beta - M_{y_2}\sin\beta\right)$$

$$M_T = -\frac{1}{2}\left(M_{y_2}+M_{y_1}\right)\cos\beta - \frac{1}{2}\left(M_{x_2}+M_{x_1}\right)\sin\beta$$

Now the Trapezoidal Panel.



$$\frac{a}{a'} = n.$$

$$M_{x_1}' = n M_{x_2} + (1-n) M_{x_1}$$

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

AIRCRAFT:		REPORT NO. 70/510/10	
C105	Fus.	SHEET NO. 5-22	
		PREPARED BY	DATE
		CB	Nov 55
		CHECKED BY	DATE

§ 5.4

Then

$$\Delta r_1 = -\frac{1}{2}\left(M_{x_1}'\cos\beta - M_{y_1}\sin\beta\right)$$

$$= -\frac{1}{2}\left(\left[(1-m)M_{x_1} + mM_{x_2}\right]\cos\beta - M_{y_1}\sin\beta\right).$$

$$\Delta r_2 = -\frac{1}{2}\left(M_{x_2}\cos\beta - M_{y_2}\sin\beta\right)$$

$$M_h = -\frac{1}{2}\left(M_{y_2} + M_{y_1}\right)\cos\beta - \frac{1}{2}\left(M_{x_2} + M_{x_1}'\right)\sin\beta$$

$$= -\frac{1}{2}\left(M_{y_2} + M_{y_1}\right)\cos\beta - \frac{1}{2}\left(M_{x_2}(1+m) + (1-m)M_{x_1}\right)\sin\beta$$

	M_{x_1}	M_{x_2}	M_{y_1}	M_{y_2}
Δr_1	$-\frac{(1-m)}{2}\cos\beta$	$-\frac{m}{2}\cos\beta$	$+\frac{\sin\beta}{2}$	—
Δr_2	—	$-\frac{\cos\beta}{2}$	—	$\frac{\sin\beta}{2}$
M_h	$-\frac{(1-m)}{2}\sin\beta$	$-\frac{(1+m)}{2}\sin\beta$	$-\frac{\cos\beta}{2}$	$-\frac{\cos\beta}{2}$

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

REPORT NO. 7/0510/10
SHEET No 5-23

AIRCRAFT: C105 | Fin.

PREPARED BY	DATE
C.B.	Nov. 55.
CHECKED BY	DATE

§§4

FOR TRIANGULAR PANEL ON CASE

	M_{x_1}	M_{x_2}	M_{y_1}	M_{y_2}
Δr_1	$-\frac{\cos\beta}{2}$	/	$+\frac{\sin\beta}{2}$	/
Δr_2	/	$-\frac{\cos\beta}{2}$	/	$\frac{\sin\beta}{2}$
M_n	$-\frac{\sin\beta}{2}$	$-\frac{\sin\beta}{2}$	$-\frac{\cos\beta}{2}$	$-\frac{\cos\beta}{2}$

$\frac{\cos\beta}{2} = .346\ 664 \qquad \frac{\sin\beta}{2} = .360\ 310.$

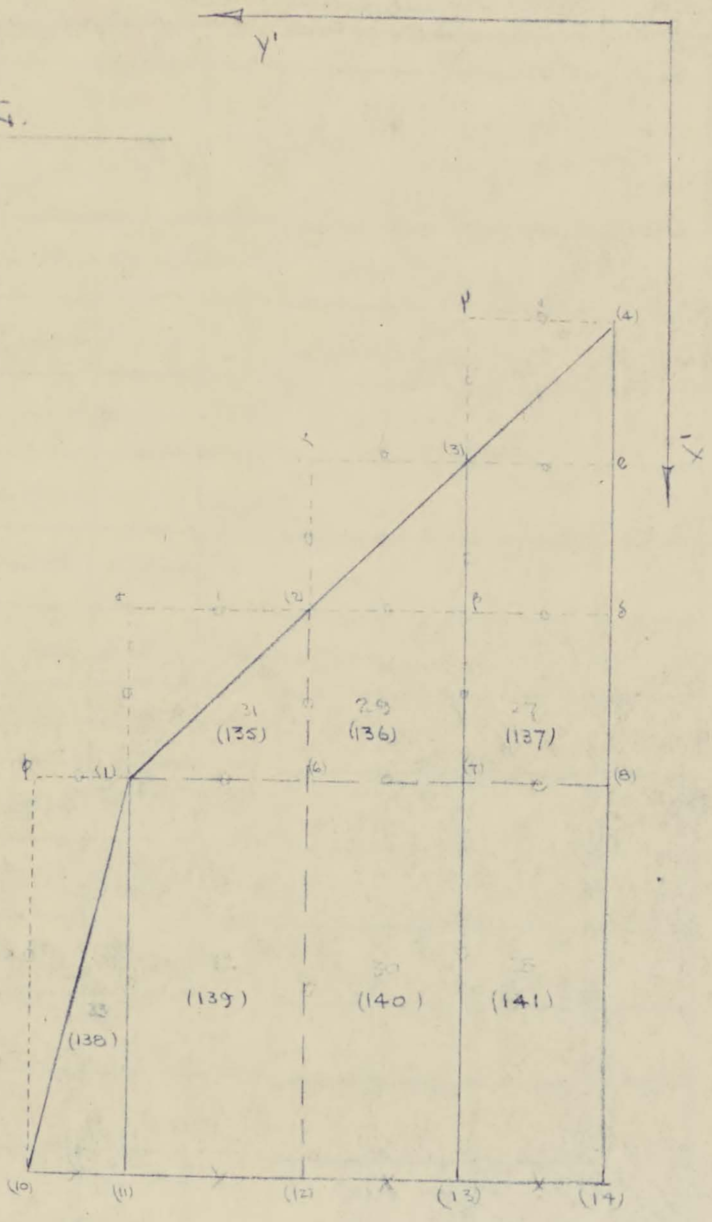
FM 1319 A

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

REPORT NO. 7/0510/10			
SHEET NO. 5-24			
AIRCRAFT: C105	FIN ANALYSIS.	PREPARED BY: C.B	DATE: OCT 55'
		CHECKED BY	DATE

§§ 5

UPPER FIN.



A. V. ROE CA[...]

MALTON

TECHNICAL [...]

AIRCRAFT -

WEIGHT -

C. G. POSITION -

§§5: Shear-Flows Due to NF Groups.

	1	2	3	4	5	6	7	8	9	10	11
Cell Panel No.	$\frac{h_{00}}{2}$	$\frac{h_{10}}{2}$	$\frac{h_{11}}{2}$	$\frac{h_{01}}{2}$	α'	γ'	$2h_{avg}$	q due to NF_1-NF_4	q due to NF_1-NF_2	$2Z_{00}$ / $2Z_{10}$	$2Z_{11}$ / $2Z_{01}$
142	1.8547	2.5768	1.6729	1.1508	27.79997	12.820745	7.0552	.00509864	.0110.96 [illegible]	7.4188 / 9.5[illegible]	6.6916 / 4.1032
146	2.3765	3.6[illegible]	1.9[illegible]	1.5264	20.00[illegible]	17.799742	8.4904	.00592398	.0065615	9.[illegible]72 / 10.7752	7.[illegible]36 / 6.1[illegible]

FORM 1543

A. V. ROE C[O.]
MALT[ON]
TECHNICA[L]

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

555 Shear Flows Due To MF Groups

	1	2	3	4	5	6	7	8	9	10	11	
Cell Panel N°	$\frac{h_{00}}{2}$	$\frac{h_{10}}{2}$	$\frac{h_{11}}{2}$	$\frac{h_{01}}{2}$	x'	y'	$2h_{avg}$	q due to MF_x-MF_z	q due to MF_y-MF_z	$2Z'_{00}$ / $2Z_{10}$	$2Z_{11}$ / $2Z_{01}$	q
36 (154)	2.1390	2.3558	2.7161	2.4877	24.7 —	9.5 —	9.6930	.0041744	[illegible]	8.[illegible]44 / 9.4348	10.8[illegible]23 / 9.9624	+ / [illegible]
37 (159)	2.3558	2.5753	2.9429	2.7161	25.0 —	9.5 —	10.5901	.0037774	.009[illegible]	9.4159 / 10.3[illegible]5	11.7643 / 10.5[illegible]	+ / [illegible]
38 (153)	2.4877	2.7161	2.9709	2.7036	24.7 —	10.0 —	10.9[illegible]	.00372[illegible]	.00[illegible]8261	9.9[illegible]9 / 10.9033	11.8447 / 10.853[illegible]	+ / [illegible]
39 (158)	2.7161	2.9429	3.2291	2.9707	25.0 —	10.0 —	11.8588	.00351302	.00843256	[illegible]2 / 11.[illegible]3	12.[illegible]48 / 11.9144	+ / [illegible]
40 (152)	2.7036	2.9709	3.0450	2.6938	24.7 —	11.62 —	11.41[illegible]3	[illegible]	[illegible]	10.73[illegible] / 11.9[illegible]5	12.0[illegible]61 / [illegible]	+ / .00
41 (157)	2.9709	3.2291	3.3686	3.0450	25.0 —	11.62 —	12.6136	.0031711[illegible]	[illegible]	11.[illegible] / 12.[illegible]	12.40[illegible] / 12.2454	+ / .00
42 (151)	2.6938	3.0450	2.5196	1.8434	24.7 —	17.799742	10.1[illegible]	[illegible]	[illegible]	[illegible] / 12.[illegible]	9.[illegible] / 7.6986	+ / [illegible]
43 (156)	3.0450	3.3686	3.0572	2.5196	25.0 —	17.799742	11.[illegible]4	.00335[illegible]	[illegible]	11.[illegible] / 13.[illegible]	12.0208 / 10.2044	+ / [illegible]
44 (150)	1.8434	2.5196	2.05[illegible]	1.3777	24.7 —	6.112012	7.7946	.005194[illegible]	[illegible]	[illegible] / 10.[illegible]	[illegible]156 / 5.[illegible]	+ / [illegible]
45 (155)	2.5196	3.0592	2.2670	1.58[illegible]5	25.0 —	12.2[illegible]	[illegible]	.0042425[illegible]	[illegible]	8.[illegible]35 / 1[illegible].3817	8.[illegible] / [illegible].4749	+ / [illegible]

FORM 1543

AVRO

TECHNICAL D

AIRCRAFT -

WEIGHT -

C. G. POSITION -

5.5.5. SHEAR FLOWS DUE TO MF GROUPS

CELL PANEL NO	1	2	3	4	5	6	7	8	9	10	11	12
	$\frac{h_{00}}{2}$	$\frac{h_{10}}{2}$	$\frac{h_{11}}{2}$	$\frac{h_{01}}{2}$	x'	y'	$2 \cdot h_{avg}$	γ DUE TO MF_{x_2}/MF_{x_1}	γ DUE TO MF_{y_2}/MF_{y_1}	$2Z_{00}$ / $2Z_{10}$	$2Z_{11}$ / $2Z_{01}$	Z_{00} − … MF …
37 (164)	2.5753	2.7333	3.1042	2.9429	18.00	9.50	11.3557	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
38 (169)	2.7333	2.8913	3.2642	3.1042		9.50	11.9930	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
39 (163)	2.9429	3.1042	3.4247	3.2271		10.00	12.7009	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
40 (168)	3.1042	3.2642	3.5856	3.4247		10.00	13.3787	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
41 (162)	3.2291	3.4247	3.5874	3.3686		11.62	13.6078	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
42 (167)	3.4247	3.5856	3.7968	3.5874		11.62	14.3945	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
43 (161)	3.3686	3.5874	3.3938	3.0592		17.779742	13.4090	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
44 (166)	3.5874	3.7968	3.6991	3.3938	18.00	17.779742	14.4771	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
45 (160)	3.0592	3.3938	2.4204	2.0858	"	[illegible]	10.5?72	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
46 (165)	3.3938	3.6991	2.8734	2.2601	"	21.7?452	11.9344	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
												Eo

FORM 1843

A. V. ROE C
MALT
TECHNICA

AIRCRAFT -
WEIGHT -
C. G. POSITION -

5.55 Shear Flows Due to MF Ground

Cell Panel No.	1 $\frac{h_{00}}{2}$	2 $\frac{h_{10}}{2}$	3 $\frac{h_{11}}{2}$	4 $\frac{h_{01}}{2}$	5 X'	6 Y'	7 $\frac{2h_x}{C}$	8 q [illegible] + (M − M)	9 q [illegible] / (M − M)	10 $\frac{2Z_{..}}{2Z_{10}}$	11 $\frac{2Z_{11}}{2Z_{01}}$	12
170	[illegible]	[illegible]	[illegible]	CALC 1.9649	27.741437	[illegible]	[illegible]	[illegible]	[illegible]	10.[illegible] 13.[illegible]	11.[illegible] 7.[illegible]	
171	3.6971	4.16[illegible]	[illegible]	3.5934	27.741437	[illegible]	[illegible]	.0024[illegible]	[illegible]	14.3136 17.0444	[illegible] 7.6764	+
172	3.7963	4.1293	4.1604	3.6771	27.741437	17.797712	15.7850	[illegible]	[illegible]	15.0564 16.6460	16.5125 14.9252	+
173	3.5356	3.7660	4.1297	3.1968	27.741437	11.6[illegible]	15.2777	[illegible]	[illegible]	14.1703 15.2161	16.3651 15.5713	+
174	3.2642	3.3450	3.7660	3.5356	29.94[illegible]	[illegible]	15.9603	.00273231	[illegible]	12.9372 13.4796	14.7674 14.4420	+
175	2.9713	2.7721	3.3450	3.2642	7.14[illegible]	[illegible]	12.4726	[illegible]	[illegible]	11.5652 11.8884	13.39[illegible] 13.0568	+
176	3.4[illegible]	4.2998	3.1487	2.9766	37.52[illegible]76	[illegible]	15.1728	[illegible]	[illegible]	13.75[illegible] 17.1592	12.5156 9.1864	+
177	4.1604	5.0127	4.2[illegible]	3.4375	37.5[illegible]76	[illegible]206452	16.9004	[illegible]	[illegible]	16.6416 20.0508	17.1592 13.7500	+
178	4.1293	4.3736	4.4047	4.1604	17.125643	17.7[illegible]	17.0650	[illegible]	[illegible]157	16.5172 17.4944	17.6198 16.6416	+
179	4.2998	[illegible] 5-33 4.0259	3.7298	[illegible] 5-33 2.7727	21.2[illegible]667	[illegible]912423	15.2366	.00911376	[illegible]97517	17.1672 19.3036	13.7140 11.1696	+

FORM 1543

A. V. ROE CANADA LIMITED
MALTON - ONTARIO

TECHNICAL DEPARTMENT (Aircraft)

REPORT NO. 7/0510/10			
SHEET NO 5-32			
AIRCRAFT:	FIN	PREPARED BY: CB	DATE: FEB 56
		CHECKED BY: RM [illegible]	DATE:

LEADING EDGE.

GROUP. 126.

$A_{CELL\ 2} = (2.4204 + 3.6991)\ 16.752355 = \underline{102.516\ 036}$

$A_{TOTAL} \quad 2.4204 \times 21.206\ 452 + 3.6991 \times 16.752355$

$+ 2.5734\ (21.206\ 452 - 16.752355) = \underline{124.758\ 906}$

RATIOS .821 713 & .178 287

GROUP 122.

$A_{②} = (2.2670 + 3.3938)\ 12.298\ 257 = 69.617\ 97$

$A_T = 2.2670 \times 16.752\ 355 + 3.3938 \times 12.298\ 257$

$+ 2.4204\ (16.752\ 355 - 12.298\ 257) = 90.496\ 112$

RATIOS .769 292 230 708

RM 1319A

BASE TRANSFORMATION.

DUE TO THE DIFFICULTIES OF PREDICTING AREAS IN THE BASE RIB REGION, THESE STRESS POINTS WILL BE NEGLECTED.

THEN ONLY THE BASE POINTS 271 TO 277 NEED BE CONSIDERED. REDUNDANTS 201 TO 224 TRANSFORM TO REDUNDANTS 61 TO 85.

FOLLOWING PAGE 5-21 & GIVING SIGNS AS REQUIRED, THE LOAD MATRIX CAN BE IMMEDIATELY DETERMINED.

FROM PAGE FOR CASE, THE "1/2AR" DIAGONAL MATRIX CONSISTS EVERYWHERE ON THE DIAGONAL AS .1

THEN, IMMEDIATELY, WE MAY WRITE THE STRESS MATRIX BY TAKING .1 TIMES THE MOMENT VALUES.

For Part 2 of Kip

	201	202	203	204	205	206	207	208	209	210	211	212
271												
272												
273												
274									+.034666	+.036031	+.034666	+.036031
275					+.034666	+.036031	+.034666	+.036031	−.034666	−.036031	−.034666	−.036031
276	+.034666	+.036031	+.034666	+.036031	−.034666	−.036031	−.034666	−.036031				
277	−.034666	−.036031	−.034666	−.036031								
Check Sums.	/	/	/	/	/	/	/	/	/	/	/	/

G"md

Supervised By: [signature]

Date.

Prepared By: [signature]

Checked By: [signature]

8	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223
													+ .034 666	+ .036 031	+ .0346
									+ 034 666	+ 036 031	+ .034 666	+ 036 031	− .034 666	− .036 031	− .034 66
					+ .034 666	+ .036 031	+ .034 666	+ .036 031	− .034 666	− .036 031	− .034 666	− .036 031			
	+ 034666	+ .036 031	+ .034666	+ .036031	− .034 666	− .036 031	− .034 666	− .036031							
31	− .034 666	− .036 031	− .034 666	− .036031											
\															
	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

WEBS

PREP…
CHECK…

23 24 25 26 27 28 29 30 31 32 33 34 35 36

+ .00942484 — .00377711

— .01002989 + .00835386 — .00337302

+ .00420540 — .00453577 — .00787346 + .01419674 — .00632329 — .00375722 + .00401526

+ .00395794 — .00428033 — .00747437 + .01346314 — .00597857 — .00359499

+ .00256311

+ 1.1852693 — .47501795

— 1.4137118 + 1.1774756 — .47542680

+ .29622294 — .31949377 — .55459634 + 1. — .44840366 — .26465377 + .28282972

+ .29420196 — .31816587 — .55560046 + 1. — .44439960 — .26727312

+ .20030776

3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
95202	+ 02524626	− 01229424	− 00447446	+ 00350227										
			+ 00434912	− 00455727	− 01119858	+ 02094010	− 00974152	− 00329554	+ 00306986					
								+ 00504441	− 00531516	− 01008512	+ 01843222	− 00839710		− 00426438
													− 00417440	
														− 00372170

3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
02728	+ 1.	− 48697272	− 17723259	+ 13872431										
			+ 20769337	− 21763363	− 53479114	+ 1.	− 46520884	− 15137939	+ 14660197					
								+ 27367349	− 28636244	− 54443361	+ 1.	− 45556639		− 23135416
													− 52498205	
														− 52451320

FLOWS IN [illegible] Y WEBS
PART 3

13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
3512	+ 01843222	− 00839710		− 00426438	+ 00429374									
			− 00417440			− .00854490		+ 00795151		+ .00942484		− 00377711		
				− 00372170		+ .00915045	− 00769257		+ 00709472	− .010 02989	+ 00835886		− 00337302	
													+ 00420540	− 00453577 .00

13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
43361	+ 1.	− 45556639		− 23135466	+ 23294752									
			− 52498205			− 1.0746260		+ 1.		+ 1.1852893		− 47501795		
				− 52451320		+ 1.2897549	− 1.0842668		+ 1.	− 1.4137118	+ 1.1774756		− .47542680	
													+ .29622294	− .31949377 55

PREPARED

CHECKED.

23 24 25 26 27 28 29 30 31 32 33 34 35 36 37

484 − 00377711

989 + 00835886 − 00337302

+ 00420540 − 00453577 − 00787346 + 01419674 − 00632328 − 00375722 + 00401526

+ 00395794 − 00428033 − 00747407 + 01346314 − 00597857 − 00359499 + 00386143

+ 00256311 − 00251879 00

13 − 47501795

18 + 1.1774756 − .47542680

+ .29622294 − .31949377 − .55459634 + 1. − .44840366 − .26465377 + .28282972

+ .29420195 − .31816587 − .55560040 + 1. − .44439960 − .26722312 + .28702816

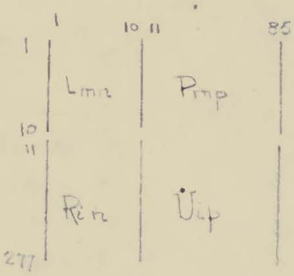
+ .20030776 − .19684414 − .55

A. V. ROE CANADA LIMITED MALTON ONTARIO **TECHNICAL DEPARTMENT (Aircraft)**	REPORT No 7/0510/10 SHEET No 5-56	
AIRCRAFT: C105	PREPARED BY: C.B.	DATE: April '56
	CHECKED BY	DATE

Establishing the $K^{\dagger}_{ip}$ Matrix.

1. Add: $J_{ip} = J'_{ip} + J''_{ip} + J'''_{ip} + J^{iv}_{ip}$

2. Split J_{ip} into:



3. Invert L_{mn} to L^{-1}_{nm}

4. Multiply $V_{np} = - L^{-1}_{nm} P_{mp}$

5. Multiply: $W_{ip} = R_{in} V_{np} = - R_{in} L^{-1}_{nm} P_{mp}$

6. Add: $K^{\dagger}_{ip} = W_{ip} + U_{ip}$.

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

REPORT No. 7/0510/10		SHEET No. 6 - 1	
AIRCRAFT: C 105	FIN	PREPARED BY: G. Gunderson	DATE: DEC 55
		CHECKED BY	DATE

INDEX

SECTION 6
STATICALLY DETERMINANT LOAD PATHS

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

REPORT NO. 7/510/10
SHEET NO. 6-2

AIRCRAFT:		PREPARED BY	DATE
C105	FIN	[illegible signature]	
		CHECKED BY	DATE

STRESSES IN STATICALLY DETERMINANT LOAD PATHS DUE TO UNIT LOADS

SPAR #1 REF

STRESS PT	LOAD PT.	L DIST. L.P. TO S.P.	γ FIN $\frac{1}{2}h$	A BOOM AREA	$f_B = \frac{L}{2\gamma A}$
16	4	29.94144	1.5975	.911	10.901016
26	↓	54.074164	1.7394	.990	15.8835546
36	↓	81.874164	1.9534	1.08	19.3056460
48	↓	101.874164	2.1390	1.13	21.073896
60	↓	126.574154	2.3558	1.24	21.6648141
72	↓	151.574164	2.5753	1.82	16.1674766
84	↓	169.574164	2.7333	2.18	14.2293770
98	4	187.574164	2.8913	2.43	13.3488419
26	8	24.132122	1.7174	.990	7.0886605
36	↓	51.932722	1.9634	1.08	12.2455570
48	↓	71.932722	2.1390	1.13	14.8801486
60	↓	96.632722	2.3558	1.24	16.5399470
72	↓	121.632722	2.5753	1.82	12.9754134
84	↓	139.632722	2.7333	2.18	11.7169185
98	8	157.632722	2.8913	2.43	11.2180370
36	14	27.800000	1.9634	1.08	6.5551443
48	↓	47.800000	2.1390	1.13	9.8880048
60	↓	72.500000	2.3558	1.24	12.4093178
72	↓	97.500000	2.5753	1.82	10.4010073
84	↓	115.500000	2.7333	2.18	9.6918837
98	14	133.500000	2.8913	2.43	9.5006175
48	20	20.000000	2.1390	1.13	4.1372435
60	↓	44.700000	2.3558	1.24	7.6509563
72	↓	69.700000	2.5753	1.82	7.4353868
84	↓	87.700000	2.7333	2.18	7.3591156
98	20	105.700000	2.8913	2.43	7.5222117

FORM 1319A

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

AIRCRAFT:		REPORT No. 7/0510/10	
C 105	FIN	SHEET No. 6-3	
		PREPARED BY	DATE
		L Gundersen	
		CHECKED BY	DATE

BENDING STRESSES
IN STATICALLY DETERMINANT LOAD PATHS
DUE TO UNIT LOADS

	STRESS PT.	LOAD PT.	L DIST. L.P. TO S.P.	z FIN ½ h	A BOOM AREA	$f_B = \frac{L}{2 \cdot z \cdot A}$
SPAR #1 REF	60	26	24.700000	2.3558	1.24	4.2277262
	72	↓	49.700000	2.5753	1.82	5.3018468
	84	↓	67.700000	2.7333	2.18	5.6808703
	98	26	85.700000	2.8913	2.43	6.0988984
	72	33	25.000000	2.5753	1.82	2.6669249
	84	33	43.000000	2.7333	2.18	3.6082337
	98	33	61.000000	2.8913	2.43	4.3411061
	84	40	18.0000000	2.7333	2.18	1.51042341
	98	40	36.000000	2.8913	2.43	2.5619643
	98	47	18.000000	2.8913	2.43	1.28098213
REF SPAR #3	15	3	20.801220	1.7782	1.41	4.1481942
	25	↓	44.933942	2.0277	1.53	7.2418478
	35	↓	72.733942	2.2993	1.66	9.5280363
	47	↓	92.733942	2.4877	1.78	10.4710617
	59	↓	117.433942	2.7161	1.87	11.5604910
	71	↓	142.433942	2.9429	2.30	10.5215604
	83	↓	160.433942	3.1042	2.67	9.6784385
	97	↓	178.433942	3.2642	3.56	7.6775157
	111	3	187.574164	3.3450	3.72	7.5370945
	25	7	24.132722	2.0277	1.53	3.8893871
	35	↓	51.932722	2.2993	1.66	6.8031079
	47	↓	71.932722	2.4877	1.78	8.1222906
	59	↓	96.632722	2.7161	1.87	9.51276691
	71	↓	121.632722	2.9429	2.30	8.9849794
	83	↓	139.632722	3.1042	2.67	8.4235712
	97	7	[illegible]	3.2642	3.56	[illegible]

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

REPORT No. 7/0510/10	
SHEET No. 6.4	
PREPARED BY	DATE
C. Gunderson	Oct 55
CHECKED BY	DATE

AIRCRAFT: C105 — FIN

BENDING STRESSES

IN STATICALLY DETERMINANT LOAD PATHS
DUE TO UNIT LOADS

STRESS PT.	LOAD PT	L DIST LP. TO S.P.	z FIN ½ h	A BOOM AREA	$f_B = \frac{L}{2zA}$
111	7	166.772944	3.3450	3.72	6.7012610
35	13	27.800000	2.2997	1.66	3.6417578
47	↓	47.800000	2.4877	1.78	5.39734143
59	↓	72.500000	2.7161	1.87	7.1370814
71	↓	97.500000	2.9429	2.30	7.2023010
83	↓	115.500000	3.1042	2.67	6.9677255
97	↓	133.50000	3.2642	3.56	5.7441332
111	13	142.640222	3.3450	3.72	5.7315614
47	19	20.000000	2.4877	1.78	2.25830186
59	↓	44.700000	2.7161	1.87	4.4003798
71	↓	69.700000	2.9429	2.30	5.1487219
83	↓	87.700000	3.1042	2.67	5.2906452
97	↓	105.700000	3.2642	3.56	4.5479766
111	19	114.840222	3.3450	3.72	4.6145034
59	25	24.700000	2.7161	1.87	2.4315298
71	↓	49.700000	2.9429	2.30	3.6713268
83	↓	67.700000	3.1042	2.67	4.0841126
97	↓	85.700000	3.2642	3.56	3.6874324
111	25	94.840222	3.3450	3.72	3.8108645
71	32	25.000000	2.9429	2.30	1.8467439
83	↓	43.000000	3.1042	2.67	2.5940450
97	↓	61.000000	3.2642	3.56	2.6246602
111	32	70.140222	3.3450	3.72	2.8183704
83	39	18.000000	3.1042	2.67	1.0858793
97	39	36.000000	3.2642	3.56	1.5489777
111	39	45.140222	3.3450	3.72	1.8138219

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

REPORT NO.	7/0510/10
SHEET NO.	6-8
AIRCRAFT:	C105
	FIN
PREPARED BY	L. Gunderson
DATE	NOV 55
CHECKED BY	
DATE	

BENDING STRESSES

IN STATICALLY DETERMINANT LOAD PATHS
DUE TO UNIT LOADS

STRESS PT	LOAD PT	L DIST L.P. TO S.A.	z FIN $\frac{1}{2}h$	A BOOM AREA	$f_B = \frac{L}{2zA}$
79	28	44.296 918	2.4204	1.144	7.998 901
92	↓	62.839 814	2.5734	.620	19.692 7272
103	↓	93.684 325	2.8290	.825	20.070 1233
115	↓	132.345 196	3.1489	1.32	15.9200851
118	28	154.063 632	3.3285	1.40	16.5300874
79	35	18.542 876	2.4204	1.144	3.348 3774
92	↓	37.085 792	2.5734	.620	11.6219386
103	↓	67.930 303	2.8290	.825	14.552 8033
115	↓	106.591 174	3.1489	1.32	12.822 0090
118	35	128.309 610	3.3285	1.40	13.7674210
92	42	18.542 896	2.5734	.620	5.8109593
103	↓	49.387 400	2.8290	.825	10.580 3329
115	↓	88.048 278	3.1489	1.32	10.5915146
118	42	109.766 714	3.3285	1.40	11.777797
115	53	38.660 871	3.1489	1.32	4.6505984
118	53	60.379 307	3.3285	1.40	6.4786054
118	56	21.718 436	3.3285	1.40	2.3303543
	⋮				
37	10	49.241 691	1.8434	1.525	8.758 173 3
85	10	137.526 479	2.5734	1.507	17.731 1041
37	16	20.603 218	1.8434	1.525	3.664 507 7
85	16	108.888 006	2.5734	1.507	14.038 784 2
85	28	62.839 814	↓	1.507	8.101 852 8
85	35	37.085 792	↓	1.507	4.781 4213
85	42	18.542 896	2.5734	1.507	2.390 7107

FORM 1319A

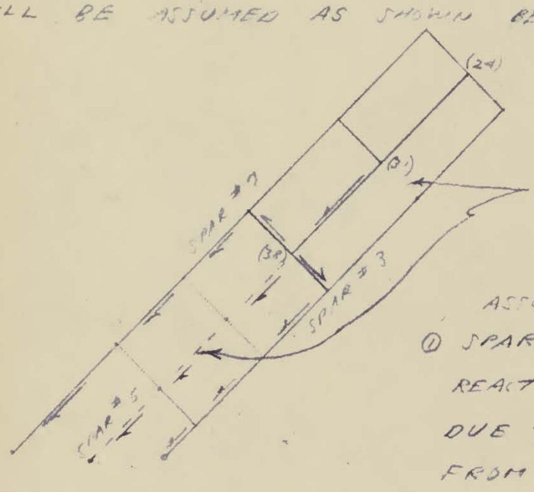
A. V. ROE CANADA LIMITED MALTON · ONTARIO **TECHNICAL DEPARTMENT (Aircraft)**		REPORT No. 7/0510/10 SHEET No. 6-9	
AIRCRAFT:		PREPARED BY	DATE
C105	FIN	Gunderson	OCT 55
		CHECKED BY	DATE

BENDING STRESSES
IN STATICALLY DETERMINANT LOAD PATH
SPAR #5

METHOD:

SINCE SPAR #5 HAS NO SHEAR WEB, ALONG MOST OF ITS LENGTH, LOADS WILL BE TRANSFERRED TO SPAR #3 AND SPAR #7 BY THE RIBS. THE RIBS ARE ASSUMED SIMPLY SUPPORTED AT SPAR #3 AND SPAR #7. STRESSES IN THESE SPARS WILL BE FACTORED DOWN FROM THE UNIT STRESSES IN PROPORTION TO THE RIB REACTION.

THE LOAD PATH FOR LOAD POINT 31 WILL BE ASSUMED AS SHOWN BELOW



ASSUMPTIONS

① SPAR #5 BELOW POINT (38) REACTS A CONSTANT MOMENT DUE TO OFFSET OF (31) FROM (38).

② RIB THROUGH (38) TRANSMITS SHEAR TO SPAR #7 & #3

FORM 1319A

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

AIRCRAFT		REPORT NO. 7/0510/10	
C105	FIN	SHEET NO. 6-10	
		PREPARED BY	DATE
		C. Guadagno	
		CHECKED BY	DATE

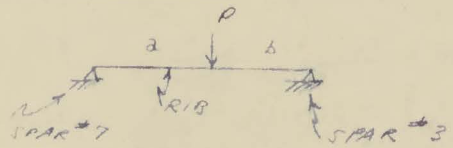
BENDING STRESSES

IN STATICALLY DETERMINANT LOAD PATH

SPAR #5

STRESSES IN RIBWISE BOOMS

$$M = \frac{P \times a \times b}{a + b}$$



(ASSUMING RIB SIMPLY SUPPORTED)

STRESS POINT	LOAD POINT	a	b	M. BENDING MOM	$\bar{z}$	A BOOM AREA	$f_B = \frac{M}{2 \bar{z} A}$
2	2	16.124 993	13.876 928	7.458 368	1.6086	.820	¯2.827 170
19	12	11.62	10.00	5.374 6531	2.1283	1.589	¯0.79462770
29	18			↓	2.4744	2.040	¯0.53237833
45	24				2.7036	2.390	¯0.41589156
64	38				3.2291	3.064	¯0.27161277
76	45				3.4247	2.87	¯0.27341102
89	51			5.374 653 1	3.5856	3.45	¯0.21723986

FORM 1318A

BENDING STRESSES

SPAR # 5

FACTORING BM STRESSES FROM UNIT ANALYSIS IN PROPORTION TO RIB REACTIONS.

REACTION ON SPAR # 7 = $\frac{P \times b}{a+b} = \frac{1. \times 10}{21.62} = 0.462\,53469$

REACTION ON SPAR # 3 = $\frac{P \times a}{a+b} = \frac{1. \times 11.62}{21.62} = 0.537\,465\,31$

1	2	3	4	5	6
STRESS POINT	LOAD POINT	L.P. OF COL (4)	(REF) fB	FACTOR	fB
23	2	1	4.891 6007	.462 534 69	2.262 535
33			5.517 6377		2.552 099
45			5.657 4295		2.616 757
57			6.150 1713		2.844 668
67			6.447 8207		2.982 341
81			6.710 8770		3.104 014
95			6.965 9827		3.222 009
106		1	7.164 8536	.462 534 69	3.313 993
15		3	4.148 1742	.537 465 31	2.229 510
25			7.241 8478		3.892 242
35			9.528 0363		5.120 989
47			10.471 0617		5.627 832
59			11.560 4910		6.213 363
71			10.521 5604		5.654 974
83			9.678 4385		5.201 825
97			7.677 5157		4.126 398
111	2	3	7.537 0945		4.050 927

AVRO AIRCRAFT LIMITED
MALTON · ONTARIO
TECHNICAL DEPARTMENT

AIRCRAFT:		REPORT No.	7/2510/10
C 105	FIN	SHEET No.	6-12
		PREPARED BY	DATE
		G. Gunderson	MARCH 56
		CHECKED BY	DATE

SPAR #5

BOOM STRESSES

1	2	3	4	5	6
STRESS POINT	LOAD POINT	L.P. PT OF COL (4)	REF f_B	FACTOR	f_B (4) × (5)
23	6	1	4.871 6007	.462 534 69	2.262 535
33	↓	↓	5.517 63871	↓	2.552 099
45			5.657 4295		2.616 757
57			6.150 1713		2.844 668
69			6.447 8207		2.982 341
81			6.710 8770		3.104 014
95		↓	6.965 9827	↓	3.222 009
106		1	7.164 8536	.462 534 69	3.313 993
25		7	3.889 3871	.537 465 31	2.090 411
35		↓	6.803 1079	↓	3.656 434
47			8.122 2900		4.365 449
59			9.512 76691		5.112 782
71			8.934 9794		4.829 115
83			8.423 5712		4.527 377
97	↓	↓	6.782 4971	↓	3.645 357
111	6	7	6.701 2610	.537 465 31	3.601 695

FORM 1219A

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

REPORT No. 7/0510/10
SHEET No. 6-15

AIRCRAFT: C105	FIN	PREPARED BY: G. Gunderson	DATE
		CHECKED BY	DATE

BENDING STRESSES
SPAR #5

LOAD POINT 31

SEE DIAGRAM SHT

POINTS ON SPAR #5

"MOM" M = 1 x 25

STRESS PT	Z	A	$f_B = \frac{M}{2ZA}$
70	3.2291	1.86	2.0812084
82	3.4247	1.92	1.9010181
96	3.5856	2.80	1.2450596
109	3.7660	2.96	1.12134173

POINTS ON SPAR #7

FACTORING UNIT LOADS IN PROPORTION TO RIB REACTION

① STRESS PT	② f_B (REF) SPAR #7	③ (2) .46253469
81	0.865 193 27	0.400 181 95
95	1.590 800 2	0.735 83128
106	2.518 977 5	1.165 114 5

POINTS ON SPAR #3

FACTORING UNIT LOAD IN PROPORTION TO RIB REACTION

① STRESS PT	② f_B REF SPAR #3	③ (2) .53746531
83	1.085 879 3	0.583 622 5
97	1.548 979 7	0.832 522 9
111	1.813 821 9	0.974 866 3

RIB BOOM
(f_B SAME AS FOR L.P. 38)
STRESS PT 64 f_B = -0.27162118 (COMP)

A. V ROE CANADA LIMITED MALTON - ONTARIO **TECHNICAL DEPARTMENT (Aircraft)**		REPORT No. 5510/10 SHEET No. 6-16	
		PREPARED BY	DATE
AIRCRAFT: C105	FIN	G. Gundesen	
		CHECKED BY	DATE

BOOM STRESSES

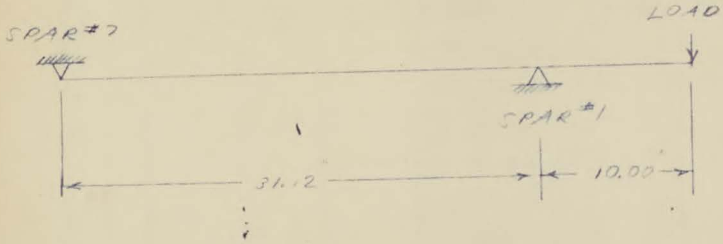
STATICALLY DETERMINANT PATH
LOAD POINTS AFT OF H/L

LOAD PATH ASSUMED:

THE LOAD WILL BE ASSUMED TO BE REACTED BY DIFFERENTIAL BENDING OF SPAR #1 AND SPAR #7

METHOD:

THE UNIT STRESSES CAN BE FACTORED PROPORTIONAL TO THE RIB REACTIONS.



APPLYING A UNIT LOAD WE OBTAIN:

$$\text{FACTOR FOR SPAR \#1} = \frac{41.12}{31.12} = 1.32133676$$

$$\text{FACTOR FOR SPAR \#7} = -\frac{10.00}{31.12} = -0.32133676$$

AVRO AIRCRAFT LIMITED
MALTON · ONTARIO

TECHNICAL DEPARTMENT

AIRCRAFT: C 105	FIN	REPORT NO 7/0510/12	SHEET No 6-17
		PREPARED BY: LLG	DATE
		CHECKED BY	DATE

BOOM STRESSES
L.P. AFT OF H/L

1	2	3	4	5	6
STRESS POINT	LOAD POINT	LP OF COL (4)	(REF) - f_b	FACTOR	f_B (4) × (5)
23	5	1	4.891 6007	-.321 336 76	-1.571 851
33			5.517 638 71		-1.773 020
45			5.657 4295		-1.817 940
57			6.150 171 3		-1.976 276
69			6.447 8207		-2.071 922
81			6.710 879 0		-2.156 452
95			6.965 982 7		-2.238 426
106		1	7.164 853 6		-2.302 331
16		4	10.901 016	1.321 336 76	14.403 913
26			15.883 5546		20.987 525
36			19.305 646 0		25.509 260
48			21.073 896		27.845 713
60			21.654 8141		28.626 515
72			16.169 4766		21.365 324
84			14.229 3770		18.801 799
98	5	4	13.348 8919		17.638 316
33	15	11	2.953 636 0	-.321 336 76	-.949 112
45			3.759 417 4		-1.208 039
57			4.614 218 7		-1.482 728
69			5.168 531 2		-1.660 839
81			5.551 037 8		-1.783 753
95			5.899 528 2		-1.895 735
106		11	6.243 045 3		-2.006 120
36		14	6.555 1443	1.321 336 76	8.661 553
48			9.888 004 8		13.065 384
60			12.409 317 8		16.396 888
72			10.401 007 7		13.743 233
84			9.691 883 7		12.806 242
98	15	14	9.500 6175		12.553 515

FORM 1319A

AVRO AIRCRAFT LIMITED
MALTON · ONTARIO

TECHNICAL DEPARTMENT

REPORT No.	7/0510/10
SHEET No.	6 - 19
PREPARED BY	B.S.
DATE	
CHECKED BY	
DATE	

AIRCRAFT: C105 — FIN

BOOM STRESSES
LP AFT OF HL

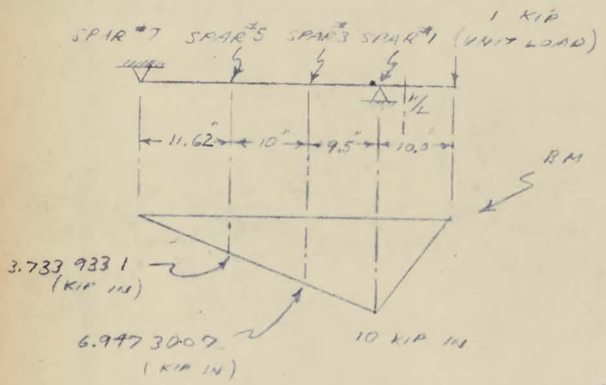
1	2	3	4	5	6
27	7	1	4.891 6007	-.321 336 76	-1.571 8511
37			5.517 6371		-1.773 0196
45			5.657 4295		-1.817 940
57			6.150 1717		-1.976 276
69			6.447 8207		-2.071 922
81			6.710 5790		-2.156 452
95		↓	6.965 9827	↓	-2.238 426
106		1	7.164 8576		-2.302 331
26		8	7.088 6605	1.321 376 76	9.366 508
36			12.245 5570		16.180 505
48			14.880 1486		19.661 687
60			16.539 9470		21.854 840
72			12.975 4134		17.144 891
84	↓	↓	11.716 9185	↓	15.481 995
98	7	8	11.218 0390		14.822 807

FORM 1319A

A. VROE CANADA LIMITED MALTON ONTARIO **TECHNICAL DEPARTMENT (Aircraft)**		REPORT NO 0510/12 SHEET NO 6-20	
AIRCRAFT:		PREPARED BY	DATE
C105	FIN	L. Gunderson	Nov 55
		CHECKED BY	DATE

BENDING STRESSES
ALONG STATICALLY DETERMINANT LOAD PATHS
IN CHORDWISE RIBS

CONSIDERING LOAD POINTS AFT OF H/L



BM AT SPAR #3

$= 10 \times \frac{21.62}{31.12} = 6.9473007$

BM AT SPAR #5

$= 10 \times \frac{11.62}{31.12} = 3.7339331$

STRESS PT	LOAD POINT	M	$\bar{y}$ FIN ½ h	A BOOM AREA	$f_B = \frac{M}{2\bar{y}A}$
2	5	3.733 933 1	1.6086	.820	1.415 385
3	↓	6.947 300 7	1.5483	.820	2.736 007
4	5	10.0000	1.2414	.811	4.966 3510
19	15	3.733 933 1	2.1283	1.589	.552 052
20	↓	6.947 300 7	2.0277	1.630	1.050981
21	15	10.0000	1.7194	1.654	1.758 156 7
29	21	3.733 933 1	2.4744	2.040	.369 859
30	↓	6.947 300 7	2.2993	2.097	.720 430
31	21	10.0000	1.9634	2.113	1.205 207 21
40	27	3.733 933 1	2.7036	2.390	.288 932
41	↓	6.947 300 7	2.4877	2.442	.571 778
42	27	10.0000	2.1390	2.460	.950 219 88
~~52~~	~~34~~	~~3.729 903 54~~	~~2.9709~~	~~2.820~~	~~.264 869 06~~
~~53~~	~~↓~~	~~6.995 332 62~~	~~2.7154~~	~~2.920~~	~~.437 487 01~~
~~54~~	~~34~~	~~10.0000~~	~~2.3558~~	~~2.955~~	~~.718 247 46~~
64	41	3.733 933 1	3.2291	3.064	.188698
65	↓	6.947 300 7	2.9429	3.750	.314 760
66	41	10.0000	2.5753	4.20	.462 266 99

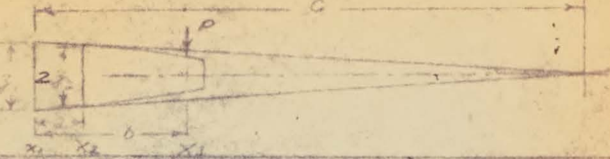
FORM 1910A

C105 FIN

REF SPAR # 1

CALCULATION OF PANEL SHEAR

SLOPE RELIEF AT $x_1 = \frac{Pb}{c}$



A. V. ROE C[...]
MALTO[...]
TECHNICAL [...]

AIRCRAFT
WEIGHT
C. G POSITION

	1	2	3	4	5	6	7	8	9	10	11	1[...]
SHEAR PANEL	LOAD POINT	x_1	x_2	x_3	a $= x_1 - x_2$ (2) − (3)	b $= x_1 - x_3$ (2) − (4)	z_1	z_2	δz (7) − (8)	SLOPE (9)/(5)	c $= z_1 \div$ SLOPE (7)/(10)	SHE[...] REL[...] $= \frac{P[...]}{c}$ (6)/(1[...])
198	7	102 .698544	74 .898544	50 .765822	27 .8000	51 .932722	2.2993	2.0277	.2716	.0099769 78417	235 .348085	.22[...] 34[...]
206		122 .698544	102 .698544		20	71 .932722	2.4940	2.2993	.1947	.00973 5000	256 .189009	.28[...] 9[...]
216		147 .398544	122 .398544		25	96 .632722	2.7184	2.4940	.2244	.00897 6000	302 .85205	.31[...] 5[...]
225		172 .398544	147 .398544		25	121 .632722	2.9429	2.7184	.2245	.00898 0000	327 .717149	.37[...] 15[...]
235		190 .398544	172 .398544		18	139 .632722	3.1042	2.9429	.1613	.00896 1111	346 .407936	.40[...] 75[...]
245		208 .398544	190 .398544		18	157 .632722	3.2642	3.1042	.1600	.00888 88889	367 .2224995	.42[...]
256	7	217 .538766	208 .398544	50 .765822	9 .140222	166 .772944	3.3450	3.2642	.0808	.00884 004787	378 .371615	.49[...] 1[...]
	8	50 .765822		50 .765822		0	1.5075	1.2414				
191		74 .898544			24 .132722	24 .132722	1.7194	1.5075	.2119	.0087806 09166	195 .817848	.12[...] 0[...]
199		102 .698544			27 .800000	51 .932722	1.9634	1.7194	.2440	.00877 697847	223 .698852	.2[...]
207		122 .698544			20	71 .932722	2.1390	1.9634	.1756	.00878 0000	243 .6218679	.29[...] 3[...]
217		147 .398544			24 .70000	96 .632722	2.3558	2.1390	.2168	.008777 327935	268 .396034	.36[...]
226		172 .398544			25	121 .632722	2.5753	2.3558	.2195	.00878 0000	293 .3143508	.41[...] 3[...]
236		190 .398544	172 .398544		18	139 .632722	2.7333	2.5753	.1580	.008777 7777	311 .3886068	.4[...] 9[...]
246	8	208 .398544		50 .765822	18	157 .632722	2.8913	2.7333	.1580	.008777 7777	329 .388607	.4[...]

R # 1

A. V. ROE CANADA LIMITED

MALTON, ONTARIO

TECHNICAL DEPT. (AIRFRAME)

AIRCRAFT	REPORT NO. 71/0510/10
WEIGHT	SHEET 6-22
C. G. POSITION	DATE
	PREPARED BY E. Gunderson

8	9	10	11	12	13	14	15	16	17	18	19
									CHECK OF COL (12)		
$\bar{z}_2$	δz	SLOPE	c	SHEAR RELIEF	WEB SHEAR (KIPS)	WEB t	f_s (KSI)	PANEL $-f_s$	f_B (KSI) BOOM STRESS	BOOM AREA IN²	SHEAR RELIEF (KIPS)
			$\frac{z}{d}$ ÷ SLOPE	$= \frac{PA(1-\alpha)}{c}$							
	(1) − (8)	$\frac{(9)}{(5)}$	$\frac{(7)}{(10)}$	$\frac{(6)}{(11)}$	1.00 − (12)		$\frac{(13)}{2(7)(14)}$				2(10)(17)(18)
.0277	.2716	.099769 28417	235 .348085	.22066 346	.77933 654	.091	1 .86233 588		6 .8031079	1.66	.22066 345 ✓
.2993	.1947	.00993 5000	276 .189009	.28077 989	.71922 011		1 .58450 635		8 .1017725	1.78	.28077 989 ✓
.4940	.2244	.00897 6000	302 .85205	.31907 567	.68092 433		1 .37630 314		9 .5047132	1.87	.31907 567
.7184	.2245	.00848 0000	327 .717149	.37115 153	.62884 847		1 .11740 838		8 .9849774	2.30	.37115 153 ✓
.9429	.1613	.00896 1111	346 .407936	.40308 754	.59691 246		1 .05654 830		8 .4235712	2.67	.40308 754
1042	.1600	.00888 83889	367 .222479	.42925 671	.57074 329		.96071 078		6 .7824971	3.56	.42925 670 ✓
3.2642	.0808	.00884 004787	378 .311615	.44074 165	.55925 835	.091	.91863 918		6 .7012610	3.72	.44074 164 ✓
.2414				0	1.00000	.125	2 .653319 67		0		0
5075	.219	.0087806 09166	195 .817848	.12324 0666	.876759 33		2 .081686 70	2 .326392 91	7 .0886605	.990	.12324 0665 ✓
.7194	.2440	.00877 6978417	223 .698852	.23215 462	.767845 38		1 .564317 77	1 .786310 05	12 .2455570	1.08	.23215 462 ✓
.9634	.1756	.00878 0000	243 .6218679	.29526 381	.704736 19		1 .317879 73	1 .435746 53	14 .3801486	1.13	.29526 381 ✓
.1390	.2168	.008777 327935	263 .396034	.36003 782	.639962 18		1 .086615 47	1 .196750 221	16 .5393470	1.24	.36003 782 ✓
2.3558	.2195	.00878 0000	293 .3143508	.41468 384	.585316 16		.909123 93	.993830 91	12 .9754134	1.82	.41468 383 ✓
2.5753	.1580	.008777 7777	311 .3886068	.44841 949	.551585 51		.772900 83	.856724 28	11 7169185	2.18	.44841 949 ✓
2.7333	.1580	.008777 7777	329 .388607	.47856 155	.521438 45	.125	.721389 62	.763089 97	11 .2180390	2.43	.47856 154 ✓

\# 1

A. V. ROE CANADA LIMITED
MALTON, ONTARIO
TECHNICAL DEPT. AIRFRAME

AIRCRAFT
WEIGHT
C. G. POSITION

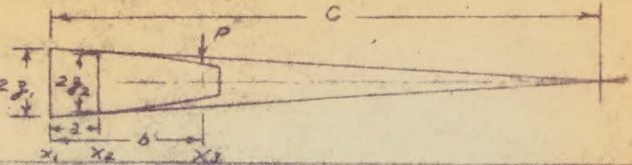
REPORT NO. 7/0510/10.
SHEET 6-23
DATE
PREPARED BY [illegible]

8	9	10	11	12	13	14	15	16	17	18	19
									CHECK OF COL. (12)		
δ_2	$\delta\delta$	SLOPE (9)/(5)	f δ_1 + SLOPE (7)/(10)	SHEAR RELIEF Pb/c (KIPS) (16)/(11)	WEB SHEAR (KIPS) 1.00 − (12)	WEB t	f_s (KSI) (13)/2(7)(14)	PANEL f_s AV OF f_s OF ENDS	f_B (KSI) BOOM STRESS	BOOM AREA in^2	SHEAR RELIEF (KIPS) 2(10)(7)(18)
	(7) − (8)										
		.008780 609166	[illegible]95 .8[illegible]7848	0	1.0[illegible]	.125	2 .326393 93	2 .037282 26	0	.990	0
		.008776 978417	223 .698852	.124274 22	.875725 78		1 .784100 60	1 .637535 87	6 .555144 3	1.08	.124274 22
		.00878 0000	243 .6218679	.196205 70	.8[illegible]3794 30		1 .503121 64	1 .364893	9 .880948	1.13	.196205 70
		.008777 327935	268 .396733	.270123 22	.729876 78		1 [illegible] 79	1 .133529	12 .4013178	1.24	.270123 22
		.00877[illegible] [illegible]	293 .343528	.332407 87	.667592 13		1 .037155 13	.777097 11	10 .401007 3	1.82	.332407 87
		.008777 77778	311 .388607	.370919 16	.629080 84		.920617 33	.870308 00	9 .5918837	2.18	.370919 16
		.008777 77778	329 .388607	.405276 35	.594703 65		.822[illegible]41 14		9 .5006175	2.43	.405276 34
				0	1.00000		2 .037282 26	1 .87003 2[illegible]	0		0
		.008778 [illegible]	243 .6218679	.082014 437	.917985 56		1 .71[illegible] 41	1 .558588	4 .372405 3	1.13	.08[illegible]4 476
		.008777 327735	268 .396033	.166544 94	.833455 06		1 .41[illegible]	.244437 92	7 .6509863	1.24	.166544 93
		.008778 [illegible]	293 .343528	.237629 01	.762370 99		1 .184127 66	1 .115766 47	7 .4353868	1.82	.237629 01
		.008777 77778	311 .3886068	.281641 65	.718358 35		1 .051258 34	.993820	7 .3571186	2.18	.281641 65
		.008777 77778	329 .388607	.320897 56	.679102 44		.739511 55		7 .222117	2.43	.320897 56
				0	1.00000		1 .870032 72	1 .697937	0	1.13	0
						.125					

C105 FIN REF SPAR #1

CALCULATION OF PANEL SHEAR

SLOPE RELIEF AT $x_1 = \frac{Pb}{c}$



A. V. ROE CA
MALTON
TECHNICAL O

AIRCRAFT
WEIGHT
C. G. POSITION

	1	2	3	4	5	6	7	8	9	10	11	12
SHEAR PANEL	LOAD POINT	x_1	x_2	x_3	a $= x_1 - x_2$ (2) - (3)	b $= x_1 - x_3$ (2) - (4)	z_1	z_2	δz (7) - (8)	SLOPE $\frac{(9)}{(5)}$	c $z_1 \div$ SLOPE $\frac{(7)}{(10)}$	SHEA RELI $= \frac{Pb}{c}$($\frac{(6)}{(11)}$
226	26	147.398544	122.698544	122.698544	24 700000	24.7	2.3558	2.1390	.2168	.008777 327935	268.396033	.0920
236	↓	172.398544	147.398544	↓	25	49.7	2.5753	2.3558	.2195	.00878 00000	293.3143508	.1694
246	↓	190.398544	172.398544	↓	18	67.7	2.7333	2.5753	.1580	.008777 7778	311.3886068	.2174
	26	208.398544	190.398544	122.698544	18	85.7	2.8913	2.7333	.1580	.008777 7778	329.388607	.2601
226	33			147.398544	0	0	2.3558			.008777 327935	268.396033	0
236	↓			↓	25	25	2.5753			.00878 00000	293.3143508	.085
246	↓			↓	18	43	2.7333			.008777 77778	311.3886068	.1380
	33			147.398544	18	61	2.8913			.008777 77778	329.388607	.1851
236	40			172.398544	0	0	2.5753			.00878 000000	293.3143508	9
246	↓			↓	18	18	2.7333			.008777 77778	311.3886068	.0578
	40			172.398544	18	36	2.8913			.008777 77778	329.388607	.1092
246	47			190.398544	0	0	2.7333			.008777 77778	311.3886068	0
	47			190.398544	18	18	2.8913			.00877 77778	329.388607	.0540

A. V. ROE CANADA LIMITED
MALTON, ONTARIO
TECHNICAL DEPT. (AIRFRAME)

AIRCRAFT
WEIGHT
C. G. POSITION

REPORT NO. 7/0510/10.
SHEET 6-24
DATE
PREPARED BY E. Gerardson

[partial]	9	10	11	12	13	14	15	16	17	18	19
									CHECK OF COL (12)		
2	δz (7) - (8)	SLOPE (9)/(5)	C z ÷ SLOPE (7)/(10)	SHEAR RELIEF = Pb/c (KIPS) (6)/(11)	WEB SHEAR (KIPS) 1.00 - (12)	WEB t	f_s (KSI) (13)/2(7)(14)	PANEL f_s AV OF f_s OF ENDS	f_B (KSI) BOOM STRESS	BOOM AREA in^2	SHEAR RELIEF (KIPS) 2(10)(17)(18)
40	.2168	.008777 327935	268 .396033	.092028 186	.907997 18	.125	1 .541722 21	1 .410 233 84	4 .227726 2	1.24	.092028 185
58	.2195	.00878 00000	293 .3143508	.169442 78	.830557 22		1 .290035 68	1 .215 527	5 .3018468	1.82	.16944 278
753	.1580	.008777 7778	311 .3886068	.217413 22	.782586 78		1 .215527 17	1 .082 678	5 .6808703	2.18	.217413 22
37	.1580	.008777 7778	329 .388607	.260179 00	.739821 00		1 .023492 98		6 .0988984	2.43	.260179 00
		.008777 327935	268 .396033	0	1.0000		1 .697937 01	1 .553217 09	0	—	0
		.00878 00000	293 .3143508	.085232 79	.914767 21		1 .420832 07	1 .338 731 61	2 .6669249	1.82	.085232 79
		.008777 77778	311 .3886068	.138091 12	.861908 88		1 .261345 45	1 .192417	3 .6082337	2.18	.138091 11
		.008777 77778	329 .388607	.185191 59	.814808 41		1 .127255 44		4 .3411061	2.43	.185191 59
		.00878 000000	293 .3143508	0	1.0000		1 .553217 10	1 .463432 49	0	—	0
		.008777 77778	311 .3886068	.057805 58	.942194 42		1 .378837 12	1 .303489	1 .510423 41	2.18	.057805 58
		.008777 77778	329 .388607	.109293 40	.890706 66		1 .232257 68		2 .561964 3	2.43	.109293 40
		.008777 77778	311 .3886068	0	1.0000		1 .463432 48	1 .383461	0	—	0
		.00877 77778	329 .388607	.054646 70	.945353 30	.125	1 .307859 16		1 .280982 13	2.43	.054646 70

C105 FIN

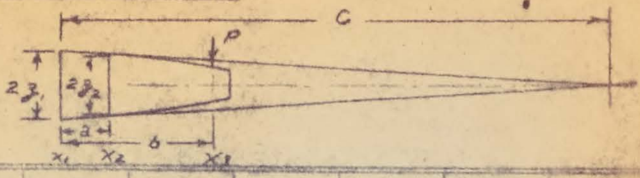
SPAR # 3

A. V. ROE CA[NADA]
MALTON
TECHNICAL C[...]

AIRCRAFT
WEIGHT
C. G. POSITION

CALCULATION OF PANEL SHEAR

SLOPE RELIEF AT $x_1 = \frac{Pb}{c}$



SHEAR PANEL	1 LOAD POINT	2 x_1	3 x_2	4 x_3	5 a $= x_1 - x_2$ (2) − (3)	6 b $= x_1 - x_3$ (2) − (4)	7 z_1	8 z_2	9 δz (7) − (8)	10 SLOPE (9)/(5)	11 c $z_1 \div$ SLOPE (7)/(10)	12 SHEA[R] RELI[EF] $= \frac{Pb}{c}$ (6)/(11)
183	3			29 .964602			1.5483					0
190	↓	50 .765822	29 .964602	↓	20 .80122	20 .80122	1.7782	1.5483	.2299	011052 27636	160 .890544	.1292 0
198		74 .898544	50 .765822		24 .132722	44 .933942	2.0277	1.7782	.2495	.010338 65968	196 .127937	.229 2
206		102 .698544	74 .898544		27 .800000	72 .733942	2.2993	2.0277	.2716	00976 778417	235 .348085	.309
216		122 .698544	102 .698544		20	92 .733942	2.4877	2.2993	.1884	.00942 00000	264 .087049	.351
225		142 .398544	122 .698544		24 .70000	117 .433942	2.7161	2.4877	.2284	09246 63562	293 .728852	.399
235		172 .398544	142 .398544		25	142 .433942	2.9429	2.7161	.2268	00907 2000	324 .393739	.439 7
245		190 .398544	172 .398544		18	160 .433942	3.1042	2.9429	.1613	00896 1111	346 .407933	.46 5
256	↓	208 .398544	190 .398544	↓	18	178 .433942	3.2642	3.1042	.1600	00888 88889	367 .222497	.485
	3	217 .538766	208 .398544	29 .964602	9 .140222	187 .574164	3.3450	3.2642	.0808	00884 04787	378 .391615	.495 4
190	7	50 .765822		50 .765822		0	1.7782					0
198	↓	74 .898544		↓		24 .132722	2.0277			10338 65968	196 .127937	.123
206		102 .698544				51 .932722	2.2993			00976 778417	235 .348085	.220
216	↓	122 .698544		↓		71 .932722	2.4877			00942 0000	264 .087049	.272
	7	142 .398544		50 .765822		96 .632722	2.7161			09246 3562	293 .728852	.328

…3

A. V. ROE CANADA LIMITED

MALTON, ONTARIO

TECHNICAL DEPT. (AIRFRAME)

AIRCRAFT

WEIGHT

C. G. POSITION

REPORT NO. 7/0510/10

SHEET 6-25

DATE

PREPARED BY E. Gundlach

8	9	10	11	12	13	14	15	16	17	18	19
									CHECK OF COL (12)		
δ_2	δ_3 (7) − (8)	SLOPE (9)/(5)	c δ_3 ÷ SLOPE (7)/(10)	SHEAR RELIEF = Pb/c (KIPS) (6)/(11)	WEB SHEAR (KIPS) 1.00 − (12)	WEB t	f_s (KSI) (13)/2(7)(14)	PANEL f_s AV OF f_s OF ENDS	f_B (KSI) BOOM STRESS	BOOM AREA IN²	SHEAR RELIEF (KIPS) 2(10)(17)(18)
				0	1.0000	.091	3 .545734 4	3 .08992 553	0		0
…5483	.2293	…011052 …27636	160 .8905144	.129288 045	.870711 96		2 .690435 1	2 .38200 733	4 .1481942	1.41	.129288 04
…7752	.2495	…010338 …65968	196 .127937	.229105 26	.770894 74		2 .088917 3	1 .87228 755	7 .2418478	1.530	.229105 26
…0277	.2716	…00976 …778417	235 .249085	.309048 37	.690951 63		1 .651127 5	1 .550521 71	9 .5280363	1.66	.309048 37
…2993	.1884	…00942 …00000	264 .087049	.351149 15	.648850 85		1 .433096 66	1 .325634 29	10 .4712617	1.78	.351149 15
…4877	.2284	…09246 …63562	293 .728852	.399803 90	.600196 10		1 .21416 029	1.13471 2	11 .56049910	1.87	.39980 390
…7161	.2268	…00907 …2000	324 .393739	.43907 735	.560922 65		1 .047263 78	1 .002345 60	10 .5215604	2.30	.43907 734
…9429	.1613	…00896 …1111	346 .407937	.46313 588	.53686 412		.96026 1856	.909966 29	9 .6784385	2.67	.46313 587
…1042	.1600	…00888 …88889	367 .222497	.48590 144	.51409 856		.86536 283	.848845 08	7 .6775157	3.56	.48590 144
…2642	.0808	…00884 …24787	378 .391615	.49571 438	.504285 62	.091	.828340 84		7 .5370945	3.72	.49571 437
				0	1.000000	.091	3 .029925 5	2 .70972 309	0		0
		…10338 …65968	196 .127937	.123045 82	.876954 18		2 .376303 0	2 .111786 23	3 .8893871	1.53	.123045 81
		…09976 …78417	235 .348085	.220663 46	.779336 54		1 .862335 9	1 .73874 557	6 .8031079	1.66	.220663 45
		…00942 …00000	264 .087049	.272382 62	.727617 38		1 .607065 84	1 .48204 7	8 .122290	1.78	.272382 62
		…09246 …3562	293 .728852	.328986 14	.671038 57	.091	1 .357470 31		9 .512766 9	1.87	.328986 14

A. V. ROE CANADA LIMITED
MALTON, ONTARIO
TECHNICAL DEPT (AIRFRAME)

REPORT NO. 7/0510/10
SHEET 6-26
DATE
PREPARED BY G. [illegible]

AIRCRAFT
WEIGHT
C. G. POSITION

9	10	11	12	13	14	15	16	17	18	19
								CHECK OF COL (12)		
δ z	SLOPE	c	SHEAR RELIEF	WEB SHEAR	WEB t	f_s' (KSI)	PANEL f_s	f_B (KSI) BOOM STRESS	BOOM AREA in^2	SHEAR RELIEF (KIPS)
		z_1 + SLOPE	$= \frac{Pb}{c}$ (KIPS)	(KIPS)			AV. OF f_s OF ENDS			
(7) - (8)	$\frac{(9)}{(5)}$	$\frac{(7)}{(10)}$	$\frac{(6)}{(11)}$	1.00 - (12)		$\frac{(13)}{2(7)(14)}$				2 (10)(17)(18)
	.00997 2000	324 .393739	.374953 97	.625046 03	.0[illegible]	1 .166984 55	1.26443 0	8 .984979 4	2.30	.374953 972
	.00996 1111	346 .407933	.403087 54	.596912 46		1 .056578 80	1 .114458 11	8 .423571 2	2.67	.403087 54
	.00888 88889	367 .222499	.429256 71	.570743 29		.960710 78	1 .010228 76	6 782477 1	3.56	.42925 671
	.00884 .004787	378 .391615	.440741 65	.559258 35		.918639 19	.941378 62	6 .7012610	3.72	.44074 164
			0	1.000000		2 .709723 08		0		0
	.00976 99417	[illegible] .348085	.118122 91	.881877 09		2 .107371 16	2 .38964 270	3 .6417578	1.66	.118122 90
	.00742 00100	264 .087049	.181000 92	.818999 08		1 .828897 75	1 .957115 18	5 397341 3	1.78	.181000 92
	.009246 963562	293 .728852	.246826 28	.753173 72		1 .523624 73	1 .663511 33	7 137081 4	1.87	.246826 28
	.00997 20000	324 .393739	.300560 67	.699439 33		1 .305879 66	1 .414923	7 .202301 0	2.30	.300560 66
	.00896 11111	46 .407933	.333421 92	.666578 08		1 .179858 6	1 .24452 651	6 767725 5	2.67	.333421 90
	[illegible]88 [illegible]8889	767 222499	.363539 32	.636460 18		1 .071329 56	1 .126549 17	5 744133 2	3.56	.363539 81
	[illegible]84 [illegible]4787	378 .391615	.376964 54	.623035 46		1 .023397 63	1 .048732 24	5 .7315614	3.72	.37694 54
			0	1.00000		2 .389642 71		0		0
	.00742 [illegible]	264 .087049	.07573 2604	.924267 40	↓	2 .041400 61	2 .20866 885	2 258301 86	1.78	.07573 2604
	.009246 963562	293 .728852	.152181 169	.847818 83	.091	1 .715086 05	1 .87255 104	4 .400379 3	1.87	.152181 169

#3

A. V. ROE CANADA LIMITED

MALTON ONTARIO

TECHNICAL DEPT. (AIRFRAME)

AIRCRAFT	REPORT NO. 7/0510/10
WEIGHT	SHEET 6-27
C. G. POSITION	DATE
	PREPARED BY G. Jacobsen

9	10	11	12	13	14	15	16	17	18	19
δz	SLOPE	c	SHEAR RELIEF	WEB SHEAR	WEB t	f_s	PANEL f_s	CHECK OF COL (12)		
		z ÷ SLOPE	$\frac{Pb}{c}$ (KIPS)	(KIPS)		(KSI)	AV OF f_s OF ENDS	f_B (KSI) BOOM STRESS	BOOM AREA in^2	SHEAR RELIEF (KIPS)
(7) - (8)	$\frac{(4)}{(3)}$	$\frac{(7)}{(10)}$	$\frac{(6)}{(11)}$	1.00 - (12)		$\frac{(13)}{2(7)(14)}$				2(10)(17)(18)
	.00907 2000	324 .393739	.214862 34	.785137 66	.091	.465881 68	1 58828 585	5 487219	2.30	.214862 34
	.00896 1111	346 .407933	.253169 72	.746830 28		1 .321906 80	1 .394360 35	5 .90645 2	2.67	.253169 72
	.00888 88889	367 .222497	.287836 39	.712163 61		1 .198758 31	1 .26054 549	4 .547976 6	3.56	.287836 39
	.00884 .004737	378 .391615	.303495 68	.696504 32	.091	1 .144079 76	1 .172399 61	4 .6145031	3.72	.303495 69
			0	1.00000	.091	2 .203089 61		0		
	.009246 963562	293 .728852	.084091 160	.915908 84		1 .852828 01	2 .02293 932	2 .431529 8	1.87	.084091 160
	.00907 20000	324 .393739	.153208 58	.846791 12		1 .580991 01	1 .71300 705	3 .6713268	2.30	.153208 87
	.00896 1111	346 .407933	.195434 32	.804565 68		1 .424077 8	1 .502154 54	4 .841126	2.67	.195434 32
	.00888 8889	367 .222497	.233373 50	.766626 50		1 .290416 81	1 .356746	3 .687432 4	3.56	.233373 499
	.00884 .004787	378 .391615	.250640 39	.749359 61	.091	1 .230900 00	1 .261368 94	3 .8108645	3.72	.250640 39
			0	1.00000	.091	2 .021227 7		0		
	.00907 20000	324 .393739	.07706 684	.922933 16		1 .723151 08	1 .86703 78	1 .846743 9	2.30	.07706 684
	.00896 1111	346 .407933	.124131 11	.875868 89		1 .550308 11	1 .635280 31	2 .594045 0	2.67	.124131 11
	.00888 88889	367 .222497	.166111 83	.833888 17		1 .403652 70	1 .47600 127	2 .624560 2	3.56	.166111 83
	.00884 .004787	378 .391615	.185364 10	.814635 90	.091	1 .338123 00	1 .371246 07	2 .818370 4	3.72	.185364 10

#3

A. V. ROE CANADA LIMITED

MALTON, ONTARIO

TECHNICAL DEPT (AIRFRAME)

REPORT NO. 7/0510/10

SHEET 6-28

AIRCRAFT

DATE

WEIGHT

C. G. POSITION

PREPARED BY G. [illegible]

	9	10	11	12	13	14	15	16	17	18	19
									CHECK OF COL (12)		
	δz (7) - (8)	SLOPE (9)/(5)	c z + SLOPE (7)/(10)	SHEAR RELIEF = P_b/c (KIPS) (6)/(11)	WEB SHEAR (KIPS) 1.00 - (12)	WEB t	f_s (KSI) (13)/2(7)(14)	PANEL f_s AV OF f_s OF ENDS	f_B (KSI) BOOM STRESS	BOOM AREA IN²	SHEAR RELIEF (KIPS) 2(10)(17)(18)
		[illegible] 2000	[illegible]	0	1.00000	.091	1 .86[illegible]037 78		0	2.30	0
		.00346 11111	346 .407933	.051961 859	.948038 14		1 .678049 34	1 .77002 302	1 .085877 3	2.67	.051961 858
		.00888 88889	367 .222497	.098033 21	.901966 79		1 .521613 41	1 .59650 2	1 .548977 7	3.56	.098033 20
		.00884 004787	378 .391615	.119294 98	.880705 02		1 .446648 30	1 .48245 774	1 .813821 9	3.72	.119294 99
				0	1.000000		1 .770023 03		0		0
		.00888 88889	367 .222499	.049016 60	.950983 40		1 .600754 71	1 .68326 252	.774487 89	3.56	.049016 60
		.00884 004787	378 .391615	.071725 220	.928274 78		1 .524786 51	1 .562530	1 .097546 9	3.72	.071725 222
				0	1.00000		1 .683262 51		0		0
		.00884 004787	378 .391615	.241554 56	.758445 44	.091	1 .245824 41	1 .27666 278	.367271 89	3.72	.241554 56
				0	1.0000	.072	2 .337~~488~~ 5		0		
09	.2582	.010328 0000	312 .654719	.079960 360	.920039 6	.072	1 .978620 6	2 .15058 190	.0812084	1.86	.079960 364

C105 FIN

REF SPAR #7

A. V. ROE CAN

MALTON

TECHNICAL DE

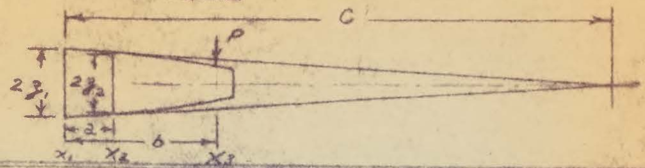
AIRCRAFT .

WEIGHT .

C. G. POSITION .

CALCULATION OF PANEL SHEAR

SLOPE RELIEF AT $x = \frac{Pb}{c}$



SHEAR PANEL	1 LOAD POINT	2 x_1	3 x_2	4 x_3	5 a $= x_1 - x_2$ (2) − (3)	6 b $= x_1 - x_3$ (2) − (4)	7 z_1	8 z_2	9 δz (7) − (8)	10 SLOPE $\frac{(9)}{(5)}$	11 c $z_1 \div$ SLOPE $\frac{(7)}{(10)}$	12 SHEA[R] RELIE[F] $= \frac{Pb}{c}$($\frac{(6)}{(11)}$
			74 .898544			115.5						
244												
	11		↓			133.5	3.7968					.4090 18.
255												
	11	SAME AS	74 .898544			163 .441441	4.1293			SAME AS	SAME AS	.4395 63
	17		102 .698544	102 .698544	0	0	2.3768					0
205												
	↓			↓		20	2.6938					.1176 .6
214												
						44.7	3.0450					.2087 65
223												
						67.7	3.3686					.2678 54
234												
						87.7	3.5874					.2971 29
244												
						105.7	3.7968					.3238 30.
255												
	17			102 .698544		135 .64144	4.1293					.3647 32
	23			122 .698544		0	2.6938					
214												
	↓			↓		24.7	3.0450					.1153 6
223												
						49.7	3.3686					.1709
234												
						67.7	3.5874					.2273 43
244												
	23			122 .698544		85.7	3.7968					.2625 34

A. V. ROE CANADA LIMITED
MALTON ONTARIO
TECHNICAL DEPT. (AIRFRAME)

REPORT NO. 7/0510/10
SHEET 6-30
DATE
PREPARED BY [illegible signature]

AIRCRAFT
WEIGHT
C. G. POSITION

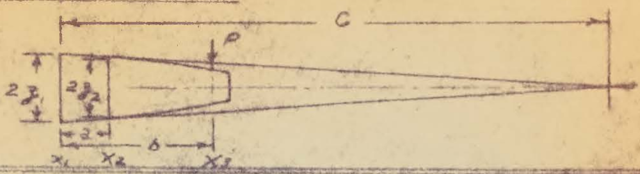
9	10	11	12	13	14	15	16	17	18	19
$\delta_{\mathfrak{z}}$ (7) - (8)	SLOPE (9)/(5)	c $\mathfrak{z}$ ÷ SLOPE (7)/(10)	SHEAR RELIEF = Pb/c (KIPS) (6)/(11)	WEB SHEAR (KIPS) 1.00 - (12)	WEB t	fs (KSI) (13) / 2(7)(14)	PANEL fs AV OF fs OF ENDS	CHECK OF COL (12) fB (KSI) BOOM STRESS	BOOM AREA IN²	SHEAR RELIEF (KIPS) 2(10)(17)(18)
					.091					
			.40904 182	.590958 18		.855199 90	.905118 74	5 899528 2	2.98	.40904 182
			.43954 637	.560453 63		.745747 60	.811055 11	6 .243045 3	3.17	.439546 37
			0	1,00000		2 .311723 95		0		0
	SAME AS	SAME AS	.117677 .63	.882322 37		1 .799660 37	2 .039685 75	1 .572978 0	2.36	.117677 63
			.20872 658	.791273 42		1 .427801 7	1 .61394 9	2 .844923 0	2.58	.20872 658
			.26782 545	.732174 55		1 .194246 00	1 .321161 60	3 .94837 2	2.80	.26782 545
			.29716 291	.702837 09		1 .076473 84	1 .146393 83	4 214943 9	2.90	.29716 291
			.32386 308	.676136 92		.978465 55	1 .035571 53	4 .671012 3	2.98	.32386 308
			.36478 327	.635216 73		.845228 44	.919248 26	5 .1811564	3.17	.36478 327
				1.00000		2 .039685 8		0		0
			.115336 61	.884663 39		1 .596317 8	1 .804435 26	1 .57202 68	2.58	.115336 61
			.190974 53	.809025 47		1 .319597 13	1 .45983 412	2 .634625 7	2.80	.190974 53
			.22939 486	.770605 14		1 .180268 21	1 .25692 99	3 .253725 2	2.90	.22939 486
			.26258 340	.737416 60	.091	1 .067145 90	1 .129436 24	3 .287187 8	2.98	.26258 340

C105 FIN

REF SPAR #7

CALCULATION OF PANEL SHEAR

SLOPE RELIEF AT $x_1 = \frac{Pb}{c}$



A. V. ROE CAN
MALTON,
TECHNICAL DE

AIRCRAFT
WEIGHT
C G POSITION

SHEAR PANEL	1 LOAD POINT	2 x_1	3 x_2	4 x_3	5 a $= x_1 - x_2$ (2) - (3)	6 b $= x_1 - x_3$ (2) - (4)	7 z_1	8 z_2	9 δz (7) - (8)	10 SLOPE $\frac{(9)}{(5)}$	11 c $z_1 \div$ SLOPE $\frac{(7)}{(10)}$	12 SHEAR RELIEF $= \frac{Pb}{c}$ $\frac{(6)}{(11)}$
255	23	238 .339985		122 .698544		115 .641441	4.1293					.3109 86
	30			147 .398544	0	0	3.0450					0
223	↓	172 .398544		↓		25	3.3686			SAME AS [illegible]	SAME AS [illegible]	.0760 64
234		190 .398544				43	3.5874					.1457 131
244		208 .398544				61	3.7968					.18690 0
255	30	238 .339985		147 .398544		70 .941441	4.1293					.2445 06
	37			172 .398544	0	0	3.3686					0
234	↓			↓		18	3.5874					.0609 124
244						36	3.7968					.11030 41
255	37			172 .398544		65 .941441	4.1293					.1773 76
	44			190 .398544	0	0	3.5874					0
244	↓			↓		18	3.7968					.0551 170
255	44			190 .398544		47 .941441	4.1293					.1289 89
	50			208 .398544	0	0	3.7968					0
255	50			208 .398544		29 .941441	4.1293					.0805 12

10).

A. V. ROE CANADA LIMITED
MALTON, ONTARIO
TECHNICAL DEPT. (AIRFRAME)

AIRCRAFT
WEIGHT
C. G. POSITION

REPORT NO 7/0510/10
SHEET 6-33
DATE
PREPARED BY G. [illegible]

9	10	11	12	13	14	15	16	17	18	19
δ z	SLOPE	c	SHEAR RELIEF = Pb/c (KIPS)	WEB SHEAR (KIPS)	WEB t	f_s (KSI)	PANEL f_s	CHECK OF COL (12): f_B (KSI) BOOM STRESS	BOOM AREA in²	SHEAR RELIEF (KIPS)
(11 - 10)	(9)/(8)	z, + SLOPE (7)/(10)	(6)/(11)	1.00 - (12)		(13)/2(7)(14)	AV OF f_s OF ENDS			2(10)(7)(18)
	21696 11111	218 .093025	.16506 7177	.834932 82	.072	1 .567447 37	1.70845 205	1 .611274 3	3.02	.16506 7175
	015406 41138	270 .037639 5	.244193 51	.755806 49		1 .261574 89	1 .418900 86	2 .768813 6	3.21	.244193 51
	014265 157810	308 .773310 5	.269022 87	.730977 13		1 .152457 62	1 .220 13 029	289754 1	3.38	.269022 87
			0	1.00000		2 .046214 99		0		0
	01696 11111	218 .093025	.082533 583	.917466 41		1 .722390 45	1 .87733 352	[illegible]	3.02	.082533 589
	015406 41138	270 .037639 5	.17753 61	.822463 9		1 .372837 71	1 .54403 905	1 .794702 94	3.21	.17753 61
	014265 157810	308 .773310 5	.21072 768	.789272 32		1 .244365 74	1 .31743 5	185295 8	3.38	.21072 768
			0	1.00000		1 .877333 53		0		0
	015406 41138	270 .037639 5	.110878 76	.889121 24		1 .454100 82	1 .669177 11	1 .120992 18	3.21	.110878 77
	014265 157810	308 .773310 5	.152432 48	.847567 52		1 .336273 88	1 .41474 030	1 .580717 4	3.38	.152432 48
			0	1.00000		1 .669177 11		0		0
	014265 157810	308 .7733105	.055463 48	.944536 52	.072	1 .489155 08	1 .57659 873	575153 62	3.38	.055463 48

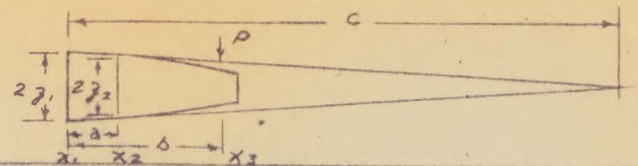
A. V. ROE CANADA LIMITED MALTON, ONTARIO TECHNICAL DEPT. (AIRFRAME)	REPORT NO.	7/0510/10
	SHEET	6-34
AIRCRAFT	DATE	
WEIGHT		
C. G. POSITION	PREPARED BY	C. Gundersen

9	10	11	12	13	14	15	16	17	18	19
								CHECK OF COL (12)		
δz	SLOPE	C $z_1 \div$ SLOPE	SHEAR RELIEF $= \frac{Pb}{c}$ (KIPS)	WEB SHEAR (KIPS)	WEB t	f_S (KSI)	PANEL f_S AV OF f_S OF ENDS	f_B (KSI) BOOM STRESS	BOOM AREA in^2	SHEAR RELIEF (KIPS)
(7) − (8)	$\frac{(9)}{(5)}$	$\frac{(7)}{(10)}$	$\frac{(6)}{(11)}$	1.00 − (12)		$\frac{(13)}{2(7)(14)}$				2(10)(17)(18)
			0	1.00000	.064	3.035866 95	2.2727 27	0		0
.8641	.02885 966837	119.1108626	.251374 55	.74862 565		1.701421 93	1.460 12 655	2.256538 18	1.93	.251374 56
.8523	.022710 451785	188.8910021	.357192 32	.642807 68		1.170668 80		2 945337 6	2.69	.357192 32
			0	1.00000			1.82118 047	0		0
.8523	.022710 451785	188.8910021	.198680 59	.801319 41	.064	1.459347 26		6382811	2.67	.198680 59

C 105 FIN

ALCULATION OF PANEL SHEAR

PE RELIEF AT $x = \frac{bP}{c}$



AVRO AIRCRA

TECHNICAL DEPT. (AIRF

AIRCRAFT

WEIGHT

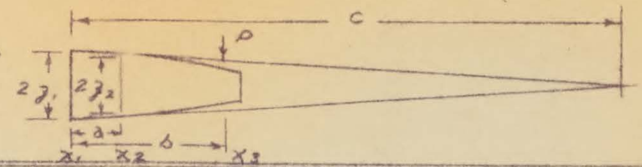
C. G. POSITION

	1	2	3	4	5	6	7	8	9	10	11	12	13
EAR NEL	LOAD POINT	x_1	x_2	x_3	a $= x_1 - x_2$ (2) − (3)	b $= x_1 - x_3$ (2) − (4)	z_1	z_2	δz (7) − (8)	SLOPE (9)/(5)	c $= z_1 \div$ SLOPE (7)/(10)	SHEAR RELIEF $= \frac{Pb}{c}$ (KIPS) (6)/(11)	WE SHE KIP 1.00 −
242 / 252	16					108 .888006	2.5734			.008272 709939	311 .020983	.350042 31	.649
252 / 260	↓					139 .732517	2.8296			.008286 725634	341 .389365	.409305 42	.590
260 / 264	↓					178 .393388	3.1489			.008274 516112	380 .5539258	.465272 89	.312
264	16					200 .111824	3.3285			.008269 472059	402 .5045323	.491166 64	.5028
	28					0	2.0539					0	1.00
221 / 232	↓					25 .754022	2.2670			.008274 435736	273 .9763872	.094900 58	.905
232 / 242	↓					44 .276918	2.4204			.008272 709939	292 .5764[illegible]	.151402 57	.848
242 / 252	↓					62 .537514	2.5734			.008272 709939	311 .020983	.202011 17	.797
252 / 260	↓					93 .654325	2.8290			.008286 725634	341 .3893651	.274420 75	.725
260 / 264	↓					132 .345196	3.1489			.008274 516112	380 .5539158	.347769 86	.652
264	28					154 .063632	3.3285			.008269 472059	402 .5045323	.382762 48	.6172
	35					0	2.2670			.008274 435736	273 .9763872	0	1.00
232 / 242	↓					18 .542896	2.4204			.008272 709939	292 .576435	.0633779 54	.93662
242 / 252	↓					37 .355792	2.5734			.008272 709939	311 .020983	.119219 71	.880
252	35					67 .930323	2.8290			.008286 725634	341 .3893661	.178981 90	.801

C 105 FIN

ALCULATION OF PANEL SHEAR

E RELIEF AT $x = \frac{bP}{c}$



AVRO AIRCRA

TECHNICAL DEPT. (AIRF

AIRCRAFT

WEIGHT

C. G POSITION

	1	2	3	4	5	6	7	8	9	10	11	12	13
EAR NEL	LOAD POINT	x_1	x_2	x_3	a $= x_1 - x_2$ (2) − (3)	b $= x_1 - x_3$ (2) − (4)	z_1	z_2	δz (7) − (8)	SLOPE (9)/(5)	c $= z_1 \div$ SLOPE (7)/(10)	SHEAR RELIEF $= \frac{Pb}{c}$ (KIPS) (6)/(11)	WE SHE KIP 1.00 −
26[illegible] 264	35					266 .591174	3.1489			.008274 516112	380 .553976	.280094 76	.719
	35					128 .309610	3.3285			.008269 472074	402 .5045323	.318778 05	.6812
242	42					0	2.4204			.008272 709937	292 .576438	0	1.00
252						18 .542896	2.5734			.008272 709937	311 .070983	.0596098 54	.940
260						49 .387407	2.8290			.008286 725634	341 .3893661	.147665 92	.85
264						88 .048278	3.1489			.008274 516112	380 .553976	.231368 [illegible]	.765
	42					109 .766714	.3285			.008269 472074	402 .5045323	.272709	.727
260	53						2.8290			.008286 725634	341 .3893661	0	1.00
264						38 .660571	3.1489			.008274 516112	380 .553776	.101591 03	.898
	53					60 .379307	3.3285			.008269 472074	402 .5045323	.150009 01	.849
264	56					0	3.1489			.008374 516112	380 .553776	0	1.00
	56					21 .718436	3.3285			.008269 472074	402 .5045323	.053958 24	.94

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

REPORT NO. 7/0510/10
SHEET NO 6-39

AIRCRAFT: C-105 — FIN

PREPARED BY	DATE
L. Gundara	
CHECKED BY	DATE

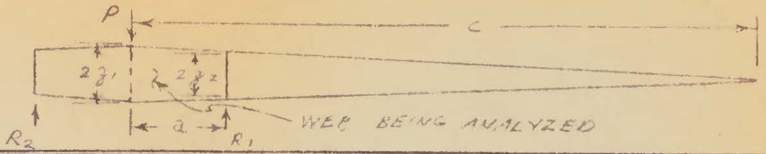
SHEAR STRESSES
SPAR #5

1	2	3	4	5	6
SHEAR PANEL	LOAD POINT	LOAD PT OF COL (4)	(REF) fs	FACTOR	fs (4)·(5)
256	12	13	1.048 732 24	.537 465 31	.563 657 2
205	18	17	2.039 685 75	.462 534 69	.943 425 4
214	↓	↓	1.613 949	↓	.746 507
223	↓	↓	1.321 161 60	↓	.611 083 1
234	↓	↓	1.146 393 83	↓	.530 246 9
244	↓	↓	1.035 529 53	↓	.478 991 4
255	↓	17	.919 248 26	.462 534 69	.425 184 2
206	↓	19	2.208 668 85	.537 465 31	1.187 082 9
216	↓	↓	1.872 551 04	↓	1.006 431 2
225	↓	↓	1.588 285 85	↓	.853 594 8
235	↓	↓	1.394 360 35	↓	.749 420 3
245	↓	↓	1.260 545 79	↓	.677 499 7
256	18	19	1.172 399 61	.537 465 31	.630 124 1
214	24	23	1.804 435 26	.462 534 69	.834 613 9
223	↓	↓	1.459 834 12	↓	.673 234 8
234	↓	↓	1.256 927 9	↓	.581 373 7
244	↓	↓	1.129 436 24	↓	.522 403 4
255	↓	23	.997 084 79	.462 534 69	.461 186 3
216	↓	25	2.022 939 32	.537 465 31	1.087 257 7
225	↓	↓	1.713 007 05	↓	.920 681 7
235	↓	↓	1.502 154 54	↓	.807 356 0
245	↓	↓	1.356 946	↓	.729 311
256	24	25	1.261 368 94	.537 465 31	.677 942 0
224	31	31	2.150 581 90	1.000	2.150 581 9
234	↓ 38	37	1.531 612 17	.462 534 69	.708 423 8
244	↓ ↓	↓	1.362 670 12	↓	.630 282 2
255	↓ ↓	37	1.190 508 53	.462 534 69	.550 651 4
235	↓ ↓	39	1.770 023 02	.537 465 31	.951 326 0
245	↓ ↓	↓	1.596 502	↓	.858 064
256	31 38	39	1.482 457 74	.537 465 31	.796 769 6

FORM 1319A

C105 FIN

CHORDWISE WEB SHEAR DUE TO LOAD POINTS ON SPAR #5



AVRO AI[illegible]

TECHNICAL DEPT

AIRCRAFT - -

WEIGHT - -

C. G. POSITION -

	1	2	3	4	5	6	7	8	9	10	11	12
SHEAR WEB	LOAD POINT	R_1 REACTION APPLIED TO RIB	a	z_1	z_2	Δz (4) − (5)	SLOPE (6)/(3)	c = z_1 ÷ SLOPE (4)/(7)	SLOPE SHEAR (2)(3)/(8)	AT z_1 WEB SHEAR KIPS (2) − (9)	WEB t	WEB f_s AT z_1 (10)/2(4)(11)
180	2	.46253469	11.62	1.6086	1.2303	.3783	.032555 9380	41 .40341	.10877 815	.353768 815	.072	1.52720 281
193	12			2.1283	1.8547	.2736	.023957 9685	88 .834744	.060501 70	.402032 979	.064	1.47577 067
201	18			2.4744	2.3768	.0976	.008399 31153	294 .595557	.018244 175	.444290 51	.064	1.40277 223
209	24			2.7036	2.6938	.0098	.000843 373494	320 .561714	.01676 94	.445768 75	.072	1.14499 790
229	31 & 38			3.2291	3.3686	−.1395	−.01200 51635	−268 .9759285	−.01999 9112	.482516 60	.072	1.03769 153
239	45			3.4247	3.5874	−.1627	−.01400 17212	−244 .5913578	−.02199 4010	.484508 70	.081	.873301 15
247	51	.46253469	11.62	3.5856	3.7968	−.2112	−.01817 55594	−197 .2739388	−.02724 434	.489779 04	[illegible]	.84318 591
181	2	.53746531	10.0	1.6086	1.5483	.0603	.00603	266 .7661691	.02014 7431	.517317 88	.072	2.2332 9931
194	12			2.1283	2.0277	.1006	.01006	211 .560636	.02544 4788	.512060 52	.064	1.87965 644
202	18			2.4744	2.2993	.1751	.01751	141 .313535	.03809 534	.499431 78	.064	1.57687 14[illegible]
210	24			2.7036	2.4877	.2159	.02159	125 .224641	.04299 092	.494545 22	.072	1.27028 473
230	31 & 38			3.2291	2.9429	.2862	.02862	112 .826695	.04761 360	.489828 95	.072	1.05341 734
240	45			3.4247	3.1042	.3205	.03205	106 .854714	.05026 605	.487166 70	.081	.878092 052
250	51	.53746531	10.0	3.5856	3.2642	.3214	.03214	111 .561917	.048 64	.489288 40	.081	.842342 10

FORM 1843

AVRO AIRCRAFT LIMITED
MALTON · ONTARIO
TECHNICAL DEPARTMENT

REPORT NO. 7/0510/10
SHEET NO. 6-42

AIRCRAFT:		PREPARED BY	DATE
C 105	FIN	L.B.G.	
		CHECKED BY	DATE

SHEAR STRESSES
LOAD POINTS AFT OF H/L

1	2	3	4	5	6
SHEAR PANEL	LOAD POINT	LOAD PT OF COL (4)	REF - fs	FACTOR	fs (4) . (5)
189	5	1	2.962 47625	-.321 336 76	.951 952 7
197	↓		1.745 816 4	↓	.561 316
205			1.333 331 6		.428 439
214			1.119 3259		.359 681
223			.961 029 58		.308 830
234			.859 371 38		.276 148
244			.791 857 86		.254 456
255		1	.717 135 17		.230 442
184		4	2.653 399 66	1.321 336 76	-3.506 035
191			1.920 67601	↓	-2.537 860
199			1.474 929 11		-1.948 878
207			1.185 361 72		-1.566 262
217			.988 135 09		-1.305 659
226			.820 505 35		-1.084 164
236			.707 375		-.934 681
246	5	4	.630 063 88		-.832 527
197	15	11	2.311 723 9	.321 336 76	.742 842
205	↓		1.661 5127	↓	.533 918
214			1.349 173 3		.433 539
223			1.128 407		.362 599
234			.992 748 64		.319 007
244			.905 118 74		.290 848
255		11	.811 035 11		.260 622
199		14	2.037 282 3	1.321 336 76	-2.691 936
207			1.637 555 87	↓	-2.163 763
217			1.364 897		-1.803 483
226			1.133 527		-1.497 774
236			.977 097 11		-1.291 077
246	15	14	.870 308 0		-1.149 970

FORM 1319A

AVRO AIRCRAFT LIMITED
MALTON - ONTARIO
TECHNICAL DEPARTMENT

REPORT NO. 7/0510/10
SHEET NO. 6 - 43

AIRCRAFT:		PREPARED BY	DATE
C 105	FIN	bPG	
		CHECKED BY	DATE

SHEAR STRESSES

1 SHEAR PANEL	2 L.P.	3 L.P. OF COL (4)	4 REF - fs	5 FACTOR	6 fs = (4).(5)
205	21	17	2.039 6857	-.321 336 76	+.655 426
214			1.613 949		+.518 621
223			1.321 1616		+.424 538
234			1.146 393 83		+.368 378
244			1.035 579 53		+.332 770
255		17	.919 24826		+.295 388
207		20	1.870 032 71	1.321 336 76	-2.470 943
217			1.558 588		-2.059 420
226			1.294 45792		-1.710 415
236			1.115 96647		-1.474 303
246	21	20	.993 820		-1.313 171
214	27	23	1.804 43526	-.321 336 76	+.579 831
223			1.459 83412		+.469 098
234			1.256 9299		+.403 898
244			1.129 43624		+.362 929
255		23	.997 084 79		+.320 400
217		26	1.697 937	1.321 336 76	-2.243 547
226			1.410 233 84		-1.863 394
236			1.215 527		-1.606 121
246	27	26	1.082 678		-1.430 582
234	41	37	1.531 61217	-.321 336 76	+.492 163
244		37	1.362 67012		+.437 876
255		37	1.190 508 53		+.382 554
236		40	1.463 432 49	1.321 336 76	-1.933 687
246	41	40	1.303 489	1.321 336 76	-1.722 348

FORM 1319A

AVRO AIRCRAFT LIMITED
MALTON · ONTARIO
TECHNICAL DEPARTMENT

AIRCRAFT: C 105	FIN	REPORT NO. 7/0519 /10	
		SHEET NO. 6-44	
		PREPARED BY: L.L.	DATE
		CHECKED BY	DATE

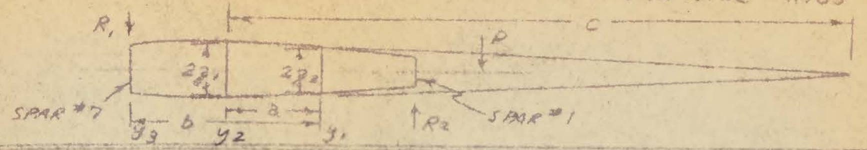
SHEAR STRESSES
LOAD PTS AFT OF HR

1	2	3	4	5	6
SHEAR PANEL	L. P.	L.P OF COL (4)	(REF) - fs	FACTOR	fs = (4) (5)
189	9	1	2.962 4768	‾.321 336 76	.951 953
197	↓	↓	1.746 816 4	↓	.561 316
205	↓	↓	1.333 391 6	↓	.428 439
214	↓	↓	1.119 3259	↓	.359 381
223	↓	↓	.961 0796	↓	.308 830
234	↓	↓	.859 3718	↓	.276 148
244	↓	↓	.791 8679	↓	.254 456
255	↓	1	.717 1352		.230 442
191	↓	8	2.326 3929	1.321 336 76	‾3.073 948
199	↓	↓	1.786 310 05	↓	‾2.360 317
207	↓	↓	1.435 7465	↓	‾1.897 105
217	↓	↓	1.196 7502	↓	‾1.581 310
226	↓	↓	.993 8309	↓	‾1.313 185
236	↓	↓	.856 724 3	↓	‾1.132 021
246	9	8	.763 0900		‾1.008 299

FORM 1313A

C105 FIN

CALCULATION OF PANEL SHEAR IN CHORDWISE RIBS



AVRO AI
TECHNICAL DEPT

AIRCRAFT

WEIGHT

C. G. POSITION

	0	1	2	3	4	5	6	7	8	9	10	11	12
SHEAR PANEL	LOAD POINT	R1 REACTION APPLIED TO RIB	y_1'	y_2'	y_3'	a $= y_1' - y_2'$	b $= y' - y_3'$	z_1	z_2	Δz (7)-(8)	SLOPE (9)/(5)	$= z_2 \div$ SLOPE (8)/(10)	SHEAR RELIEF $= \frac{Pb}{c}(1+?)$ / (11)
	5	.321336 76	34.6	23.0	34.62				1.2303				0
180													
			23.0			11.62	11.62	1.2303	1.6086	-.3783	-.03261 206897	-49 .325297	-.07556 9869
181													
			13.0			10.0	21.62	1.6086	1.5483	.0603	.00603 0000	256 .766167	.02705 69157
182													
	5		3.5	13.0		9.5	31.12	1.5483	1.2414	.3069	.03230 526315	38 .427175 16	.260232 50
	15							1.8547	1.8547	0			0
193													
						11.62	11.62	1.8547	2.1283	-.2736	-.02358 620689	-90 .234741	-.04130 89026
194													
						10.0	21.62	2.1283	2.0277	.1006	.01006 00000	201 .560636	.03446 75471
195													
	15					9.5	31.12	2.0277	1.7194	.3083	.03245 263157	52 .981835 8	.188743 9315
	21							2.3768	2.3768	0			0
201													
						11.62	11.62	2.3768	2.4744	-.0976	-.008413 793103	-294 .088524	-.01267 47767
202													
						10.0	21.62	2.4744	2.2993	.1751	.01751 0000	131 .313535 12	.05290 6204
203													
	21					9.5	31.12	2.2993	1.9634	.3359	.035357 89473	55 .529324 2	.180085 0295
	27							2.6938		0			0
209													
						11.62	11.62	2.6938	2.7036	-.0098	-.00084 4827586	-3200 .179577	-.00116 47804
210													
	27	.321336 76			34.6	10.0	21.62	2.7036	2.4877	.2159	.02157 0000	115 .224641	.050293 5333

AVRO AIRCRAFT LIMITED
TECHNICAL DEPT. (AIRFRAME)

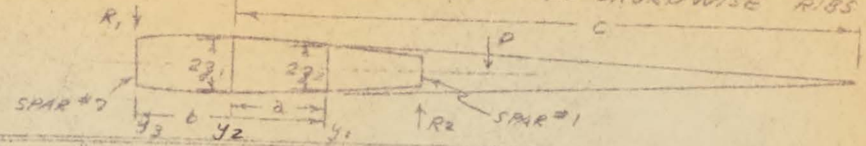
AIRCRAFT
WEIGHT
C. G. POSITION

REPORT NO. 7/0510/10
SHEET 6-45
DATE
PREPARED BY

(8)	9	10	11	12	13	14	15	16	17	18	19
	Δ_{∂} (7)-(8)	SLOPE (9)/(3)	$c_1 = \partial_2 \div$ SLOPE (8)/(10)	SHEAR RELIEF = Pb(KIPS) (1VE)/(11)	WEB SHEAR KIPS (1)+(12)	WEB t	f_S KSI (AT y_1) (13)/2(8)(14)	PANEL f_S 13/2(7)(14)	CHECK OF COL (12) f_B(KSI) BOOM STRESS	BOOM AREA	SHEAR RELIEF 2(10)(7)(18)
03				0	.321543 408	.072	1.814955 97	1.387234	0		0
76	-.3783	-.03261 206897	-49.325297	-.07556 9869	.245766 9	.072	1.061676 03	1.504041	1.4138577	.820	-.07561 8473
77	.0603	.00663 0000	256.766167	.02705 69157	.348393 7	.072	1.563509 97	2.608458	2.735233 5	.820	.02704 9271
14	.3069	.03230 526315	38.427175 16	.260232 50	.58156 93	.072	3.254479 19		4.966351 0	.811	.260232 506
17	0			0	.321543 408	.064	1.35442 814	1.179554	0		0
93	-.2736	-.02358 620689	-90.234241	-.04130 89026	.280027 9	.064	1.028578 927	1.306076	.551455 795	1.580	-.04133 54680
77	.1006	.01006 00000	201.560636	.03446 75471	.355804 3	.064	1.371632 64	1.965284	1.050683 9	1.620	.03445 73076
94	.3083	.03245 263157	52.181835 8	.188743 9315	.510080 7		2.318611 05		1.758156 7	1.654	.18874 393
8	0			0	.321543 408	.064	1.056907 55	1.014567	0		0
14	-.0976	-.008413 793103	-294.088524	-.01267 47767	.308662	.064	.975174 79	1.181609	.369460 09	2.040	-.01268 29279
3	.1751	.01751 0000	131.313535 12	.05290 6204	.374243	.064	1.272244 07	1.703718	.721948 214	2.097	.052891 2545
4	.3359	.035357 89473	55.529324 2	.180085 0295	.501422		1.996013 12		1.205207 21	2.113	.180085 0299
	0			0	.321543 408	.072	.828918 380	.825383	0		0
6	-.0098	-.00084 4827586	-3200.179577	-.00116 47804	.320172 0	.072	.822920 55	.980252	.288620 56	2.390	.00116 52944
7	.2157	.02157 0000	115.224641	.050293 5333	.381630 3		1.065854 84		.571636 17	2.442	.060276 4960

C105 FIN

CALCULATION OF PANEL SHEAR IN CHORDWISE RIBS



AVRO TECHNICA

AIRCRAFT

WEIGHT

C. G. POSITION

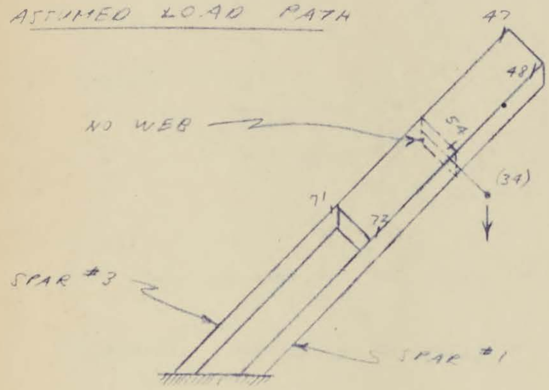
	0	1	2	3	4	5	6	7	8	9	10	11	12
SHEAR PANEL	LOAD POINT	R. REACTION APPLIED TO RIB	y_1'	y_2'	y_3'	a $y_1 - y_2$	b $= y - y_3'$	z_1	z_2	Δz (7)-(8)	SLOPE $\frac{(9)}{(5)}$	c $= \frac{z_2}{SLOPE}$ $\frac{(8)}{(10)}$	S… R… = …
211	27	.321336 76				9.5	31.12	2.4877	2.1390	.3487	.037368 42105	57 .2408451	.17 10
229	41 ↓	↓						3.3686		0			
230						11.62	11.62	3.3686	3.2291	.1395	.01202 586206	268 .5129742	.0 0
231	↓	↓				10.0	21.62	3.2291	2.9429	.2862	.02862 0000	102 .826684 61	.06 20
	41	.321336 76				9.5	31.12	2.9429	2.5753	.3676	.03869 473684	66 .5542710	.15 3
IMAGINARY RIB	34	.052631 58				9.5	9.5	2.7184	2.3558	.3626	.038168 4210	61 .721180 4	.16 92
	34												

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

AIRCRAFT: C105	FIN	REPORT No. 7/0510/10
		SHEET No. 6-42
		PREPARED BY: L. Gundersen — DATE: NOV 55
		CHECKED BY: — DATE:

LOAD POINT 34
STATICALLY DETERMINANT PATH

ASSUMED LOAD PATH



METHOD

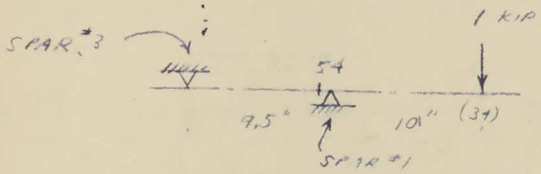
SINCE NO RIB WEB EXISTS ADJACENT TO LP 34 THE TWO CELLS WILL REPLACE THE RIB. BELOW THE CELLS THE LOAD WILL BE REACTED BY DIFFERENTIAL BENDING OF THE SPARS.

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

AIRCRAFT:		REPORT NO. 7/0512/10
C105	FIN	SHEET NO. 6-48
		PREPARED BY: L. Gundersen — DATE:
		CHECKED BY: — DATE:

LOAD POINT (34)
STATICALLY DETERMINANT PATH

LOADS IN IMAGYUARY RIB



REACTION APPLIED TO SPAR #3 $= \frac{1 \times 10}{9.5} = 1.052\,631\,58 \uparrow$

REACTION APPLIED TO SPAR #1 $= \frac{1 \times 19.5}{9.5} = 2.052\,631\,58 \downarrow$

BENDING STRESS AT S.P. 54

$M = 1.0 \times 10 = 10$ KIP IN LB

BOOM AREA $= 2.955\ ''^2$

$\frac{1}{2}$ HEIGHT "z" $= 2.3558''$

$\therefore f_B = \frac{M}{2zA} = \frac{10}{2 \times 2.955 \times 2.3558} = \underline{0.718\,247\,46}$

SHEAR IN IMAGINARY RIB

SEE SHT 6-46 REF.

SHEAR LOAD IN KIPS AT SPAR #1 $= 1.214\,650\,51$
(FROM ABOVE) AT SPAR #3 $= 1.052\,631\,58$

AV SHEAR FLOW $= \frac{1.052\,631\,58}{2 \times 2.3558} = 0.223\,412\,8$ KIPS / INCH

AVRO AIRCRAFT LIMITED
MALTON - ONTARIO
TECHNICAL DEPARTMENT

REPORT NO. 7/0510/10
SHEET NO. 6-49

AIRCRAFT:		PREPARED BY	DATE
C 105	FIN	[illegible signature]	
		CHECKED BY	DATE

SHEAR FLOW IN IMAGINARY RIB FROM kip

$q = .00417440 + .00377711 = .00795151$ KIP/IN

FACTOR "R" TO SOLVE REDUNTANT STRESSES

$q = .2234128 + .00795151\ R = 0$

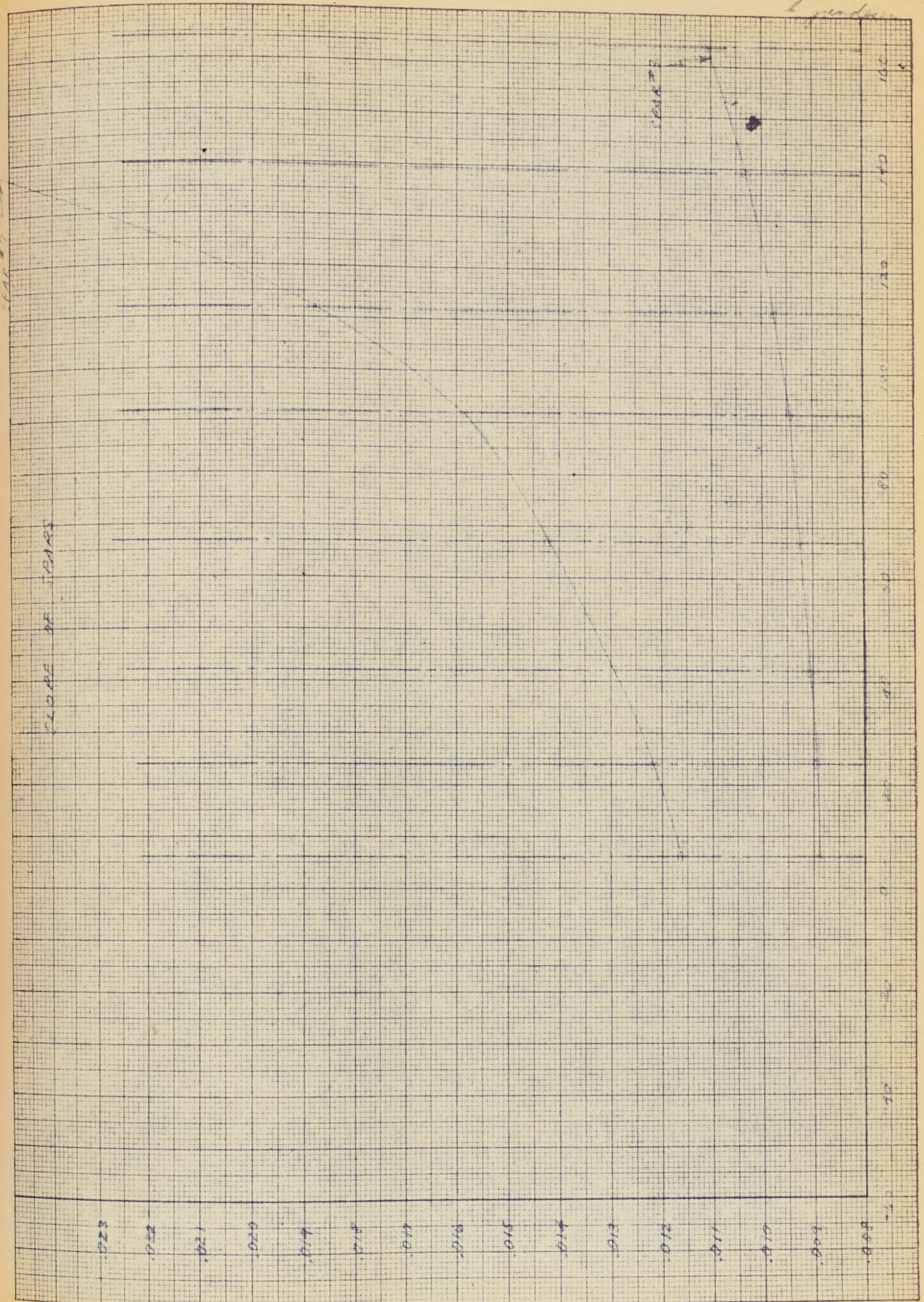
$R = \dfrac{.2234128}{.00795151} = -28.09690$

S.P.	SHEAR FLOW (REF SHT 5-27)	t	STRESS
154	+.00417440	.154950	+.02694030
159	+.00377711	.199700	+.01891392
211	−.00417440	.072	−.05797778
216	−.00328650	.091	−.03611538
217	+.00440783	.125	+.03526264
225	+.00358143	.091	+.03935637
226	−.00471915	.125	−.03775320
231	−.00377711	.072	−.05245986

S.P. 60 $\quad STRESS = \dfrac{1}{2 \times 2.3558 \times 1.240} = 0.1711630$

S.P. 59 $\quad STRESS = \dfrac{1}{2 \times 2.7161 \times 1.870} = 0.09844 25$

7/0510 /10
6-51

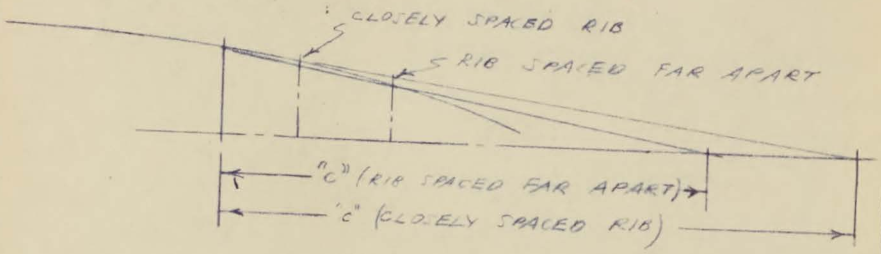


A. V. ROE CANADA LIMITED
MALTON · ONTARIO
TECHNICAL DEPARTMENT (Aircraft)

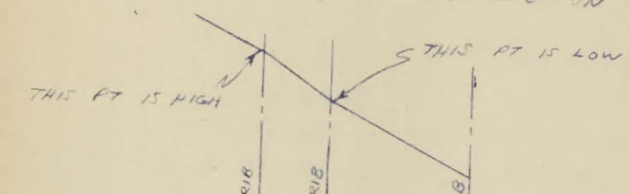
AIRCRAFT:		REPORT NO 7/0510/10	
C105	FIN	SHEET NO 6 - 53	
		PREPARED BY	DATE
		[signature]	DEC 55
		CHECKED BY	DATE

CONCLUSIONS DRAWN FROM GRAPHICAL CHECK (PREVIOUS SHT)

A SLIGHT UNEVENESS IS EVIDENT IN THE GRAPH OF DIM "C". WE BELIEVE THIS IS DUE TO THE UNEVEN RIB SPACING.



EFFECT OF UNEVEN SPACING ON GRAPH



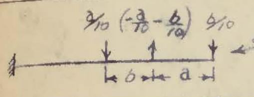
CONCLUSION

SINCE THIS IS THE TYPE OF UNEVENESS EVIDENT WE CAN CONCLUDE THAT THE CALCULATIONS DO NOT CONTAIN ANY SERIOUS ERRORS.

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

REPORT No.	7/05/10/10
SHEET No.	6-54

AIRCRAFT:		PREPARED BY	DATE
C105	FIN	L.S.G.	DEC 55
		CHECKED BY	DATE



SELF EQUILIBRIATING GROUP OF LOADS APPLIED TO SPAR

CHECK OF TIA BY MEANS OF SELF EQUILIBRIATING LOADS

GROUP	① L.P.	② LOAD FOR COL ① DM b × 1/10	③ L.P.	④ LOAD FOR ③ COL -②-⑥	⑤ L.P.	⑥ LOAD FOR ⑤ DM a × 1/10
1	1	2.780 000	11	-5.193 272 2	17	2.413 272 2
2	1	1.000 0000	2	-2.162 000 0	3	1.162 000 0
3	3	2.413 272 2	7	-4.493 394 2	13	2.080 122 0
4	4	2.413 272 2	8	-5.407 416 4	14	2.994 144 2
5	1	1.000 000 0	4	-4.112 000 0	5	3.112 000 0
6	10	4.604 819	16	-7.468 666	28	2.863 847
7	11	2.000 000 0	17	-4.780 000 0	23	2.780 000 0
8	6	2.780 000 0	12	-5.193 272 2	18	2.413 272 2
9	7	↓	13	↓	19	↓
10	8	↓	14	↓	20	↓
11	9	2.780 000 0	15	-5.193 272 2	21	2.413 272 2
12	16	2.575 402	28	-7.180 221	35	4.604 819
13	23	2.500 000 0	30	-4.970 000 0	37	2.470 000 0
14	18	4.970 000 0	24	-6.970 000 0	38	2.000 000 0
15	19	2.470 000 0	25	-4.470 000	32	↓
16	20	2.470 000 0	26	-4.470 000	37	↓
17	21	4.970 000 0	27	-6.970 000 0	41	2.000 000 0
18	22	2.500 000 0	29	-4.970 000 0	36	2.470 000 0
19	28	1.854 287 6	35	-4.429 691 8	42	2.575 402 2
20	30	1.800 000 0	37	-4.300 000 0	44	2.500 000 0
21	37	1.000 000 0	31	-2.162 000 0	39	1.162 000 0
22	32	1.800 000 0	39	-4.300 000 0	46	2.500 000 0
23	37	1.800 000 0	40	-4.300 000 0	47	2.500 000 0
24	32	1.000 000 0	33	-1.950 000 0	34	.950 000 0
25	42	3.866 087	53	-8.804 828	56	4.938 741
26	29	1.800 000 0	36	-4.300 000 0	43	2.500 000 0
27	37	1.800 000 0	44	-3.600 000 0	50	1.800 000 0
28	38	1.800 000 0	45	-3.600 000 0	51	1.800 000 0
29	39	1.800 000 0	46	-3.600 000 0	52	1.800 000 0
30	48	3.752 898	53	-6.747 042	58	2.994 144
31	43	2.994 143 9	47	-4.794 143 9	55	1.800 000 0

FORM 1319A

A. V ROE CANADA LIMITED
MALTON - ONTARIO

TECHNICAL DEPARTMENT (Aircraft)

REPORT No. 7/0510/10	SHEET No. 6-55	
AIRCRAFT: C 105	FIN	
PREPARED BY: C. Gundersen	DATE: DEC. 55	
CHECKED BY:	DATE:	

	1	2	3	4	5	6
GROUP	L.P.	LOAD FOR ①	L.P.	LOAD FOR ③	L.P.	LOAD FOR ⑤
32	44	2.994 1439	50	-4.794 1439	60	1.800 000 0
33	45	1.876 150 7	51	-3.676 150 7	61	1.800 000 0
34	46	.914 022 2	52	-2.714 022 2	62	1.800 000 0
35	40	1.800 000 0	47	-3.600 000 0	63	1.800 000 0
36	53	2.171 8436	56	-6.037 930 7	57	3.866 087 1
37	49	1.712 5643	55	-4.706 7082	59	2.994 1439

METHOD:

THE TIA MATRIX WILL BE MULTIPLIED BY THE MATRIX CALCULATED ABOVE. THIS SHOULD YIELD ONLY LOCAL STRESSES NEAR THE LOADS. THE POSITION OF THESE LOCAL STRESSES HAS BEEN PLOTTED ON A DUMMY MATRIX. STRESSES FOUND IN THE RESULT, BUT NOT THE DUMMY, WILL INDICATE ERRORS.

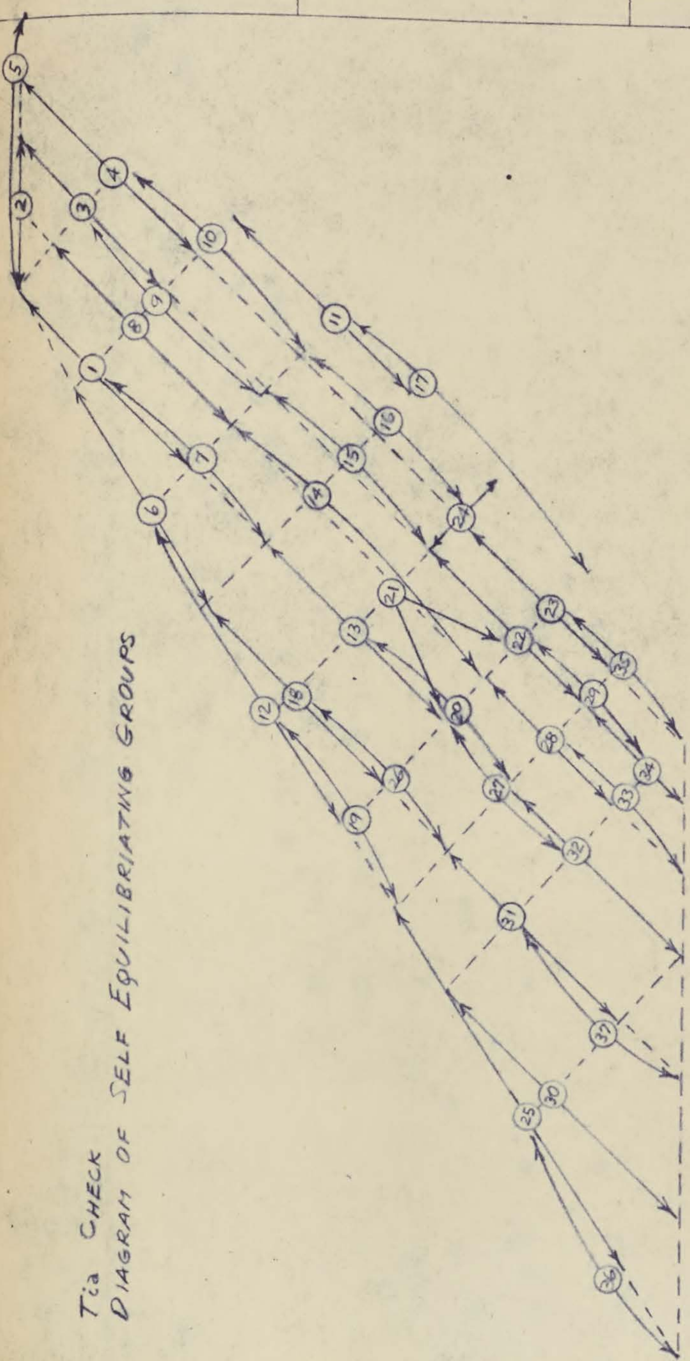
A FEW POINTS HAVE BEEN CALCULATED BY HAND ON THE FOLLOWING PAGES. HOWEVER, THE WHOLE PROBLEM HAS BEEN COMPUTED BY MACHINE.

CONCLUSION:

ERRORS DISCOVERED IN TIA HAVE BEEN CORRECTED. POINTS NOT CHECKED BY THIS CHECK HAVE BEEN RECALCULATED ON A DESK CALCULATOR.

AVRO AIRCRAFT LIMITED
MALTON - ONTARIO
TECHNICAL DEPARTMENT

AIRCRAFT:		REPORT No. 7/0510/10	
C105	FIN	SHEET No. 6-56	
		PREPARED BY	DATE
		E. Gundesen	APR 56
		CHECKED BY	DATE



Tia Check
Diagram of Self Equilibriating Groups

FORM 1319A

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

REPORT NO. 7/0510/10
SHEET NO. 6 - 60

AIRCRAFT: C 105 | FIN

PREPARED BY: E.L.S. | DATE: DEC 55
CHECKED BY: | DATE:

TIA CHECK (CALCULATED BY DESK CALCULATOR)

1	2	3	4	5	6	7
GROUP	STRESS POINT	LOAD POSITION	LOAD	STRESS (TIA)	STRESS COL (4) x (5)	Σ COL(6) CHECK
1	33	1	2.780	5.517 639	15.339 036	
	↓	11	-5.193 2722	2.953 636	-15.339 036	
	33	17	2.413 2722	0		0
1	95	1	2.780	6.965 983	19.365 433	
	↓	11	-5.193 2722	5.899 528	-30.637 855	
1	95	17	2.413 2722	4.671 012	11.272 423	.000 001
	255	1	2.2800	-.717 13517	-1.9936358	
	↓	11	-5.193 2722	-.811 05511	4.2120300	
1	255	17	2.413 2722	-.919 24826	-2.2183963	-.000 002
32	274	44	2.994 144	4.129 777	12.365 207	
		50	-4.794 144	2 832 680	-13.580 276	
		60	1.800 000	.675 038	1.215 068	0
21	274	37	1.000 000	5.426 914	5.426 914	
		31	-2.162 000	2.510 136	-5.426 914	0
	276	31	-2,162000	2,111 129	-4.564 261	
		39	1.162000	3.927 935	4.564 260	-.000 001
5	189	1	1.000	-2.962 477	-2.962 477	
		5	3.112 000	.951 9529	2,962 477	0
4	236	4	2.413 272	-.707 375	-1.707088	
		8	-5.407 416	-.856 724	+4.632 663	
		14	2.994 144	-.977 099	-2.925 575	0
	246	4		-.630 064	-1.520 516	
		8		-.763 090	4.126 345	
		14		-.870 308	-2.605 827	+.000 001
	.245	18	4.970	-.677 500	-3.367 175	
14		24	-6.970	-.729 311	5.083 298	
		38	2.000	-.859 9670	-1.716 128	-.000 005
19	264	2.8	1.854 290	-1,361 228	-2.524 111	
		35	-4.429 692	-1.502 336	+6.654 886	
		42	2.575 402	-1.603 935	-4.130 777	-.000002

FORM 1318A

AVRO AIRCRAFT LIMITED
MALTON · ONTARIO
TECHNICAL DEPARTMENT

AIRCRAFT: C105	FIN	REPORT NO. 7/0510/10	SHEET NO. 6-64
		PREPARED BY: L. Gunderson	DATE: MARCH 56
		CHECKED BY:	DATE:

CALC OF T_{i3} FOR BASE

METHOD:

THE FIN IS ASSUMED MOUNTED ON HORIZONTAL BEAMS WHICH DUPLICATE THE FUSELAGE STIFFNESS. THE STIFFNESS COEFFICIENTS OF THESE BEAMS WAS CALCULATED (REF AND ARE INCLUDED IN THE C_{ik}. SINCE WE ARE INTERESTED IN STIFFNESS ONLY, THE BEAMS HAVE ARBITRARILY BEEN ASSUMED 5" DEEP WITH 1.0"² BOOM AREAS. THEREFORE, THE T_{i3} STRESSES CAN BE CALCULATED BY TAKING THE LOAD POINT HEIGHT (x ORDINATE) ABOVE THE FIN ℄ AND DIVIDING BY 10. THE SAME LOAD PATHS ARE ASSUMED AS FOR THE PREVIOUS T_{i3}.

① STRESS POINT	② LOAD POINT	③ x - ORDINATE	④ $f_8 = (154.5 - \text{COL}(3)) \div 10$
271	10	25.830 045	12.866 996
↓	16	41.093 809	11.340 619
	28	65.636 623	8.886 338
	35	79.363 029	7.513 697
	42	89.246 042	6.525 396
	53	115.568 589	3.893.141
↓	56	136.174 108	1.832 589
271	57	147.749 621	.675 038
272	48	99.129 055	5.537 094
↓	54	120.705 469	3.379 453
272	58	147.749 621	.675 038
273	22	52.074 934	10.242 507
↓	29	69.874 260	8.462 574
	36	87.889 774	6.661 023
	43	100.860 944	5.363 906
	49	113.832 114	4.066 789
↓	55	135.408 531	1.909 147
273	59	147.749 621	.675 038

FORM 1319A

AVRO AIRCRAFT LIMITED
MALTON · ONTARIO
TECHNICAL DEPARTMENT

REPORT No. 7/0510/10
SHEET No. 6-65

AIRCRAFT:		PREPARED BY	DATE
C 105	FIN	b Gundesen	MARCH 56
		CHECKED BY	DATE

CALC OF TIQ FOR BASE

1 S.P.	2 L.P.	3 X-ORDINATE	4 fB = (154.5 − col(3)) ÷ 10
274	1	12.579 824	14.192 018
↓	11	29.970 759	12.452 964
	17	50.003 610	10.449 639
	23	64.416 021	9.008 398
	30	82.215 349	7.228 465
	37	100.230 863	5.426 914
	44	113.202 033	4.129 797
	50	126.173 203	2.832 680
274	60	147.749 621	.675 038
276	3	12.579 823	14.192 018
↓	7	27.569 610	12.693 039
	13	44.960 146	10.953 985
	19	64.993 397	8.950 660
	25	79.405 808	7.509 419
	32	97.205 136	5.729 486
	39	115.220 650	3.927 935
	46	128.191 820	2.630 818
	52	141.162 990	1.333 701
276	62	147.749 621	.675 038
277	4	12.579 823	14.192 018
↓	8	34.156 241	12.034 376
	14	51.546 777	10.295 322
	20	71.580 028	8.291 997
	26	85.992 439	6.850 756
	33	103.791 767	5.070 823
	40	121.807 281	3.269 272
	47	134.778 451	1.972 155
277	63	147.749 621	.675 038

S.P 275. MOMENT = DIFFERENCE IN CO-ORD LP 31 & 38
= 18.015 514

fB = 1.801 551

FORM 1319A

AVRO AIRCRAFT LIMITED
MALTON · ONTARIO
TECHNICAL DEPARTMENT

AIRCRAFT:		REPORT No. 2/0510/10	
C105	FIN	SHEET No. 6-66	
		PREPARED BY	DATE
		L. Gundersen	MARCH 56
		CHECKED BY	DATE

CALC OF $\bar{\sigma}_{ia}$ FOR BASE

ASSUMED LOAD PATH FOR SPAR #5
0.462 53469 OF LOAD GOES DOWN SPAR #7
0.537 465 31 " " " " " #3

ASSUMED LOAD PATH FOR HINGE LINE LOAD POINTS
-0.321 543 41 OF LOAD GOES DOWN SPAR #7
1.321 543 41 " " " " " #1

STRESSES IN S.P. 274 (FACTOR .462 5347)

1	2	3	4
L.P.	L.P. COL(3)	REF f_B	f_B
2	1	14.192 018	6.564 301
6	1	14.192 018	6.564 301
12	11	12.452 964	5.759 728
18	17	10.447 639	4.833 321
24	23	9.008 398	4.166 697
31	37	5.426 914	2.510 136
38	37	5.426 914	2.510 136
45	44	4.129 797	1.910 174
51	50	2.832 680	1.310 213
61	60	.675 038	.312 228

S.P. 274 (FACTOR -.32133676)

1	2	3	4
L.P.	L.P. COL(3)	REF f_B	f_B
5	1		-4.560 417
9	1		-4.560 417
15	11		-4.001 595
21	17		-3.357 853
27	23		-2.894 729
~~34~~	~~30~~		~~-2.324 265~~
41	37		-1.743 867

S.P. 276 (FACTOR .537 46531)

1	2	3	4
L.P.	LP COL(3)	REF f_B	f_B
2	3	14.192 018	7.627 717
6	7	12.693 039	6.822 068
12	13	10.953 985	5.887 387
18	19	8.950 660	4.810 669
24	25	7.509 419	4.036 052
31	39	3.927 935	2.111 129
38	39	3.927 935	2.111 129
45	46	2.630 818	1.413 973
51	52	1.333 701	.716 818
61	62	[illegible]	[illegible]

S.P. 277 (FACTOR 1.321 33676

1	2	3	4
LP	LP COL(3)	REF f_B	f_B
5	4	14.192 018	18.752 435
9	8	12.034 376	15.901 463
15	14	10.295 322	13.603 587
21	20	8.291 997	10.956 520
27	26	6.850 756	9.052 156
34	33	~~5.070 823~~	~~6.701 313~~
41	40	3.269 272	4.319 809

FORM 1319A

AVRO AIRCRAFT LIMITED
MALTON · ONTARIO
TECHNICAL DEPARTMENT

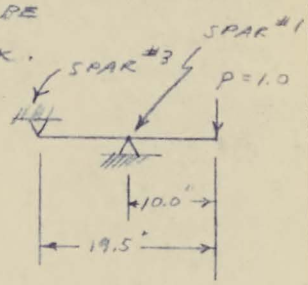
REPORT No. 7/0510/10	SHEET No. 6-87	
AIRCRAFT: C 105	FIN	
PREPARED BY: E. Gundesen	DATE: MARCH 56	
CHECKED BY:	DATE:	

CALC OF T/A FOR BASE

LOAD POINT 34

LOAD PATH ASSUMED:

THE LOAD IS ASSUMED REACTED BY BY SPAR #1 + SPAR #3 TO BE CONSISTENT WITH PREVIOUS WORK.



LOAD APPLIED TO SPAR #3

$= -1.0 \times \frac{10.0}{9.5} = -1.052\,631\,58$

LOAD APPLIED TO SPAR #1

$= \frac{19.5 \times 1.0}{9.5} = 2.052\,631\,58$

STRESS POINT 276

X-ORDINATE (LP 32) $= 154.5 - 97.205136$
$= 57.294\,864$

$f_B = \frac{57.294\,864 \times (-1.052\,631\,58)}{10} = -6.031\,038$

STRESS POINT 277

X-ORDINATE (LP 33) $= 154.5 - 103.791\,767$
$= 50.708\,233$

$f_B = \frac{50.708\,233 \times 2.052\,631\,58}{10} = 10.408\,532$

AVRO AIRCRAFT LIMITED
MALTON - ONTARIO
TECHNICAL DEPARTMENT

AIRCRAFT:		REPORT NO. 7/0510/10	
		SHEET NO. 6-68	
		PREPARED BY	DATE
C105	FIN	LLG	APR 56
		CHECKED BY	DATE

OPERATIONS REQUIRED TO CHECK Tia

1/ GIVEN MATRICES

Tia SHEETS 1 TO 5

CHECK MATRIX Xia
1 SHEET

2/ MULTIPLY

Tia × Xia = (Tia)(Xia)

ORM 1319A

AVRO AIRCRAFT LIMITED
MALTON - ONTARIO
TECHNICAL DEPARTMENT

AIRCRAFT:		REPORT NO. 7/0510/10	
		SHEET NO. 7-2	
		PREPARED BY	DATE
C-105	FIN FOUNDATION	E. AUGUSTINE	25/APR/56
		CHECKED BY	DATE

INTRODUCTION —

FOR PURPOSES OF THIS CALCULATION, IT IS ASSUMED THAT ONLY 3 COMPONENTS OF THE UNDER FIN STRUCTURE DEFORM UNDER FIN ASYMMETRICAL LOADING.

THESE COMPONENTS ARE (REF. FIG. 1 SHEET 7-4)

- 1) FIN FRAMES 1→6
- 2) 3 MAIN FORMER VEE TRUSSES
- 3) WING.

FIN LOADING IS EXPRESSED AS TORQUE PER UNIT LENGTH OF FIN-FUSELAGE CONNECTING LINE. (REF. FIG. 2, SHT 7-5). UNDER THIS LOADING, THE STIFFNESS CHARACTERISTICS OF THE 3 COMPONENTS ARE CALCULATED & THE FOUNDATION CURVE (INCH KIPS/INCH/RADIAN) ARRIVED AT (REF. SHEET 7-15).

RESISTANCES FROM THE CURVE ARE

AVRO AIRCRAFT LIMITED
MALTON · ONTARIO
TECHNICAL DEPARTMENT

		REPORT No. 7/0570/10	
		SHEET No. 7-3	
AIRCRAFT: C-105	FIN FOUNDATION	PREPARED BY: G. AUGUSTINE	DATE: 25/APR./56
		CHECKED BY	DATE

LUMPED ACCORDING TO FIN SPAR LOCATIONS-
THE RESULTS GIVING THE FIN BOUNDARY
CONDITIONS.

FORM 1319A

AVRO AIRCRAFT LIMITED
MALTON · ONTARIO

TECHNICAL DEPARTMENT

REPORT No: 7/0570/10	SHEET No 7-4
AIRCRAFT: C-105	FIN FOUNDATION
PREPARED BY: R. AUGUSTINE	DATE: 25/APR./5?
CHECKED BY:	DATE:

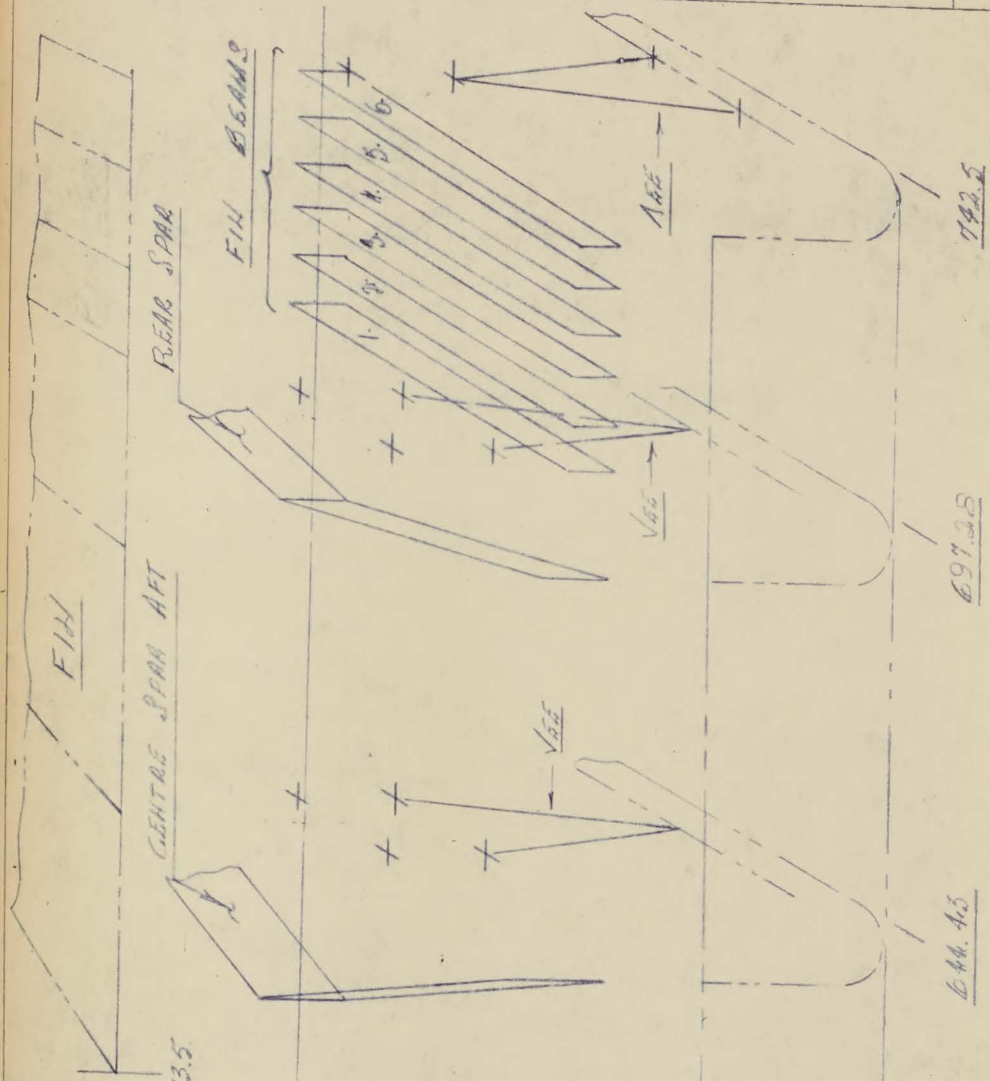


FIG: 1

AVRO AIRCRAFT LIMITED
MALTON - ONTARIO
TECHNICAL DEPARTMENT

AIRCRAFT:		REPORT No. 7/05 10/10	
C-105	FIN FOUNDATION	SHEET No. 7-5	
		PREPARED BY	DATE
		R. AUGUSTINE	25/APR/56
		CHECKED BY	DATE

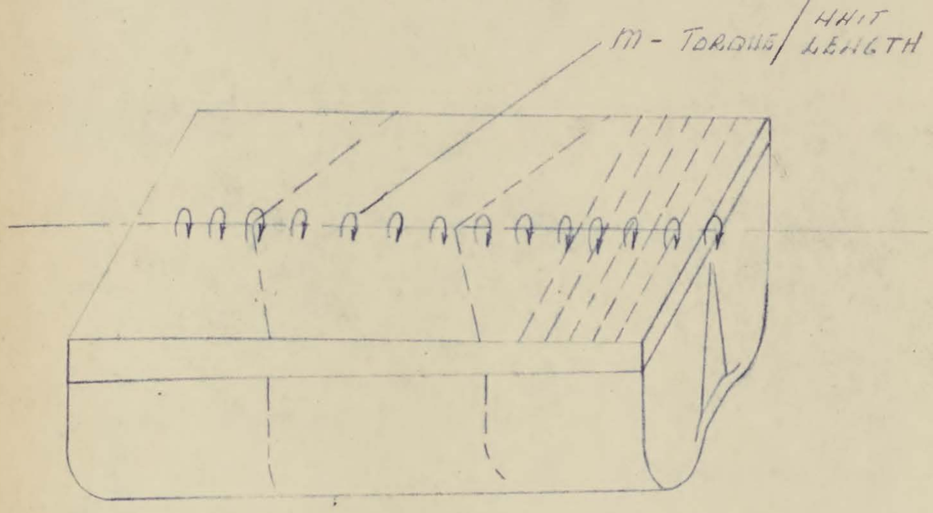


FIG. 2

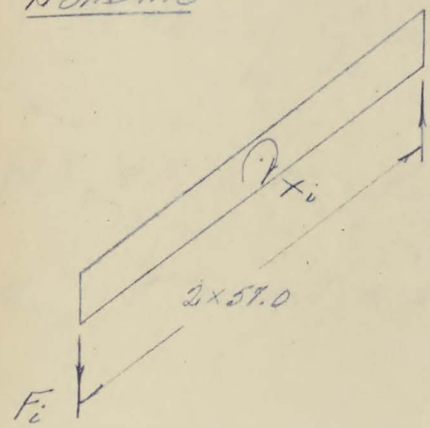
FORM 1319A

AVRO AIRCRAFT LIMITED
MALTON ONTARIO
TECHNICAL DEPARTMENT

AIRCRAFT:		REPORT No. 7/0510/10	
C-105	FIN FOUNDATION	SHEET No. 7-6	
		PREPARED BY	DATE
		B. AUGUSTINE	25/APR/..
		CHECKED BY	DATE

FIN BEAMS.

LOADING —



F_i (BEAM - FUSE. SIDE REACTION)

$$F_i = \frac{1}{2 \times 57.0} X_i$$

X_i - MOMENT.

STRAIN ENERGY

MOMENT OF INERTIA - IN GENERAL - VARIES AS SHOWN IN FIG. 3. BELOW.

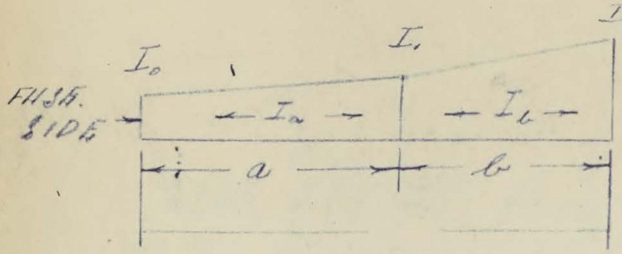


FIG. 3

AVRO AIRCRAFT LIMITED
MALTON · ONTARIO
TECHNICAL DEPARTMENT

AIRCRAFT:		REPORT No. 71/OSTR/10	
		SHEET No. 7-9	
		PREPARED BY	DATE
C-105	FIN FOUNDATION	E. AUGUSTINE	25/APR/56.
		CHECKED BY	DATE

STIFFNESS COEFFICIENTS OF FIN BEAMS.

$2V_i = K_i X_i^2$ – REF. FORMULA, SHEET 7-7
SECTION PROP. " 7-8

$\frac{\partial V_i}{\partial X_i} = K_i X_i = \theta$ (RADIANS).

$X_i/\theta = 1/K_i$ (INCH KIPS / RADIAN)

Δx – BEAM SPACING (INCHES)

$M_i/\theta = 1/K_i \cdot \Delta x$ (INCH KIPS/INCH/RADIAN)

BEAM	X_i/θ	Δx	M_i/θ
1	14,307.	6.07	2,357.
2	13,919.	6.095	2,284.
3	11,586.	6.12	1,893.
4	11,434.	6.12	1,868.
5	11,026.	6.295	1,751.
6	7,356	6.47	1,137.

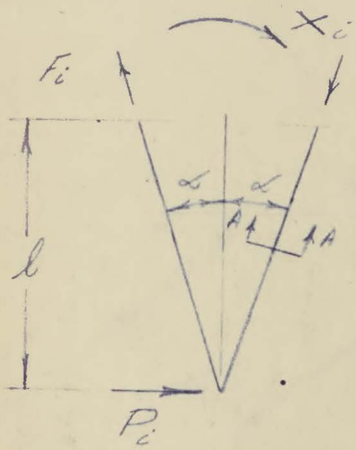
FORM 1319A

AVRO AIRCRAFT LIMITED
MALTON · ONTARIO
TECHNICAL DEPARTMENT

AIRCRAFT:		REPORT No. 71/STRUC/10	
C-105	FIN FOUNDATION	SHEET No. 7-10	
		PREPARED BY	DATE
		R. ANGUSTINE	25/APR./56
		CHECKED BY	DATE

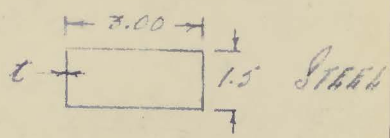
VEE. TRUSSES. (STAS. 697.28, 644.43, 591.65).

LOADING.—



$$P_i = 1/l \; X_i$$

$$F_i = \frac{1}{2l \sin\alpha} \cdot X_i$$



SECT. A-A

STA.	l	t	AREA
697.28	50.0	.058	.522
644.43 / 591.65	54.5	.049	.441

STRAIN ENERGY—

$$2V = \frac{1}{2EAl \cos\alpha \sin^2\alpha} X_i^2 = \frac{(10)^{-3}}{60 A l \cos\alpha \sin^2\alpha} X_i^2$$

AVRO AIRCRAFT LIMITED
MALTON · ONTARIO
TECHNICAL DEPARTMENT

AIRCRAFT		REPORT No. 7/0570/10	
		SHEET No. 7-11	
		PREPARED BY	DATE
C-105	FIN FOUNDATION	F. AUGUSTINO	25/MAR/55
		CHECKED BY	DATE

EFFECT ON STRAIN ENERGY OF "VEE" OF REACTING FORCES P_i INTO ADJACENT PANELS – SEE FIG. 4 BELOW.

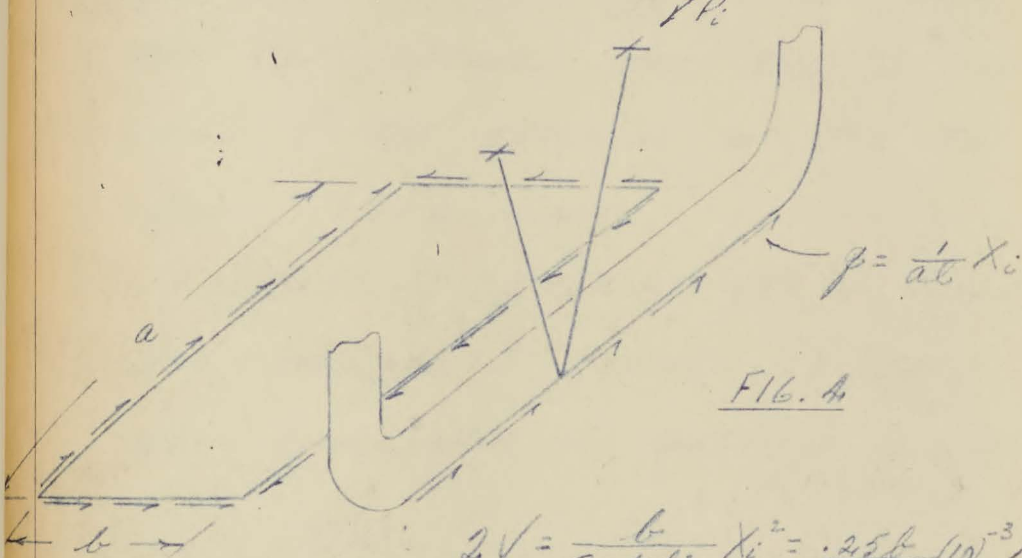


FIG. 4

$$2V = \frac{b}{Gatl^2} X_i^2 = \frac{.25b}{atl^2} (10)^{-3} X_i^2$$

AVRO AIRCRAFT LIMITED
MALTON · ONTARIO
TECHNICAL DEPARTMENT

AIRCRAFT: C-105	FIN FOUNDATION	REPORT No 71/STRESS/10 SHEET No 7-12	
		PREPARED BY: E. AUGUSTINE	DATE: 25/APR./56.
		CHECKED BY:	DATE:

STIFFNESS COEFFICIENTS OF VEE TRUSSES.

THE VEE AT STATION 697.28 IS CONSIDERED TO BE EFFECTIVE OVER THE GAP BETWEEN THE END OF THE WING & THE BEGINNING OF THE FIN BEAMS. (20.0 INCHES.)

VEES AT STATIONS 644.43 & 591.65 ARE ARBITRARILY ASSUMED TO BE EFFECTIVE OVER A RANGE OF 10.0 INCHES.

STA.	$2V/x^2$ VEE	PANEL	$2V/x^2$ TOTAL.	X/θ	Δx	m/θ
697.28	.000025908	.000001656	.000027564	36,279.	20.0	1,814.
644.43	.000033487	.000001394	.000034881	28,669.	10.0	2,867.
591.65	.000033487	.000001394	.000034881	28,669.	10.0	2,867

WING.

LOADING — SEE FIG. 5 BELOW.

CONSIDER UNIT WIDTH OF WING —

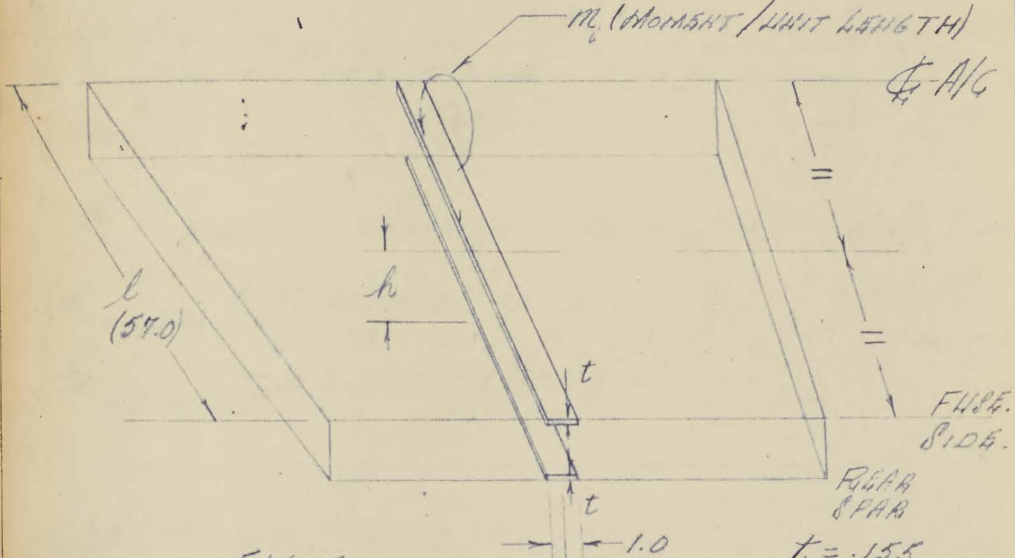


FIG. 5

F_c — FUSE. SIDE REACTION.

DEFINE DISTANCE BETWEEN CAPS AS h —
— SMALL VARIATION OF ACTUAL DISTANCE SPANWISE IS IGNORED.

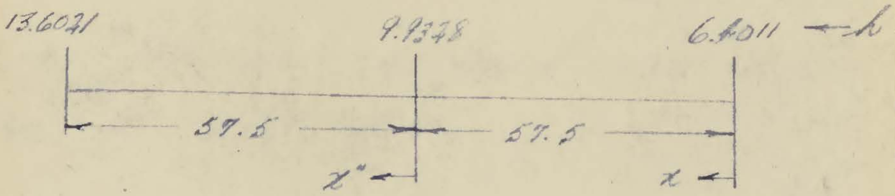
AVRO AIRCRAFT LIMITED
MALTON - ONTARIO
TECHNICAL DEPARTMENT

AIRCRAFT: C-105	FIN FOUNDATION	REPORT No. 7/0510/10
		SHEET No. 7-14
		PREPARED BY: R. AUGUSTINE — DATE: 25/APR/56.
		CHECKED BY: — DATE:

MOMENT OF INERTIA / UNIT WIDTH (I) -

$$I = h^2 t/2 = .0775\,h^2$$

CHORDWISE VARIATION OF h - (REF. REPT. 7/0510/7 FIG.10)



h - LINEAR VARIATION (CLOSELY) FROM REAR SPAR FWD.

$$h_{x\,0\to 57.5} = 6.4011 + .061421\,x'$$

$$h_{x\,57.5\to 115.0} = 6.2685 + .063814\,x'$$

STRAIN ENERGY -

$$2V/\text{UNIT WIDTH} = \frac{2}{4EI}\int_0^l m^2\,dx = \frac{l}{6EI}\,m^2$$

$$= \frac{12.2581}{h^2}(10)^{-3}\,m^2$$

STIFFNESS COEFFICIENTS OF WING.

IT IS ASSUMED THAT WING RESISTANCE TO FIN APPLIED MOMENTS BEGINS AT FUSELAGE STATION (695.00) [ORIGIN OF x'] DEFINED BY A POINT ON THE WING REAR SPAR LYING MIDWAY BETWEEN THE FUSE. SIDE & A/C ℄.

x'	h	h^{2}	$2V(10^9/m^2)$	M/θ
0	6.4011	40.9741	.29917	3343.
10	7.01531	49.2144	.24708	4015.
20	7.62952	58.2093	.21059	4748.
30	8.24373	67.9586	.18038	5544.
40	8.85794	78.4624	.15623	6401.
50	9.47215	89.7236	.13564	7330.
57.5	9.9328	98.6605	.12425	8048.
60	10.0923	101.8545	.12035	8309.
70	10.7305	115.1436	.10646	9393.
80	11.3686	129.2451	.09484	10,544.
90	12.0068	144.1632	.08503	11,761.
100	12.6449	159.8935	.07666	13,045.
115	13.6021	185.0171	.06625	15,094.

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

AIRCRAFT		REPORT NO. 7/0510/10	
C105	FIN	SHEET NO. 7-16	
		PREPARED BY	DATE
		C.B	FEB. 56
		CHECKED BY	DATE
		R.N. SHEARLY	MAR. '56

DISTRIBUTION OF FOUNDATION STIFFNESS

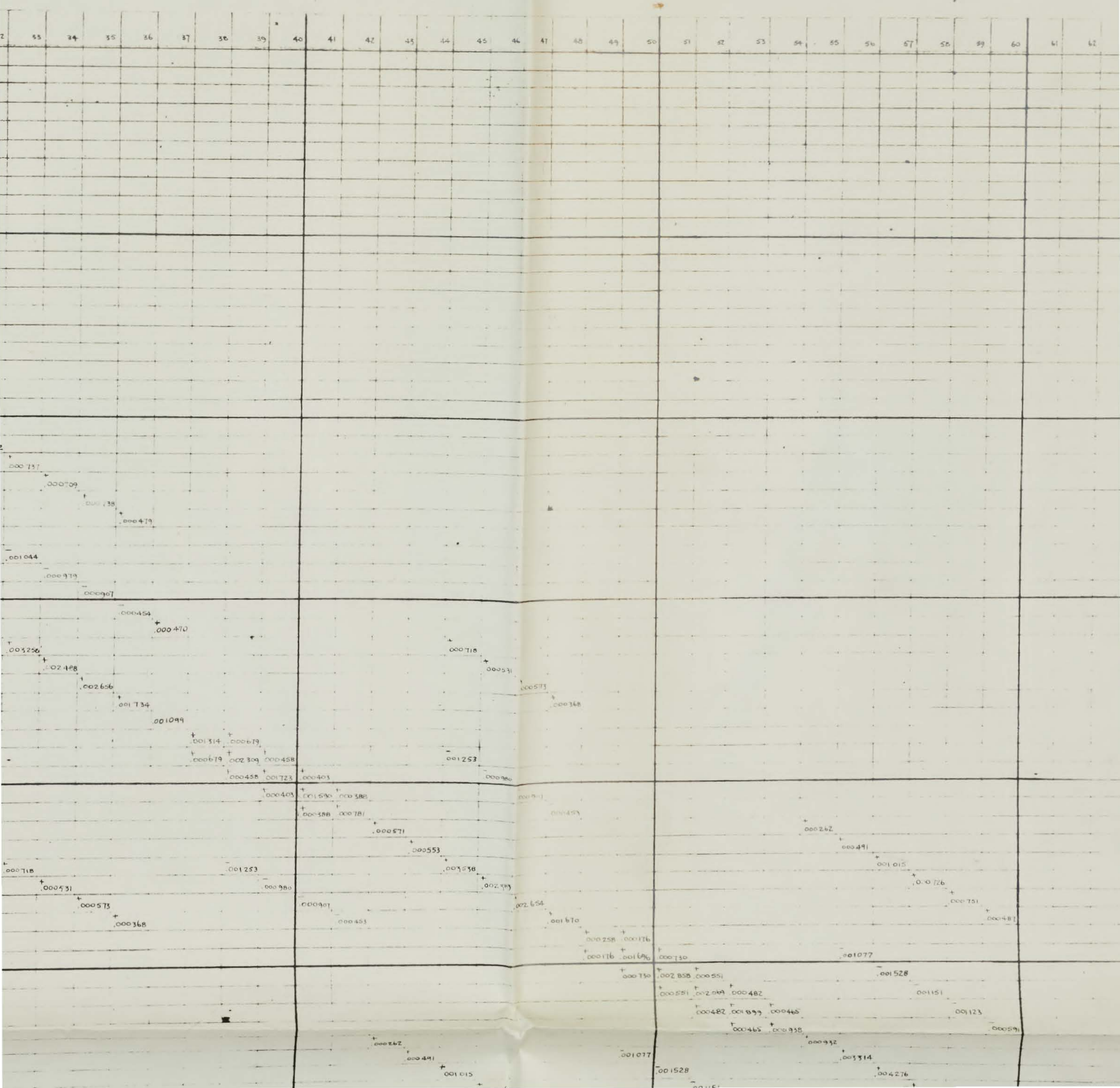
THE UNIT FOUNDATION STIFFNESS WILL BE LUMPED AT THE VARIOUS SPAR STATIONS.

LOAD PT.	Y	A/C STN	WING & FIN BEAMS	VRES	M/B TOTAL
57	274.732	611.517 } *	40 @ 9,300	14,350	386,350
58	244.324	641.925	30 @ 6,500	28,700	223,700
59	214.897	671.352	27 @ 4,300		116,100
60	190.176	696.053	—	36,300	36,300
61	174.071	712.178	8 @ 2,300	—	18,400
62	160.194	726.055	16 @ 1,850	—	29,600
63	147.011	739.238	8 @ 1,500	—	12,000
	7/0510/10 P 360		P. 17	P 15	

284.449 *
22,800
579,000
886,249

THE VALUES MARKED THUS * SHOULD BE INCREASED BY 1.00 IN.; THE EFFECT ON THE SUBSEQUENT WORK IS NEGLIGIBLE.

FORM 1310A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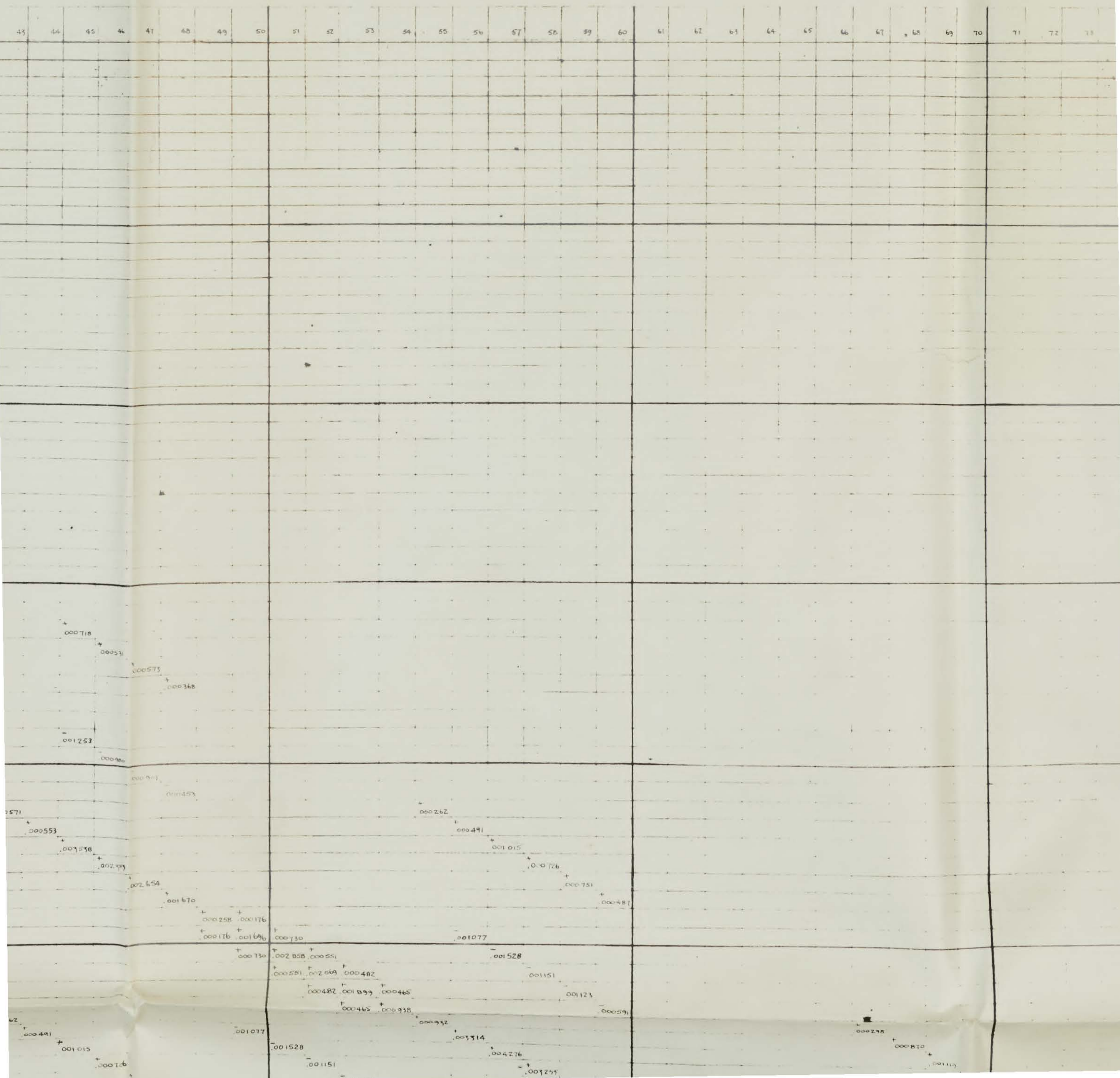
HALF SIZE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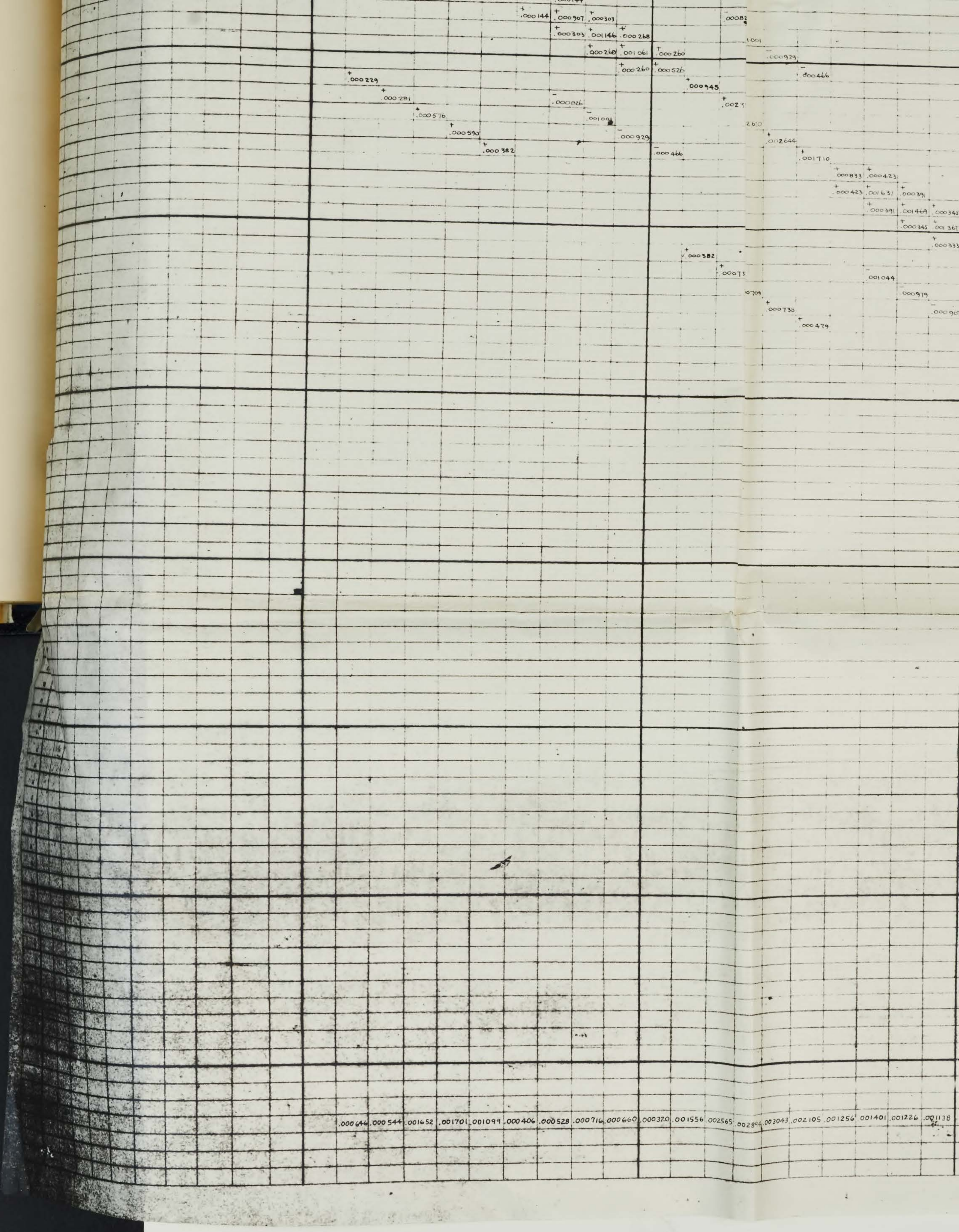
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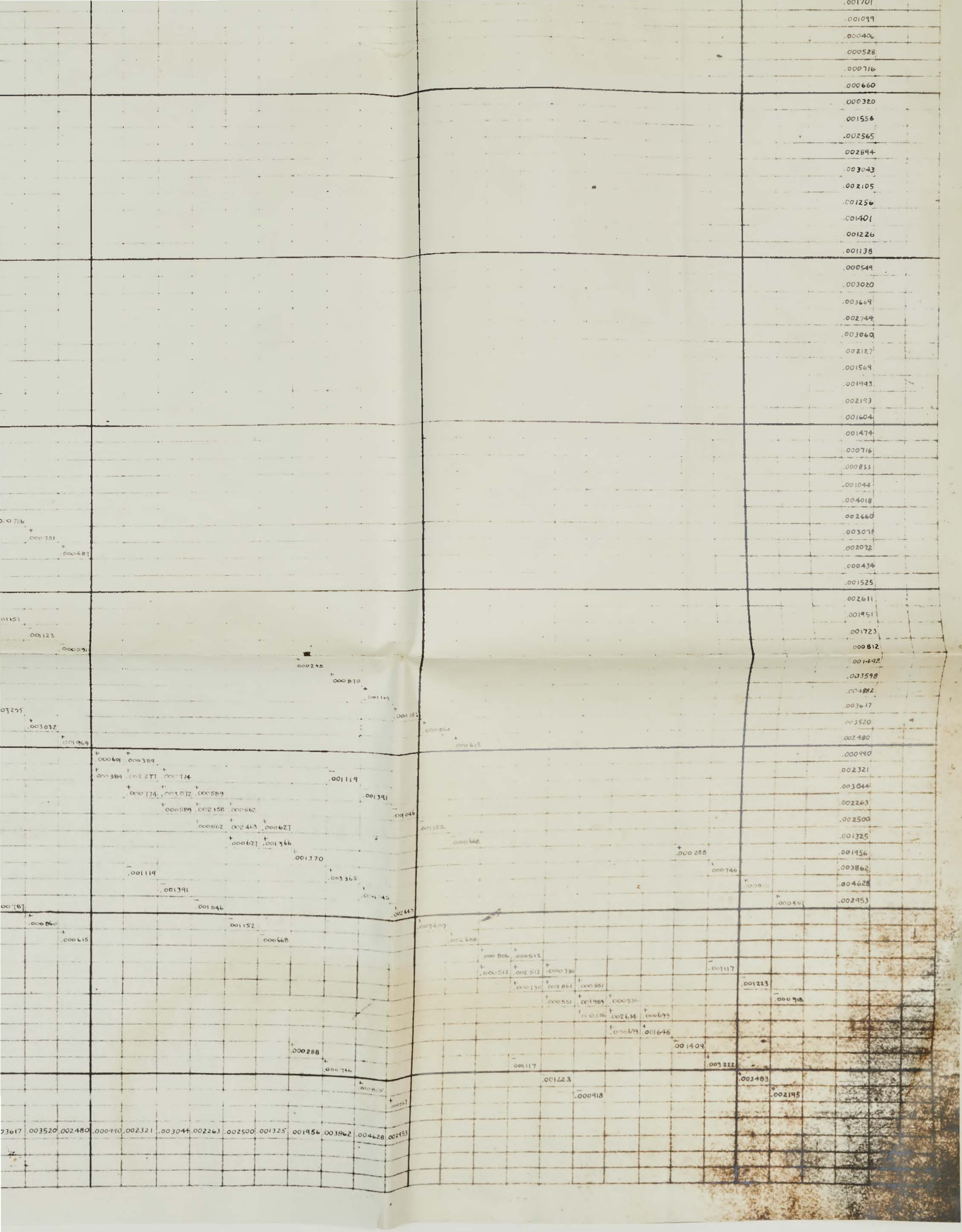
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.004628
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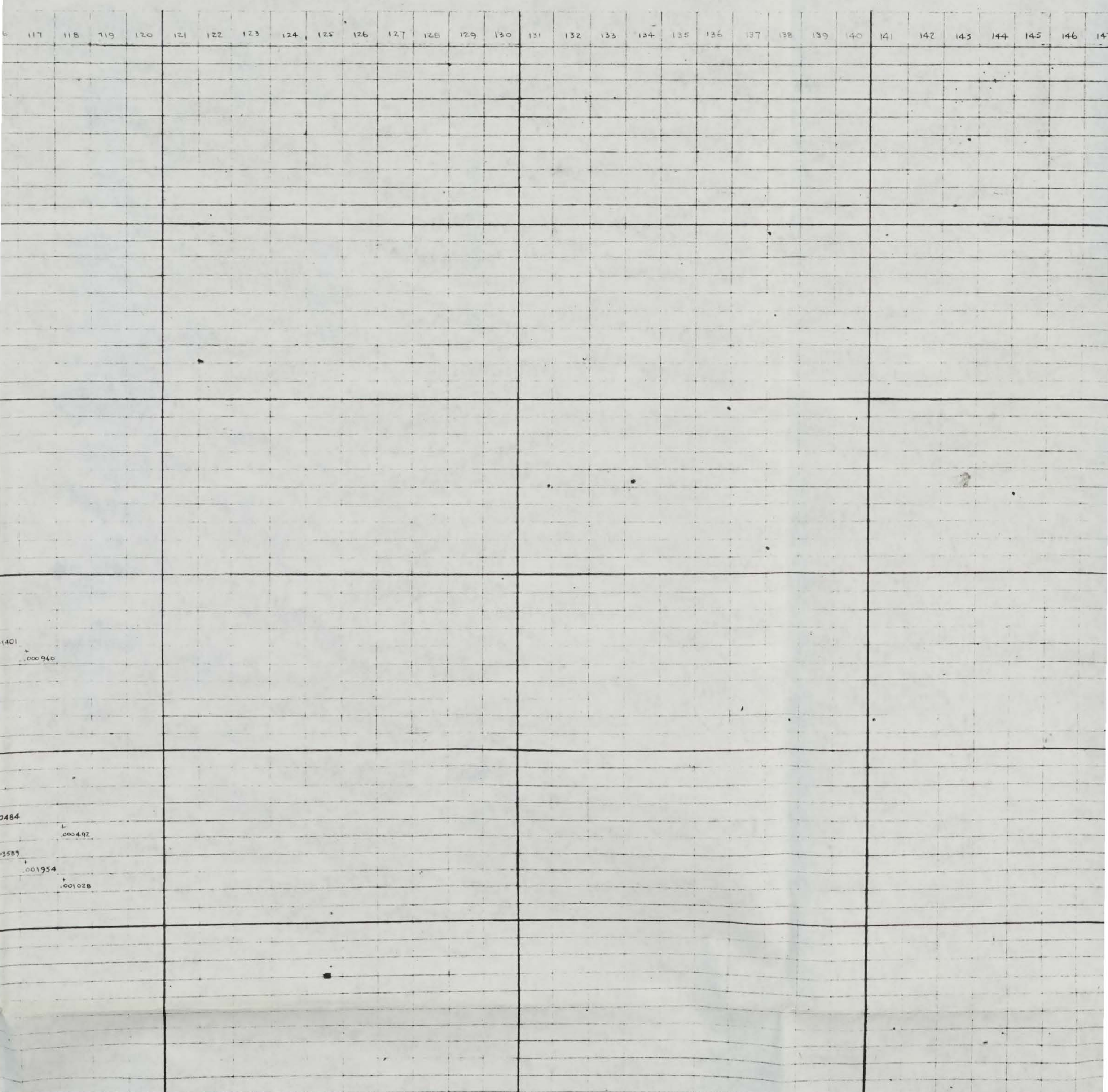
.003617 .003520 .002480 .000990 .002321 .003044 .002263 .002500 .001325 .001956 .003862 .004628 .002953

HALF SIZE

PREPARED BY
CHECKED BY Clifford
SUPERVISED BY
DATE MARCH



HALF SIZE

PREPARED BY [signature]
CHECKED BY Clifford Gunders [signature]
SUPERVISED BY [signature]
DATE MARCH 56

REPORT NO 7/0510/10
SHEET NO 2

128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	CHECK SUM
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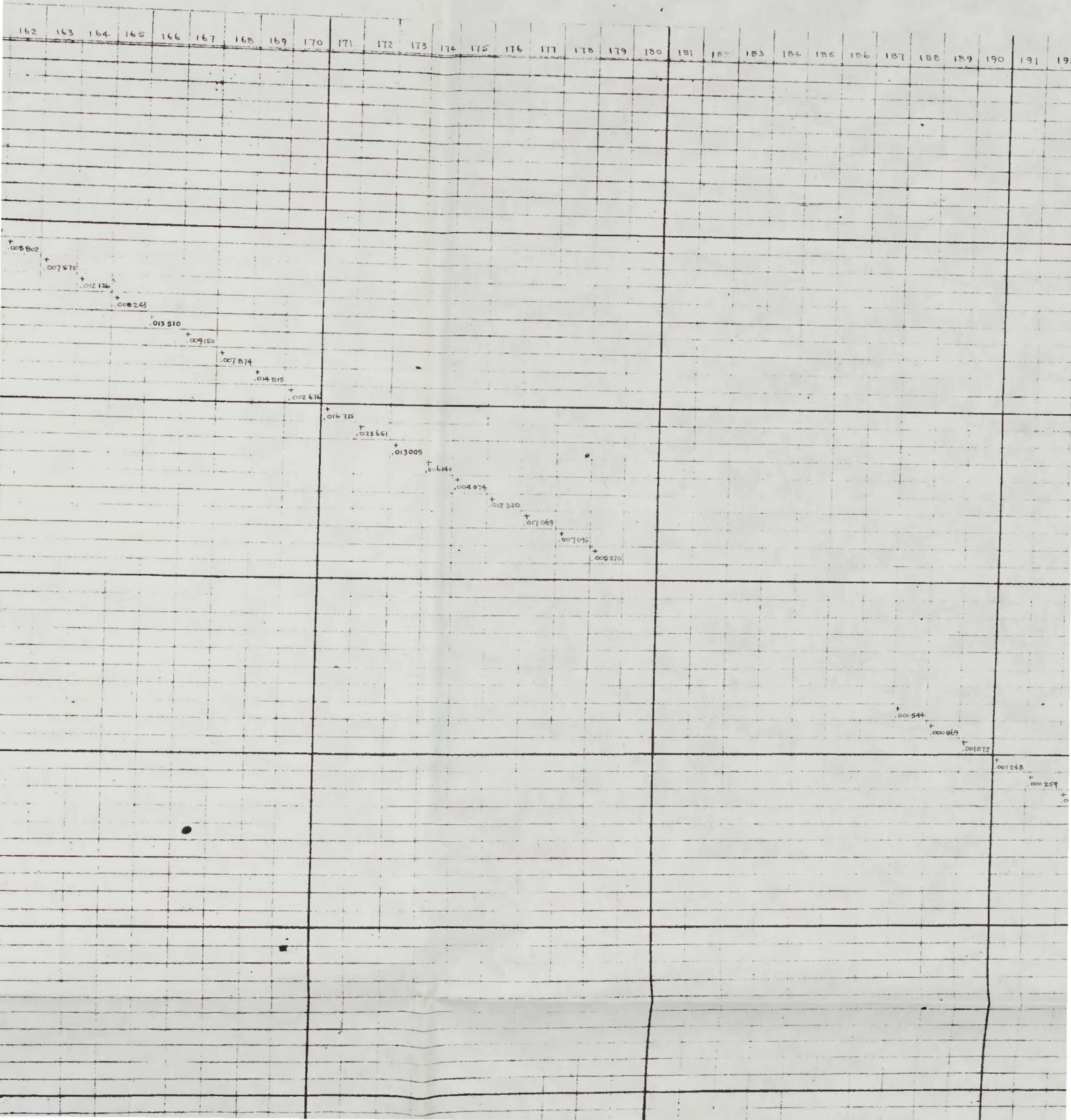
HALF SIZE



162 163 164 165 166 167 168 169 170 171 172 173 174 175 176 177 178 179 180 181 183 184 185 186 187 188 189 190 191
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.008 243
.013 510
.009 150
.007 874
.014 815
.002 676
.016 725
.023 651
.013 005
.006 340
.004 074
.012 320
.017 069
.007 095
.005 270
.000 544
.000 869
.001 072
.001 248
.000 259

PREPARED BY L. Burrell
CHECKED BY Clifford Gunderson
SUPERVISED BY [signature]
DATE MARCH 56

REPORT NO 7/0210/10
SHEET NO 3

208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225	226	227	228	229	230	CHECK SUM
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							.001294																.001294
								+															.001500

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C_{1} MATRIX 7/0510/10 SHEET 4

HA

Column	Diagonal entry	Bottom row
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235	.001270	.001270
236	.001531	.001531
237	.001022	.001022
238	.002071	.002071
239	.001358	.001358
240	.001088	.001088
241	.000924	.000924
242	.000855	.000855
243	.001178	.001178
244	.001551	.001551
245	.001337	.001337
246	.001622	.001622
247	.001396	.001396
248	.002223	.002223
249	.001430	.001430
250	.001142	.001142
251	.000975	.000975
252	.001538	.001538
253	.001477	.001477
254	.002172	.002172
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256	.000705	.000705
257	.000688	.000688
258	.002387	.002387
259	.002160	.002160
260	.003424	.003424
261	.002379	.002379

PREPARED BY	[signature]						
CHECKED BY	[signature]				REPORT NO	7/0510/10	
SUPERVISED BY	[signature]				SHEET NO	4	
DATE	MARCH 56						

HALF SIZE

252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277		CHECK SUM
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			.002769																								.002769
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												.001299															.001299
																			.000259								.000259
																				.000447							.000447
																					.000861						.000861
																						.002755					.002755
																							.005435				.005435
																								.003378			.003378
																									.008333		.008333
																										This P	
538	.001477	.002172	.002769	.000705	.000688	.002387	.002160	.003424	.002379	.001354	001303	001 299							.000259	.000447	.000861	.002755	.005435	.003378	.008333	0 72 20	.770276

PART 1 FOR KIP LOADS & FLOWS IN VARIOUS ELEMENTS.

NOT FOR COM

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S.P 12	+.9707220	−.2402050																								
22			+.4853610	−.1201025	+.4853610	−.1201025																				
32							+.4853610	−.1201025	+.4853610	−.1201025																
37											+.9707220	−.2402050														
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55															.4853610	−.1201025	.4853610	−.1201025								
67																			.4853610	−.1201025	.4853610	−.1201025				
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85																										
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115																										
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1	.1201025	.4853610	.1201025	.4853610																						
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252																										

PART I For Kip - G'md

7/0510/10
Pg. 5-35

8	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	Check Sums
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																																	-.0573154
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	+.1167509	-.4718163	-.1059523	+.4281770																													-.0328407
					+.0762590	-.3081796	-.0684434	+.2765949																									-.0237691
									+.0676220	-.2732758	-.0612655	+.2475876																					-.0193317
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Checked By: R. N. [illegible]

Approved: [illegible]

Feb '5'

HALF SIZE

DUE TO UNIT LOAD FOR K_{1P} PART NO. 3
(FIRST SHEET)

11	14	15	18	19	20	23	24	25	28	29	30	33	34	35	39	40	41	42	45	46	47	48	52	53	54	58	59	60
.197 344																												
	.204 278																											
		.199 421																										
			.175 055																									
				.147 847																								
					.151 279																							
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									.105 236																			
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											.103 699																	
												.106 246																
													.129 532															
														.130 998														
															.079 220													
																.077 380												
																	.082 305											
																		.095 022										
																			.078 649									
																				.113 459								
																					.112 915							
																						.206 862						
																							.058 641					
																								.063 044				
																									.071 825			
																										.087 656		
																											.098 443	
																												.171 163

A^{III}_{mn}

	48	52	53	54	58	59	60	63	64	65	66	69	70	71	72	75	76	77	81	82	83	88	89	90	95	96	97	102	106	139	140
915																															
	.206862																														
		.058641																													
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PREPARED BY [signature]
CHECKED BY [signature]
SUPERVISED BY [signature]
DATE MARCH 1956

REPORT NO. 7/0510/10
SHEET NO. 5-45

…FOR K_{1p} PART NO 3
…)

HALF SIZE

A'''_{mn}

	198	201	202	205	206	209	210	211	215	216	217	224	225	226	229	230	231	234	235	239	240	244	245	249	250	255	256		Check Sum
																													10.989011
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PREPARED BY Clifford Gundersen
CHECKED BY T. Burrell
SUPERVISED BY A. Gnisdox
DATE MARCH 1956

REPORT NO. 7/0510/10
SHEET NO. 5-47

B'''nd

8	319	320	321	322	323	324	325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	CHECK SUM
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...NSFORMATION MATRIX FOR PART # 3 OF K_{Lp}

F_{dp}

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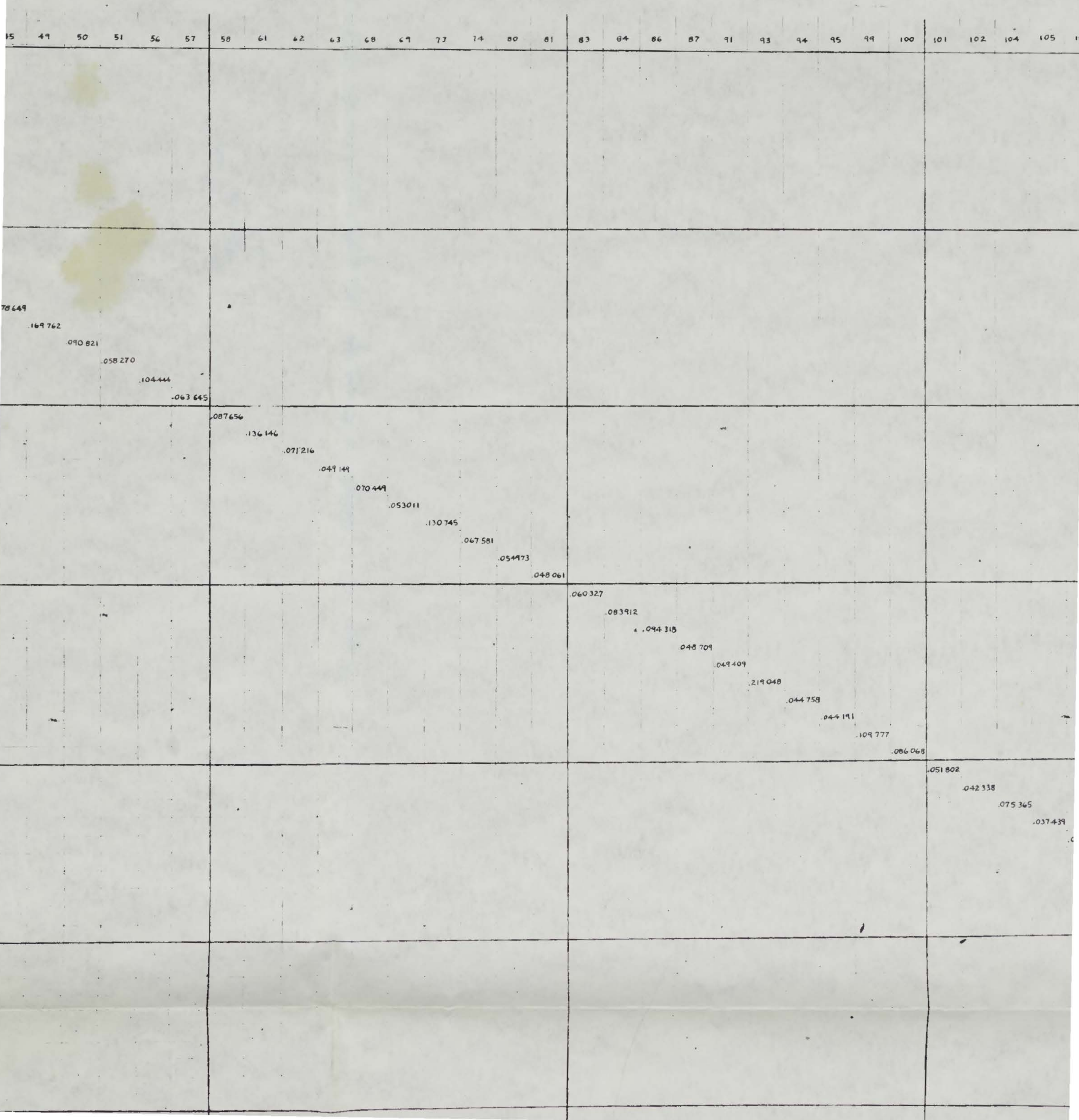
HALF SIZE



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PREPARED BY Clifford Gun[illegible]
CHECKED BY C. Bussel[illegible]
SUPERVISED BY C.G.M.
DATE MARCH 1956

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009	7.078 243	6.782 282	12.519 092	6.656 728	6.394 312	11.413 180	6.330 556	6.092 768	3.615 983	10.627 218	6.081 098	2.959 569	10.628 800	9.734 444	5.777 909	2.732 509	9.413 625	8.705 342	5.508 276	8.563 183	.043027	.071166	214.333 981

STRESSES DUE TO UNIT LOADS FOR K_{LP} PART NO 4 (SECOND SHEET)

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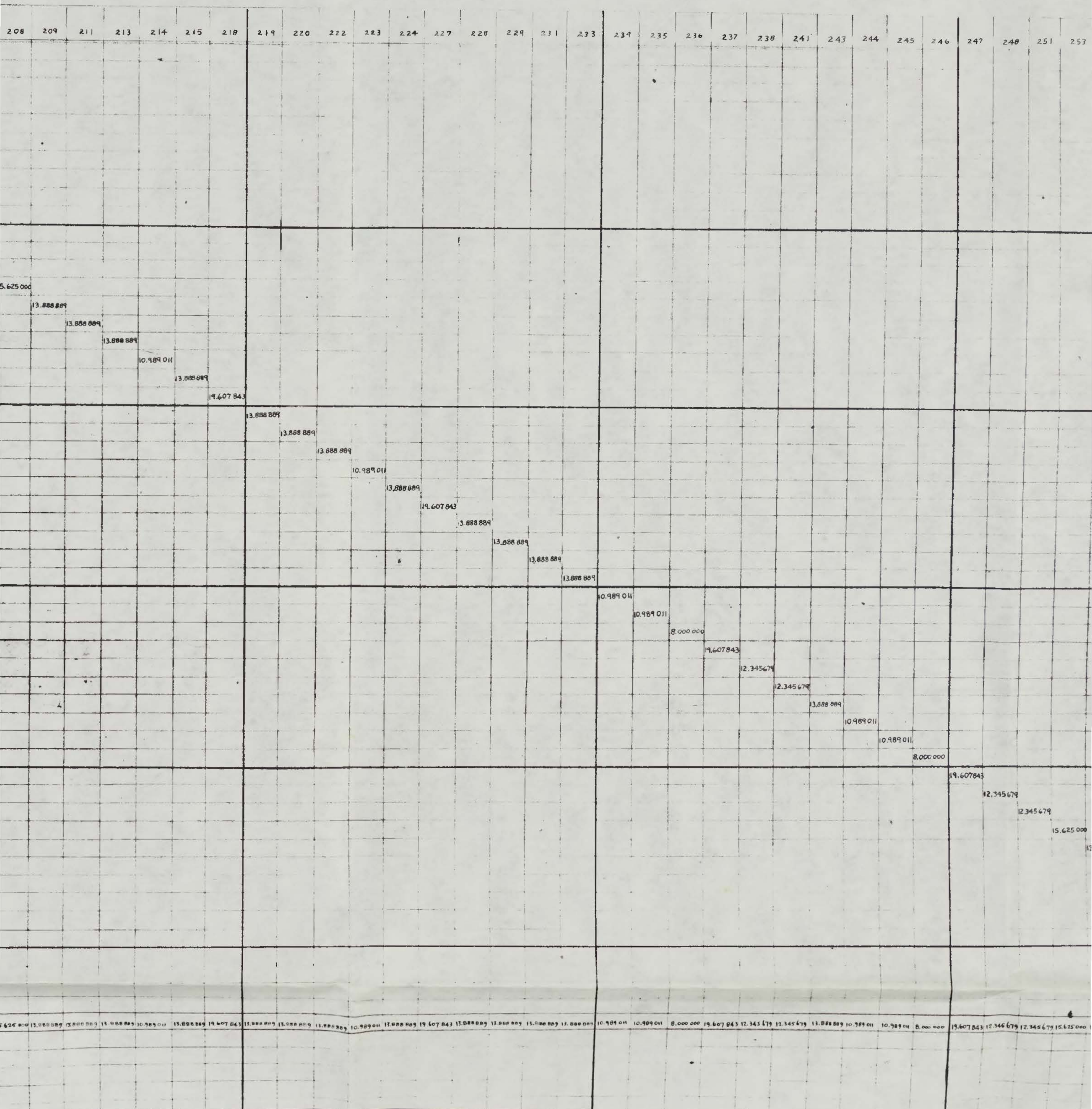

PRODUCT OF $B^{IV}_{nd} \times F^{IV}_{dp}$

SHEET 1

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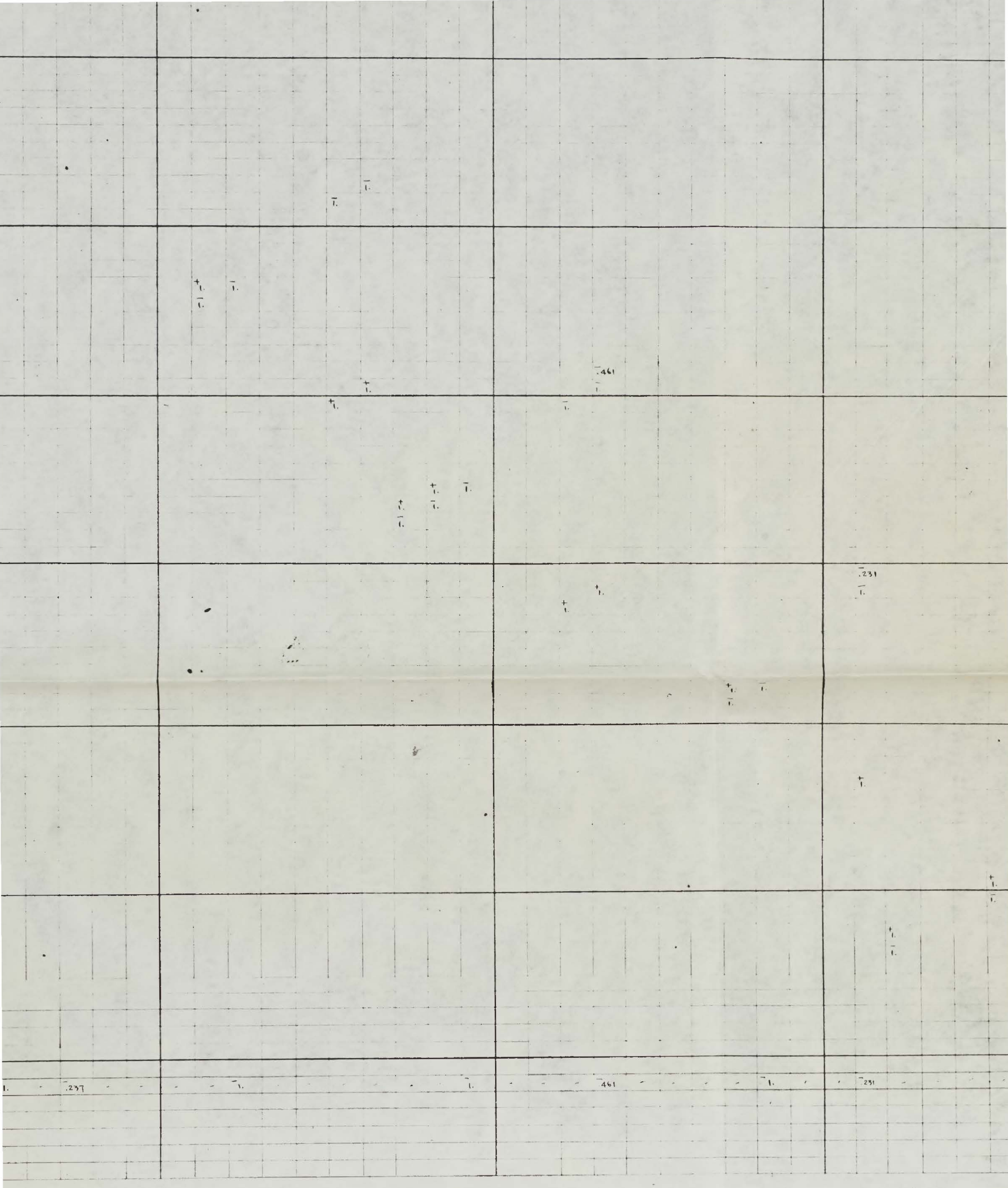

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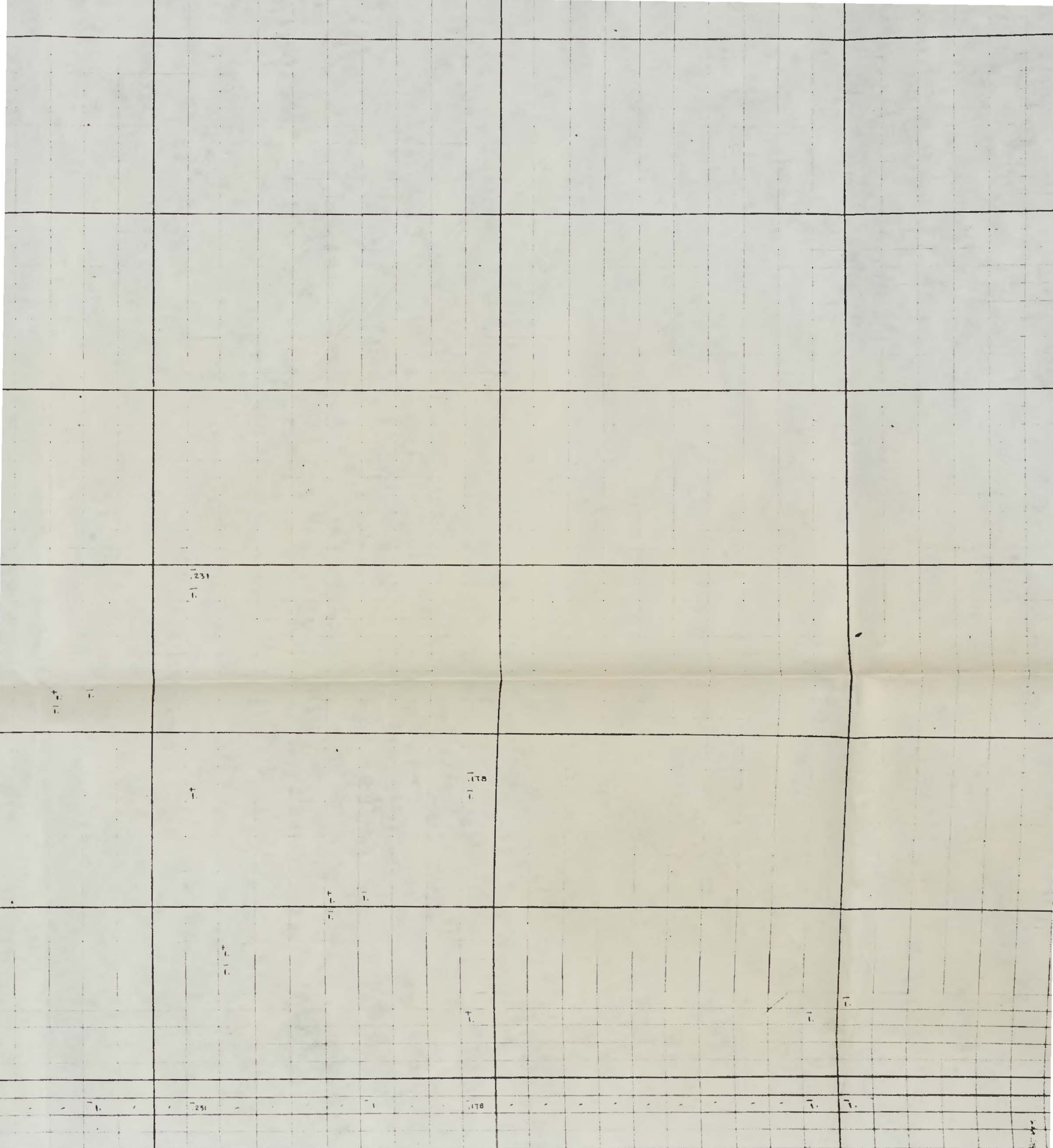

.231
.178

PRODUCT OF $B^{IV}_{nd} \times F^{IV}_{dp}$

SHEET 2

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.562468 +.01184142 +.00562468

−.00519409 −.02099046 +.00519409

−.00400778 −.00556144 +.00556144 +.00400778

−.00354725 −.00754017 +.00754017 +.00354725

−.00424255 −.00862428 +.00424255

−.00333544 −.00468468 +.00468468 +.00333544

−.00317118 −.00682268 +.00682268 +.00317118

−.00506931 −.00544685

−.00414315 −.00418977 +.00418977

PRODUCT OF $B''_{nd} \times F^{IV}_{dp}$

HAL

SHEET 2

40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70

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+.00519409

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−.00468468 +.00468468
+.00333544
+.00424255
−.00682268 +.00682268
+.00317118

−.00506931
−.00544606
+.00506931
−.00414315
−.00418977 +.00418977
+.00414316

+.00926967
+.00489230

HALF SIZE

Prepared By: C. Burrell
Checked By: L. Gundersen
Supervised: A. G.

7/0610/10
Sheet 5-53
Mar 56

58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85

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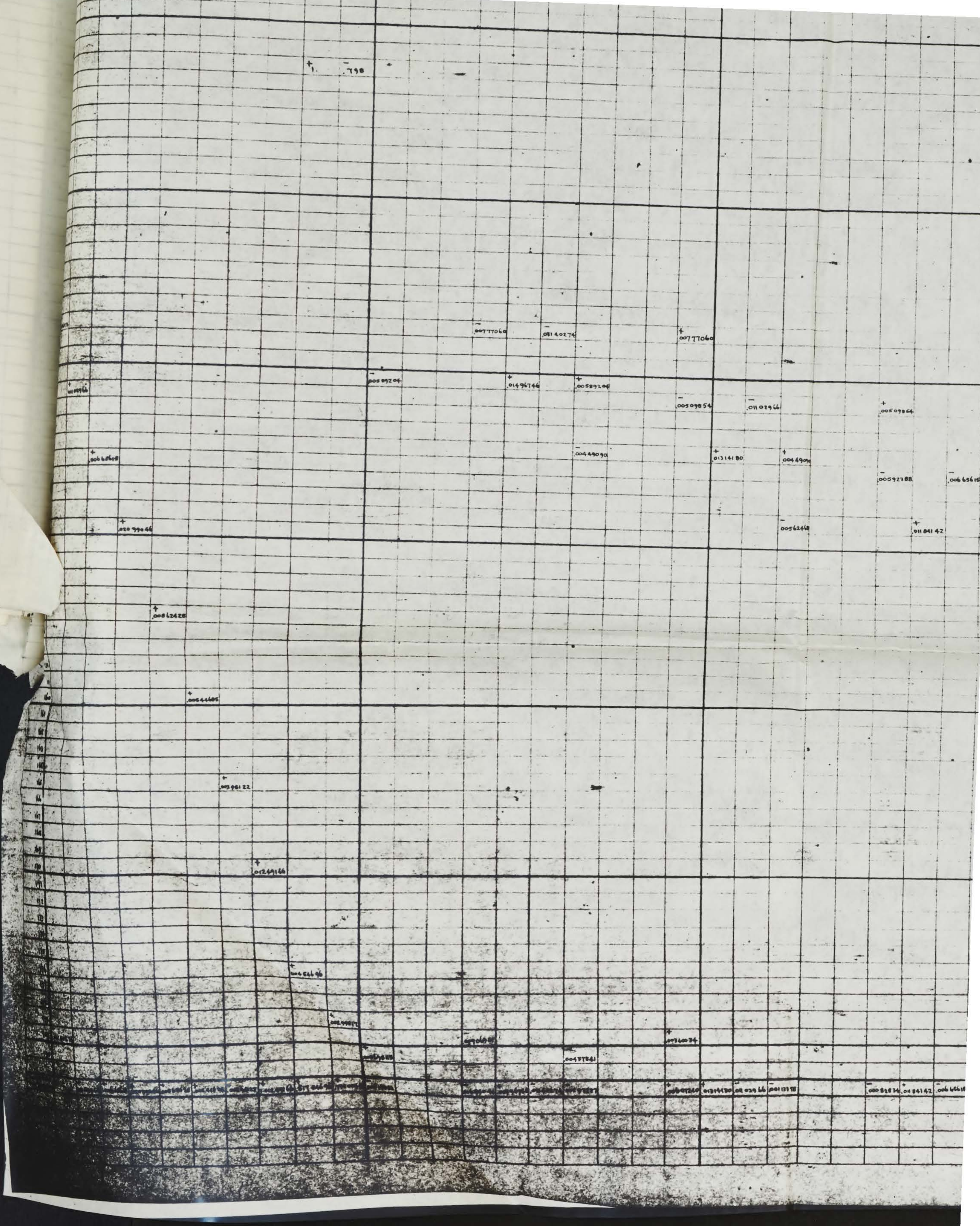

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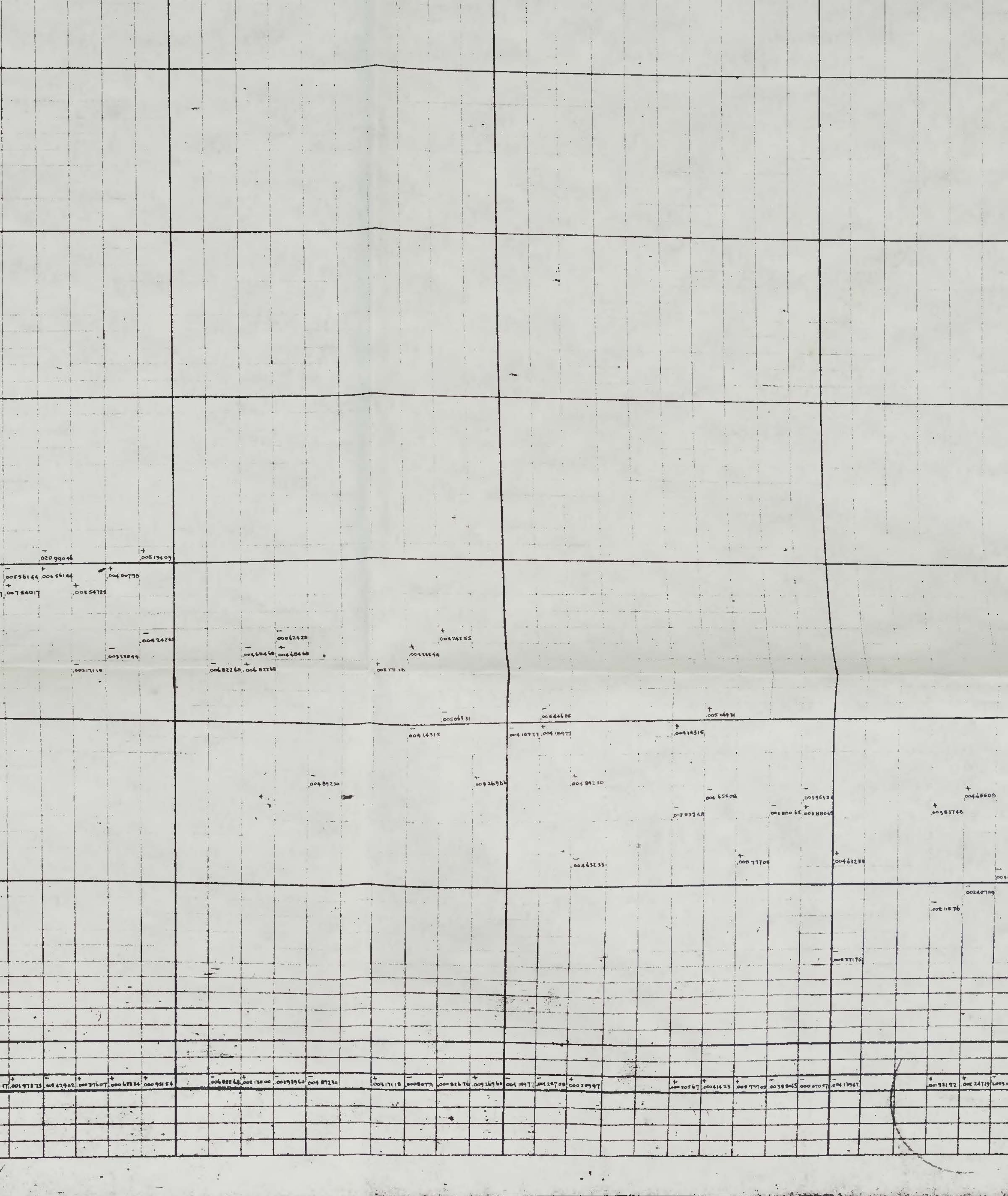

PRODUCT OF $B''_{nd} \cdot F''_{dp}$

Sheet 3.

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+.01050365 −.00471029 .005405

+.01101702 −.00562768

−.00459444 +.00356667

−.00443771

−.01184142 +.00694657

−.00592388 +.00377160 +.00993166 −.00519061 +.00903356 −.00400778

+.00830980 −.00354725

+.00650992 −.00381101 −.00556144 +.02655190 −.00429410 +.00284009

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−.00400778 +.00342385 −.00596875 +.00734322

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−.00596898 −.00326882

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−.00643565 +.00601325 −.00317118

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−.00359801 −.00682268

−.00424255 +.00450999 +.00890667 −.00396502

−.00333544 +.00352261 −.00466254 +.00747859 −.00422138 +.00490639

−.00317118 −.00601325

−.00489230

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−.00417441 −.00418977

−.00405852

−.00589737 −.00926963 +.00526734

−.00506931 +.00334758

−.00414315 +.00357782 −.00415839

−.00489230 −.00768983 +.00952463

+.00431467

−.00563225

−.00463233

.00163199 −.00082440 −.00093869 −.00401682 | +.00036207 +.00664487 −.00900510 | +.00095988 −.00176676 +.03554270 −.00016422 −.00074276 +.00324944 | −.01325833 −.00118431 +.00873285 −.01078967 | .00596614 −.00013423 −.00122363 −.01695946 | −.00483333 +.00557741 −.00000876

Product of $B''_{nd} \cdot F''_{dp}$

Sheet 3.

48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77

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−.00331968 +.00221860 .4496 +.00250806

+.00890667 −.00396502 −.00466412
+.00747859 −.00422138 +.00490639 −.00414318

−.00489230

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−.00417441 −.00418977 +.00353800
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−.00506931 +.00334750 +.00943148 −.00280754 −.00436217
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.00563225 .00877705
−.00465508 +.00242269 +.00706297 −.00315265 +.00541783 −.00240789
−.00383749 +.00347133 −.00376270 +.00595324 .00319101 +.00396931 −.00211576

−.00463233 −.00734930 .01340408 −.00926897 +.00760432 −.00877175
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.00232010 −.00355898 +.00189704
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PREPARED BY Clifford Gunderson
CHECKED BY
SUPERVISED BY A Day
DATE MARCH 1956

REPORT NO 7/0510/10
SHEET NO 6-69

12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37		CHECK SUM
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																											2.162000
																											3.575272
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																											3.112000
																											2.780000
																											-1.713394
																											$\bar{2}$.627416
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																											4.604819
																											$\bar{3}$.193272
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																											$\bar{5}$.193272
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				2.470000																							4.883272
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			10.901 016	14.403913																					
											-.794 628			.552 052											
														1.050981											
														1.758 157											
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	[illegible]	[illegible]			2.090411	3.689 387																			
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																	-.532378			.369 859					
																				.720 430					
																				1.205 207					
									6.908 846																
3.517639	2.552099			-1.773020	2.552099			-1.773020		2.953 636	1.366 159			-.949 112											
	3.120 989	9.528 036			3.656 434	6.803 108					1.957 319	3.641 758													
			19.305 646	25.509 260			12.245 557	16.180 505					6.555 144	8.661553											
									8.758 173						3.664 507										
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	5.627832	10.471062			4.365449	8.122 290					2.900 884	5.397 341					1.213 759	2.258 302							
			21.073 896	27.845 713			14.880 149	19.661687					9.888 005	13.065 384					4.137 240	5.466688					
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6.150171	2.844 668			-1.976276	2.844 668			-1.976 276																	
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	6.213 363	11.560491			5.112 782	9.512 767																			
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			21.664 814	28.626515			16.539 947	21.854 840																	

PREPARED BY Clifford Gunderson
CHECKED BY [signature]
SUPERVISED BY
DATE

REPORT NO 7/0510/10
SHEET NO 6-70

HALF SIZE

32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56		CHECK SUM THIS SHT ONLY
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																										.720 430
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																										12.422 680
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																										116.018 762
	.718 241																									.718 247
																										50.242069
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																										18.193 341
	2.765929																									51.110314
	4.809 149																									149.875962
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3.120 989 9.528 936 3.656 434 6.803 108 1.957 319 3.641 758
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1.817 940 2.616 757 1.817 940 3.759 417 1.738 861 1.208 039 1.572 978 .727 557 .505 456
5.627 832 10.471 062 4.365 449 8.122 290 2.900 884 5.397 341 1.213 759 2.258 302
21.072 896 27.845 713 14.880 149 19.661 687 9.888 005 13.065 384 4.137 240 5.466 688
19.162 291
31.079 778 2.579 775
1.976 276 2.844 668 1.976 276 4.614 849 2.134 250 1.482 728 2.844 923 1.315 876 .914 178 1.572 027 .727 117 .505 160
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21.664 814 28.626 515 16.539 947 21.854 840 12.409 318 16.396 888 7.650 986 10.109 529 4.227 726 5.586 250
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5.694 974 10.521 560 4.829 115 8.984 979 10.401 007 13.743 233 7.435 387 9.824 650 5.301 847 7.005 525
16.169 477 21.365 324 12.975 413 17.144 891
16.314 039
21.485 422 3.721 668
2.156 452 3.104 014 2.156 452 5.551 038 2.567 543 1.783 753 4.214 944 1.949 558 1.354 416 3.253 725 1.504 961 1.045 54
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4.527 377 8.423 571 9.691 884 12.806 242 7.359 119 9.723 874 5.680 870 7.506 342
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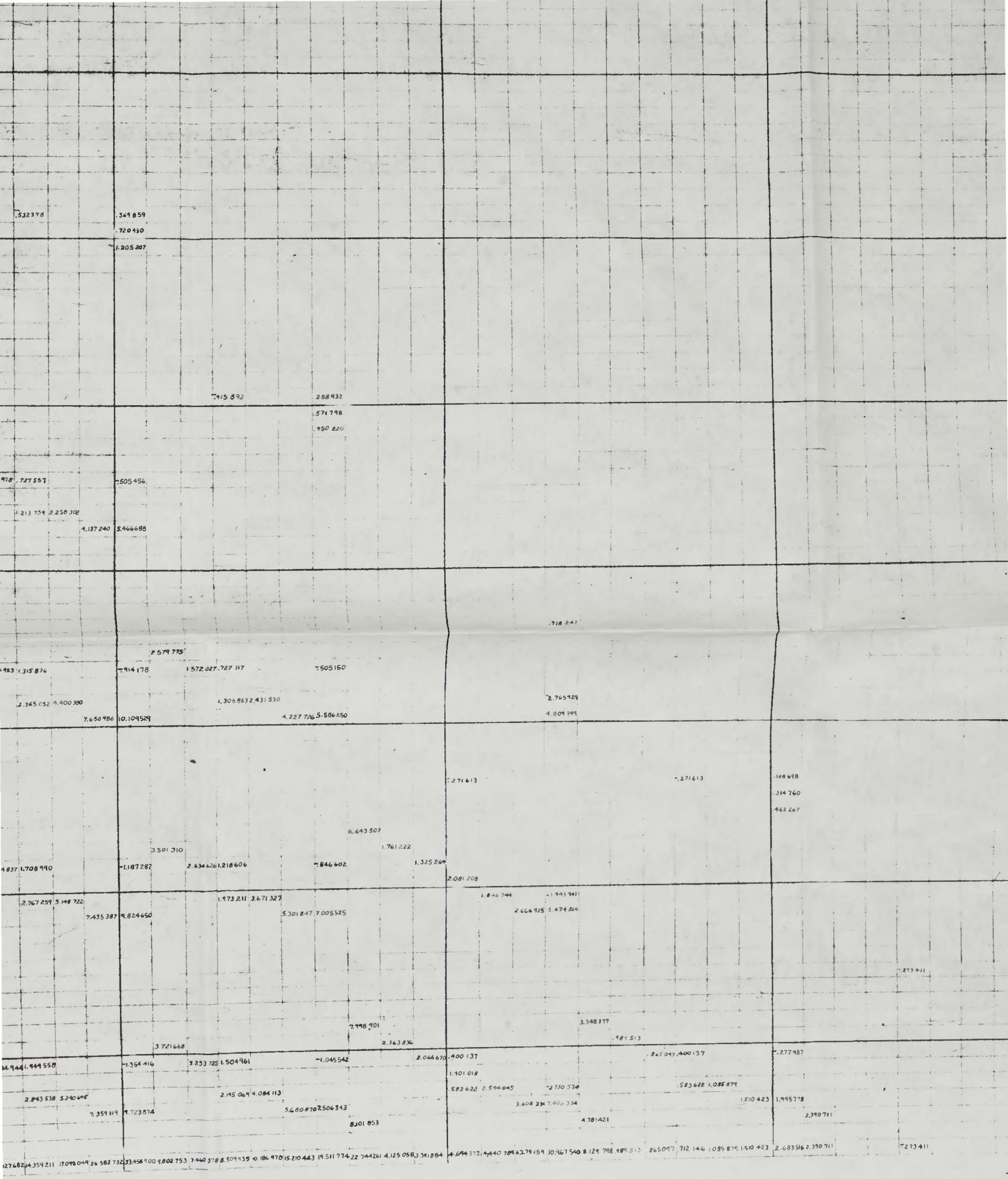
146.172 588 140.943 982 145.736 102 75.446 644 88.322 965 132.258 170 22.046 871 25.712 845 30.346 206 48.945 758 60.950 019 80.233 590 12.327 682 14.359 211 17.098 049 26.582 732 33.458 900 9.802 753 7.460 378 8.509 935 10.186 970 15.210 443 19.511 77



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HALF SIZE

A MATRIX FIN 7/0510/10 SHEET 2

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																					3.835 728					
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	4.126 398	7.677 516			3.645357	6.782 497					3.087 272	5.744 133					2.444 380	4.547 977					1.981 867	3.687 432		
			13.348 842	17.638316			11.218 039	14.822807					9.500 617	12553515					7.522 212	9.939375					6.098 898	8.0586
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																					4.329 556					
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	4.050 927	7.537 094			3.601695	6.701 261					3.080 511	5.731 561					2.480136	4.614 503					2.048 207	3.810 864		
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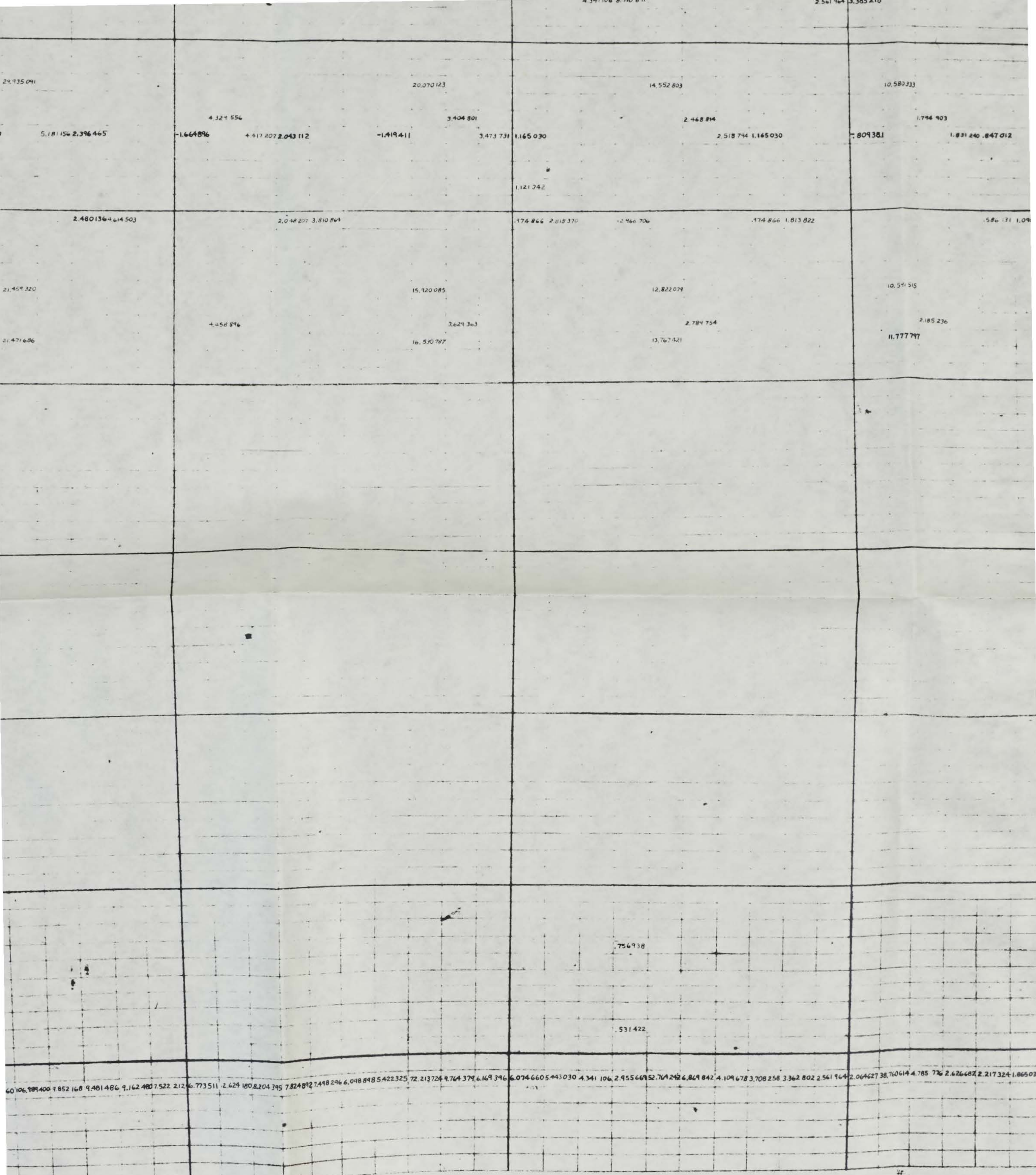

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10,580 333
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1,121 242
2,480136 4,614 503
2,048 207 3,810 864
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21,459 320
15,920 085
12,822 079
10,541 515
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2,784 754
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16,510 787
13,767 821
11,777 797
.756938
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60 106,989400 9 852 168 9.481 486 9.162 480 7.522 212 6.773511 2.624 180 8.204 395 7.824892 7.498 296 6.098 898 5.422 325 72.213724 9.764 379 6.169 396 6.074660 5.443030 4.341 106 2.955669 52.764242 6.869 842 4.109 678 3.708 258 3.362 802 2.561 964 2.064627 38.760614 4.785 776 2.626682 2.217 324 1.86503

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4.341 106 8.910 691 2.561 964 3.385 218 1.280 962 131.781 281

14.552 803 10.580 333 41.208 791

2.256 538 2.256 538

2.468 814 1.794 903 1.180 992 13.119 066

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13.767 421 11.777 797 .478 605 2.330 354 96.901 200

.756 938 .756 938

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.605 443 030 4.341 106 2.955 669 52.764 242 6.869 842 4.109 678 3.708 258 3.362 802 2.561 964 2.064 627 38.760 614 4.785 776 2.626 687 2.217 324 1.865 027 1.280 962 5.201 876 2.701 709 1.143 686 .509 151 .367 272 11.129 203 1.638 281 .575 154 2.330 354 768.434 711

34 x 54

HALF SIZE

PREPARED BY Clifford Gunderson
CHECKED BY
SUPERVISED BY A. Gray
DATE MARCH 56

REPORT NO 7/0510/10
SHEET NO 6-72

17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	CHECK SUM THIS SHT ONLY
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																									1.965284
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																									[illegible] 369
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$\bar{1}$.006431 $\bar{1}$.872 551 $\bar{1}$.087260 $\bar{2}$.022939 1.014730 $\bar{1}$1.846 759
$\bar{1}$.558588 $\bar{2}$.059420 $\bar{1}$.697937 $\bar{2}$.243547 $\bar{.}$990771 16.790493

$\bar{3}$.063275 [illegible]
$\bar{2}$.270020 $\bar{4}$.059 724
$\bar{1}$ 789 704 7.342 794
2 $\bar{.}$611083 .424538 $\bar{1}$.459834 $\bar{.}$693035 .469098 $\bar{1}$.631095 $\bar{2}$.150582 $\bar{2}$.150582
$\bar{1}$.867038 .859 511 $\bar{1}$1.947089
$\bar{.}$853595 $\bar{1}$ 588286 $\bar{.}$920682 $\bar{1}$ 713007 $\bar{1}$.553 217 $\bar{2}$.125287 $\bar{1}$6.799993
$\bar{1}$.294458 $\bar{1}$.710415 $\bar{1}$ 410 234 $\bar{1}$.863394
$\bar{.}$994 719 $\bar{.}$994 719 .691 061 1.[illegible]377
1.155863 1.155 863 .836 361 3.148 087
797 5.111 543 $\bar{5}$.669506 $\bar{4}$.723079 $\bar{.}$742299 $\bar{4}$.545873 $\bar{3}$ 264 269 $\bar{3}$ 343 125 $\bar{3}$.735946 $\bar{3}$.108171 $\bar{.}$123662 $\bar{3}$.063275 $\bar{2}$.270020 $\bar{1}$ 631095 $\bar{1}$.989438 $\bar{1}$.867038 $\bar{1}$.553217 .387179 .161 144 1.527422 170.890421

TIA MATRIX 7/0510/10 SHEET 4

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	2[illegible]
231																											
232										$\bar{1}$.817 517						$\bar{2}$.117 362											
233																						$\bar{1}$.428 265					
234	.859 372	.397 489			.276 148	‾.397 489			.276 148		‾.992 749	‾.459 181			.319 007		$\bar{1}$.146 394	.530 247			.368 378		$\bar{1}$.256 930	‾.581 374			.40
235		‾.538 726	$\bar{1}$.002 346			‾.598 983	$\bar{1}$.114 458					‾.668 890	$\bar{1}$.244 527					‾.749 420	$\bar{1}$.394 360					‾.807 356	$\bar{1}$.502 155		
236				‾.707 375	‾.934 681			‾.856 724	$\bar{1}$.132 021					‾.977 099	$\bar{1}$.291 077					$\bar{1}$.115 766	$\bar{1}$.474 303					$\bar{1}$.215 527	$\bar{1}$.60
237																											
238																											
239																											
240																											
241																											
242										$\bar{1}$.600 670						$\bar{1}$.864 814											
243																						$\bar{1}$.242 152					
244	‾.341 868	.366 266			.254 456	‾.366 266			.254 456		‾.905 119	‾.418 649			.290 848		$\bar{1}$.035 580	‾.478 991			.332 770		$\bar{1}$.129 436	‾.522 402			.36
245		‾.489 075	.909 966			‾.542 963	$\bar{1}$.010 229					‾.605 481	$\bar{1}$.126 549					‾.677 500	$\bar{1}$.260 546					‾.729 311	$\bar{1}$.356 946		
246				‾.630 064	‾.832 527			‾.763 090	$\bar{1}$.008 299					‾.870 308	$\bar{1}$.149 970					‾.993 820	$\bar{1}$.313 171					$\bar{1}$.082 678	$\bar{1}$.43
247																											
248																											
249																											
250																											
251																											
252										$\bar{1}$.367 642						$\bar{1}$.594 018											
253																											
254																						$\bar{1}$.073 381					
255	‾.717 135	‾.331 700			.230 442	‾.331 700			.230 442		‾.811 055	‾.375 141			.260 622		‾.919 248	‾.425 184			.295 388		‾.997 085	‾.461 186			.320
256		‾.456 225	.848 845			‾.505 958	‾.941 379					‾.563 657	$\bar{1}$.048 732					‾.630 124	$\bar{1}$.172 400					‾.677 942	$\bar{1}$.261 369		
257																											
258																											
259																											
260										$\bar{1}$.119 291						$\bar{1}$.304 022											
261																											
262																						‾.951 460					
263																											
264										‾.952 014						$\bar{1}$.108 926											
265																											
266																											
267																											
268																											
269																											
270																											
	$\bar{2}$.368 375	$\bar{2}$.579 481	$\bar{2}$.761 157	$\bar{1}$.337 439	$\bar{1}$.006 162	$\bar{2}$.743 359	$\bar{3}$.066 066	$\bar{1}$.619 814	$\bar{1}$.879 274	$\bar{6}$.857 134	$\bar{2}$.708 923	$\bar{3}$.090 999	$\bar{3}$.419 808	$\bar{1}$.847 407	$\bar{1}$.570 570	$\bar{7}$.989 142	$\bar{3}$.101 222	$\bar{3}$.491 466	$\bar{3}$.827 306	$\bar{2}$.109 586	$\bar{1}$.790 938	$\bar{4}$.695 258	$\bar{3}$.383 451	$\bar{3}$.779 572	$\bar{4}$.120 470	$\bar{2}$.298 205	$\bar{1}$.949

	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
	$\bar{2}$.117362												$\bar{2}$.599486		
							$\bar{1}$.428265							$\bar{1}$.735375	
77		$\bar{1}$.146394	.530247			.368378		$\bar{1}$.256970	.581374			.403898			$\bar{1}$.393442
			.749420	$\bar{1}$.394360					.807356	$\bar{1}$.502155					
77					$\bar{1}$.115766	$\bar{1}$.474303					$\bar{1}$.215527	$\bar{1}$.606121			
	$\bar{1}$.864814												$\bar{2}$.289534		
							$\bar{1}$.242152							$\bar{1}$.473894	
48		$\bar{1}$.035580	.478991			.332770		$\bar{1}$.129436	.522402			.362929			$\bar{1}$.245349
			.677500	$\bar{1}$.260546					.729311	$\bar{1}$.356946					
170					.993820	$\bar{1}$.313171					$\bar{1}$.082678	$\bar{1}$.430582			
	$\bar{1}$.594018												$\bar{1}$.958011		
							$\bar{1}$.073381							$\bar{1}$.245098	
22		.919248	.425184			.295388		.997085	.461186			.320400			$\bar{1}$.093213
			.630124	$\bar{1}$.172400					.677942	$\bar{1}$.261369					
	$\bar{1}$.304022												$\bar{1}$.601052		
							.951460							$\bar{1}$.084184	
	$\bar{1}$.108926												$\bar{1}$.361228		
0	$\bar{7}$.989142	$\bar{3}$.101222	$\bar{3}$.491466	$\bar{3}$.827306	$\bar{2}$.109586	$\bar{1}$.790938	$\bar{4}$.695258	$\bar{3}$.383451	$\bar{3}$.779572	$\bar{4}$.120470	$\bar{2}$.298205	$\bar{1}$.949476	$\bar{9}$.809311	$\bar{5}$.539351	$\bar{3}$.732004

31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	
			1.473959							1.112824					
				$\bar{2}$.869131											
					$\bar{2}$.046215										
.708424						$\bar{1}$.531612	.708424			.492163					
.951326	$\bar{1}$.635280		1.721347				.951326	$\bar{1}$.770023							
		$\bar{1}$.338732	$\bar{2}$.747923						$\bar{1}$.463432	$\bar{1}$.933687					
														.833694	
														.968753	
				$\bar{2}$.527074							$\bar{2}$.698102				
					$\bar{1}$.708452							$\bar{1}$.877334			
.630282						$\bar{1}$.362670	.630282			.437876			$\bar{1}$.447141	.669353	
.858064	$\bar{1}$.476001		1.547382				.858064	$\bar{1}$.596502						.904695	
		$\bar{1}$.192417	2.447593						$\bar{1}$.303489	$\bar{1}$.722348					
				$\bar{2}$.161586							$\bar{2}$.308160				
					$\bar{1}$.418901							$\bar{1}$.544039			
.550651						$\bar{1}$.190508	.550651			.382554			$\bar{1}$.260561	.583053	
.796770	$\bar{1}$.371246		1.443417				.796770	$\bar{1}$.482468						.839806	$\bar{1}$.
				$\bar{1}$.767176							$\bar{1}$.886786				
					$\bar{1}$.220130							$\bar{1}$.317435			
				$\bar{1}$.502337							$\bar{1}$.603935				
$\bar{4}$.495517	$\bar{4}$.482527	$\bar{2}$.531149	.990589	$\bar{10}$.827304	$\bar{6}$.393698	$\bar{4}$.084790	$\bar{4}$.495517	$\bar{4}$.848983	$\bar{2}$.766921	$\bar{1}$.230618	$\bar{8}$.496983	$\bar{4}$.738808	$\bar{2}$.707702	$\bar{2}$.861848	$\bar{3}$.2

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HALF

21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50

1.473959 1.112824

$\bar{2}$.599486 $\bar{2}$.869131

$\bar{1}$.428265 $\bar{1}$.735375 $\bar{2}$.046215

8378 $\bar{1}$.256930 .581374 .403898 $\bar{1}$.393442 .708424 $\bar{1}$.531612 .708424 .492163

.807356 $\bar{1}$.502155 .951326 $\bar{1}$.635280 1.721347 .951326 $\bar{1}$.770023

74.303 $\bar{1}$.215527 $\bar{1}$.606121 $\bar{1}$.338732 $\bar{2}$.747923 $\bar{1}$.463432 $\bar{1}$.933687

.833694

.968753

$\bar{2}$.289534 $\bar{2}$.527074 $\bar{2}$.698102

$\bar{1}$.242152 $\bar{1}$.473894 $\bar{1}$.708452 $\bar{1}$.877334

2.770 $\bar{1}$.129436 .522402 .362929 $\bar{1}$.245349 .630282 $\bar{1}$.362670 .630282 .437676 $\bar{1}$.437141 .669353

.729311 $\bar{1}$.356946 .858064 $\bar{1}$.476001 1.547382 .858064 $\bar{1}$.596502 .904695 $\bar{1}$.683263

3171 $\bar{1}$.082678 $\bar{1}$.430582 $\bar{1}$.192417 $\bar{2}$.447593 $\bar{1}$.303489 $\bar{1}$.722348 $\bar{1}$.383461

$\bar{1}$.958011 $\bar{2}$.161586 $\bar{2}$.308160

$\bar{2}$.272727

$\bar{1}$.073381 $\bar{1}$.245098 $\bar{1}$.418901 $\bar{1}$.614039 $\bar{1}$.669177

5388 .997085 .461186 .320400 $\bar{1}$.093213 .550651 $\bar{1}$.190508 .550651 .382554 $\bar{1}$.260561 .583053 $\bar{1}$.330614

.677942 $\bar{1}$.261369 .796770 $\bar{1}$.371246 1.443417 .796770 $\bar{1}$.482458 .839806 $\bar{1}$.562530

$\bar{1}$.601052 $\bar{1}$.767176 $\bar{1}$.886786

$\bar{1}$.460927

.951460 $\bar{1}$.084984 $\bar{1}$.220130 $\bar{1}$.317435 $\bar{1}$.414740

$\bar{1}$.361228 $\bar{1}$.502337 $\bar{1}$.603935

938 $\bar{4}$.695258 $\bar{3}$.383451 $\bar{3}$.779372 4.120470 $\bar{2}$.298205 $\bar{1}$.949476 $\bar{9}$.809311 $\bar{5}$.539351 $\bar{3}$.732004 $\bar{4}$.495517 $\bar{4}$.482527 $\bar{2}$.531149 .990589 $\bar{10}$.827304 $\bar{6}$.393698 $\bar{4}$.084790 $\bar{4}$.495517 $\bar{4}$.848983 $\bar{2}$.766921 $\bar{1}$.230618 $\bar{8}$.496983 $\bar{4}$.738808 $\bar{2}$.707702 $\bar{2}$.861848 $\bar{3}$.245793 $\bar{1}$.383461 $\bar{3}$.733654 $\bar{3}$.083917 $\bar{1}$.330614 $\bar{1}$.17