AVRO AIRCRAFT

TECHNICAL REPORT

F Shenston

ANALYZED

A. V. ROE CANADA LIMITED
MALTON - ONTARIO

TECHNICAL DEPARTMENT (Aircraft)

AIRCRAFT: C105

REPORT NO. 7/0503/2

FILE NO:

~~CONFIDENTIAL~~

NO. OF SHEETS:

TITLE: LOWER FIN STRESS DISTRIBUTION BY MODIFYING MATRIX STRESSES (C.P. AFT)

Classification cancelled / Changed to UNCLASS
By authority of AVRS
Date 30 Sept 56
Signature
Unit / Rank / Appointment AVRS

PREPARED BY H. N. SHOJI, A. COOKE, J. L. DIXON DATE MAY 18TH 1955

CHECKED BY DATE

SUPERVISED BY DATE

APPROVED BY DATE

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

FORM 1316A

AVRO AIRCRAFT LIMITED

TECHNICAL DEPARTMENT (Aircraft)

AIRCRAFT	
C105	FIN

REPORT No

SHEET No

PREPARED BY	DATE
S - [illegible]	12 MAY 53
CHECKED BY	DATE

INDEX

CONFIDENTIAL

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

FORM 1194

AVRO AIRCRAFT LIMITED

TECHNICAL DEPARTMENT (Aircraft)

REPORT No.

SHEET No.

AIRCRAFT		PREPARED BY	DATE
698	FIN	S - D.K.D.	13 MAY 59
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CONFIDENTIAL

SECTION	DESCRIPTION	
1	LOAD DISTRIBUTION TO MATRIX STRUCTURE.	
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FORM 1319A

AVRO AIRCRAFT LIMITED

TECHNICAL DEPARTMENT (Aircraft)

AIRCRAFT		REPORT No.	
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GIDE	FIN	S - [illegible] S	12 MAY 53
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FORM 1715A

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

REPORT No.
SHEET No. 1-1

AIRCRAFT:		PREPARED BY	DATE
C105	FIN	J. L. DIXON	10 NOV 54
		CHECKED BY	DATE

FIN ROOT STRUCTURE - LOAD DISTRIBUTION

CENTRE OF PRESSURE AFT

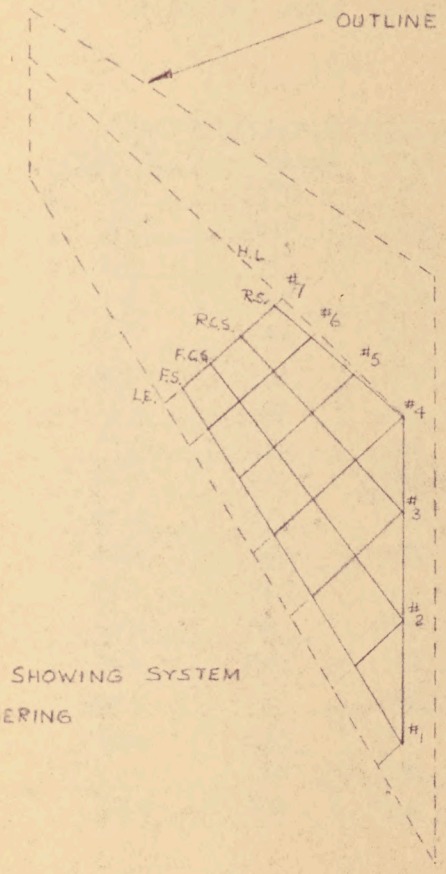


DIAGRAM SHOWING SYSTEM OF NUMBERING

ORM 1319A

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

AIRCRAFT:

REPORT No.

SHEET No. 1-2

PREPARED BY	DATE
J. L DIXON	10 NOV 1954
CHECKED BY	DATE

FROM INTER-DEPARTMENTAL MEMORANDUM #5227/07/J THE LOAD/IN OF SPAN AT VARIOUS POINTS WAS DETERMINED. TO ASCERTAIN THE LOAD/IN² ACROSS THE CHORD OF THE FIN THE LOAD (W lb/IN) WAS DIVIDED BY THE CHORDAL DISTANCE (C)

LINE	DISTANCE FROM FIN DATUM LINE IN.	LOAD (W) IN lb/IN OF SPAN	CHORDAL DISTANCE (C)	$\frac{W}{C}$ lb/IN²
O	0	293	228	1·28
A	9·6	291	218	1·33
B	19·8	287	208	1·38
C	21·0	286	207	1·38
D	30·0	283	198	1·43
E	36·8	280	190	1·47
F	39·0	278	188	1·48
G	46·5	275	181	1·52
H	51·9	271	175	1·55
J	55·5	269	172	1·56
K	63·0	265	165	1·60
L	69·3	260	157	1·66
M	77·0	254	149	1·70
N	82·1	250	144	1·74
O	89·0	244	137	1·78
P	92·7	238	133	1·79
Q	99·0	230	126	1·82

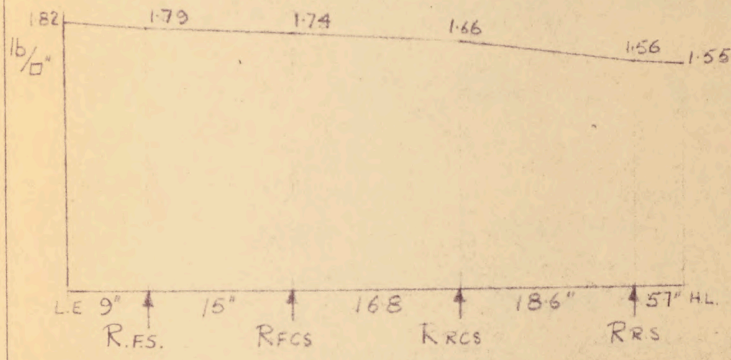
FORM 1318A

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

REPORT No.
SHEET No. 1-3

AIRCRAFT:		PREPARED BY	DATE
C 105	FIN 7	J. L. DIXON	10 NOV 1954
		CHECKED BY	DATE

EACH RIB WAS CONSIDERED AS A BEAM WITH A LOADING OBTAINED FROM THE PREVIOUS TABLE. THE RIBS WERE THEN SPLIT UP INTO SECTIONS IN ORDER THAT THE REACTIONS COULD BE DETERMINED. RIB #7 IS GIVEN AS AN EXAMPLE BELOW



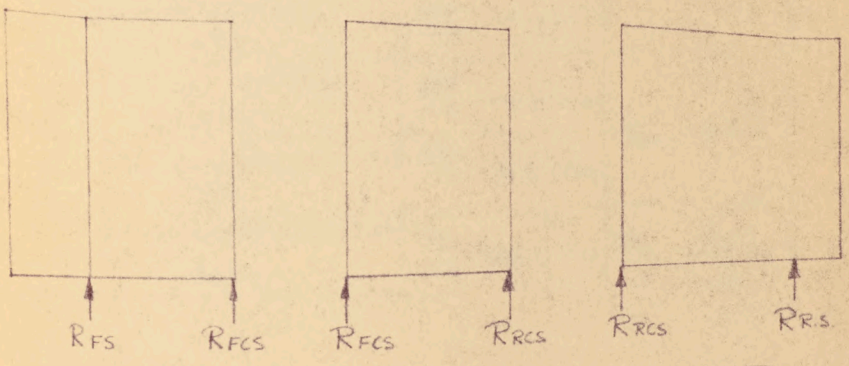


FIG I FIG II FIG III

FORM 1194

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

REPORT No. _____
SHEET No. 1-4

AIRCRAFT:		PREPARED BY	DATE
C 105	FIN	J. L. DIXON	10 NOV '54
		CHECKED BY	DATE

EX.

IN FIG I TAKING MOMENTS ABOUT R_{FCS}

$$R_{FS} = \frac{1.805 \times 9 \times 19.51 + 1.765 \times 15 \times 7.53}{15}$$

$$= \frac{317 + 199}{15} = 34.4 \text{ lb/in.}$$

TAKING MOMENTS ABOUT R_{FS}

$$R_{FCS} = \frac{1.765 \times 15 \times 7.47 - 1.805 \times 9 \times 4.51}{15}$$

$$= \frac{198 - 73.2}{15} = 8.30 \text{ lb/in}$$

RIB #7

TAKING MOMENTS ABT.	MOMENT (M)	REACTION M ÷ x	TOTAL lb/in.
R_{FCS}	$(1.805 \times 9 \times 19.51) + (1.765 \times 15 \times 7.51) = 516$	$\frac{516}{15} = 34.4 = R_{FS}$	$R_{FS} = 34.4$
R_{FS}	$(1.765 \times 15 \times 7.47) - (1.805 \times 9 \times 4.51) = 124.8$	$\frac{124.8}{15} = 8.3 = R_{FCS}$	$R_{FCS} = 22.7$
R_{RCS}	$1.700 \times 16.8 \times 8.46 = 242$	$\frac{242}{16.8} = 14.4 = R_{FCS}$	
R_{FCS}	$1.700 \times 16.8 \times 8.34 = 238$	$\frac{238}{16.8} = 14.2 = R_{RS}$	$R_{RCS} = 27.7$
R_{RS}	$(1.610 \times 18.6 \times 9.39) - (1.555 \times 5.7 \times 2.85) = 252$	$\frac{252}{18.6} = 13.5 = R_{RCS}$	
R_{RCS}	$(1.610 \times 18.6 \times 9.21) + (1.555 \times 5.7 \times 2.14) = 466$	$\frac{466}{18.6} = 25.1 \; R_{RS}$	$R_{RS} = 25.1$

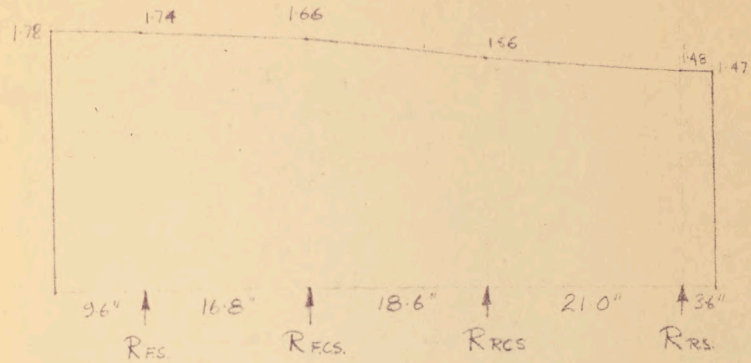
FORM 1319A

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

REPORT No.
SHEET No. 1-5

AIRCRAFT:		PREPARED BY	DATE
		J. L. DIXON	10 NOV '54
		CHECKED BY	DATE

RIB #6



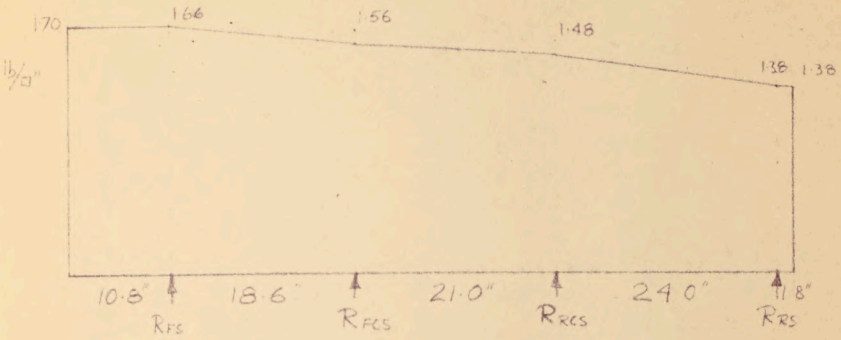
TAKING MOMENTS ABOUT	MOMENT (M)	REACTION M ÷ X	TOTAL lb/in.
R FCS	(1·760 · 9·6 × 21·61) + (1·700 · 16·8 × 8·46) = 607	$\frac{607}{16·8}$ = 36·2 - R FS	R FS = 36·2
R FS	(1·700 × 16·8 × 8·34) - (1·768 × 9·6 × 4·81) = 157·7	$\frac{157·7}{16·8}$ = 9·4 = R FCS	R FCS = 24·5
R RCS	1·610 × 18·6 × 9·39 = 281	$\frac{281}{18·6}$ = 15·1 = R FCS	
R FCS	1·610 × 18·6 × 9·21 = 276	$\frac{276}{18·6}$ = 14·8 = R RCS	R RCS = 30·4
R RS	(1·520 × 21 × 10·60) - (1·475 × 3·6 × 1·79) = 328·5	$\frac{328·5}{21·0}$ = 15·6 = R RS	
R FCS	(1·520 × 21 × 10·40) + (1·475 × 3·6 × 2·07) = 452	$\frac{452}{21·0}$ = 21·5 = R RS	R RS = 21·5

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

REPORT NO:
SHEET NO: 1-6

AIRCRAFT:		PREPARED BY	DATE
		J. L DIXON	11 NOV 195?
		CHECKED BY	DATE

RIB #5



TAKING MOMENTS ABOUT	MOMENT (M)	REACTION M÷ℓ	TOTAL 16/10
R_{FCS}	$(1·68 \times 10·8 \times 24·04) + (1·610 \times 18·6 \times 9·39)$ = 716	$\frac{716}{18·6} = 38·5 = R_{FS}$	$R_{FS} = 38·5$
R_{FS}	$(1·610 \times 18·6 \times 9·21) - (1·68 \times 10·8 \times 5·41)$ = 178	$\frac{178}{18·6} = 9·6 = R_{FCS}$	$R_{FCS} = 25·7$
R_{RCS}	$(1·520 \times 21·0 \times 10·60)$ = 338	$\frac{338}{21} = 16·1 = R_{FCS}$	
R_{FCS}	$(1·520 \times 21·0 \times 10·40)$ = 332	$\frac{332}{21} = 15·8 = R_{RCS}$	$R_{RCS} = 33·1$
R_{RS}	$(1·43 \times 24·0 \times 12·13) - (1·38 \times 1·8 \times 9)$ = 414·8	$\frac{414·8}{24} = 17·3 = R_{RIS}$	
R_{RCS}	$(1·43 \times 24 \times 11·87) + (1·38 \times 1·8 \times 24·9)$ = 468·6	$\frac{468·8}{24} = 19·6 = R_{RS}$	$R_{RS} = 19·6$

FORM 1318A

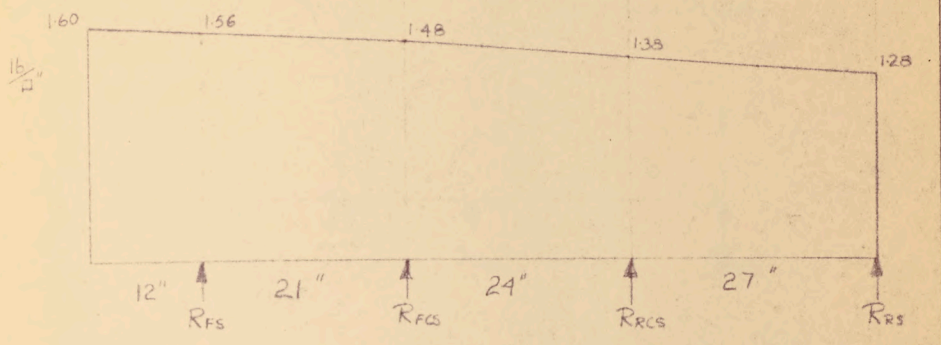
A. V. ROE CANADA LIMITED
MALTON - ONTARIO
TECHNICAL DEPARTMENT (Aircraft)

AIRCRAFT:	

REPORT No.
SHEET No. 1·7

PREPARED BY	DATE
J. L DIXON	11 NOV '54
CHECKED BY	DATE

RIB #4



TAKING MOMENTS ABOUT	MOMENT M	REACTION M ÷ L	TOTAL lb/IN
R_{FCS}	(1·580×12×27·03)+(1·52×21×10·6) = 850	$\frac{850}{21}$ = 40·5 = R_{FS}	R_{FS} = 40·5
R_{FS}	(1·52×21×10·4)+(1·580×12×6·03) = 218	$\frac{218}{21}$ = 10·3 = R_{FCS}	R_{FCS} = 27·7
R_{RCS}	(1·43×24×12·13) = 416	$\frac{416}{24}$ = 17·4 = R_{FCS}	
R_{FCS}	1·43×24×11·87 = 407	$\frac{407}{24}$ = 16·9 = R_{RCS}	R_{RCS} = 35·1
R_{RS}	1·33×27×13·67 = 490	$\frac{490}{27}$ = 18·2 = R_{RCS}	
R_{RCS}	1·33×27×13·33 = 479	$\frac{479}{27}$ = 17·7 = R_{RS}	R_{RS} = 17·7

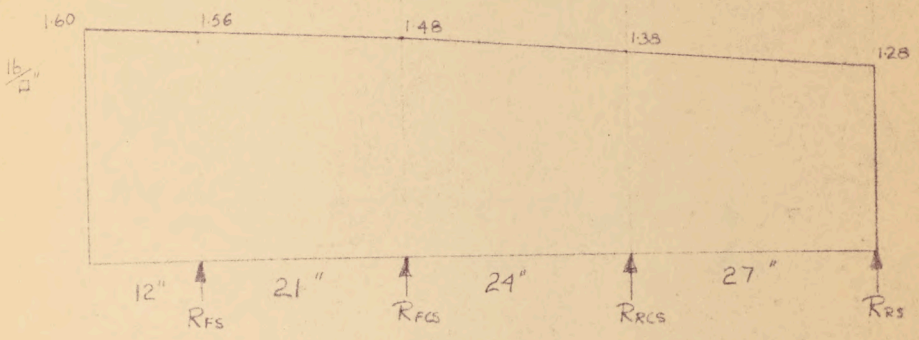
FORM 1310A

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

REPORT No.
SHEET No. 1·7

AIRCRAFT:		PREPARED BY	DATE
		J. L DIXON	11 NOV '54
		CHECKED BY	DATE

RIB #4



TAKING MOMENTS ABOUT	MOMENT M	REACTION M ÷ I	TOTAL lb/IN
R_{FCS}	(1·580×12×27·03)+(1·52×21×10·6) = 850	$\frac{850}{21}$ = 40·5 = R_{FS}	R_{FS} = 40·5
R_{FS}	(1·52×21×10·4)+(1·580×12×6·0) = 218	$\frac{218}{21}$ = 10·3 = R_{FCS}	R_{FCS} = 27·7
R_{RCS}	(1·43×24×12·13) = 416	$\frac{416}{24}$ = 17·4 = R_{RCS}	
R_{FCS}	1·43×24×11·87 = 407	$\frac{407}{24}$ = 16·9 = R_{RCS}	R_{RCS} = 35·1
R_{RS}	1·33×27×13·67 = 490	$\frac{490}{27}$ = 18·2 = R_{RCS}	
R_{RCS}	1·33×27×13·33 = 479	$\frac{479}{27}$ = 17·7 = R_{RS}	R_{RS} = 17·7

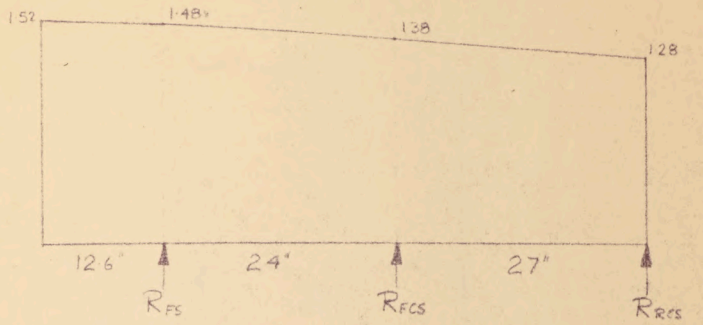
FORM 1319A

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

REPORT No.
SHEET No. 1-8

AIRCRAFT:		PREPARED BY	DATE
		J. L. DIXON	11 NOV 54
		CHECKED BY	DATE

RIB #3



TAKING MOMENTS ABOUT	MOMENT M	REACTION M÷x	TOTAL lb/IN
R_{FCS}	$(1·50 \times 12·6 \times 30·32) + (1·43 \times 24 \times 12·13)$ = 989	$\frac{989}{24}$ = 41·2 = R_{FS}	R_{FS} = 41·2
R_{FS}	$(1·43 \times 24 \times 11·87) - (1·50 \times 12·6 \times 6·32)$ = 288	$\frac{288}{24}$ = 12·0 = R_{FCS}	R_{FCS} = 30·2
R_{RCS}	$(1·33 \times 27 \times 13·67)$ = 490	$\frac{490}{27}$ = 18·2 = R_{FCS}	
R_{FCS}	$1·33 \times 27 \times 13·43$ = 479	$\frac{479}{27}$ = 17·7 = R_{RCS}	R_{RCS} = 17·7

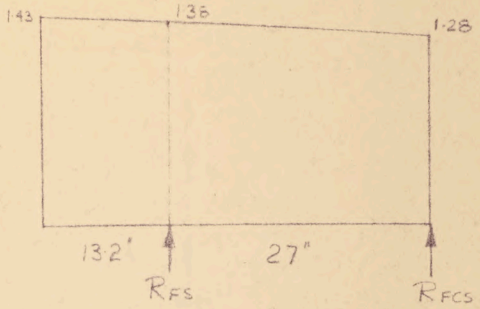
FORM 1319-A

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

REPORT No. _____
SHEET No. 49

AIRCRAFT:		PREPARED BY	DATE
		J. L. DIXON	11 NOV 59
		CHECKED BY	DATE

RIB #2



TAKING MOMENTS ABOUT	MOMENT M	REACTION M ÷ L	TOTAL lb/in
R_{FCS}	(1·405×13·2×33·63)+(1·33×27×13·67) = 1113	$\frac{1113}{27}$ = 41·2 = R_{FS}	R_{FS} = 41·2
R_{FS}	(1·33×27×13·43)−(1·405×13·2×66²) = 359	$\frac{359}{27}$ = 13·3 = R_{FCS}	R_{FCS} = 13·3

FORM 1316A

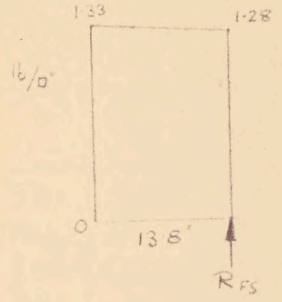
A. V. ROE CANADA LIMITED
MALTON - ONTARIO
TECHNICAL DEPARTMENT (Aircraft)

REPORT No.

SHEET No. 1-10

AIRCRAFT:		PREPARED BY	DATE
		J L DIXON	11 NOV 54
		CHECKED BY	DATE

#1



TAKING MOMENTS ABOUT	MOMENT M	REACTION M÷ℓ	TOTAL lb/in
0	1·305×13·8×6·86 = 123·5	$\frac{123.5}{13.8}$ = 8·9	R_{FS} = 8·9

ORM 1719A

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

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		PREPARED BY	DATE
		V. L. DIXON	12 NOV 54
		CHECKED BY	DATE

SPAR REACTIONS IN POUNDS PER INCH OF SPAN

	#1	#2	#3	#4	#5	#6	#7
R_{FS}	8·9	41·2	41·2	40·5	38·5	36·2	34·4
R_{FCS}	-	13·3	30·2	27·7	25·7	24·5	22·7
R_{RCS}	-	-	17·7	35·1	33·1	30·4	27·7
R_{RS}	-	-	-	17·7	19·6	21·5	25·1

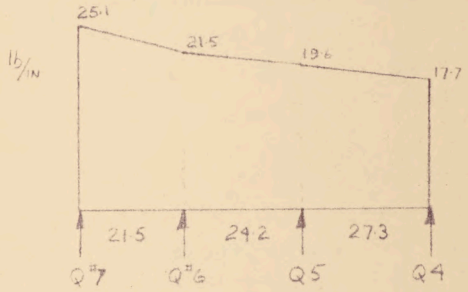
ORM 1319A

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

AIRCRAFT:		REPORT No.	
		SHEET No.	1-12
		PREPARED BY	DATE
		J. L DIXON	12 NOV 54
		CHECKED BY	DATE

EACH SPAR WAS CONSIDERED AS A BEAM WITH LOADINGS OBTAINED FROM THE SPAR REACTIONS. THE RIB LOADS (Q) WERE DETERMINED AS BEFORE.

REAR SPAR



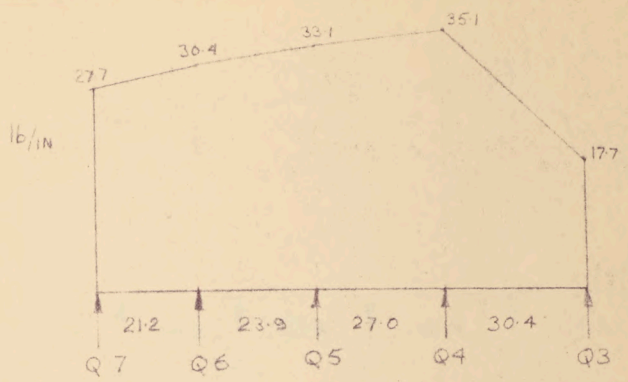
TAKING MOMENTS ABOUT	MOMENT · M	REACTION M ÷ I	TOTAL lbs
Q6	23·3 × 21·5 × 11·01 = 5510	$\frac{5510}{21·5}$ = 257 = Q7	Q7 = 257
Q7	23·3 × 21·5 × 10·49 = 5240	$\frac{5240}{21·3}$ = 246 = Q6	Q6 = 499
Q5	20·55 × 24·2 × 12·30 = 6110	$\frac{6110}{24·2}$ = 253 = Q6	
Q6	20·55 × 24·2 × 11·90 = 5910	$\frac{5210}{24·2}$ = 244 = Q5	Q5 = 502
Q4	18·65 × 27·3 × 13·88 = 7050	$\frac{7050}{27·3}$ = 258 = Q5	
Q5	18·65 × 27·3 × 13·42 = 6830	$\frac{6830}{27·3}$ = 251 Q4	Q4 = 251

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

REPORT No.
SHEET No. 1-13

AIRCRAFT:		PREPARED BY	DATE
		J L DIXON	12 NOV 54
		CHECKED BY	DATE

REAR CENTRE SPAR



TAKING MOMENTS ABOUT	MOMENT (M)	REACTION M ÷ L	TOTAL lb
Q6	23·05 × 21·2 × 10·42 = 6410	$\frac{6410}{21·2}$ = 303 = Q7	Q7 = 303
Q7	29·05 × 21·2 × 10·78 = 6640.	$\frac{6640}{21·2}$ = 313 = Q6	Q6 = 687
Q5	31·75 × 23·9 × 11·78 = 8930	$\frac{8930}{23·9}$ = 374 = Q6	
Q6	31·75 × 23·9 × 12·12 = 9200	$\frac{9200}{23·9}$ = 385 = Q5	Q5 = 840
Q4	34·1 × 27·0 × 13·35 = 12,250	$\frac{12250}{27·0}$ = 455 = Q5	
Q5	34·1 × 27·0 × 13·65 = 12 540	$\frac{12,540}{27·0}$ = 465 = Q4	Q4 = 887
Q3	26·4 × 30·4 × 16·73 = 13420	$\frac{13420}{30·4}$ = 422 = Q4	
Q4	26·4 × 30·4 × 13·67 = 10960	$\frac{10960}{30·4}$ = 361 = Q3	Q3 = 361

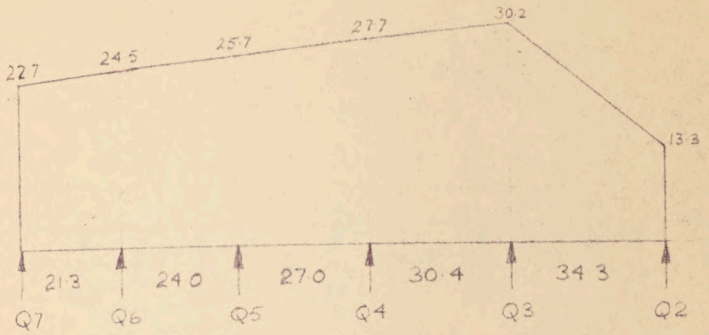
FORM 1319A

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

REPORT NO.
SHEET NO. 1-14

AIRCRAFT:		PREPARED BY	DATE
		J L DIXON	12 NOV 59
		CHECKED BY	DATE

FORWARD CENTRE SPAR



TAKING MOMENTS ABOUT	MOMENT (M)	REACTION M÷I	TOTAL lb
Q6	23.6×21.3×10.51 = 5290	$\frac{5290}{21.3}$ = 248	Q7=248
Q7	23.6×21.3×10.79 = 5410	$\frac{5410}{21.3}$ = 254	Q6=553
Q5	25.1×24.0×11.90 = 7170	$\frac{7170}{24.0}$ = 299	
Q6	25.1×24.0×12.10 = 7280	$\frac{7280}{24.0}$ = 303	Q5=659
Q4	26.7×27.0×13.31 = 9600	$\frac{9600}{27}$ = 356	
Q5	26.7×27.0×13.60 = 9780	$\frac{9780}{27}$ = 362	Q4=796
Q3	28.95×30.4×14.98 = 13180	$\frac{13180}{30.4}$ = 434	
Q4	28.95×30.4×15.42 = 13580	$\frac{13580}{30.4}$ = 447	Q3=868
Q2	21.75×34.3×19.36 = 14430	$\frac{14430}{34.3}$ = 421	
Q3	21.75×34.3×14.94 = 11140	$\frac{11140}{34.3}$ = 325	Q2=325

FORM 1318A

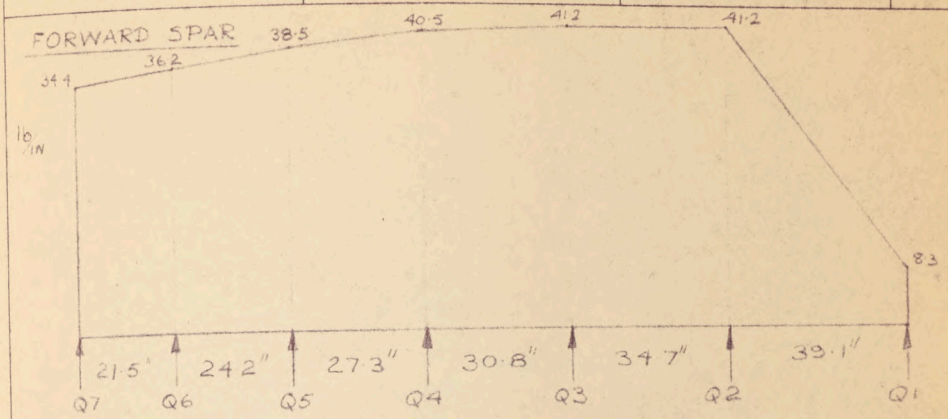
A. V ROE CANADA LIMITED
MALTON - ONTARIO

TECHNICAL DEPARTMENT (Aircraft)

REPORT No.

SHEET No. 1-15

AIRCRAFT:		PREPARED BY	DATE
		J L DIXON	12 NOV 59
		CHECKED BY	DATE



TAKING MOMENTS ABOUT	MOMENT (M)	REACTION M÷x	TOTAL
Q6	35·3 × 21·5 × 10·66 = 8090	8090/21·5 = 376	Q7=376
Q7	35·3 × 21·5 × 10·84 = 8230	8230/21·5 = 383	Q6=830
Q5	37·35 × 24·2 × 11·98 = 10820	10820/24·2 = 447	
Q6	37·35 × 24·2 × 12·22 = 11050	11050/24·2 = 456	Q5=990
Q4	39·5 × 27·3 × 13·52 = 14580	14580/27·3 = 534	
Q5	39·5 × 27·3 × 13·78 = 14840	14840/27·3 = 544	Q4=1171
Q3	40·85 × 30·8 × 15·35 = 19310	19310/30·8 = 627	
Q4	40·85 × 30·8 × 15·45 = 19430	19430/30·8 = 631	Q3=1846
Q2	41·20 × 34·7 × 17·35 = 24800	24800/34·7 = 715	
Q3	41·20 × 34·7 × 17·35 = 24800	24800/34·7 = 715	Q2=1306
Q1	24·75 × 39·1 × 23·9 = 23100	23100/39·1 = 591	
Q2	24·75 × 39·1 × 15·2 = 14700	14700/39·1 = 376	Q1=376

FORM 1310A

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

REPORT No.

SHEET No. 1-16

AIRCRAFT:		PREPARED BY	DATE
		J. L. DIXON	12 NOV 59
		CHECKED BY	DATE

AIRLOAD FROM RIB #7 TO TIP

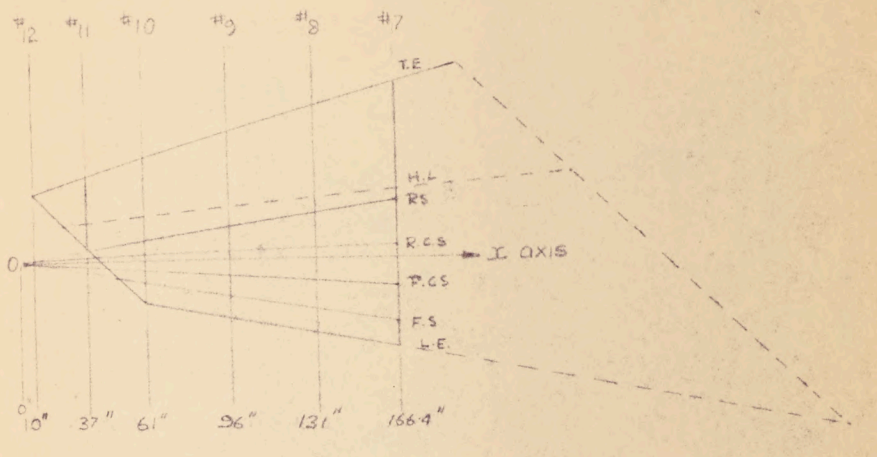


DIAGRAM SHOWING POSITION OF RIBS

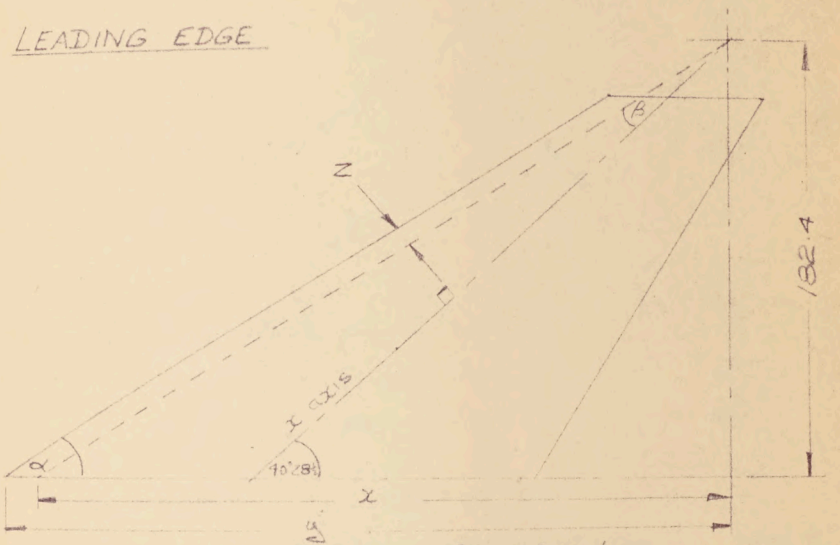
FORM 1319A

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

AIRCRAFT:		REPORT No.	
		SHEET No.	1-17
		PREPARED BY	DATE
		J. L DIXON	15 NOV 54
		CHECKED BY	DATE

TO FIND EQUATION RELATING POSITION OF LEADING EDGE, HINGE LINE, & TRAILING EDGE TO X AXIS

LEADING EDGE



$\angle\alpha = 30°39\frac{1}{2}'$ $\therefore \angle\beta = 9°49'$

$x = 182.4 \cot 30°39\frac{1}{2}' = 307.70$

$y = 182.4 \cot 29°53 = 317.41$ (REF REP # 7/0510/1 PAGE 3)

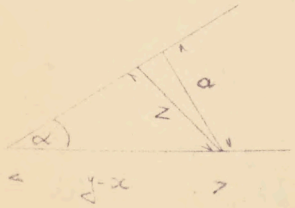
$y - x = 9.71$

$a = 9.71 \sin 30°39\frac{1}{2}'$

$= 4.94$

$z = 4.94 \sec 9°49'$

$= 5.01''$



FORM 1319A

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

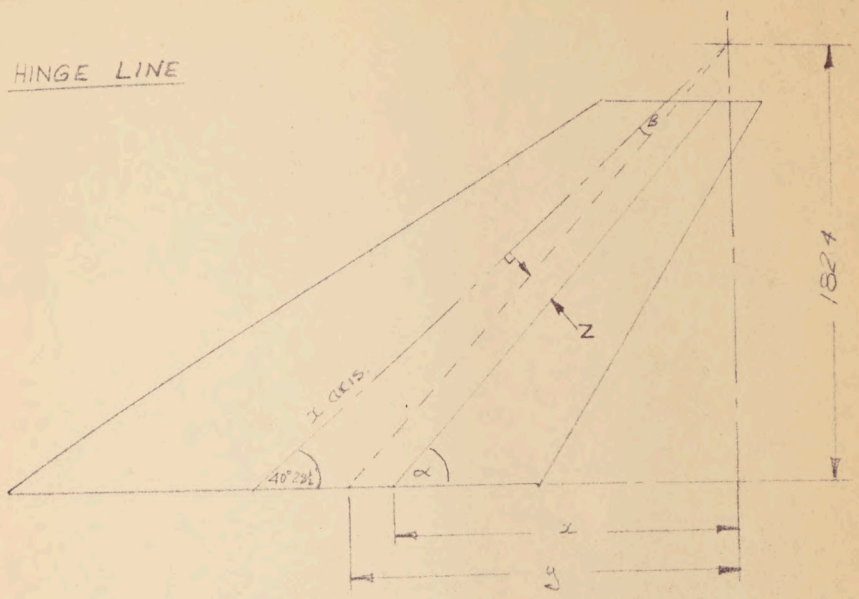
REPORT No.

SHEET No. 1-18

AIRCRAFT:	

PREPARED BY	DATE
J L DIXON	15 NOV 59
CHECKED BY	DATE

HINGE LINE



$\alpha = 46°6'$ $\beta = 5°37\frac{1}{2}'$

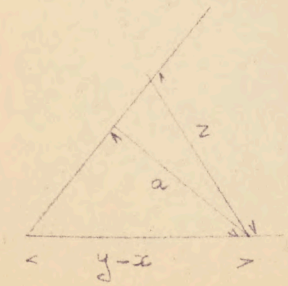
$x = 182.4 \cot 43°7'$ (REF: REP # 7/0510/1 PAGE 3)

$= 157.30$

$y = 182.4 \cot 46°6'$

$= 175.53$

$y - x = 17.63$



$a = 17.63 \sin 46°6'$

$= 12.70$

$z = 12.70 \sec 5°37\frac{1}{2}'$

$= 12.76''$

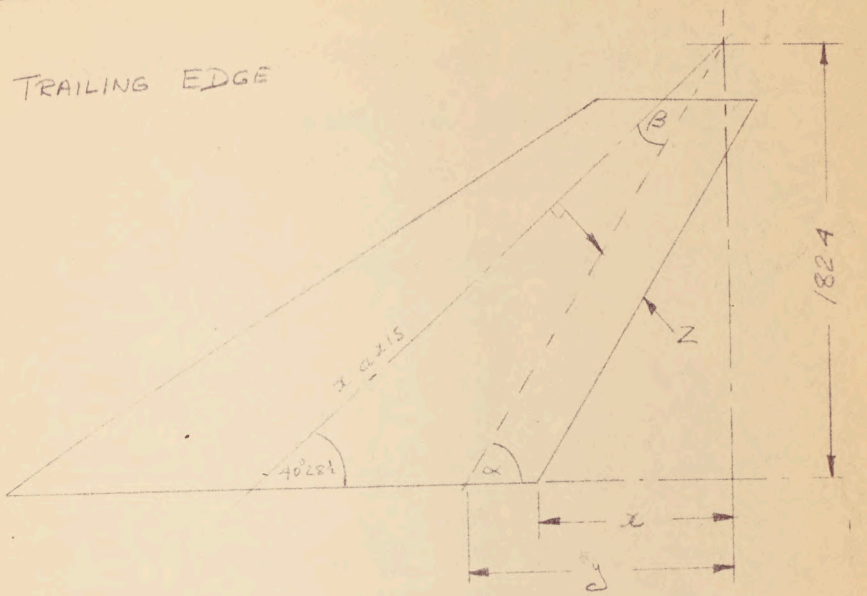
FORM 1198A

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

REPORT NO.
SHEET NO. 1-19

AIRCRAFT:		PREPARED BY	DATE
		J. L DIXON	15 NOV 54
		CHECKED BY	DATE

TRAILING EDGE



$\alpha = 56°55'$ $\quad B = 16°26\frac{1}{2}'$

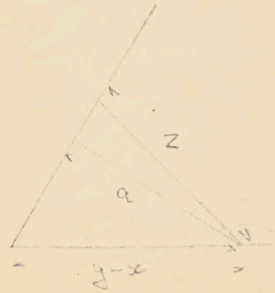
$x = 182.4 \cot 63°52'$ (REF. REP. 7/0510/1 PAGE 3)

$= 80.49$

$y = 182.4 \cot 56°55'$

$= 118.84$

$y - x = 29.35$



$a = 29.35 \times \sin 56°55'$

$= 24.60$

$z = 24.60 \sec 16°26\frac{1}{2}'$

$= 25.65$

CRNA 1310-A

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

REPORT No.
SHEET No. 1-20

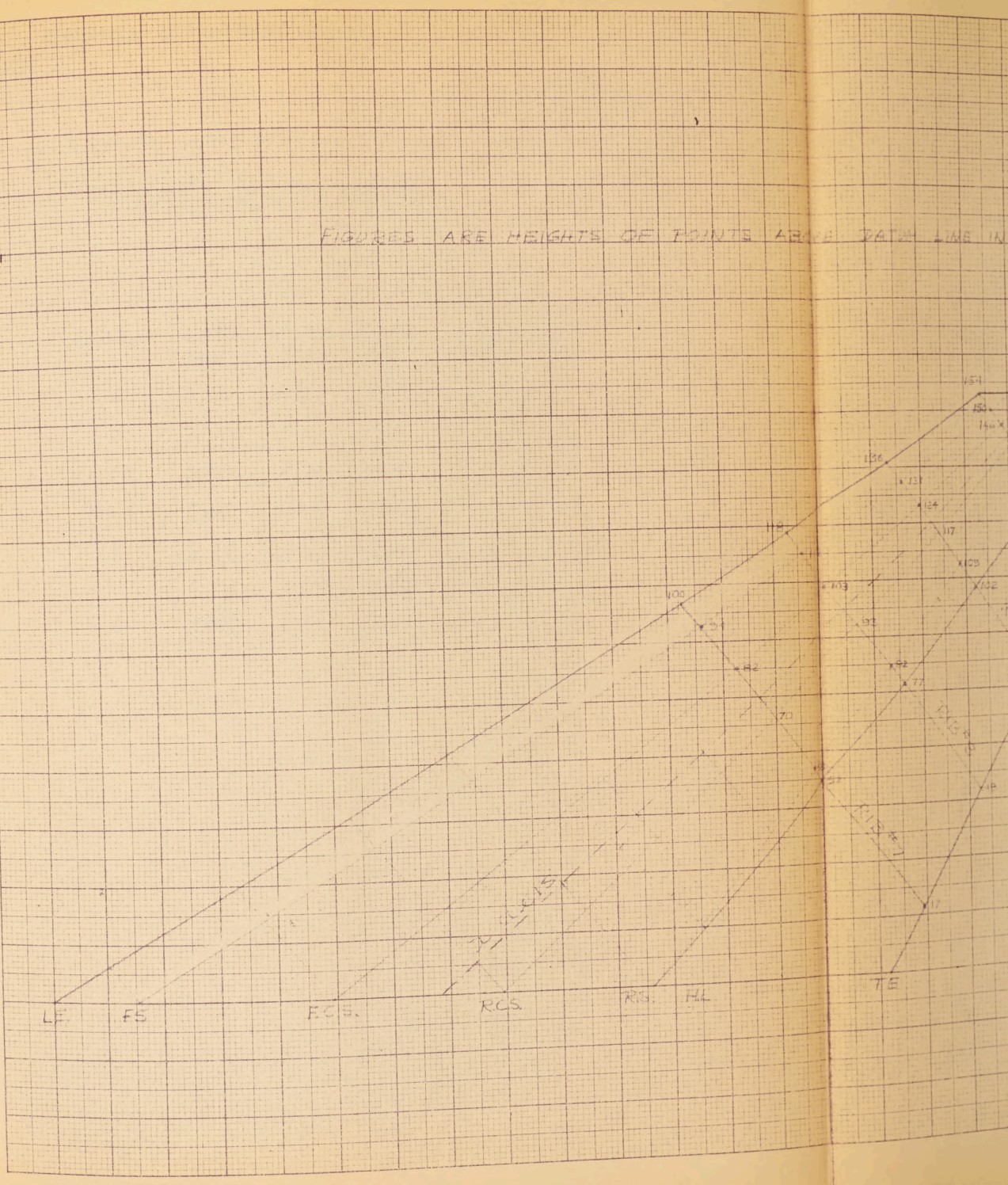
AIRCRAFT:		PREPARED BY	DATE
		J L DIXON	15 NOV '54
		CHECKED BY	DATE

CHORDAL DISTANCES (ALONG RIBS)

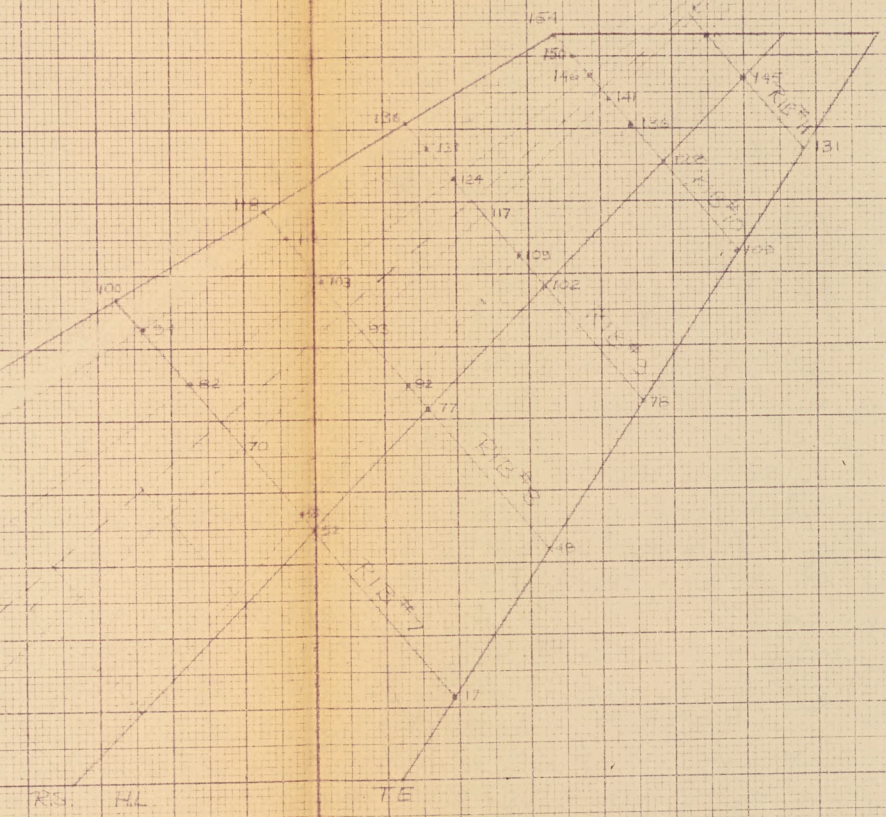
DISTANCES ARE MEASURED FROM X AXIS

X →	RIB #11 370"	RIB #10 610"	RIB #9 96.0"	RIB #8 131.0"	RIB #7 166.4"
L.E. Y = (1730x + 5.01)	11.41	15.56	21.62	27.66	33.81
	5.79	6.29	7.03	7.76	8.53
F.S. Y = .1520 x	5.62	9.27	14.59	19.90	25.28
	3.30	5.45	8.58	11.70	14.86
F.C.S. Y = .0626x	2.32	3.82	6.01	8.20	10.42
	3.74	6.16	9.70	13.23	16.81
R.C.S. Y = -.0384x	-1.42	-2.34	-3.69	-5.03	-6.39
	4.20	6.93	10.90	14.87	18.89
R.S. Y = -.1520x	-5.62	-9.27	-14.59	-19.90	-25.28
	10.78	9.50	7.63	5.77	3.89
H.L. Y = (.0985x + 1.274)	-16.40	-18.77	-22.22	-25.67	-29.17
	20.14	24.83	31.66	38.51	45.43
T.E. Y = (.2941x + 25.69)	-36.54	-43.60	-53.88	-64.18	-74.60

FORM 1319A



S OF POINTS ARE PATH LINE IN INCHES



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

AIRCRAFT:

REPORT No.

SHEET No. 122

PREPARED BY	DATE
J L DIXON	15 NOV '54
CHECKED BY	DATE

WEIGHT DISTRIBUTION

LOCATION	RIB #7 lb/IN	RIB #8 lb/IN	RIB #9 lb/IN	RIB #10 lb/IN	RIB #11 lb/IN	RIB #12 lb/IN
L.E.	233	206	159	0	–	–
F.S.	239	216	176	65	–	–
F.C.S.	250	228	194	102	–	–
R.C.S.	260	240	208	136	–	–
R.S.	270	250	220	159	0	–
H.L.	272	255	230	184	110	–
T.E.	288	274	254	220	176	–

CFM 1719A

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

AIRCRAFT:	

REPORT NO. _____
SHEET NO. 1-23

PREPARED BY	DATE
J. L. DIXON	15 NOV 54
CHECKED BY	DATE

PRESSURE DISTRIBUTION

LOCATION		RIB #7	RIB #8	RIB #9	RIB #10	RIB #11	RIB #12
L.E.	CHORD LGTH. IN	123	105	86	68		
	PRESSURE lb/□"	1.89	1.96	1.85	0		
F.S	CHORD LENGTH IN	130	111	92	72		
	PRESSURE lb/□"	1.84	1.95	1.91	.90		
F.C.S	CHORD LGTH. IN	142	120	99	76		
	PRESSURE lb/□"	1.76	1.90	1.96	1.34		
R.C.S	CHORD LGTH IN	156	131	106	82		
	PRESSURE lb/□"	1.67	1.83	1.96	1.66		
R.S	CHORD LGTH. IN.	170	142	115	86	68	
	PRESSURE lb/□"	1.59	1.76	1.91	1.85	0	
H.L.	CHORD LGTH. IN.	174	147	122	95	77	
	PRESSURE lb/□"	1.56	1.73	1.89	1.94	1.43	
T.E	CHORD LGTH. IN.	210	178	145	114	92	
	PRESSURE lb/□"	1.37	1.54	1.75	1.93	1.91	

FORM 1198A

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

REPORT No. _____
SHEET No. 1-29

AIRCRAFT:		PREPARED BY	DATE
		J. L. DIXON	16 NOV 54
		CHECKED BY	DATE

RIB LOADING

1 LOCATION	2 ΔC	3 PRESSURE lb/in²	4 G.G.	5 DIST. OF CG FROM LE	6 AVERAGE PRESSURE	7 LOAD lb/in	8 DISTANCE OF G.G. FROM	9 MOMENT lb.in/in.
				2×4	$\frac{3+3E}{2}$	2×6		
RIB #7								
L.E.	8.53	1.83 1.84	.5025	4.34	1.865	15.90	29.62	471
F.S.	14.86	1.84 1.76	.5040	7.49	1.800	26.75	17.91	479
F.C.S.	16.81	1.76 1.67	.5045	8.48	1.715	28.80	2.09	60
R.C.S.	18.80	1.67 1.59	.5045	9.52	1.630	30.78	-15.76	-484
R.S.	3.80	1.59 1.56	.5015	1.05	1.575	6.12	-27.22	-167
H.L.	45.43	1.56 1.37	.5110	23.21	1.465	66.50	-51.39	-3417
T.E.					TOTAL =	174.85	TOTAL =	-3058
RIB #8								
L.E.	7.76	1.96 1.95	.5005	3.89	1.955	15.18	23.79	361
F.S.	11.70	1.95 1.90	.5020	5.87	1.925	23.53	14.07	331
F.C.S.	13.23	1.90 1.83	.5030	6.66	1.865	24.68	1.63	40
R.C.S.	14.87	1.83 1.76	.5030	7.47	1.795	25.66	-12.43	-319
R.S.	5.77	1.76 1.73	.5010	2.89	1.745	10.08	-22.78	-229
H.L.	38.51	1.73 1.54	.5095	19.61	1.635	61.35	-44.57	-2738
T.E.					TOTAL =	160.48	TOTAL =	-2554

FORM 1198A

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

REPORT No.
SHEET No. 1-25

PREPARED BY	DATE
J. L. DIXON	16 NOV 54
CHECKED BY	DATE

AIRCRAFT:

RIB LOADING

1	2	3	4	5	6	7	8	9
LOCATION	ΔC	PRESSURE lb/□"	C.G	DIST. OF C.G FROM L.H END	AVERAGE PRESSURE	LOAD lb/IN	DISTANCE OF C.G FROM X AXIS	MOMENT lb.in/in
RIB # 9				2×4	$\frac{3a+3b}{2}$	2×6		
L.E.	7.08	1.85 1.91	.4975	3.50	1.880	13.21	18.09	239
F.S.	8.58	1.91 1.96	.4980	4.27	1.935	16.61	10.28	171
F.C.S.	9.70	1.96 1.96	.5000	4.85	1.960	19.01	1.16	22
R.C.S.	10.90	1.96 1.91	.5020	5.47	1.935	21.09	-9.12	-192
R.S.	7.63	1.91 1.83	.5010	3.82	1.900	14.50	-18.40	-267
H.L.	31.66	1.89 1.75	.5030	15.93	1.780	56.40	-37.95	-2139
T.E.					TOTAL =	140.82	TOTAL =	-2166
RIB # 10								
L.E.	6.20	0 .90	.3333	2.20	.450	2.83	11.47	32
F.S.	5.45	.90 1.34	.4667	2.54	1.120	6.10	5.36	33
F.C.S.	6.16	1.34 1.66	.4810	2.96	1.400	8.63	.62	5
R.C.S.	6.03	1.66 1.85	.4910	3.40	1.755	13.91	-5.87	- 82
R.S.	9.50	1.85 1.94	.4960	4.71	1.895	18.01	-14.06	-253
H.L.	24.83	1.94 1.93	.5004	12.42	1.935	48.05	-31.18	-1499
T.E.						97.53		-1764

FORM 1319A

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

AIRCRAFT:

REPORT NO.
SHEET NO. 1-26

PREPARED BY	DATE
J. L. DIXON	16 NOV 54
CHECKED BY :	DATE

1	2	3	4	5	6	7	8	9
LOCATION	Δ C	PRESSURE lb/D²	C.G.	DIST. OF C.G FROM R.H END	AVERAGE PRESSURE	LOAD lb/IN.	DISTANCE OF C.G. FROM X AXIS	MOMENT lb IN/IN
RIB # 11				2×4	$\frac{3a+3b}{6}$	2×6		
R.S.		0						
	10·78	1·43	·3333	3·59	·7150	7·70	-12·81	-99
H.L.		1·43						
	20·14	1·91	·4760	9·59	1·6700	33·60	-26·95	-905
T.E						41·30		-1004

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

RIB	LOAD lb/IN	MOMENT lb.IN/IN
7	174·85	3058
8	160·48	2554
9	140·82	2166
10	97·53	1764
11	41·30	1004
12	0	0

FORM 1318A

TORQUE ABOUT X AXIS

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

REPORT No. _____
SHEET No. 1-28

AIRCRAFT:		PREPARED BY	DATE
		J. L. DIXON	16 NOV 54
		CHECKED BY	DATE

LIMIT AIRLOAD SHEARS BENDING MOMENTS & TORQUES

1	2	3	4	5	6	7	8	9
STATION ON X AXIS	ΔX "	LOADING LB/IN	AVERAGE LOAD LB/IN	AIRLOAD LB.	SHEAR LB	SHEAR LB	Δ B.M. IN. LB	B.M. IN. LB
RIB #	SHEET # 17	SHEET # 28	$\frac{3A+3B}{2}$	2×4	Σ 5	SHEET 30		
12		0				0		
	27·0	38·0	19·0	513		400	5,400	
					513			5,400
11		42·0				420		
	24·0	98·0	70·0	1680		2000	29,020	
					2193			34,420
10		101·5				2080		
	35·0	143·0	122·25	4280		6300	146,800	
					6473			181,220
9		142				6500		
	35·0	161·5	151·75	5310		11800	320,200	
					11783			501,420
8		160·5				11800		
	35·4	175	167·75	5940		17800	524,000	
					17,723			1025,420
7								

TOTAL AIRLOAD TORQUE

$= \Sigma$ (TORQUE PER INCH) $\times \Delta X$

$= \left(\frac{920}{2}\right)\times 27 + \left(\frac{1070+1790}{2}\right)\times 24 + \left(\frac{1790+2190}{2}\right)\times 35 + \left(\frac{2160+2540}{2}\right)\times 35$
$+ \left(\frac{2540+3050}{2}\right)\times 35{\cdot}4$

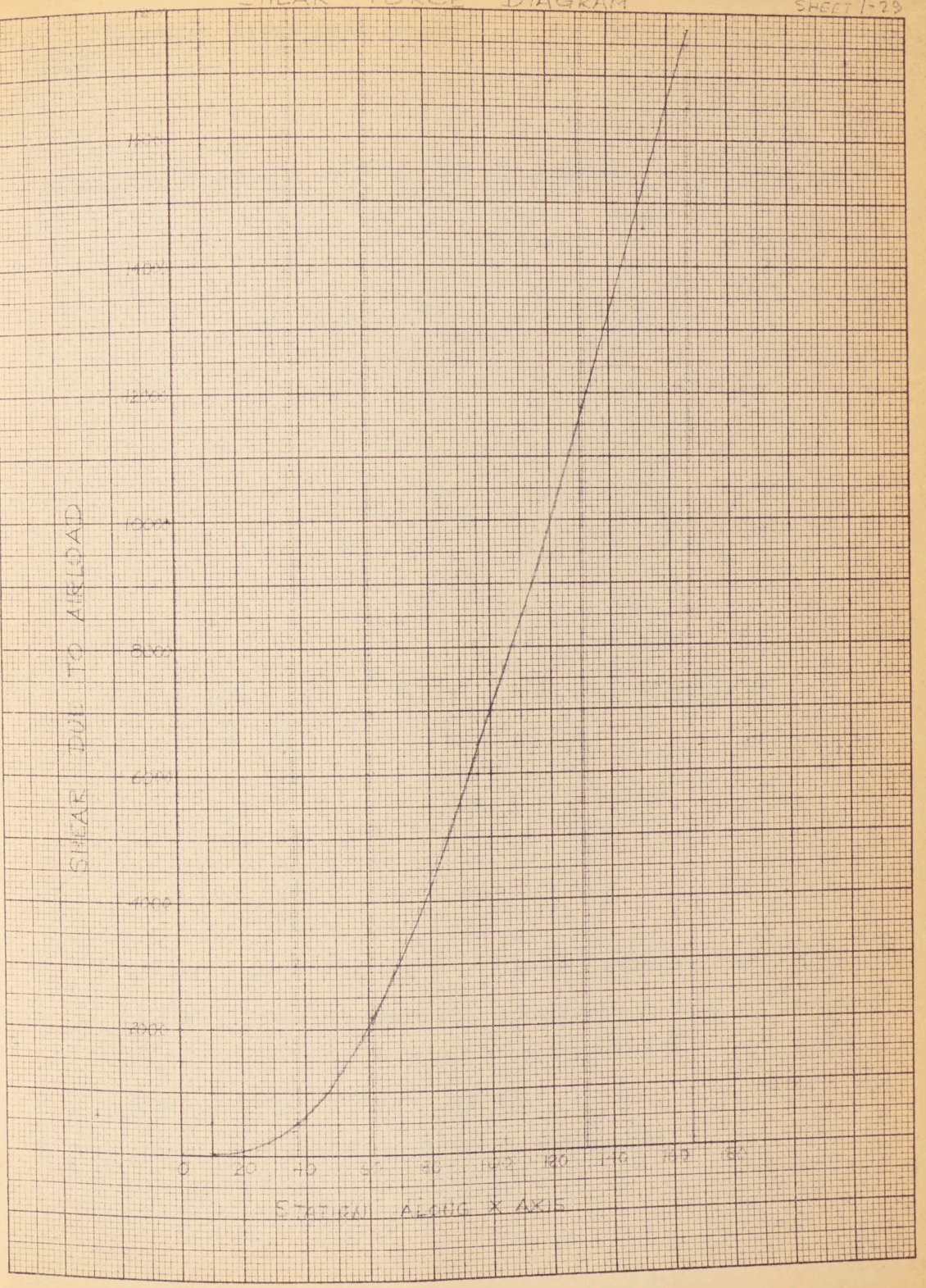
$= 460\times 27 + 1430\times 24 + 1990\times 35 + 2350\times 35$
$+ 2795\times 35{\cdot}4$

$= 12{,}420 + 34{,}300 + 69{,}600 + 82{,}300 + 98{,}900$

$= \underline{297{,}520 \text{ IN LB}}$

FORM 1318A

SHEAR FORCE DIAGRAM

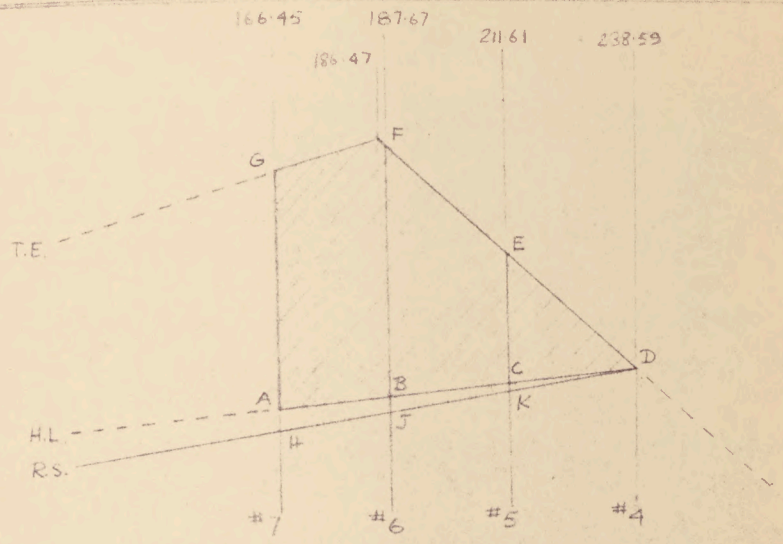


A. V ROE CANADA LIMITED
MALTON - ONTARIO
TECHNICAL DEPARTMENT (Aircraft)

REPORT No.
SHEET No. 1-30

AIRCRAFT:		PREPARED BY	DATE
		J. L DIXON	16 NOV '54
		CHECKED BY	DATE

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



FROM SHEETS 3 & 24 AIRLOAD PRESSURE

AT POINT A = 1·55 LB/IN²
" B = 1·47 " "
" C = 1·38 " "
" D = 1·28 " "
" E = 1·28 " "
" F = 1·28 " "
" G = 1·37 " "

LENGTH GA = 45·43 H.A = 3·89 (PAGE 21)

BF = (·2341 × 187·67 + 25·65) − (·0985 × 187·67 + 12·76) = 49·30

BJ = (·0985 × 187·67 + 12·76) − (·1520 × 187·67) = 2·73

CE = $\frac{49·30}{52·12}$ × 26·98 = 25·47

CK = (·0985 × 211·61 + 12·76) − (·1520 × 211·61) = 1·45

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

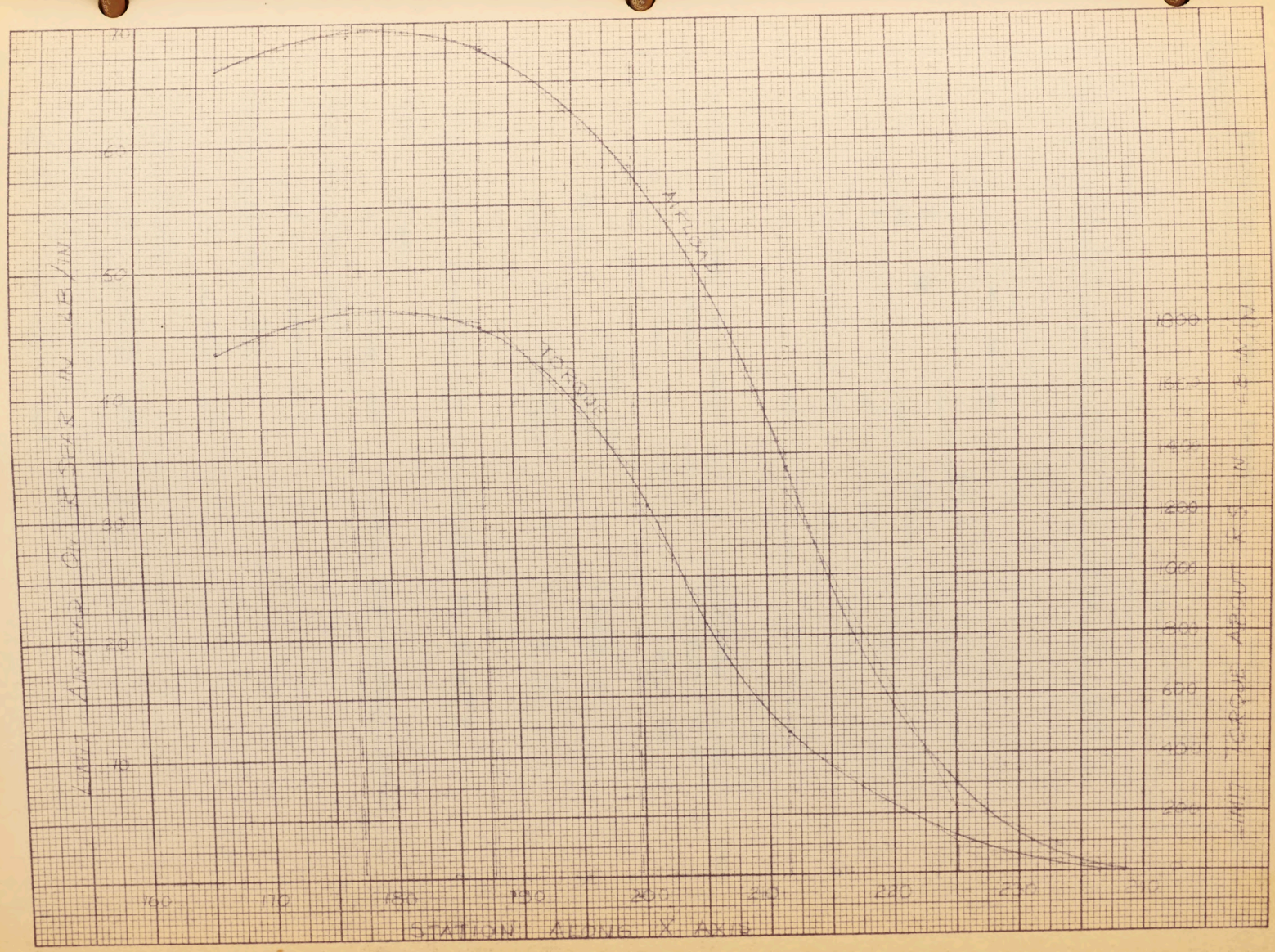
AIRCRAFT:

REPORT NO.
SHEET NO. 1-31

PREPARED BY	DATE
J. L. DIXON	16 NOV '54
CHECKED BY	DATE

1	2	3	4	5	6	7	8	9	10
STATION	DISTANCE BTN N. T.E. & H.L	DISTANCE FROM R.S. TO H.L.	PRESSURE lb/□"	C.G.	DISTANCE OF CG FROM H.LINE	AVERAGE PRESSURE lb/□"	LOAD lb/IN	DISTANCE FROM REAR SPAR TO CG	TORQUE ABOUT R. SPAR lb IN/IN.
		SHEET 31	SHEET 31		5X2	$\frac{4a+4b}{8}$	7×2	3+6	8×9
#7	45·43	3·89	1·55 1·37	490	22·35	1·460	66·20	26·24	1739
#6	49·30	2·73	1·47 1·28	488	24·05	1·375	67·75	26·78	1813
#5	25·47	1·45	1·38 1·28	494	12·59	1·330	33·87	14·04	476
#4	0	0	1·28	0	0	1·28	0	0	0

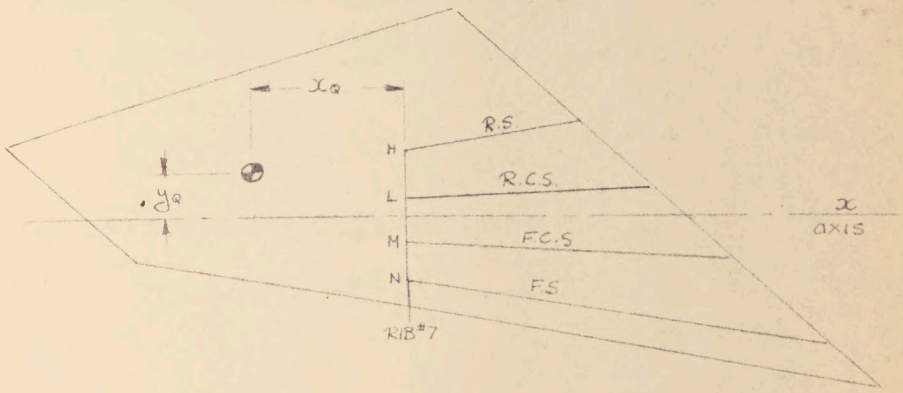
FORM 1319A



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

AIRCRAFT:		REPORT No.	
		SHEET No. 133	
		PREPARED BY	DATE
		J L DIXON	17 NOV '54
		CHECKED BY	DATE

LOADS AT RIB - SPAR INTERSECTIONS AT RIB #7



TOTAL LIMIT AIRLOAD B.M. ABOUT RIB #7 = 1,025,420 IN. LB. (SHT. 29)
" " " TORQUE " X AXIS = 297,520 IN LB (")
" " " SHEAR AT RIB #7 = 17,723 LB (")

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

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

SECTION PROPERTIES OF SPARS AT RIB #7

FRONT SPAR
$I = 1.096 \text{ IN}^4$ (FROM REP # 7/0510/1 SHEET A-34)

FRONT CENTRE SPAR
$I = 5.080 \text{ IN}^4$ (" " " " " ")

REAR CENTRE SPAR
$I = 6.250 \text{ IN}^4$ (" " " " A 35)

REAR SPAR
$I = 2.058 \text{ IN}^4$ (" " " " " ")

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

ORM 1319A

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

REPORT No.
SHEET No. 1-34

AIRCRAFT:		PREPARED BY	DATE
		J L DIXON	17 NOV '54
		CHECKED BY	DATE

DISTRIBUTION OF AIRLOAD B.M. AT RIB #7

$M_H = 1,025,420 \times \frac{2055}{14484} \times 1.0148 \text{ (SEC } 8°38') = 147,600 \text{ IN LB}$

$M_L = 1,025,420 \times \frac{6260}{14484} \times 1.00074 \text{ (SEC } 2°12') = 443,000 \text{ IN LB}$

$M_M = 1,025,420 \times \frac{5000}{14484} \times 1.00126 \text{ (SEC } 3°35') = 353,000 \text{ IN LB}$

$M_N = 1,025,420 \times \frac{1026}{14484} \times 1.01145 \text{ (SEC } 8°38') = 77,700 \text{ IN LB}$

$Q_H = \frac{147,600}{57.86} \times .08865 = 2,520 \text{ LB}$

$Q_L = \frac{443,000}{57.86} \times .09026 = 7650 \text{ LB}$

$Q_M = \frac{353,000}{57.86} \times .09805 = 6210 \text{ LB}$

$Q_N = \frac{77,700}{57.86} \times .08865 = 1329 \text{ LB}$

TOTAL TQ AT RIB #7 = 297,520 + (147600 × 15026) +
(443,000 × 03830) − (353,000 × 06250) − (77,700 × 15026)
+ (2,520 × 25·28) + (7650 × 6·39) − (6210 × 10·42)
− (1329 × 25·28)

= 316,840 lb. in.

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

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

CRM. 1119A

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

REPORT No.
SHEET No 1-35

AIRCRAFT:		PREPARED BY	DATE
		J. L DIXON	17 NOV '54
		CHECKED BY	DATE

LOADS AT RIB - SPAR INTERSECTIONS AT REAR SPAR

POINT H ON RIB #7

FROM SHEET #33

LIMIT AIRLOAD = $\frac{1}{2}(1867 - 1645) \times \frac{1}{2}(696 + 665)$

= $\frac{1}{4} \cdot 21.22 \times 1361$ = 722 lb

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

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

POINT J ON RIB #6

LIMIT AIRLOAD = $\frac{1}{4} \times 2122\ (697 + 66) + \frac{1}{4}(211.61 - 187.67)(68.5 + 5.48)$

= $\frac{1}{4} \times 2122 \times 1377 + \frac{1}{4} \times 23.94 \times 126.3$

= 731 + 753

= 1484 lb

LIMIT TORQUE = $\frac{1}{4} \times 2122\ (1885 + 1830) + \frac{1}{4} \times 23.94 \times (1870 + 1350)$

= $\frac{1}{4} \times 2122 \times 3715 + \frac{1}{4} \times 23.94 \times 3220$

= 19,710 + 19,270

= 38,980 IN LB

POINT K ON RIB #5

LIMIT AIRLOAD = $\frac{1}{4} \times 23.94\ (587 + 34.9) + \frac{1}{4}(2389 - 2116)(31.9 + 5.2)$

= $\frac{1}{4} \times 23.94 \times 936 + \frac{1}{4} \times 26.08 \times 37.1$

= 560 + 241 = 801 lb

LIMIT TORQUE = $\frac{1}{4} \times 23.94\ (1260 + 420) + \frac{1}{4} \times 26.98\ (450 + 100)$

= $\frac{1}{4} \times 23.94 \times 1680 + \frac{1}{4} \times 26.98 \times 550$

= 10,050 + 3,710 = 13,760 IN LB

POINT D ON RIB #4

LIMIT AIRLOAD = $\frac{1}{4} \times 26.98 \times 5.7$

= 38.4 lb

LIMIT TORQUE = $\frac{1}{4} \times 26.98 \times 88$

= 593 IN LB

ORM 1318A

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

AIRCRAFT:

REPORT NO.

SHEET NO. 1-36

PREPARED BY	DATE
J L DIXON	17 NOV 54
CHECKED BY	DATE

SUMMARY OF LIMIT LOADS

LOAD NO		LOAD	
1		147,600 LB. IN	SHEET 35
2		443 000 LB. IN.	SHEET 35
3		359,900 LB. IN.	SHEET 35
4		77,700 LB. IN	SHEET 35
5		19,320 IN-LB.	SHEET 36
6	257 + 2520 + 722 + 6260 =	9,759 LB	
7	303 + 7650 =	7,953 LB	
8	248 + 6210 =	6,458 LB	
9	376 + 1329 - 6260 =	-4,555 LB.	
10.		38,980 IN LB	
11.	499 + 1484 =	1,983 LB	
12.		687 LB	
13.		553 LB	
14		830 LB	
15		13,760 IN LB	
16	502 + 801	1303 LB	
17		840 LB	
18		659 LB	
19		990 LB	
20		887 LB	
21		796 LB.	
22		1171 LB	
23		868 LB	
24		1346 LB	
25		1306 LB	
26		376 LB	
27		325 LB	
28		361 LB	
29		593 IN LB	
30	251 + 38	289 LB	

TOTAL 35,185 LB

FORM 1319A

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

AIRCRAFT:		REPORT No.	
		SHEET No.	1.37
		PREPARED BY	DATE
		J. L. DIXON	18 NOV '59
		CHECKED BY	DATE

MOMENTS CHECK

HEIGHT OF RIB-SPAR INTERSECTIONS ABOVE FIN DATUM LINE

RIB	#1	#2	#3	#4	#5	#6	#7
F.S.	0	20.6	38.9	55.2	69.7	82.5	94.0
F.C.S.	–	0	20.6	38.9	55.2	69.7	82.5
R.C.S.	–	–	0	20.6	38.9	55.2	69.7
R.S.	–	–	–	0	20.6	38.9	55.2

DISTANCE OF RIB-SPAR INTERSECTIONS FROM JUNCTION OF LEADING EDGE & FIN DATUM LINE

RIB	#1	#2	#3	#4	#5	#6	#7
F.S.	23.5	56.7	86.0	112.0	135.0	156.0	174.4
F.C.S.	–	74.6	101.9	126.1	147.3	167.0	184.0
R.C.S.	–	–	119.5	141.8	161.3	179.3	194.9
R.S.	–	–	–	159.8	177.2	193.2	207.3

FORM 1319A

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

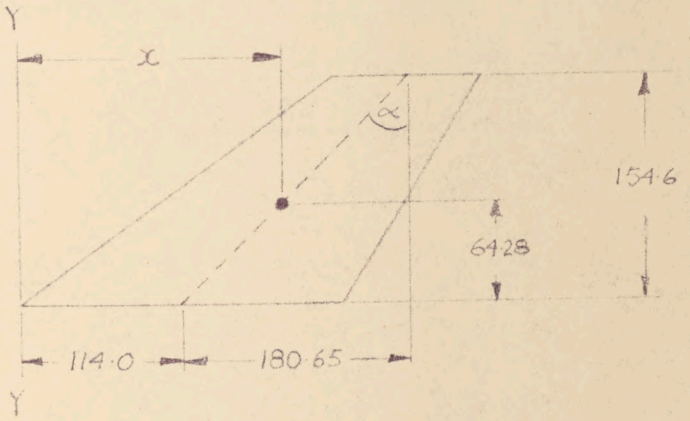
REPORT No.

SHEET No 1-38

AIRCRAFT:		PREPARED BY	DATE
		J. L DIXON	18 NOV 54
		CHECKED BY	DATE

FROM THE GRAPH IN INTER-DEPARTMENTAL MEMO #5227/07/J THE CENTRE OF PRESSURE WAS FOUND TO BE 64.28 INS. ABOVE THE FIN DATUM LINE.

THE C.OF P. MUST BE ON A LINE MIDWAY BETWEEN THE LEADING & TRAILING EDGES SINCE THE LOAD IS UNIFORMLY DISTRIBUTED THUS -



$$\text{TAN } \alpha = \frac{180\cdot65}{154\cdot6}$$

$$\therefore \alpha = 49^\circ 26.5'$$

$$L = 114\cdot0 + 64\cdot28 \times \text{TAN } 49^\circ 26.5'$$

$$= 189.107$$

ORM 1319A

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

REPORT No.

SHEET No 1-39

AIRCRAFT:		PREPARED BY	DATE
		J L DIXON	18 NOV '54
		CHECKED BY	DATE

CONSIDER PORTION OF RUDDER BETWEEN RIB #7 & #4

TOTAL TORQUE AT REAR SPAR = 19,320 + 38,980 + 13,760 + 593

= 72,653 LB IN

MOMENT CREATED BY THIS TORQUE ABOUT FIN DATUM LINE = -72,653 cos 40°28½'

= -55,260 lb in

MOMENT CREATED ABOUT YY LINE

= 72,653 sin 40°28½'

= 47 150 lb in.

FORM 1518A

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

AIRCRAFT:		REPORT No.	
		SHEET No.	1-40
		PREPARED BY	DATE
		J. L. DIXON	18 NOV '54
		CHECKED BY	DATE

PORTION BETWEEN RIB #7 & TIP OF FIN

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

AT POINT H; BM = 147,600 IN LB

MOMENT OF THIS LOAD AT FIN DATUM LINE = 147,600 × Sin 42°07'
= 111,590 IN. LB.

MOMENT OF THIS LOAD AT YY LINE = 147,600 × Cos 42°07'
= 96,607 IN. LB.

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

MOMENT OF THIS LOAD AT FIN DATUM LINE = 443,000 × Sin 42°40½'
= 300,280 IN. LB.

" " " " " YY LINE = 443000 × Cos 42°40½'
= 325,710 IN. LB.

AT POINT M, BM = 359,900 IN LB

MOMENT OF THIS LOAD AT FIN DATUM LINE = 359,900 × Sin 36°53½'
= 216,050 IN. LB.

" " " " " YY LINE = 359,900 Cos 36°53½'
= 287,850 IN LB

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

MOMENT OF THIS LOAD AT FIN DATUM LINE = 77,700 × Sin 31°50'
= 40,980 IN. LB

" " " " " YY LINE = 77,700 Cos 31°50'
= 66,063 IN. LB

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

" " " YY LINE = 776,230 IN LB

FORM 1318A

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

REPORT NO
SHEET NO 1-41

AIRCRAFT:		PREPARED BY	DATE
		J L DIXON	18 NOV 1954
		CHECKED BY	DATE

MOMENT OF SPAR REACTIONS ABOUT YY LINE

REAR SPAR

(257+122+2520+6260)	× 207·3	= 2,022,000	
(493+1484)	× 193·2	= 383,000	
(502+801)	× 177·2	= 231,000	
(251+38)	× 159·8	= 46,100	
		2,682,100	2,682,100

REAR CENTRE SPAR

(1650+303)	× 194·9	1,550,000	
687	× 179·3	= 123,200	
840	× 161·3	= 135,500	
857	× 141·8	= 125,800	
361	× 119·5	= 43,100	
		1,977,600	1,977,600

FRONT CENTRE SPAR

(6210+248)	× 184·0	= 1,180,000	
553	× 167·0	= 92,300	
659	× 147·3	= 97,000	
796	× 126·1	= 100,500	
868	× 101·9	= 88,400	
325	× 74·6	= 24,250	
		1,591,450	1,591,450

FRONT SPAR

(1329-6260+376)	× 174·4	= -795,000	
830	× 154·0	= 129,500	
990	× 135·0	= 133,700	
1171	× 112·0	= 131,200	
1346	× 86·0	= 115,800	
1306	× 56·7	= 74,000	
376	× 23·5	= 8,830	
		-201,970	-201,970

TOTAL 6,049,280 lb.ins.

FORM 1318A

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

REPORT No. _____
SHEET No. 1-42

AIRCRAFT:		PREPARED BY	DATE
		J L DIXON	18 NOV '54
		CHECKED BY	DATE

MOMENT OF SPAR REACTIONS ABOUT FIN DATUM LINE

REAR SPAR

(257+722+2520+6260) × 55·2	= 539,000	
(499+1484) × 38·9	= 77,200	
(502+801) × 20·6	= 26,850	
(251+38) × 0	= 0	
	643,050	643,050

REAR CENTRE SPAR

(7650+303) × 69·7	555,000	
687 × 55·2	= 37,950	
840 × 38·9	= 32,700	
887 × 20·6	= 18,290	
361 × 0	= 0	
	643,940	643,940

FRONT CENTRE SPAR

(6210+248) × 82·5	= 553,000	
553 × 69·7	= 38,550	
659 × 55·2	= 36,400	
796 × 38·9	= 31,000	
868 × 20·6	= 17,890	
325 × 0	= 0	
	676,840	676,840

FRONT SPAR

(1329-6260+376) × 94·0	= -428,500	
830 × 82·5	= 68,500	
950 × 69·7	= 69,000	
1171 × 55·2	= 64,700	
1346 × 38·9	= 52,300	
1306 × 20·6	= 26,900	
376 × 0	= 0	
	-147,100	-147,100

1,816,730

FORM 1319A

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

AIRCRAFT:		REPORT NO.	
		SHEET NO	1-43
		PREPARED BY	DATE
		J. L DIXON	19 NOV 54
		CHECKED BY	DATE

THUS GRAND TOTAL OF MOMENTS ABOUT YY LINE

= 6,049,280
+ 47,150
+ 776,230
6,872,660 LB. IN.

THE MOMENT SHOULD BE :-
36,500 × 189·107
= 6,902,400 LB IN

& GRAND TOTAL OF MOMENTS ABOUT FIN LINE

= 1,816,730
− 55,260
668,900
2,430,370 LB. IN.

THE MOMENT SHOULD BE :-
36,500 × 64·28
= 2,346,200 LB. IN.

FORM 1319A

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

AIRCRAFT	

REPORT No. _____
SHEET No. 1-49

PREPARED BY	DATE
J. L DIXON	19 NOV '54
CHECKED BY	DATE

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

LOAD NO.	LOAD
1	153,000 LB IN.
2	459,000 LB IN.
3	373,000 LB IN.
4	80,500 LB IN.
5	20,020 IN LB
6	10,100 LB
7	8,250 LB
8	6,700 LB
9	-4,725 LB
10	40,400 IN LB
11	2,058 LB
12	712 LB
13	573 LB
14	861 LB
15	14,270 IN LB
16	1351 LB
17	871 LB
18	683 LB
19	1026 LB
20	920 LB
21	825 LB
22	1215 LB
23	899 LB
24	1395 LB
25	1353 LB
26	350 LB
27	335 LB
28	374 LB
29	615 IN LB
30	300 LB

TOTAL 36,476 LB

ORM 1319A

[illegible]

1) [illegible]

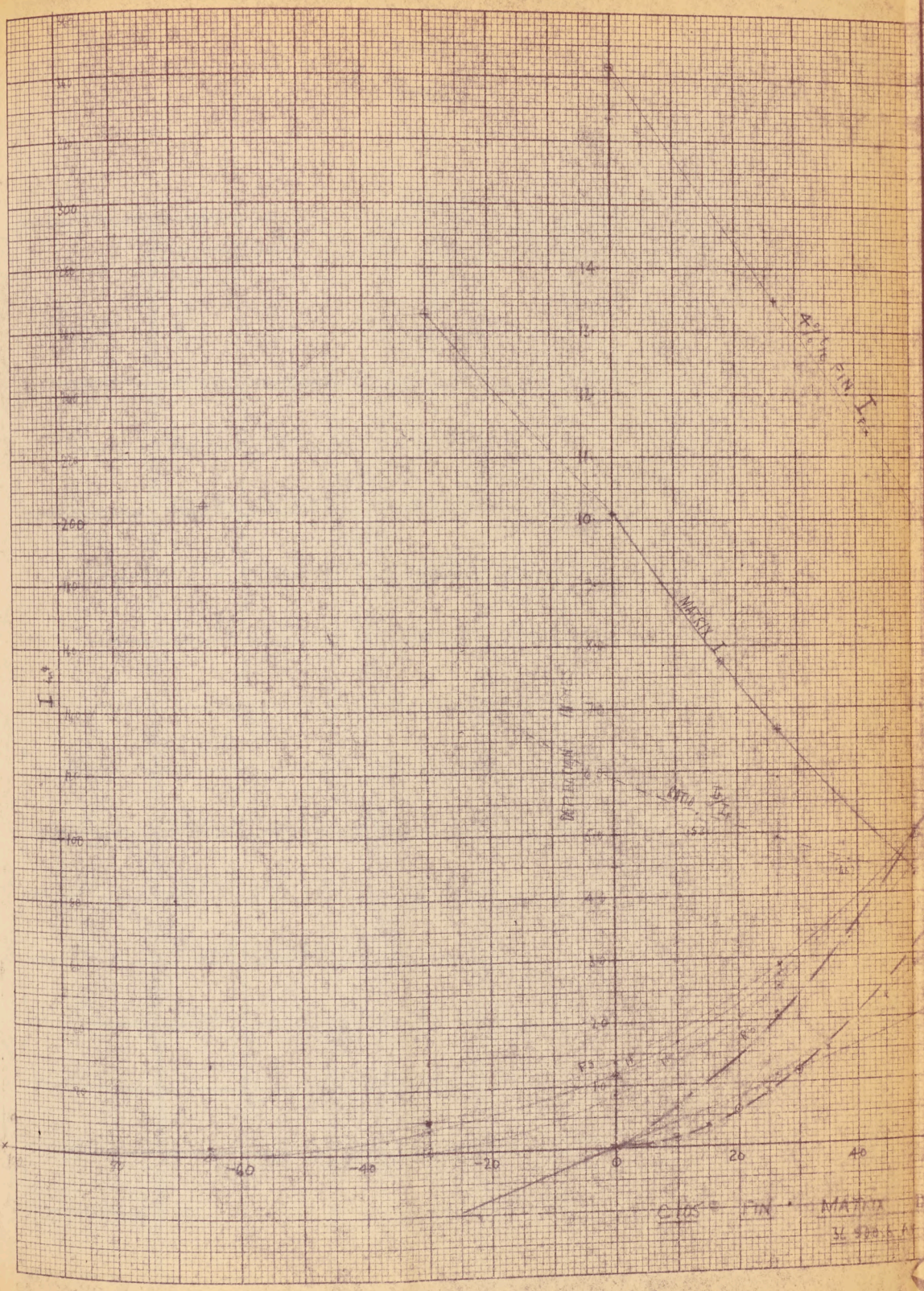
* STAR INDICATES
-VE SIGN

101	.0276119
201	31401
301	349767
401	20746
501	351523
601	13913 *
701	246708
801	49715 *
901	49465 *
1001	41678 *
1101	278983
1201	25402
1301	373895
1401	5075
1501	370848
1601	8968 *
1701	238687
1801	50263 *
1901	31667 *
2001	19351 *
2101	293784
2201	6687
2301	415187
2401	42259 *
2501	352991
2601	15731 *
2701	226798
2801	19755
2901	10968
3001	7853
3101	683487
3201	73471 *
3301	316252
3401	6583
3501	305573
3601	25771 *
3701	176861
3801	84243
3901	49065
4001	31442
4101	290396
4201	51151 *
4301	146206
4401	17786
4501	127464
4601	47976
4701	23983
4801	129287
4901	13710 *
5001	40688
5101	22021
5201	40443
5301	370437 *
5401	239324 *
5501	102860 *
5601	4725 *

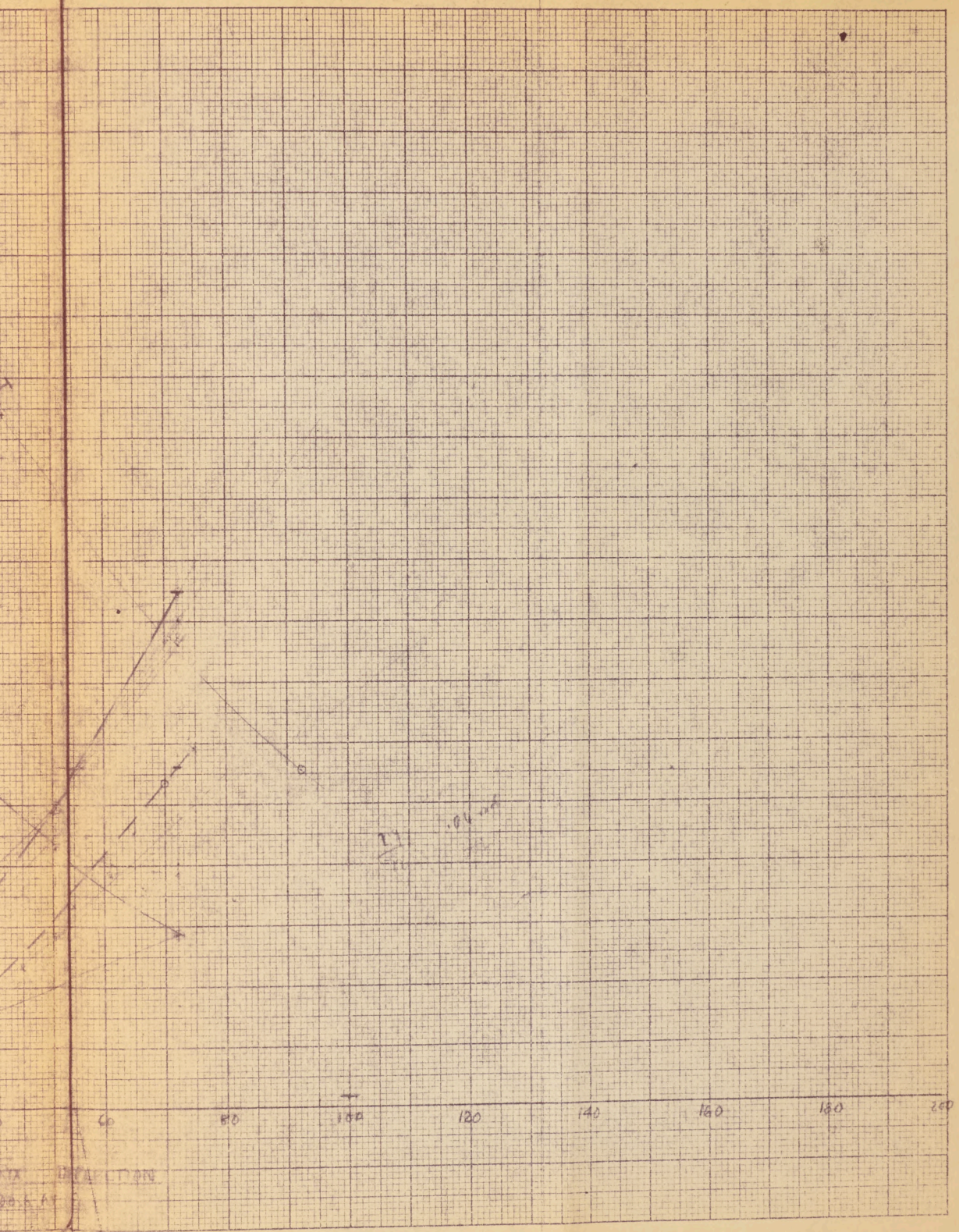
5238474

101	.04537	
201	.04045	
301	.03771	
401	.03548	
501	.04441 *	
601	2.11991	
701	2.00074	
801	1.93828	
901	1.91304	
1001	.06646 *	
1101	1.25049	
1201	1.24444	
1301	1.23988	
1401	1.25084	
1501	.08877 *	
1601	.50232	
1701	.62928	
1801	.68112	
1901	.71992	
2001	.21144	
2101	.29636	
2201	.34567	
2301	.08697	
2401	.12530	
2501	.02977	

1672514



2-2A



FIN ROOT STRESSES FROM PHOTOELASTIC (C.P.A.M.)

REF. R. SHEARLEY

POINT	1 σ_n	2 $\pm\tau_{xy}$	3 $2m$	4	5 ① × ④	6	7 ③ × ⑥	8 σ_n' ⑤ + ②	9
A	68,350	-7350		.535	36,500	.579	-4250	32,250	-.4
B	29,040	-5120	8029	.4747	13,790		-2940	10,850	-.5
C	12,930	-1370	4795	.3749	4850		-790	4060	-.4
D	4,040	0	2202	.3194	1290	.579	0	1290	-.6
	$\sigma_n' + \sigma_n''$	$\tau' + \tau''$							
A	93,300	-33,110							
B	77,500	-16,610							
C	11,150	-6900							
D	7870	-2070			3330				

FORM 1543.

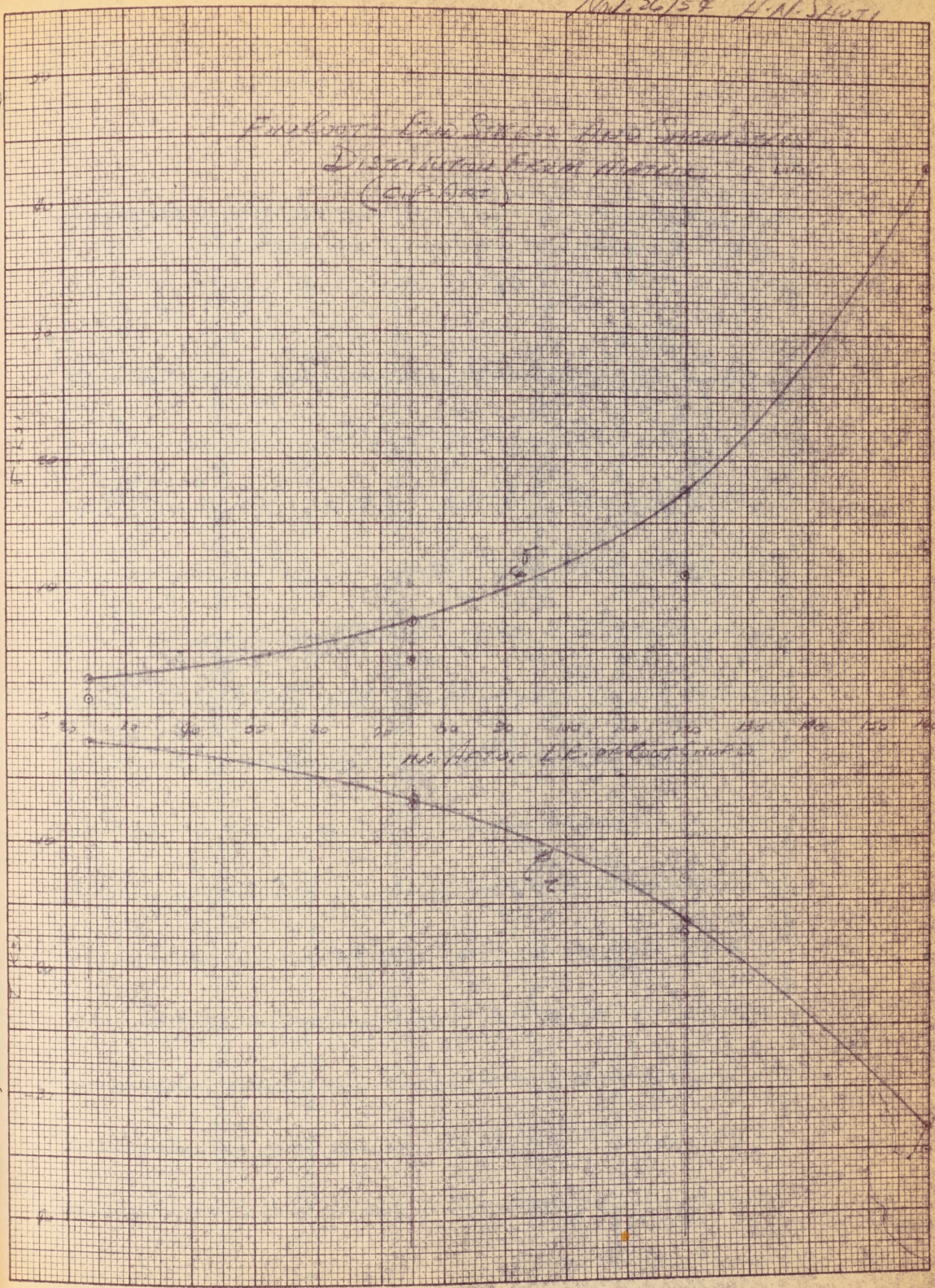
A. V. ROE CANADA LIMITED
MALTON, ONTARIO
TECHNICAL DEPT. (AIRFRAME)

AIRCRAFT . . C105
WEIGHT . .
C. G. POSITION .

REPORT NO. .
SHEET . . 2-3
DATE . . Nov. 26/54
PREPARED BY - H.N. Shosi

	8	9	10	11	12	13	14	15	16	17	18	19
	σ_n' (5)+(7)		(1)×(9)		(2)×(11)	τ_T' (10)+(12)		$\Delta\sigma_n''$ (3)×(14)	σ_n'' Ave.		$\Delta\tau_T''$ (3)×(17)	τ_T'' Ave
0	37,250	-.4[illegible]3	-31,600	.494	-3630	-36,230	[illegible]		11,050			2120
							1.312	11,050		.252	2120	
0	10,850	-.5[illegible]5	-15000		-2530	-17,530	.915	7700	6650	.126	1060	820
							.164	5590		.140	720	
0	4060	-.4[illegible]9	-6660		-680	-7140	.812	3900	3090	.062	300	640
							1.032	2280		.075	170	
	1290	-.6[illegible]4	-2030	.494	0	-2030	.720	1500	1550	.005	10	10

Nov. 26/59 H.N. Shoji



FIN ROOT CHORD - REINFORCED SKIN THICKNESSES

STIFFENERS:

No. ① T $\frac{1}{2}$ × $\frac{1}{2}$ × $\frac{1}{16}$ A = .119 in² $\bar{y}$ = .21 in.

No. ② T $\frac{1}{2}$ × $\frac{1}{2}$ × $\frac{1}{8}$ A = .202 in² $\bar{y}$ = .37 in.

No. ③ I $1\frac{1}{2}$ × $\frac{1}{2}$ × $\frac{1}{8}$ A = .119 in² $\bar{y}$ = .59 in.

PANEL	1	2	3	4	5	6	7	8	9	10
			SKIN							STIFF.
	WIDTH	AVG. t	A	$\bar{y}$	$A\bar{y}$		No. ①			No.
						A	$\bar{y}$	$A\bar{y}$	A	$\bar{y}$
①	10.9	.1355	3.51	.0928	.326	.237	.3955	.0938		
②	13.7	.1355	2.69	.0925	.236	.474	.3955	.1875	.202	.37
③	24.4	.185	4.52	.0925	.419	.474	.395	.1870	.404	.74
④	26.2	.185	4.67	.0925	.431	.474	.395	.1870	.404	.74
⑤	29.5	.122	3.03	.061	.185	.474	.332	.1572	.404	.74
⑥	29.5	.1215	3.62	.0608	.220	.474	.3315	.1570	.404	.74

FORM 1543

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

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

REPORT NO. -
SHEET - - 2-5
DATE - - Nov. 26/54
PREPARED BY - H.N. Shori

9	10	11	12	13	14	15	16	17	18	19
Stiffeners							Effec. t		Aver. $\bar{y}$	t_{eff}/t
No. 3				No. 3		ΣA		$\Sigma A\bar{y}$		
A	$\bar{y}$	$A\bar{y}$	A	$\bar{y}$	$A\bar{y}$	(5)+(6)+(9)+(12)	(15)/(1)		(17)/(15)	
-	-	-	.234	.2755	.1815	3.981	.210	.6013	.151	1.131
.202	.5555	.1121	-	-	-	3.216	.234	.5356	.167	1.260
.404	.555	.2242	-	-	-	5.390	.221	.8302	.154	1.194
.404	.5555	.2242	-	-	-	5.548	.220	.8422	.152	1.190
.404	.492	.1990	-	-	-	3.925	.157	.5412	.138	1.287
.404	.4916	.1985	-	-	-	4.498	.151	.5155	.128	1.241

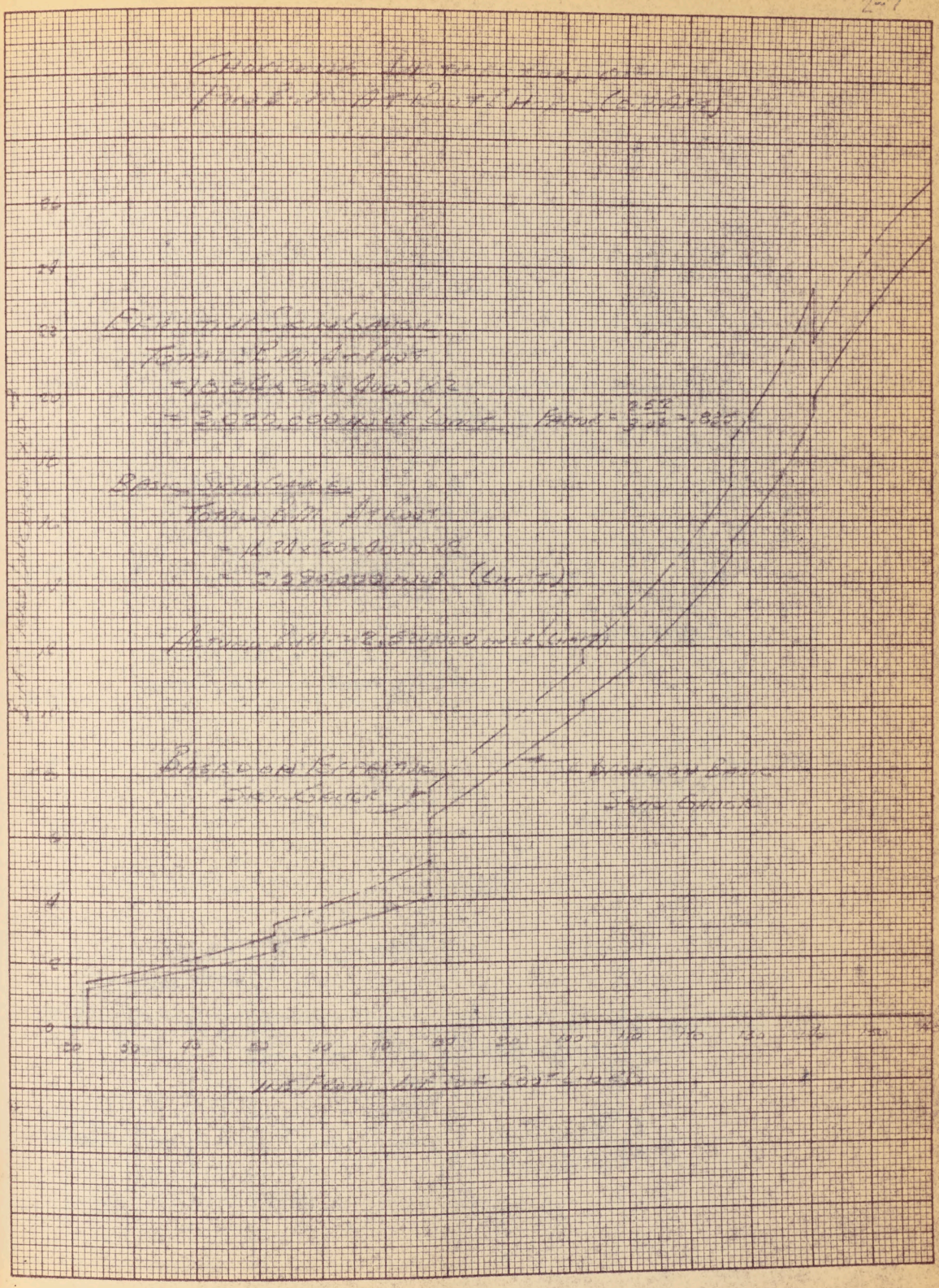
FIN ROOT – END LOAD AND SHEAR DISTRIBUTION FROM MATRIX (C.P. AFT)

CHORDWISE STA.	1 Flow Γ 10^3 psi	2 SKIN GAUGE t	3 p LBS/IN	4 h	5 ph LBS/IN	6 ULT. P LBS/IN	7 τ	8 δ LBS/IN	9 ULT. δ LBS/IN
22.8	2.8	.125	350	3.99	1203	478	2.2	275	375
40.0	3.8	.121	460	4.10	1886	620	3.0	363	495
52.6	4.5	.113 .125	527 600	4.36	2470 2610	775 819	0.1	485 518	662 707
65.0	6.1	.122	795	4.53	3350	1017	5.4	660	901
77.4	7.7	.119 .135	917 1098	4.55	4170 4600	1251 1379	7.1	845 1236	1151 1686
90.0	9.9	.135	1281	4.51	8260	2500	9.2	1700	2320
102.6	12.5	.132 .135	2250 2350	4.39	10,000 10,310	3120 3210	11.6	2110 2180	2880 2980
115.0	15.9	.135	2940	4.16	12,220	4010	15.0	2750	3800
127.0	20.7	.132 .138	3770 3890	3.95	14,590 15,370	5150 5310	19.0	3460 3580	4780 4940
135.0	25.0	.135	4630	3.76	17,400	6320	22.1	4090	5550
140.7	28.7	.133 .138	5250 5400	3.70	19,400 19,970	7170 7330	24.5	4490 4610	6130 6300
150.0	35.3	.136	6580	3.47	22,800	8330	28.6	5320	7270
159.6	43.3	.133	7930	3.16	25,050	10,310	33.3	6100	8340

FORM 1543

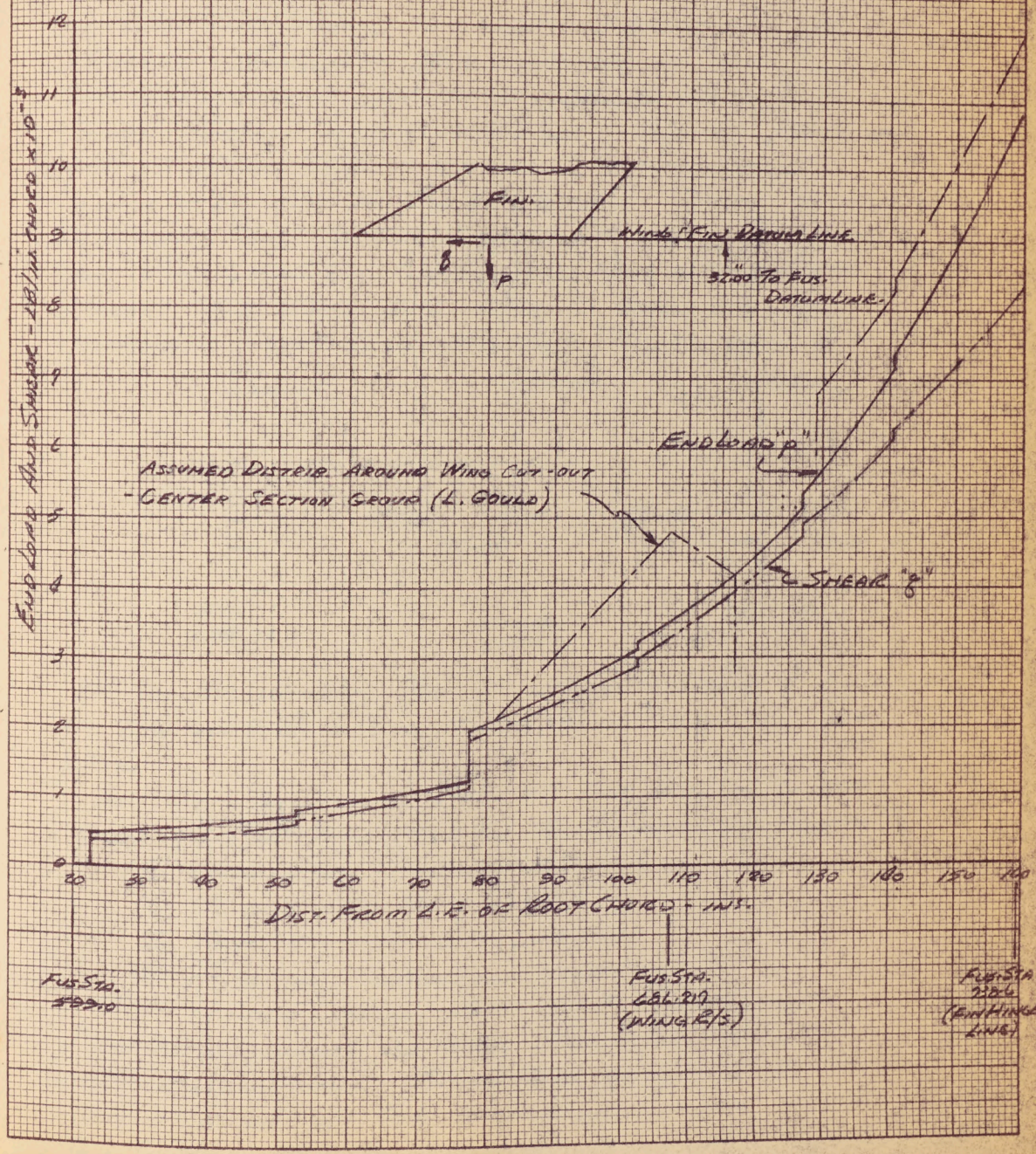
A. V. ROE CANADA LIMITED MALTON, ONTARIO TECHNICAL DEPT. (AIRFRAME)	REPORT NO. -
AIRCRAFT - - C105	SHEET - - 2-6
WEIGHT - -	DATE - - Nov. 24/54
C. G. POSITION - -	PREPARED BY - H.W. [illegible]

9	10	11	12	13	14	15	16	17	18	19
			CORRECTED STRESS					LIMIT		
ULT 8 LBS/IN		F.CORR.	t_{EFF} ③×⑪	$P_{CORR.}$ ①×⑬	$\bar{y}$	$h-\bar{y}$	ΔM ⑬×⑮	$\sigma_{CORR.}$ ①×.859		
378		1.241	.156	437	.128	3.302	14[illegible]	2.34		
435		1.241	.150	570	.128	3.972	2260	3.17		
66[illegible]		1.241	.147	706	.128	4.232	2990			
700		1.287	.161	773	.138	4.222	3260	4.00		
901		1.287	.157	960	.138	4.392	4220	5.10		
1151		1.287	.153	1180	.138	4.412	5210			
1312		1.190	.224	1725	.152	4.392	7590	6.42		
2380		1.190	.220	2180	.152	4.350	9510	8.36		
2500		1.190	.217	2710	.152	4.238	11,480			
2930		1.194	.225	2810	.154	4.236	11,870	10.42		
3800		1.194	.221	3520	.154	4.006	14,100	13.27		
4700		1.194	.218	4510	.154	3.796	17,140			
4900		1.260	.237	4910	.167	3.788	18,600	17.5		
5330		1.260	.233	5840	.167	3.593	21,000	20.[illegible]		
6130		1.260	.231	6630	.167	3.533	23,400			
6800		1.131	.213	6110	.151	3.549	21,700	24.0		
7270		1.131	.211	7450	.167	3.319	24,700	29.5		
8310		1.131	.207	8970	.151	3.009	26,900	36.1		



Nov. 20 1-9. H.N. Shoji

C105 Fin Root - Chordwise Distribution of End Loads And Shears - Ultimate Loads For C.P. Aft Case.



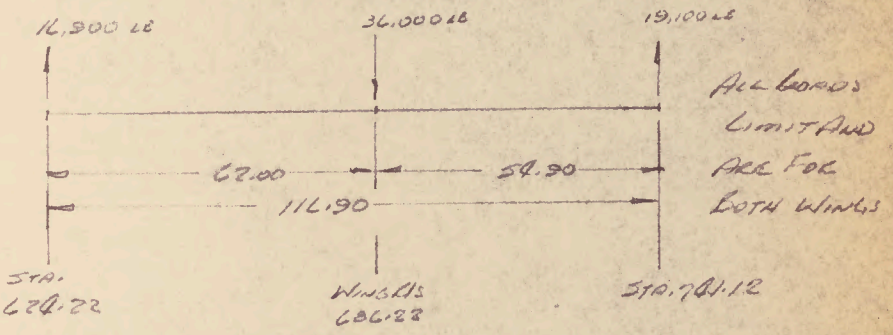
A. V. ROE CANADA LIMITED
MALTON ONTARIO
TECHNICAL DEPARTMENT (Aircraft)

REPORT NO.
SHEET NO. 2-10

AIRCRAFT: C106	FIN	PREPARED BY	DATE
		H.N.S. HOSI	DEC. 3/58
		CHECKED BY	DATE

EFFECT OF WING CHORDWISE BENDING.

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



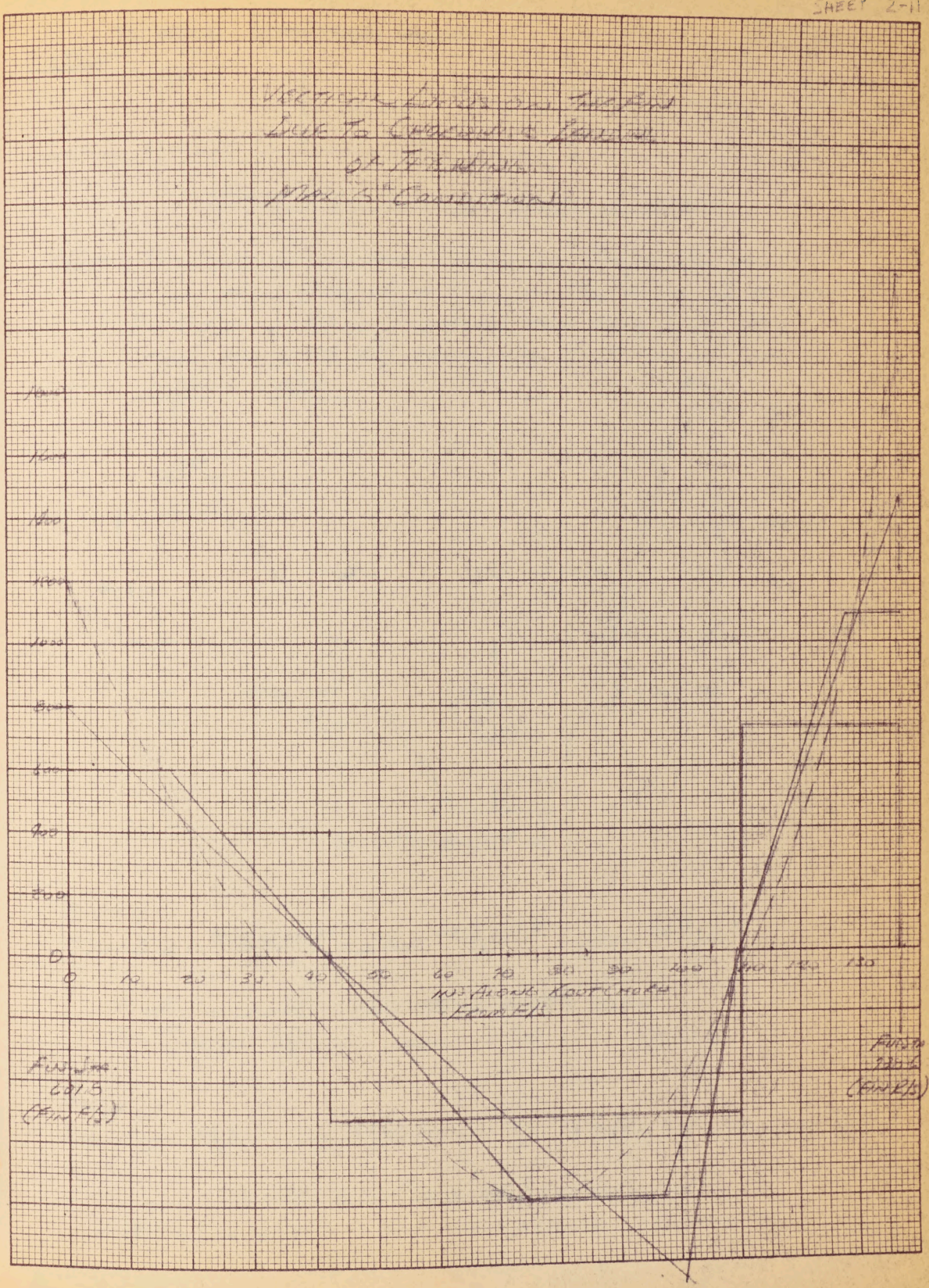
AT THE A/C DATUM, THE FIN FRONT SPAR IS LOCATED AT STA. 601.0 AND THE REAR HINGE SPAR AT STA. 735.6

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

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

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

FORM 1319A



K&E 10 X 10 TO THE ½ INCH 359-12
KEUFFEL & ESSER CO. MADE IN U.S.A.

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

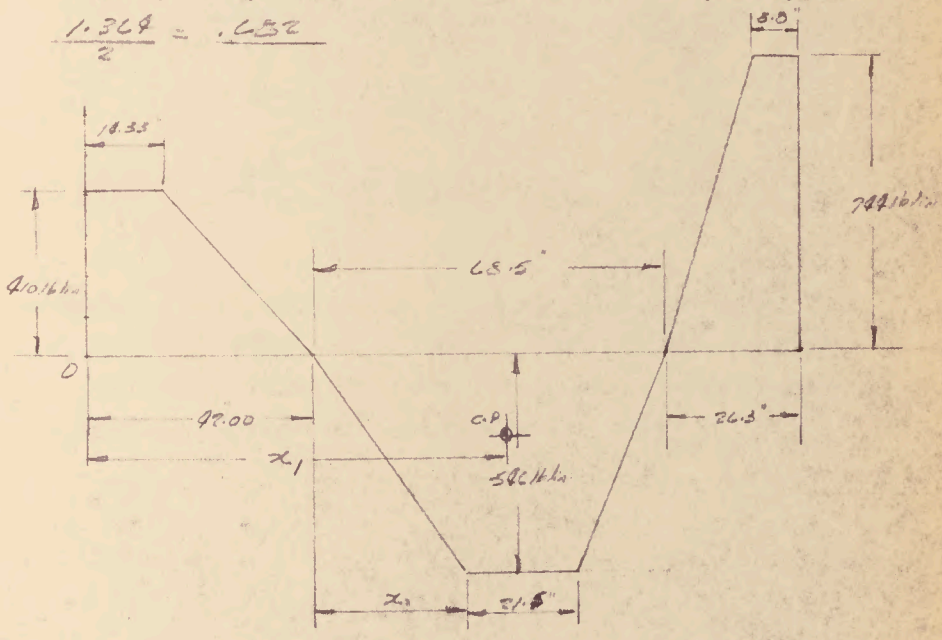
REPORT NO.
SHEET NO. 2-12.

AIRCRAFT: C105	FIN	PREPARED BY	DATE
		H.U. Sweet	Dec. 3/52
		CHECKED BY	DATE

EFFECT OF WING CANTILEVER LANDING

NOTE: THE LOADINGS ON THE PREVIOUS SHEET ARE LIMIT LOADS AND FOR BOTH SIDES OF THE WING. IN ORDER TO OBTAIN ULTIMATE LOADS FOR ONE SIDE, THE LOADS HAVE TO BE MULTIPLIED BY A FACTOR OF

$$\frac{1.364}{2} = .682$$



$$\Sigma V = 0$$

$$\Sigma V = 410 \times \frac{42.00 + 10.33}{2} - 546 \times \frac{68.5 + 21.5}{2} + 744 \times \frac{26.3 + 5.5}{2}$$

$$= 410 \times 26.165 - 546 \times 45.00 + 744 \times 15.90$$

$$= 11,530 - 24,600 + 13,070 = 0 \quad \text{CHECK}$$

$$\Sigma M_0 = 0$$

$$\Sigma M_0 = 410 \times \frac{10.33^2}{2} + 410 \times \frac{27.67}{2}\left(10.33 + \frac{27.67}{3}\right) + 744 \times \frac{15.5}{2} \times \left(42.00 + 68.5 + \frac{15.5 \times 2}{3}\right)$$

$$+ 744 \times 5.8\,(136.8 - 4.4) - 24,600 x_1 = 0$$

$$= 42,100 + 133,900 + 795,000 + 865,000 - 24,600 x_1 = 0$$

$$1,836,000 - 24,600 x_1 = 0$$

$$x_1 = \frac{1,836,000}{24,600} = 74.7 \text{ in.}$$

ORM 139A

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

REPORT No.
SHEET No. 2-13

AIRCRAFT: C105	FIN	PREPARED BY	DATE
		H.N. SHOZI	Dec. 9/58
		CHECKED BY	DATE

EFFECT OF WING CHORDWISE BENDING

$$40.0(29.7 - 12.00) = \frac{x_2}{2} \times \frac{2x_2}{3} + 21.5\,(x_2 + 10.75) + \frac{(42.0 - x_2)}{2}\left(x_2 + 21.5 + \frac{42.0 - x_2}{3}\right)$$

$$40 \times 32.7 = \frac{x_2^2}{3} + 21.5x_2 + 231.2 + (23.5 - \frac{x_2}{2})(\frac{2x_2}{3} + 37.17)$$

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

$$1308 = 18.6x_2 + 1104$$

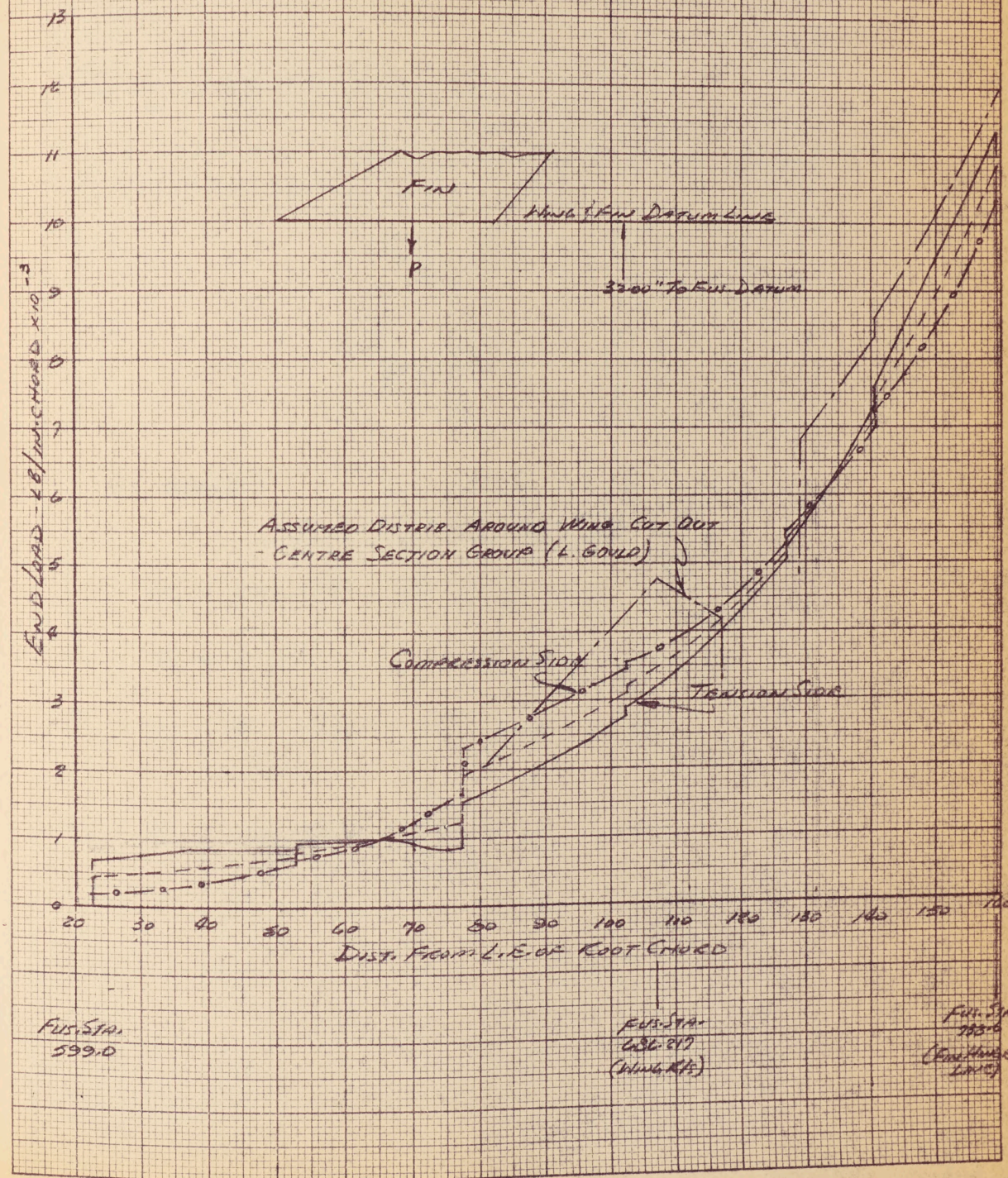
$$x_2 = \frac{204}{18.6} = 10.9 \text{ in.} \quad \text{SAY } 11.0 \text{ in.}$$

INBOARD TO COMBINE THESE LOADS WITH THE MAXIMUM FIN LOADS; IT WILL BE ASSUMED THAT 2/3 OF MAX "G" WILL BE DEVELOPED CONSEQUENTLY THE LOADS WILL BE REDUCED TO 2/3.

CRM 1319A

DEC. 8, 1950 H.N. SHOZI

C105 FIN ROOT - CHORDWISE DISTRIBUTION OF END LOADS FROM FIN LOADS AND LOADS INDUCED BY WING CHORDWISE BENDING UNDER 2/3 MAX "G" - ULTIMATE LOADS FOR C.P. ACT CASE -



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

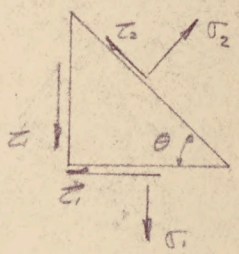
REPORT NO.
SHEET NO 2-15

AIRCRAFT C105	FIN	PREPARED BY	DATE
		H N Smith	Nov 1954
		CHECKED BY	DATE

FIN ROOT STRESSES
(C.P. AFT)

RESOLUTION OF STRESSES

IT IS REQUIRED TO FIND THE END STRESSES IN DIRECTION OF SPARS FROM THE ROOT STRESSES JUST CALCULATED, i.e. τ_1 & σ_1



$\theta = 43°54'$ $\quad \sin 43°54' = .6934$
$\cos 43°54' = .7206$

$$\sigma_2 = \sigma_1 \cos^2\theta + 2\tau_1 \sin\theta \cos\theta$$

$$\tau_2 = \sigma_1 \sin\theta\cos\theta + \tau_1(\sin^2\theta - \cos^2\theta)$$

$$\sigma_2 = \sigma_1 .7206^2 + 2\tau_1 .6934 \times .7206$$
$$= .520\sigma_1 + \tau_1$$

$$\tau_2 = .500\sigma_1 + \tau_1(1 - .520)$$
$$= .500\sigma_1 + .480\tau_1 - .04\tau_1$$

FORM 1319A

Fin Root - Stresses in Direction of Spars (C.P. Aft)

Chordwise Sta. From L.E.	1 f_{root} KSI	2 τ KSI	3 .520 × ①	4 Limit f_2 ③ + ② KSI	5 Ult f_2 ④ × 1.67 KSI	6 .500 × ①	7 .450 × ②	8 Limit τ_2 ⑥ + ⑦	9 Ult τ_2 ⑧ × 1.67
22.8	2.54	2.2	1.215	3.92	6.47	1.17	1.06	2.23	3.04
0.0	3.17	3.0	1.65	4.82	6.35	1.59	.99	3.03	4.14
32.6	4.00	4.1	2.03	6.15	8.99	2.00	1.97	3.97	2.62
60.0	5.10	5.9	2.65	8.05	11.0	2.55	2.59	5.14	7.00
77.4	6.92	7.1	3.59	10.99	20.3	3.21	3.91	6.62	9.05
90.0	8.36	9.2	4.35	12.55	18.5	4.15	4.41	8.59	11.71
102.6	10.02	11.6	5.43	17.03	23.2	5.21	5.57	10.78	14.71
115.0	13.27	15.0	6.90	21.90	29.9	6.64	7.20	13.84	18.9
127.0	17.3	19.0	9.00	28.00	38.3	8.65	9.13	17.75	24.2
135.0	20.5	22.1	10.8	32.9	45.0	10.90	10.60	21.00	28.7
140.2	24.0	26.5	12.5	37.0	50.6	12.00	11.75	23.75	32.4
150.0	29.5	23.6	15.3	43.9	60.0	14.75	13.71	28.46	38.9
152.6	36.1	33.2	18.8	52.1	71.2	18.05	16.00	34.05	46.5

FORM 1543

…s on Spikes

A. V. ROE CANADA LIMITED

MALTON, ONTARIO

TECHNICAL DEPT. (AIRFRAME)

AIRCRAFT - - C-105

WEIGHT - -

C. G. POSITION -

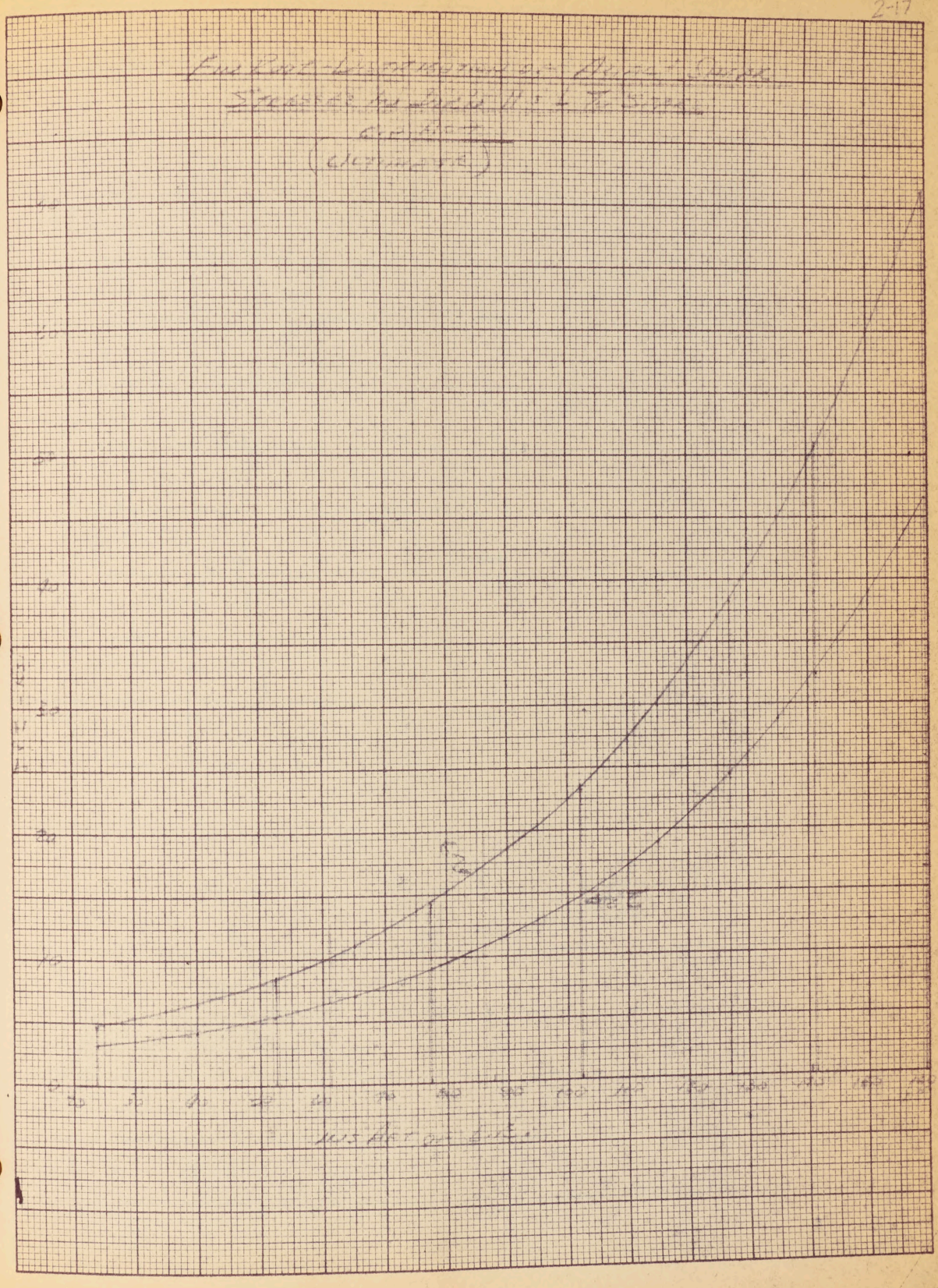
REPORT NO. -

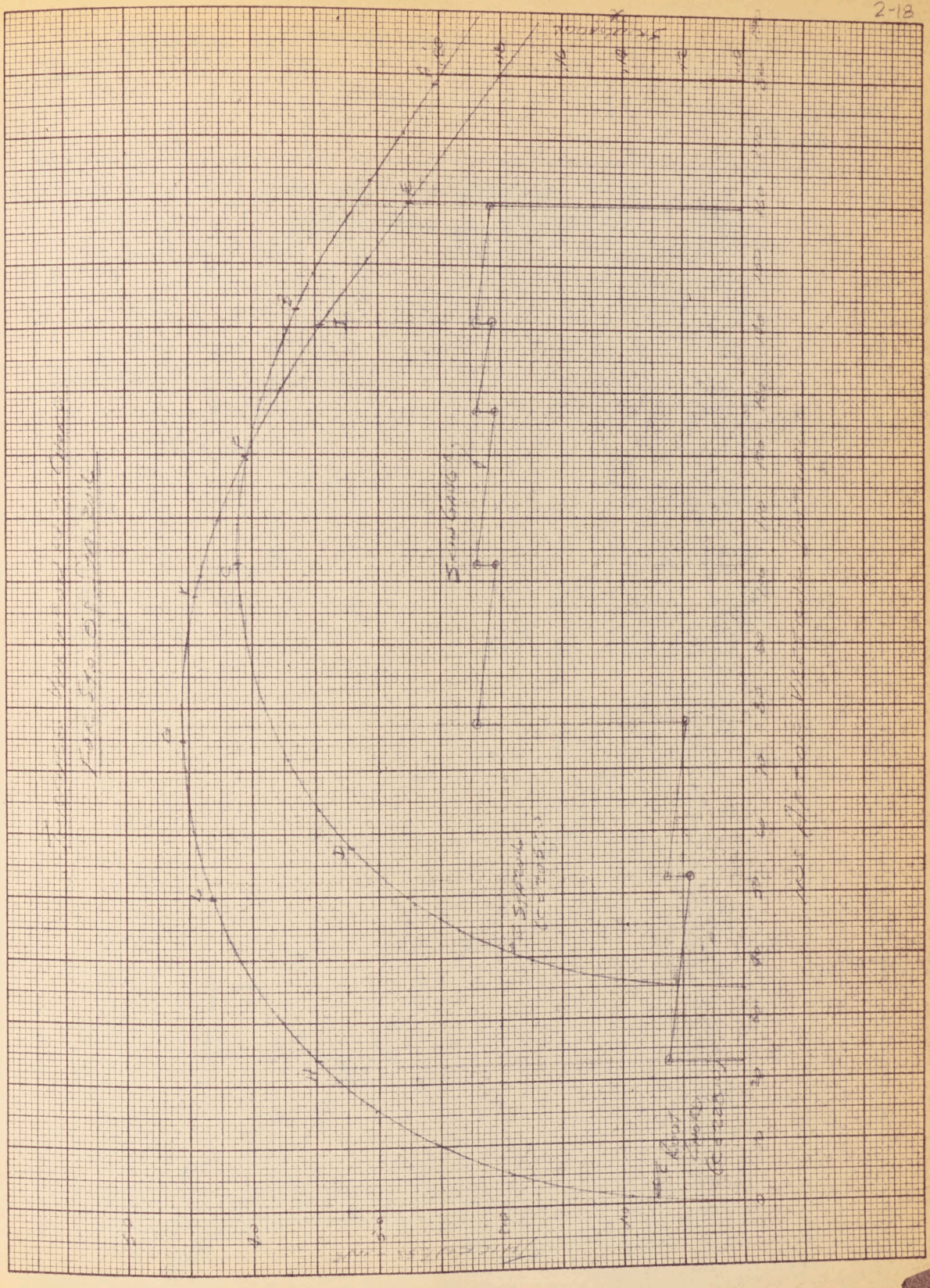
SHEET - - 2-16

DATE - - Nov 26/54

PREPARED BY - H.M. Sm[illegible]

7	8	9	10	11	12	13	14	15	16	17	18	19
.450 × ⑤	Limit τ_2 ⑥+⑦	Ult τ_2 ⑧ × 1.368										
1.06	2.23	3.05										
1.44	3.03	4.14										
1.97	3.97	5.42										
2.59	5.14	7.00										
3.41	6.62	9.05										
4.41	8.59	11.71										
5.57	10.78	14.71										
7.20	13.84	18.9										
9.13	17.75	24.3										
10.60	21.00	28.7										
11.75	23.75	32.4										
13.71	28.46	38.9										
16.00	34.05	46.5										





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

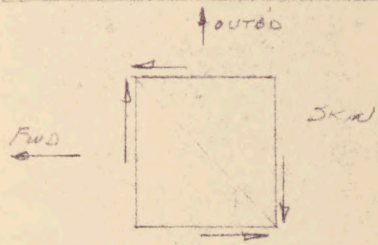
REPORT No. _____
SHEET No. 2-19

AIRCRAFT: C105	FIN

PREPARED BY	DATE
H. N. Smith	Nov. 23/59
CHECKED BY	DATE

FIN ROOT STRESSES
(FROM MATRIX C.P.A.-7)

SHEAR SIGN CONVENTION



POSITIVE SHEAR AS SHOWN ON TENSION SIDE

SCALE 1 "= 20"

CRM 1318A

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

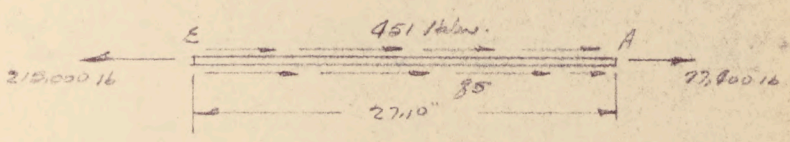
REPORT NO.
SHEET NO. 2-20

AIRCRAFT: C105	FIN	PREPARED BY	DATE
		H.J. Smith	Nov. 23/54
		CHECKED BY	DATE

Fin Root Stresses From Matrix (C.P. Acft)

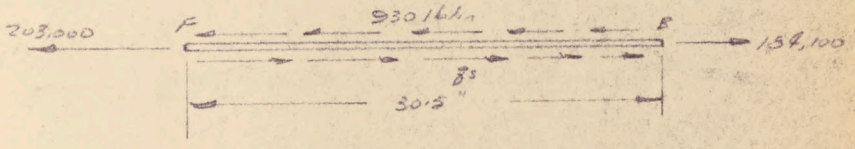
Equilibrium of Spar Caps

A-E



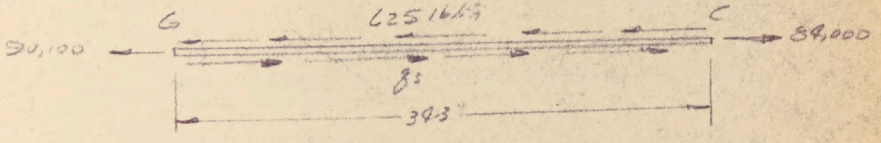
$$q_s = \frac{215{,}000 - 77{,}900}{27.10} - 451 = \frac{137{,}600}{27.10} - 451$$
$$= 5080 - 451 = \underline{4629\ \#/in.}$$

B-F



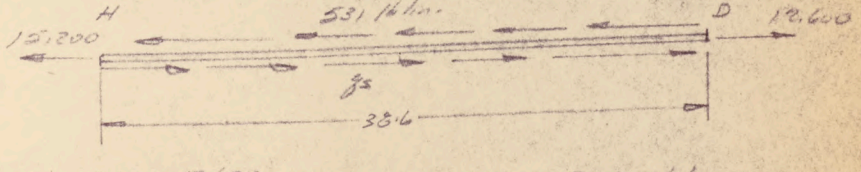
$$q_s = \frac{203{,}000 - 139{,}000}{27.10} + 930$$
$$= \frac{19{,}000}{27.10} + 930 = 701 + 930 = \underline{1631\ \#/in.}$$

C-G



$$q_s = \frac{90{,}100 - 89{,}000}{39.3} + 625 = 178 + 625 = \underline{803\ \#/in.}$$

D-H



$$q_s = \frac{15{,}200 - 12{,}600}{38.6} + 531 = 67 + 531 = \underline{598\ \#/in.}$$

CRM 1319A

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

REPORT No.
SHEET No. 2-21

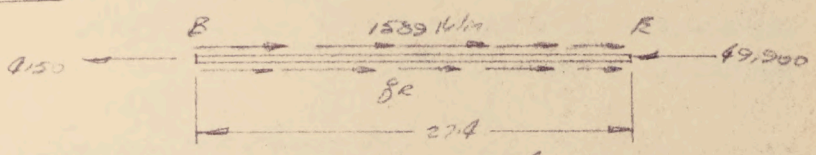
AIRCRAFT: C105	FIN

PREPARED BY	DATE
H.N. Smart	Nov. 23/59
CHECKED BY	DATE

FIN ROOT STRESSES FROM MATRIX
(C.P.A.F.)

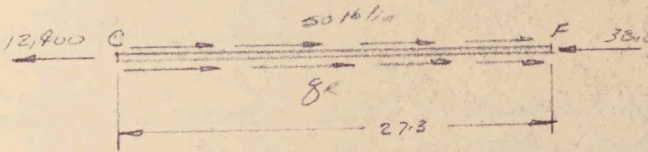
EQUILIBRIUM OF RIB CAPS

B-E



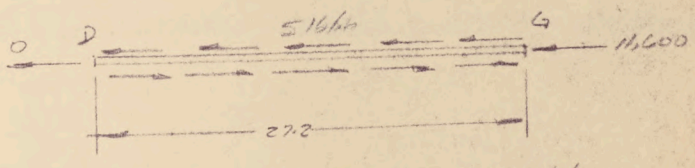
$$q_R = \frac{9150 + 49,900}{27.4} - 1589 = \frac{59,050}{27.4} - 1589 = 1972 - 1589 = \underline{383\ lb/in}$$

C-F



$$q_R = \frac{12,900 + 38,300}{27.3} - 50 = \frac{51,200}{27.3} - 50 = 1875 - 50 = \underline{1825\ lb/in}$$

D-G



$$q_R = \frac{11,600}{27.2} + 5 = 427 + 5 = \underline{432\ lb/in}$$

FORM 1319A

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

REPORT No.
SHEET No. 2-22

AIRCRAFT: C105	FIN	PREPARED BY	DATE
		H.N. SHOJI	NOV. 29/58
		CHECKED BY	DATE

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

SIDE SHEAR AT POINT "E"

SPAR SHEAR = 9629 × 2 × 2.75 = 26,450 LB
RIB SHEAR = -383 × 2 × 2.75 = -2105 LB
NET SHEAR = 23,345 LB

SIDE SHEAR AT POINT "F"

SPAR SHEAR = 1631 × 2 × 4.09 = 13,200 LB
RIB SHEAR = -1525 × 2 × 4.09 = -12,790 LB
NET SHEAR = -1590 LB

SIDE SHEAR AT POINT "G"

SPAR SHEAR = 803 × 2 × 4.55 = 7300 LB
RIB SHEAR = -432 × 2 × 4.55 = -3940 LB
3360 LB

SIDE SHEAR AT POINT "H"

SPAR SHEAR = 598 × 2 × 3.49 = 4190 LB

FORM 1194

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

REPORT No.
SHEET No. 2-23

AIRCRAFT: C105	FIN

PREPARED BY	DATE
H.A.J. Smith	Nov. 29/58
CHECKED BY	DATE

FIN ROOT STRESSES FROM MATRIX (C.P. AFT)

ESTIMATION OF SPAR SHEARS.

IN ORDER TO ESTIMATE THE SHEARS AT THE SPAR PICK-UP POINTS AT THE ROOT RIB, THE MATRIX SPAR AND RIB SHEARS AT THE ROOT WILL BE DE-LUMPED TO SIMULATE SHEAR DISTRIBUTION IN A STRUCTURE WITH INFINITE NUMBER OF SPAR WEBS. THE SHEARS WILL THEN BE LUMPED TO THE ACTUAL SPAR POINTS. SINCE THE CORRECTION FACTOR, TO TAKE ACCOUNT OF DIFFERENCES IN MATRIX STRUCTURE FROM THE ACTUAL STRUCTURE, FOR SHEAR DISTRIBUTION IS APPROX. 1.00, THE MATRIX RESULTS MAY BE USED DIRECTLY.

FROM PRECEDING CALCULATIONS:

AT POINT "E"

SPAR SHEAR + RIB SHEAR = 25,960 - 2105 = 23,855 LB.

EFFECTIVE CHORDWISE WIDTH = $\frac{39.98}{2}$ = 19.99 IN.

SHEAR / IN CHORD = $\frac{23,855}{19.99}$ = 1194 LB/IN

AT POINT "F"

SPAR SHEAR + RIB SHEAR = 13,200 - 14,790 = -1590 LB

EFFECTIVE CHORDWISE WIDTH = $19.99 + \frac{45.10}{2}$

$= 19.99 + 22.55 = 42.54$ IN.

SHEAR / IN. CHORD = $\frac{-1590}{42.54}$ = -36 LB/IN.

AT POINT "G"

SPAR SHEAR + RIB SHEAR = 7300 - 3940 = 3360 LB

EFFECTIVE CHORDWISE WIDTH = $\frac{22.65 + 50.66}{2}$

$= 22.58 + 25.425 = 47.995$ IN.

SHEAR / IN. CHORD = $\frac{3360}{47.995}$ = 70 LB/IN

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

REPORT No.
SHEET No. 2-24

AIRCRAFT: C105	FIN	PREPARED BY	DATE
		H. N. SHOZI	NOV. 29/59
		CHECKED BY	DATE

FIN ROOT STRESSES FROM MATRIX (C.P. AFT)

AT POINT "H"

SPAR SHEAR + L.E. SHEAR = 4170 LB
EFFECT. CHORDWISE WIDTH = 25.925 IN
SHEAR/IN. CHORD = $\frac{4170}{25.925}$ = 161 LB/IN.

SHEARS DISTRIBUTED TO ACTUAL SPARS (FROM GRAPH)

SPAR	AVERAGE SHR/IN CHORD	EFFEC. CHORDWISE WIDTH	SHEAR - LB	
			LIMIT	ULTIMATE
HINGE SPAR	1790	9.95	16,900	23,100
2	405	16.30	6600	9000
3	-50	19.05	-950	-1300
4	-25	29.80	-620	-850
5	60	25.00	1500	2050
6	110	27.30	3000	4100
FRONT SPAR	190	14.90	2830	3860
		Σ	29,260	39,960

FORM 1319A

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

REPORT NO.
SHEET NO. 2-25

AIRCRAFT: C105	FIN	PREPARED BY: H.N. SHOJI	DATE: Nov. 29/60
		CHECKED BY	DATE

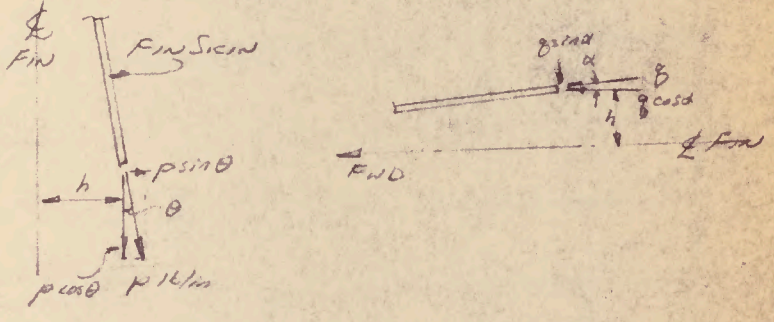
FIN ROOT STRESS DISTRIBUTION FROM MATRIX (C.P. AFT)

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

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

SHEAR = 36,500 × 1.364 = 49,900 LBS.
B.M. = 2,520,000 × 1.364 = 3,440,000 IN LBS.
TORQUE = 2,120,000 × 1.364 = 2,739,000 IN LBS
} ULTIMATE

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



AT CHORDWISE STATION "x"
LOADS DUE TO SKIN END LOAD "p" & SHEAR "q"

SIDE LOAD = 2p sinθ − 2q sinα
B.M. = 2 h_x p cosθ
TORQUE = (2p sinθ − 2q sinα)x + 2q h cosα

LOCAL VALUES OF "θ" MAY BE OBTAINED BY: $\theta = \tan^{-1}\frac{h_1 - h_2}{20.6}$
WHERE h_1 = SECTION HALF DEPTH AT ROOT CHORD
h_2 = " " " AT SPANWISE STA. 20.6

FORM 1318A

A. V. ROE

MA

TECHNI

AIRCRAFT .

WEIGHT .

C. G. POSITION

Chordwise Sta. From L.E. of Root Chord "x"		1	2	3	4	5	6	7	8	9	10	11
		h_R	$h_{20\cdot6}$	$h_R - h_{20\cdot6}$	$\frac{\tan\theta}{20\cdot6}$	θ	$\sin\theta$	$\cos\theta$	2ρ	$h_{R_2} - h_{R_1}$	$\frac{\tan\alpha}{\frac{h_{R_2} - h_{R_1}}{\Delta x}}$	α
22·8	Δx 0	3·43							980			
38·0	15·2	4·04	1·49	2·55	·1238	7°35′	·1229	·9924	1200	·61	·04013	2° 18′
52·7	14·7	4·36	2·94	1·42	·0689	3°56′	·0686	·9976	1500	·32	·02178	1° 15′
52·7	14·7	4·36	2·94	1·42	·0689	3°56′	·0686	·9976	1700	·32	02178	1° 15′
65·0	12·3	4·50	3·52	·98	·0476	2°44′	·0477	·9989	2040	·14	01139	0° 39′
77·3	12·3	4·55	3·85	·70	·0340	1°57′	·0340	·9994	2500	·05	·00406	0° 14′
77·3	12·3	4·55	3·85	·70	·0340	1°57′	·0340	·9994	3940	·02	00406	0° 14′
90·0	12·7	4·52	4·04	·48	·0233	1°20′	·0233	·9997	5000	-·03	-·00236	-0° 8′
102·4	12·4	4·33	4·11	·29	·0141	0°48′	·0140	·9999	6220	-·13	-·01049	-0° 36′
102·4	12·4	4·39	4·11	·29	0141	0°48′	·0140	·9999	6440	-·13	-·01049	-0° 36′
115·0	12·6	4·16	4·08	·08	·0039	0°13′	·0038	·99999	8040	-·23	-·01826	-1° 3′
127·0	12·0	3·86	3·95	-·09	-·0044	-0°15′	-·0042	·99998	10300	-·30	-·02500	-1° 26′
127·0	12·0	3·86	3·95	-·09	-·0044	-0°15′	-·0043	·99998	10700	-·30	-·02500	-1° 26′

FORM 1543

A. V. ROE CANADA LIMITED

MALTON, ONTARIO

TECHNICAL DEPT. (AIRFRAME)

REPORT NO. .

SHEET . . 2-26

DATE . . 27-11-59

AIRCRAFT . . C.F.105

WEIGHT . .

C. G. POSITION . .

PREPARED BY . J L Dixon

8	9	10	11	12	13	14	15	16	17	18	19
$2p$	$h_{R_2}-h_{R_1}$	$\tan\alpha$ $\frac{h_{R_2}-h_{R_1}}{\Delta x}$	α	$\sin\alpha$	$\cos\alpha$	$2q$	$2p\sin\theta$	$2q\sin\alpha$	ΔS (15)-(16)	$2p\cos\theta$	ΔM $2p\cos\theta h_R$
980			2° 42'	·0465	·999	780		36·3	149·9		
1200	·61	04013	2° 18'	·04013	·9992	920	147·4	36·9	110·5	1191	4810
1500	·32	·02178	1° 15'	·02178	·9998	1260	103·0	27·4	75·6	1496	6520
1700	·32	02178	1° 15'	·02178	·9998	1400	116·8	30·5	86·3	1696	7300
2040	·14	01139	0° 39'	·01139	·99994	1800	97·4	20·5	76·9	2038	9,160
2500	·09	00406	0° 14'	·00406	·99998	2260	85·0	9·2	75·8	2499	11,370
3940	·09	00406	0° 14'	·00406	·99998	3660	134·0	14·9	119·1	3939	17,330
5000	-·03	-·00236	-0° 8'	-·00236	·99998	4640	116·5	-11·0	127·5	4999	22,560
6220	-·13	-·01049	-0° 36'	-·01049	·99995	5620	87·1	-58·9	146·0	6220	27,300
6440	-·13	-·01049	-0° 36'	-·01049	·99995	6000	90·1	-62·9	153·0	6440	28,260
8040	-·23	-·01826	-1° 3'	-·01826	·9998	7600	30·6	-135·8	169·4	8040	33,500
10300	-·30	-·02500	-1° 26'	-·02500	·9997	9420	-44·3	-235·5	191·2	10300	39,700
10700	-·30	-·02500	-1° 26'	-·02500	·9997	9820	-46·0	-245·5	199·5	10700	41,300

A. V. ROE

TECH

AIRCRAFT

WEIGHT

C. G. POSITIO

CHORDWISE STA. FROM L.E. OF ROOT CHORD "x"	1	2	3	4	5	6	7	8	9	10	11
	$2q\cos\alpha$	$2q\cos\alpha h_R$	$\Delta S.x$	ΔT ②+③							
22·8	770	2,680	3520	6,200							
38·0	910	3,715	4,200	7,915							
52·7	1260	5490	3,990	9,480							
52·7	1400	6100	4,550	10,650							
65·0	1800	8100	5,000	13,100							
77·3	2260	10290	5,860	16,150							
77·3	3660	16550	9,220	25,770							
90·0	4640	20980	11,470	32,450							
102·4	5620	24700	14,950	39 650							
102·4	6000	26360	15,670	42,030							
115·0	7600	31600	19,490	51,090							
127·0	9420	36400	24,260	60,660							
127·0	9820	37900	25,350	63,230							

FORM 1543

A. V. ROE CANADA LIMITED

MALTON, ONTARIO

TECHNICAL DEPT. (AIRFRAME)

AIRCRAFT - - C.F. 105

WEIGHT - -

C. G. POSITION -

REPORT NO. -

SHEET - - 2-27

DATE - - 29-11-59

PREPARED BY - J. L. DIXON

8	9	10	11	12	13	14	15	16	17	18	19

A. V. ROE C
MALT
TECHNICA

AIRCRAFT -
WEIGHT -
C. G. POSITION

CHORDWISE STA FROM LE. OF ROOT CHORD "x"		1	2	3	4	5	6	7	8	9	10	11	
		h_R -	$h_{20\cdot6}$	$h_R - h_{20\cdot6}$	$\frac{\tan\theta}{20\cdot6}$ (3)	θ	$\sin\theta$	$\cos\theta$	$2p$	$h_{R1} - h_{R1}$	$\frac{\tan\alpha}{\Delta x}$ $h_{R2} - h_{R1}$	α	
134·0	Δx 7·0	3·66	3·83	-·17	-·0082	-0°28'	-·0082	·99997	12400	-·20	-·02857	-1°38'	
140·7	6·7	3·45	3·70	-·25	-·0121	-0°42'	-·0122	·9999	14300	-·2	-·03135	-1°48'	
140·7	6·7	3·45	3·70	-·25	-·0121	-0°42'	-·0122	·9999	14700	-·2	-·03135	-1°48'	
150	9·3	3·11	3·47	-·36	-·0175	-1°0'	-·0174	·9998	17900	-·34	-·03657	-2°6'	
159·6	9·6	2·76	3·17	-·41	-·0199	-1°8'	-·0199	·9998	21600	-·35	-·03646	-2°6'	

FORM 1543

A. V. ROE CANADA LIMITED

MALTON, ONTARIO

TECHNICAL DEPT. (AIRFRAME)

AIRCRAFT - - C.F.105

WEIGHT - -

C. G. POSITION -

REPORT NO. -

SHEET - - 2-28

DATE - - 29.11.54

PREPARED BY - J. L. DIXON

8	9	10	11	12	13	14	15	16	17	18	19
$2p$	$h_{R2}-h_{R1}$	$\frac{\tan\alpha}{h_{R2}-h_{R1}}\Delta x$	α	$\sin\alpha$	$\cos\alpha$	$2q$	$2p\sin\theta$	$2q\sin\alpha$	ΔS (15)-(16)	$2p\cos\theta$	ΔM $2p\cos\theta h_R$
12400	-.20	-.02857	-1° 38'	-.02857	.9996	11000	-101.8	-314.3	212.5	12400	45,400
14300	-.21	-.03135	-1° 48'	-.03135	.9995	12240	-174.5	-383.5	209.0	14300	49,300
14700	-.21	-.03135	-1° 48'	-.03135	.9995	12580	-179.3	-394.0	214.7	14700	50,700
17900	-.34	-.03657	-2° 6'	-.03657	.9993	14420	-311.5	-527.0	215.5	17900	55,600
21600	-.35	-.03646	-2° 6'	-.03646	.9993	16580	-430.0	-605.0	175.0	21600	59,600
							-294.3	-380.7			

A. V. R

AIRCRAFT

WEIGHT

C. G. POS

	1	2	3	4	5	6	7	8	9	10
	$2q_{max}\alpha$	$2q_{max}xh_K$	$\Delta s.x$	ΔT ② + ③						
1390	11,000	40,300	28,500	68,200						
1401	13,240	42,200	29,400	71,600						
1407	12580	43,400	30,100	73,600						
1459	14410	44,800	32,300	77,100						
1526	16512	45,700	27,900	73,600						
		49,265	29,810							

FORM 1543

A. V. ROE CANADA LIMITED

MALTON, ONTARIO

TECHNICAL DEPT. (AIRFRAME)

AIRCRAFT - - C.F. 105

WEIGHT - -

C. G. POSITION -

REPORT NO. -

SHEET - - 2-29

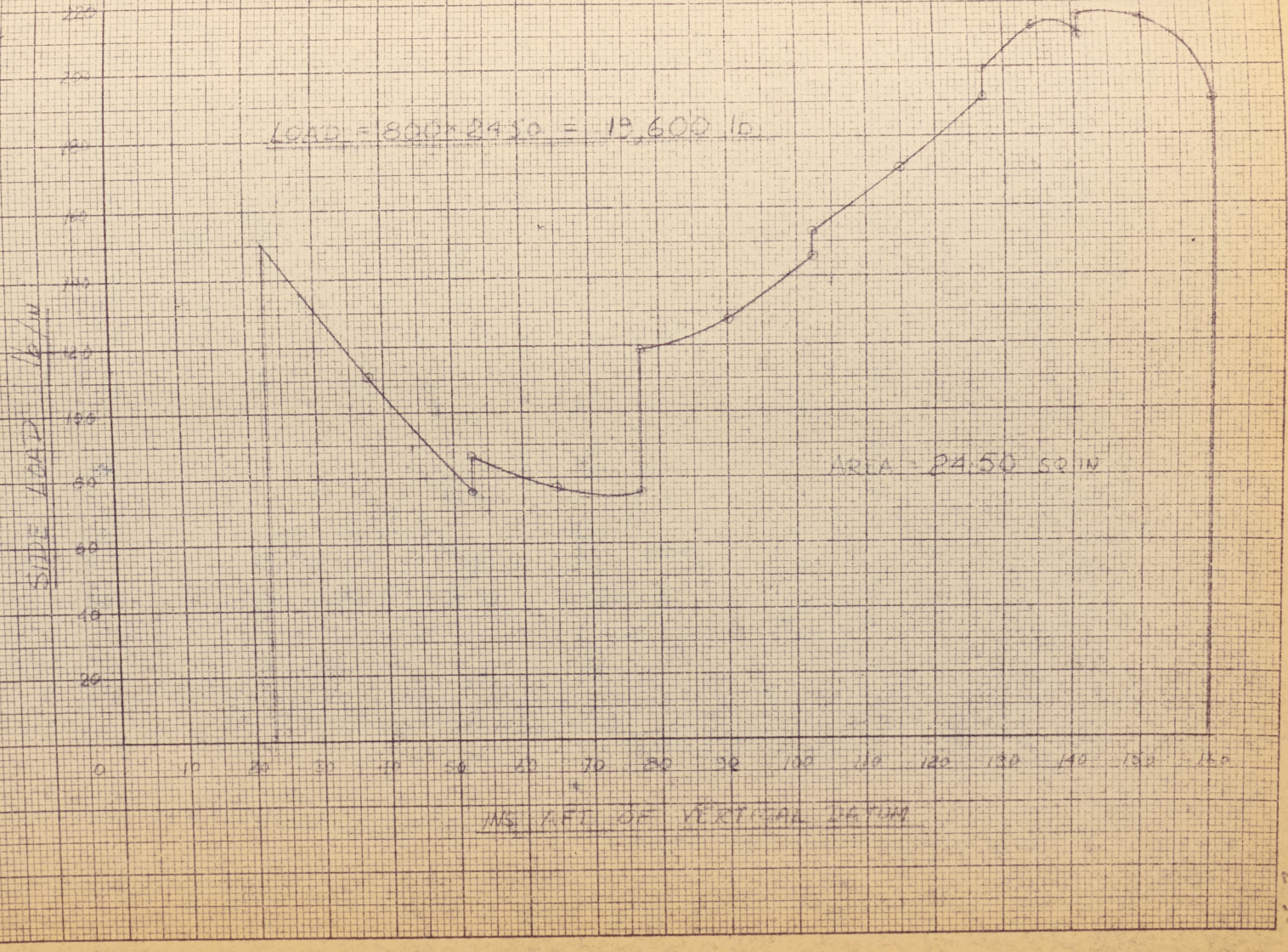
DATE - - 29.11.54

PREPARED BY - J.L. Dixon

8	9	10	11	12	13	14	15	16	17	18	19

SIDE LOAD DUE TO SKIN AND LOAD R STRUT

LOAD = 800 × 24.50 = 19,600 lb

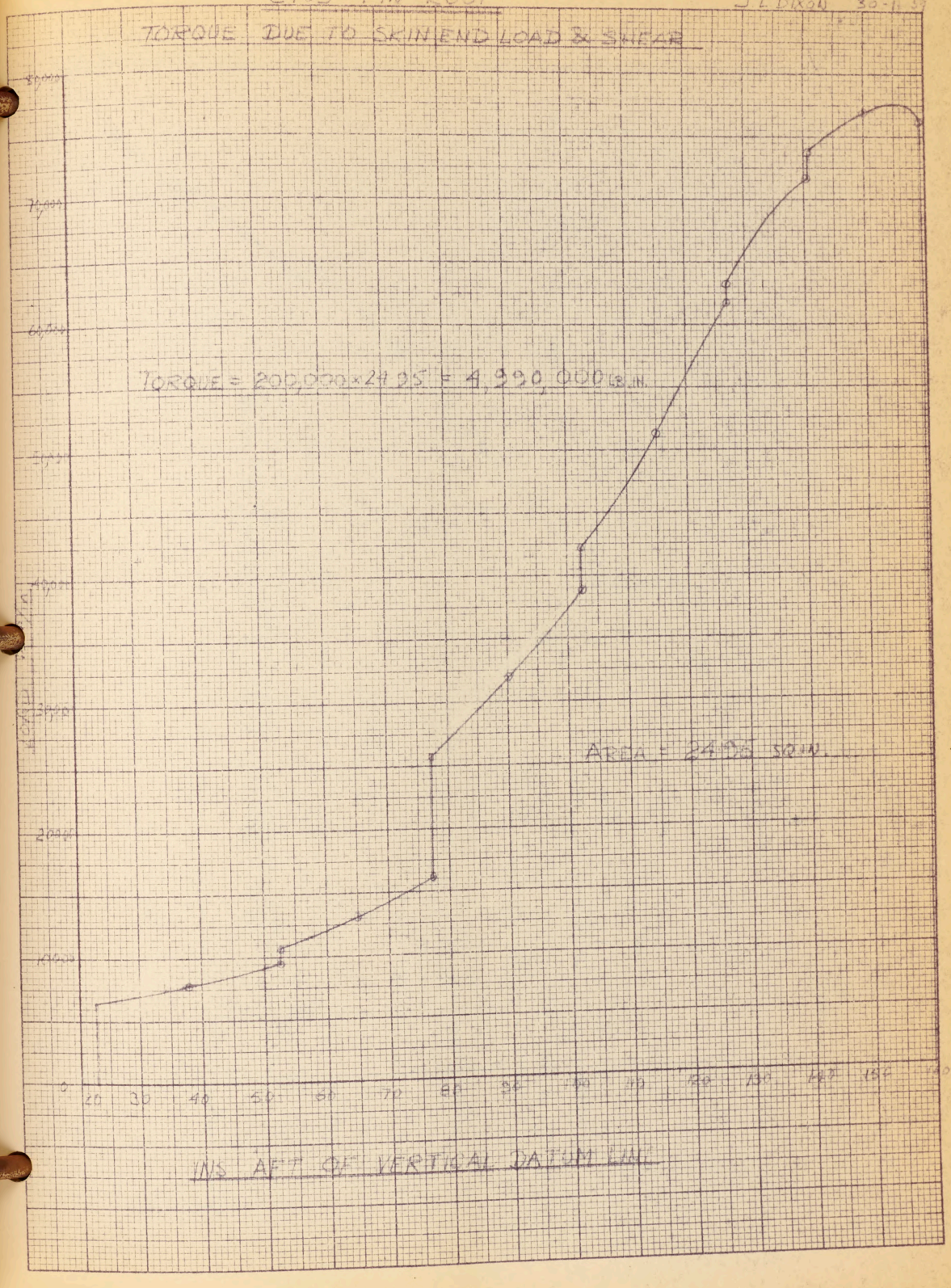


2-20

C105 FIN ROOT

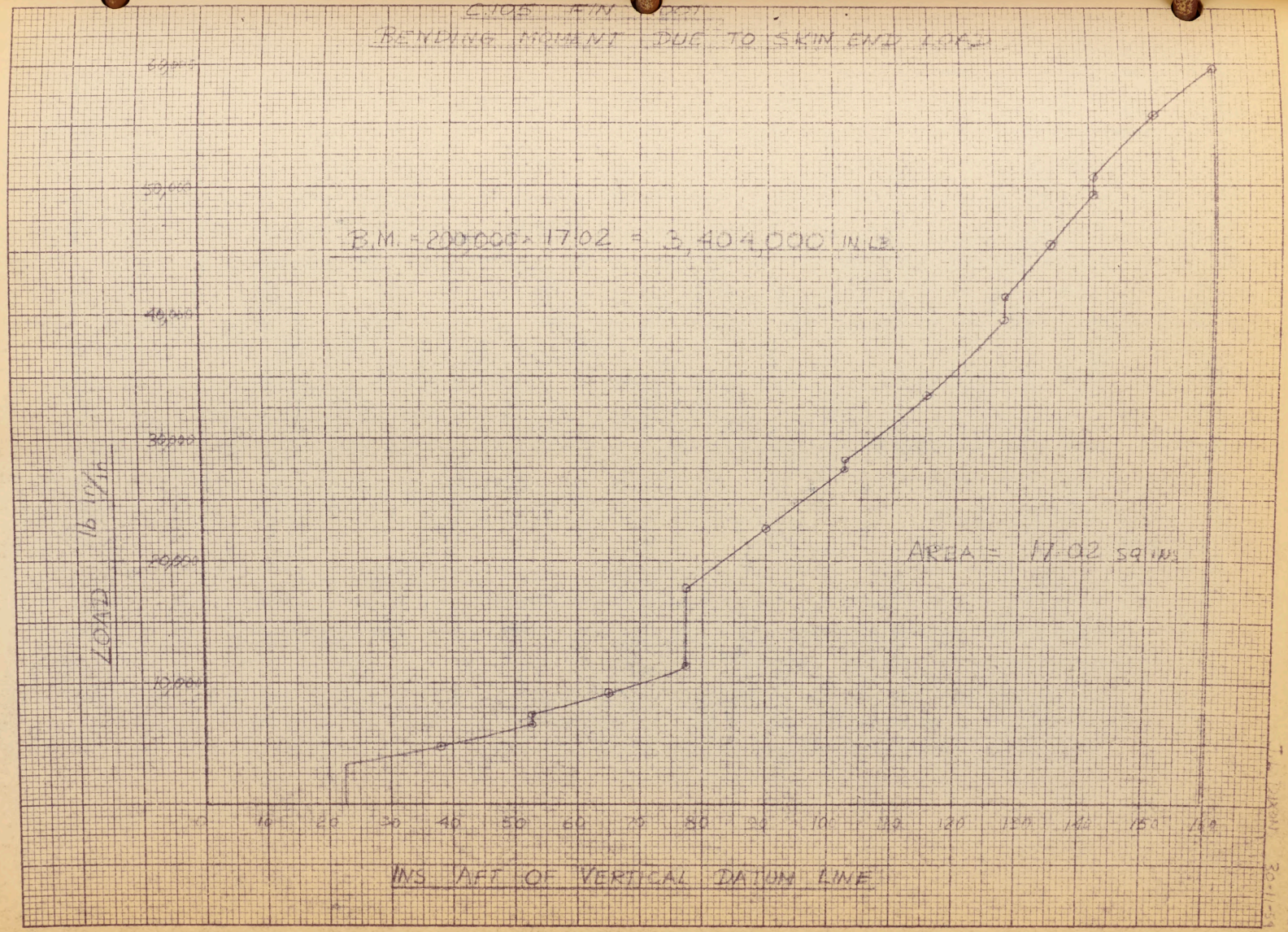
J L DIXON 30-11-59

TORQUE DUE TO SKIN END LOAD & SHEAR



C.105 FIN

BENDING MOMENT DUE TO SKIN END LOAD



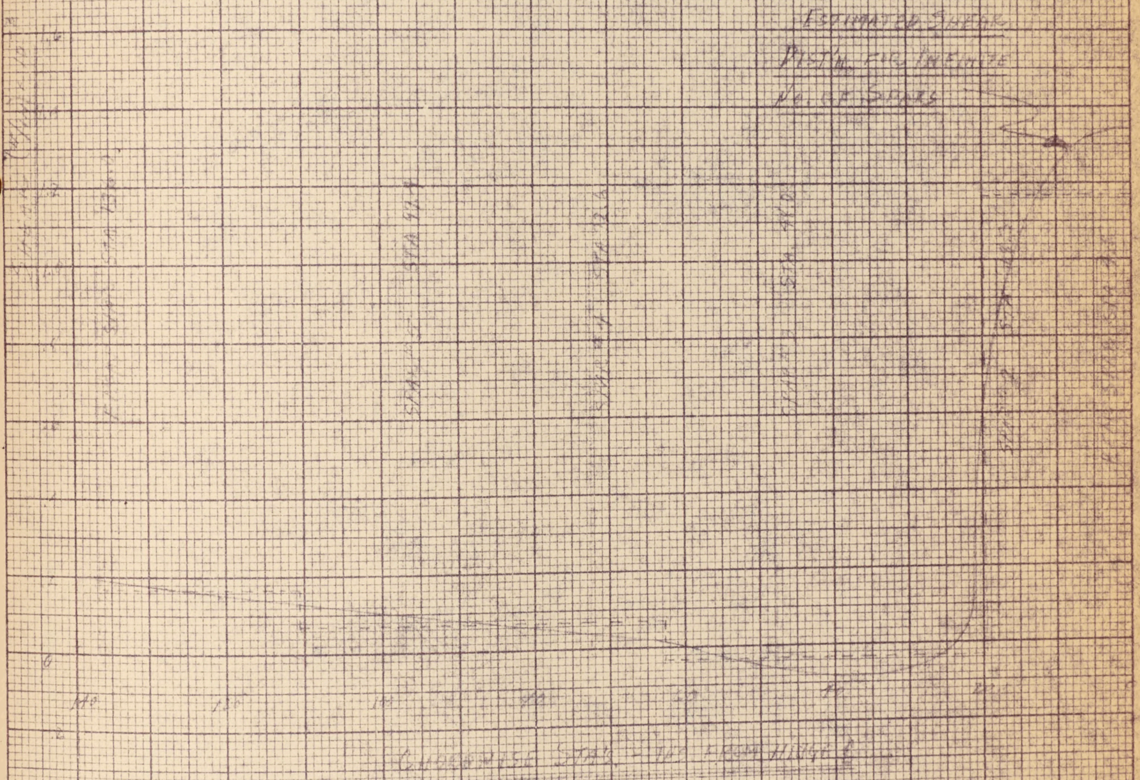
30-11-59

2-32

RAFT COMPONENT SHEET No. 2-33 REPORT No.

W. DATE 1-18-54 PREP. BY L. MATALON

105-FIN DISTRIBUTION OF SIDE SHEARS
AT SPAR PICK-UP POINTS AT THE ROOT
LIMIT SHEARS - C.P. AFT



MADE IN U.S.A.

FORM 1746

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

REPORT No. _____
SHEET No 2-29

AIRCRAFT:		PREPARED BY	DATE
C-105	FIN	L. MATALON	1-28-55
		CHECKED BY	DATE

FIN ROOT STRESSES FROM MATRIX

SHEARS DISTRIBUTED TO ACTUAL SPARS (FROM GRAPH)

SPAR	AVERAGE SHEAR / IN. CHORD	EFFECTIVE CHORDWISE WIDTH	SHEAR (LBS) LIMIT	SHEAR (LBS) ULTIMATE	SHEAR FLOW Limit	SHEAR FLOW Ult.
HINGE SPAR	1310	11.40	14900	20300	56	3630
2	362	21.75	7869	10730	70	1540
3	26.A	27.15	-716	-976	80	-122
4	32.5	24.70	803	1094	87	126
5	103.4	31.70	3280	4470	86	520
FRONT SPAR	168.5	19.30	3250	4420	66	670
		Σ	29377	40048		

FORM 1319A

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

REPORT No.
SHEET No. 2-35

AIRCRAFT:		PREPARED BY	DATE
C-105	FIN	L. MATALON	1-28-55
		CHECKED BY	DATE

TORQUE DUE TO FLAT SHEARS *

SPAR REF.	SHEAR P_4	$\bar{x}$	TORQUE $\times 10^3$ SHEAR $\times \bar{x}$
HINGE SPAR	20300	154.3	3145
2	10730	140.1	1507
3	- 976	110.8	- 108
4	1077	86.2	94
5	4970	61.4	274
FRONT SPAR	9432	22.8	191
Σ	40048		5013

TOTAL CALCULATED SHEAR

$= 40048 + 19620 = 59648^{\#}$ (REF P_4)

ACTUAL SHEAR $= 49900^{\#}$ REF P_4

% ERROR $= 19.5\%$

TOTAL CALCULATED TORQUE

$= 4990 \times 10^3 + 5013 \times 10^3 = 10.003 \times 10^6$

REF. PG 2-32
$P_4 = 3.446 \times 10^6$ ACTUAL
3.464×10^6 CALC
% ERROR $= 1.05\%$

ACTUAL TORQUE $= 7.730 \times 10^6$

% ERROR $= 2.8\%$

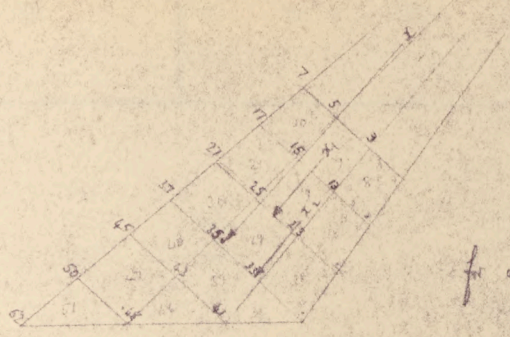
* TORQUE ABOUT VERTICAL REF LINE AT THE INTERSECTION OF THE WING & FIN DATUM LINE WITH THE LEADING EDGE TIP.

FORM 1319A

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

REPORT NO.
SHEET NO. 2-36

AIRCRAFT:		PREPARED BY	DATE
C 105	FIN ROOT SKIN SHEAR	A. Cooke	JAN 3 '55
	MATRIX SHEAR	CHECKED BY	DATE



$$\tau = \frac{x_1 x_2}{x^2}\,\tau_m$$

for analysis $x = x_1$ or x_2

$$\tau_1 = \frac{x_2}{x_1} \qquad \tau_1 = \frac{x_1}{x_2}$$

x_1	166·446	$\frac{x_1}{x_2}$ ·8869	$\frac{x_2}{x_1}$ 1·1275
x_2	187·673	$\frac{x_2}{x_3}$ ·8869	$\frac{x_3}{x_2}$ 1·1275
x_3	211·606	$\frac{x_3}{x_4}$ ·8869	
x_4	238·590	$\frac{x_4}{x_5}$ ·8869	
x_5	269·014	$\frac{x_5}{x_6}$ ·8869	
x_6	303·317	$\frac{x_6}{x_7}$ ·8869	
x_7	341·972		

MATRIX Nº	τ_m	τ_2	τ_1
8	- 4 971	- 5 605	- 4408
9	- 4 966	- 5 577	- 4387
10	- 4 168	- 4 699	- 3696
18	- 5 026	- 5 667	- 4457
19	- 3 567	- 3 571	- 2809
20	- 1 935	- 2 182	- 1716
28	+ 1 973	+ 2 227	+ 1 752
29	↓ 1097	↓ 1 237	↓ 973
30	785	885	696
38	8414	9 498	7 471
39	4 906	5 531	4 351
40	3 140	3 545	2 788
46	4798	5 410	4 255
47	2398	2 704	2 127
51	2 202	2 483	1 953

FORM 1194

A.V.ROE CANADA LIMITED MALTON – ONTARIO **TECHNICAL DEPARTMENT (Aircraft)**	REPORT NO. 7/0583/1 SHEET NO. 2-37
AIRCRAFT: C 105 — FIN MATRIX SHEAR CORRECTED TO STRUCTURE	PREPARED BY: A Cooke — DATE: JAN 3 '55 CHECKED BY: — DATE:

REAR SPAR

	T	·9553T = T"
8 u	-4408	-4211
l	-5605	-5354
18 u	-4457	-4258
l	-5667	-5414
28 u	+1752	+1674
l	+2227	+2127
35 u	[illegible]	7137
l	[illegible]	9073

	-18
8u	-8090
	-9500
18u	-8404
	-10018
	-2930
	-1380
	+3630
	+5853

	σ	·1109 σ
3	34976	3879
13	37389	4146
23	41518	4604
33	31625	3507
41	29039	3220

	T	·9553T
9 u	-4387	-4191
l	-5577	-5328
19 u	-2809	-2683
l	-3571	-3411
29 u	+973	+930
l	+1237	+1182
39	4351	4156
	5531	5283
44 u	4555 (?)	4065
l	[illegible]	5168

-11	-18
-16396	-8070
-16074	-9474
-13449	-6829
-13658	-8015
-9317	-3674
-7689	-2325
-4715	+649
+1039	+2063
-179	–
+1615	–

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

REPORT NO. 7405837/1
SHEET NO. 2-28

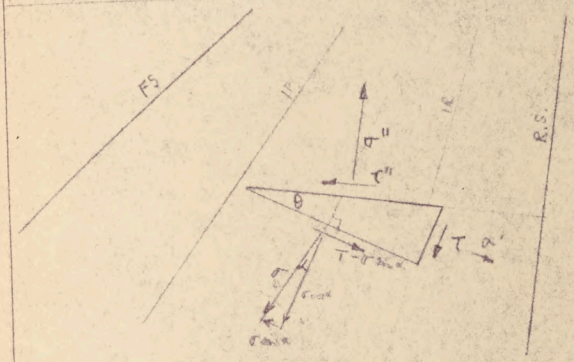
AIRCRAFT:		PREPARED BY	DATE
C105	FIN ROOT SKIN SHEAR MATRIX SHEAR CORRECTION	A Corke	JAN 3 55
		CHECKED BY	DATE

θ = angle between matrix Ox axis and RS is constant

$\theta = 8^\circ 38\frac{1}{2}'$

θ	$\sin\theta$	$\cos\theta$	$\sin^2\theta$	$\cos^2\theta$	T: $\sin^2\theta - \cos^2\theta$	$\sin\theta\cos\theta$
$8^\circ 38\frac{1}{2}'$	1502	·9889	·02256	·9779	−·9553	·1485

	α	$\sin\alpha$	$\cos\alpha$	$\sin\alpha\cos^2\theta$	$\cos\alpha\sin\theta\cos\theta$	T: $\sin\alpha\cos^2\theta + \cos\alpha\sin\theta\cos\theta$	
FS	$+8^\circ 38\frac{1}{2}'$	·1502	+·9889	·1469	·1468	+ ·2937	FS
IF	$+3^\circ 35'$	·0625	·9980	0611	1682	+ ·2093	IF
IR	$-2^\circ 12'$	−·0384	+·9993	−·0375	·1484	+ ·1109	IR
RS	$-8^\circ 38\frac{1}{2}'$	−·1502	+·9889	−·1469	·1469	0	RS



$$T'' = -(T - \sigma\sin\alpha)\cos^2\theta + T\sin^2\theta + \sigma\cos\alpha\sin\theta\cos\theta$$

$$= -T\cos^2\theta + \sigma\sin\alpha\cos^2\theta + T\sin^2\theta + \sigma\cos\alpha\sin\theta\cos\theta$$

$$T'' = T(\sin^2\theta - \cos^2\theta) + \sigma(\sin\alpha\cos^2\theta + \cos\alpha\sin\theta\cos\theta)$$

$$T'' = \underset{FS}{\cdot 9553\,T} - \underset{FS}{\cdot 2937\,\sigma} \quad [\sigma \; \underset{IF}{\cdot 2093\,\sigma} \; \underset{IR}{\cdot 1109\,\sigma}]$$

EFFECT OF RIBWISE DIRECT STRESS.

Add to $[T - \sigma\sin\alpha]$ term σ' term

for $T'' \pm \sigma'\sin\theta\cos\theta$

FORM 1319A

A.V.ROE CANADA LIMITED
MALTON – ONTARIO

TECHNICAL DEPARTMENT (Aircraft)

REPORT NO. 7 6583 11

SHEET NO. 2-39

AIRCRAFT		PREPARED BY: A. Costa	DATE: MAR 6 55
C105	FIN MATRIX SHEAR CORRECTED TO STRUCTURE	CHECKED BY:	DATE:

9553 F

10	-3696	-3531
	-4699	-4487
20	-1716	-1639
	-2182	-2084
	+696	+665
30	+885	+845
	↓	↓
	2788	2663
40	3545	3386
	2127	2032
47	2704	2583
	1953	1866
51	2483	2372

IF

	-10 777	-13 852
	-11 499	-15 255
	-8 447	-12 405
	-8 745	-12 331
	-5 996	-9 582
	-4 343	-8 026
	-2 486	-6 108
	-357	-858
	-1 711	-2 212
	+1 388	-1170
	+671	—
	+1184	—

IF
F

9038 F

5	35 152	10 205
15	37 085	10 766
25	35 299	10 247
35	30 557	8871
43	14 671	4244
48	12 928	3753

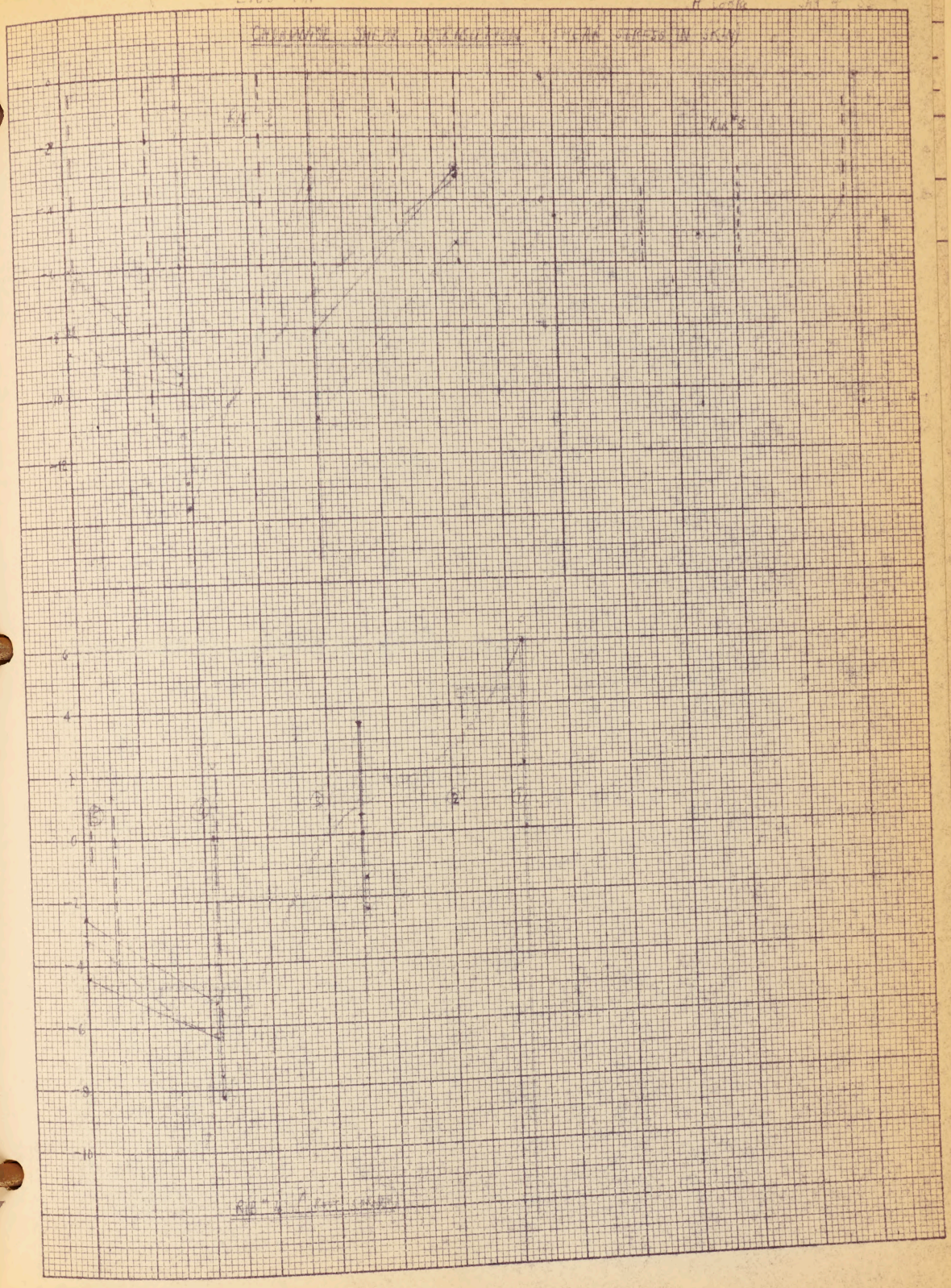
FS
F

2937 F

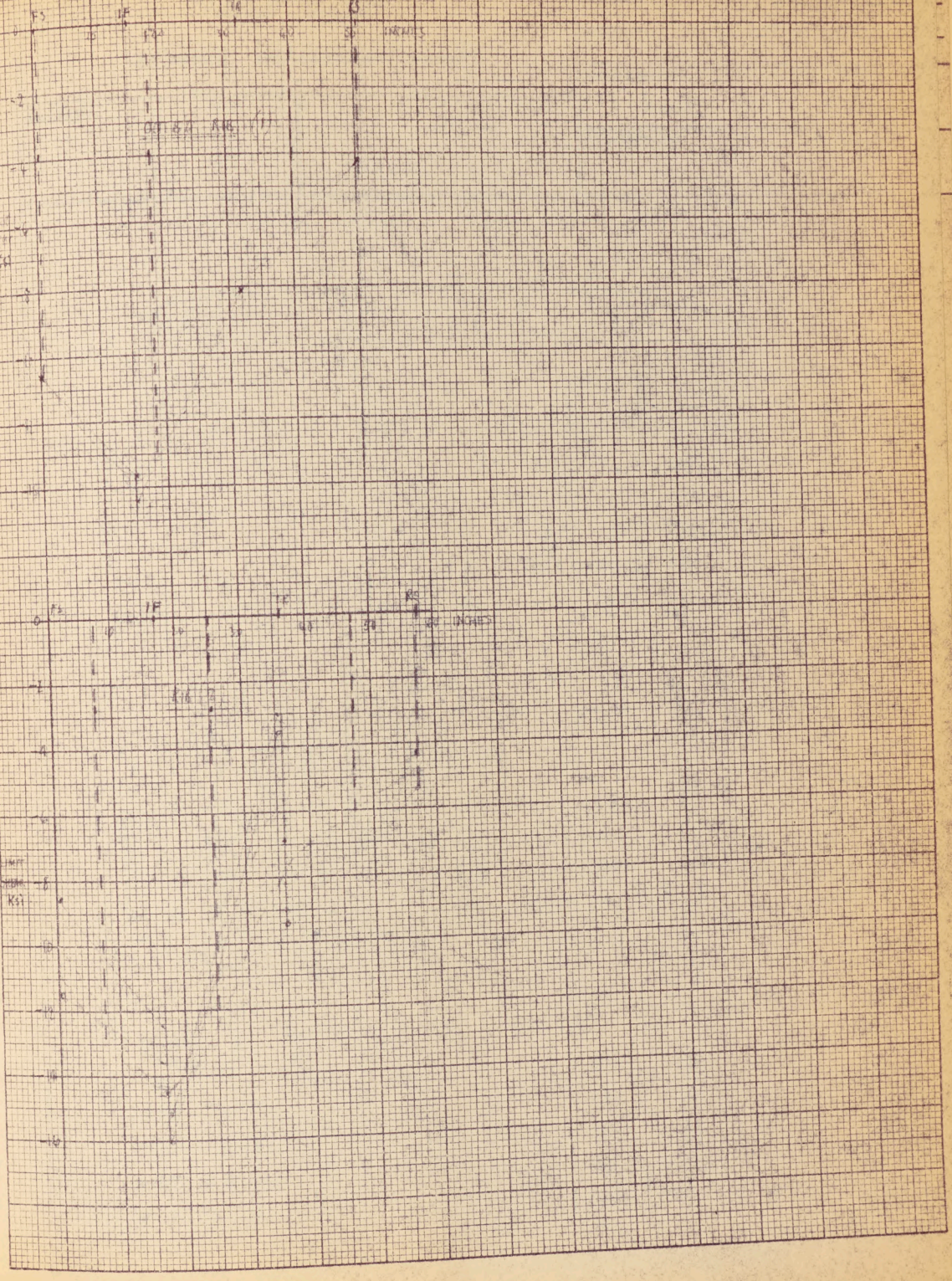
7	24 611	7246
17	23 868	7010
21	22 680	6661
37	17 686	5194
46	12 746	3743
50	4 069	1195
52	4 044	1188

C105 FM

A Lanke



RIGHTSIDE MATRIX SHUTTLE STAGE IN ORBIT



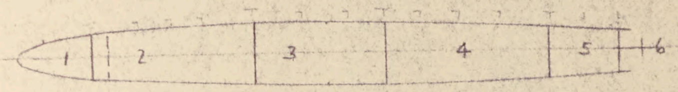
A.V. ROE CANADA LIMITED
MALTON – ONTARIO

TECHNICAL DEPARTMENT (Aircraft)

REPORT NO.	7/0583/2
SHEET NO.	3-1
PREPARED BY:	A Cooke
DATE:	JAN 5 '55
CHECKED BY:	
DATE:	
AIRCRAFT	C 105
	FIN ROOT SHEARS STN 6.00 → 16.[illegible]

CP ·5c 36 [illegible] MATRIX CORRECTION FACTOR K

ANGLE A [illegible]
TEE A [illegible]
LEG A = ·10



1 WEB No	2 b_F	3 t_F	4 $b_F t_F$	5 $b_R t_R$	6 bt = 4+5	7 $A_{SPAR\ [illegible]}$	8 A_1 = 6+7	9 $b_F + b_R$ ·0056	10 [illegible]	11 A_2 = [illegible]
1 – 2	6	·051	·308	1·03	1·33	·777	2·107	·059	2·048	1·927
2 – 3	10·5	·098	1·03	1·51	2·56	·979	3·519	·070	3·449	3·329
3 – 4	9·0	·168	1·51	1·90	3·41	·979	4·389	·072	4·317	4·317
4 – 5	10·9	·174	1·90	·865	2·765	·827	3·592	·056	3·536	3·536
5 – 6	4·75	·182	·865	·45	1·31	150	1·66	·025	1·635	1·435
							15·067			

	12 σ_1	13 σ_2	14 $\sigma_1 A_1$	15 $\sigma_2 A_2$	16 ($q_{[illegible]}$) $\frac{\sigma_1 A_1 - \sigma_2 A_2}{[illegible]}$	17 $\tau_{[illegible]}$	18 t	19 ($q_{[illegible]}$) τt	20	21 (q/WEB) 20 × [illegible]
1 – 2	22 000	19 [illegible]	46 354	36 618	800	−6900	·098	−680 K	−280 K	−920 K
2 – 3	32 400	31 800	114 016	107 [illegible]	700	−5400	·168	−910 K	−230 K	−310 K
3 – 4	37 000	36 860	162 393	159 [illegible]	340	−1300	·174	−225 K	+685 K	+930 K
4 – 5	65 800	40 500	164 [illegible]	142 [illegible]	2,150	+ 800	[illegible]	+ 146 K	+371 K	+505 K
5 – 6	58 000	44 200	84 480	634 27	2,125				−166 K	−198 K

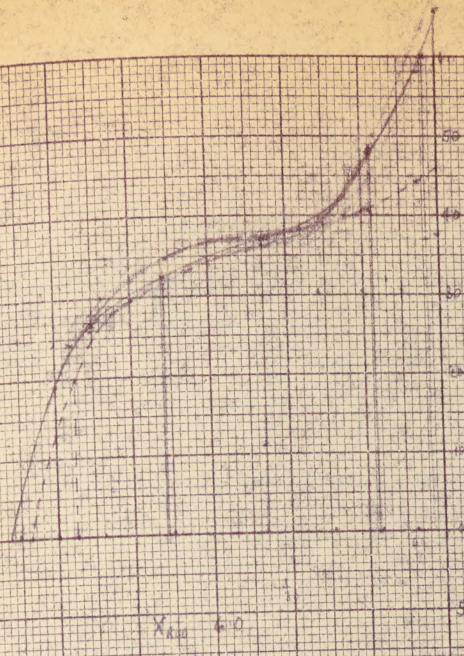
	19 × 1·36 × 1·54 = k [illegible] q	q / t	HEIGHT OF WEB
1 – 2 FS			5·1
	−1420	−14 500	
2			7·3
	−1900	+11 300	
3			7·6
	− 470	− 2 700	
4			6·5
	+ 305	+ 1 600	
5 – 6 RS			5·8

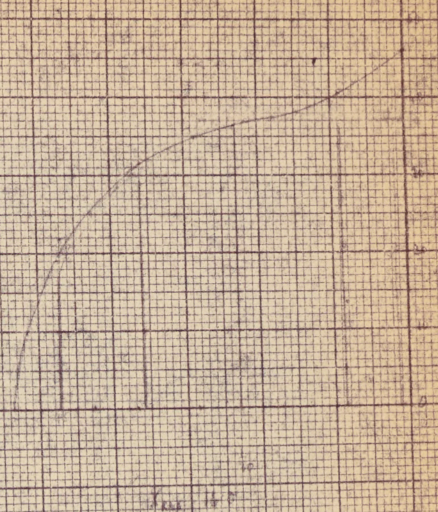
27 21 × 1·54	28 27 + 16	29 WEB SHEAR FOR [illegible]
−1420	− 620	− 3 150
− 480	+ 220	+ 1 600
+ 1440	+ 1780	+ 13 600
+ 780	+ 2930	+ 19 000
− 305	+ 1820	+ 10 800

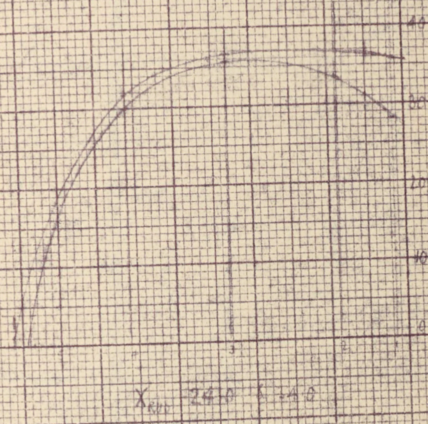
+ 41 650
[illegible] = 12 840
54 490

C105 FIN ROOT SHEAR

J-2







A. V. ROE
MA
TECHN

AIRCRAFT
WEIGHT
C. G. POSITION

E 105 FIN ROOT. SHEAR FLOW FROM SPARS
FROM DIFFERENCE IN END LOADS
(CP Art.)

STN.	1	2	3	4	5	6	7	8	9	10	11
		F.S. 1→2				2→3				③–④	
	A	σ	σA	$\frac{\sigma A - \sigma A}{2}$	A	σ	σA	$\frac{\sigma A_1 - \sigma A_2}{2}$	A	σ	σA
0	2·20	22·4	49·3	51	3·63	32·2	117	2	4·43	37	164
6	2·10	22	46·2	500	3·50	32·4	113	660	4·36	37	162
16	1·92	19·7	37·8	840	3·30	31·7	104·3	880	4·25	36·9	156
24	1·79	18	32·2	5·6 700	3·13	31	97	7·9 900	4·13	36·4	150
34	1·60	16	25·6	6·6 660	2·90	29·7	86·9	10·1 1010	4·07	35·6	145
42	1·44	14·3	20·5	5·1 640	2·72	28·6	78·0	8·0 1110	4·00	34·8	138
52	1·26	12·2	15·4	5·1 510	2·52	27	67·5	10·5 1050	3·92	33·5	130

FORM 1543

A. V. ROE CANADA LIMITED

MALTON, ONTARIO

TECHNICAL DEPT. (AIRFRAME)

REPORT NO. -

SHEET - - 3-3

DATE - - JAN 10 '55

AIRCRAFT - - C105

WEIGHT - -

C. G. POSITION -

PREPARED BY - A. Cooke

8	9	10	11	12	13	14	15	16	17	18	19
		③ - ④				④ - 5				5 - 6	
$\frac{\sigma A_1 - \sigma A_2}{\ell}$	A	σ	σA	$\frac{\sigma A_1 - \sigma A_2}{\ell}$	A	σ	σA	$\frac{\sigma A_1 - \sigma A_2}{\ell}$	A σ	σA	$\frac{\sigma A_1 - \sigma A_2}{\ell}$
660	4.43 4.36	37 37	164 162	330	3.64 3.60	50.5 45.8	183 165	3000	1.485 71 1.45 58	106 84	4700
880	4.25	36.9	156	600	3.51	40	140	2500	1.42 46.2	63	2100
900	4.18	36.4	150	670	3.44	36.6	126	1750	1.41 36	51	1500
1010	4.17	36.4	145	550	3.35	33.2	111	1500	1.38 29	40	1100
1110	4.10	34.8	138	875	3.28	31.4	103	1000	1.37 26.4	36	500
1105	3.70	33.5	130	800	3.20	29.4	94	900	1.34 25.1	33.6	960
										4710	
										1070 +3630	

A. V. ROE C
MALT
TECHNICAL

AIRCRAFT .
WEIGHT .
C. G. POSITION .

BENDING STRESS DISTRIBUTION AT RIB STN 6·00" C/F AFT (MATRIX CORRECTION TO NEW STRUCTURE)

CHORDWISE STATION	1 MATRIX LIMIT STRESS σ ksi	2 EQUIVALENT SKIN GAUGE t_e	3 P LBS PER INCH	4 EFFECTIVE h INCH	5 ΔM IN-LBS/IN	6	7 CORRECTED LIMIT STRESS	8 P_{com} LBS/INCH $= \sigma_{com} \times t_{eq}$	9	10	11
9·10	14·5	·078 ·200	1·13 2·90	2·32	2 620 6 710		16	1·24 3·2			
15	22·0	·156	3·44	4·84	9 700		24·8	3·78			
20	25·6	·156	4·00	3·15	12 600		28·4	4·40			
30	29·8	·156 ·216	4·65 6·43	3·51	16 400 22 600		33·0	5·15 7·14			
40	31·0	·216	6·70	3·65	24 500	34	35·0	7·59	74		
48	31·2	·216 ·222	6·75 6·21	3·57	24 100 24 700	34·5	35·9	7·77 7·92	78 77		
60	32·6	·222	7·21	3·35	24 200	34·0	37·0	8·21	77		
69·5	33·3	·222 ·214	8·70 8·10	3·09	26 900 26 [illegible]		43·3	9·6 9·15			
74	44·7	·214	9·55	4·90	27 600		49·4	10·5			
78	51·8	·214	11·0	2·75	30 400		57·0	12·2			
82·3	68·4	·214	14·6	If $d = 5·3"$ ρ_{air} 2·55	37 200		75·1	16·0			
11·6	·177	·200 ·156	3·54 2·76	2·57	9 100 7 100		12·7	3·94 3·05			

FORM 1543

A. V. ROE CANADA LIMITED

MALTON, ONTARIO

TECHNICAL DEPT. (AIRFRAME)

AIRCRAFT - - C 105

WEIGHT - -

C. G. POSITION -

REPORT NO. -

SHEET - - 3-4

DATE - - JAN 6 '55
JAN 21 '55

PREPARED BY - N Cuckow

8	9	10	11	12	13	14	15	16	17	18	19
$P_{cont.}$ LBS/INCH $= \sigma_{cont} \times t_{upper}$											
1.24											
3.2											
3.78											
4.40											
5.15											
7.14											
7.59											
7.77											
7.92											
8.21											
9.6											
9.75											
10.5											
12.2											
16.0											
3.24											
3.05											

C105 FIN

BENDING STRESS DISTRIBUTION AT STN x_{RUD} 0.

AND AT STN x_{RUD} 16·0

STN INCHES FROM H.L.	1 ULTIMATE σ ksi	2 t ins	3 y ins	4 $\sigma t y = M$	5	6 $\sigma \times \cdot 97 \cdot$ ksi σ_{CORR} ult	7 CORRECTED ULT END LOAD PER IN. ksi $\sigma_{CORR} \times t$	8	9
1·0	76	·216	2·62	43·000		74	16		
3·5	71·5	·216	2·74	42·300		69·1	15·		
7·0	62	·216	2·88	38·500		60	13·		
13·0	48	·216 ·226	3·1	32·100 33·600		46·5	10·1 10·5		
25·0	37·4	·226	3·48	29·400		36·1	8·2		
34·62	36·5	·226 ·219	3·66	30·300 29·200		35·5	8·0 7·8		
44·0	36	·219	3·70	29·000		35	7·7		
52·62	35	·219 ·158	3·60	27·500 19·900		34	7·45 5·4		
61·0	34	·158	3·40	18·300		33	5·2		
70·62	26	·158 ·202	2·80	11·600 14·800		25·1	3·96 5·1		
75·2	16	·202 ·078	2·40	7·800 3·000		15·5	3·13 1·20		
80	-	·078	-	—		-	-		

FORM 1543

A. V. ROE CA

MALTO

TECHNICAL

AIRCRAFT -

WEIGHT -

C. G. POSITION -

10 STN INCHES FROM H.L	11 ULT σ ksi	12 t
1·0	44·5	·2
3·5	44·5	·2
7·0	43	·2
13·0	40	·2 ·2
25·0	37	
34·62	36·2	·2 ·2
44·0	34·6	
52·62	32·0	
61·0	28	
70·62	20	
75	13	

A. V. ROE CANADA LIMITED

MALTON, ONTARIO

TECHNICAL DEPT. (AIRFRAME)

REPORT NO. -

SHEET - 3-5

AIRCRAFT - C 105 FIN

DATE - JAN 21 '55 / JAN 24 '55

WEIGHT -

C. G. POSITION -

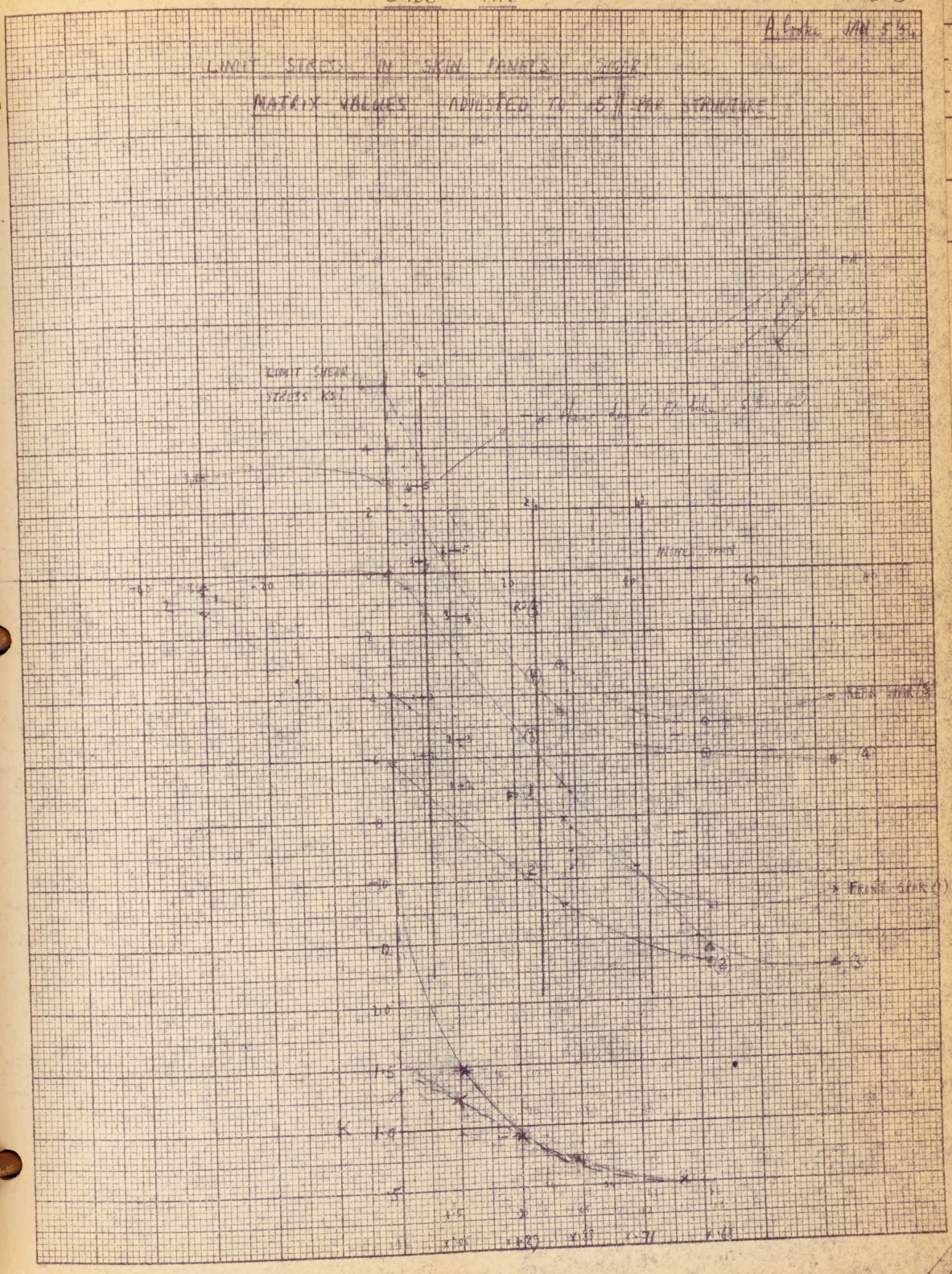
PREPARED BY - A. Locke

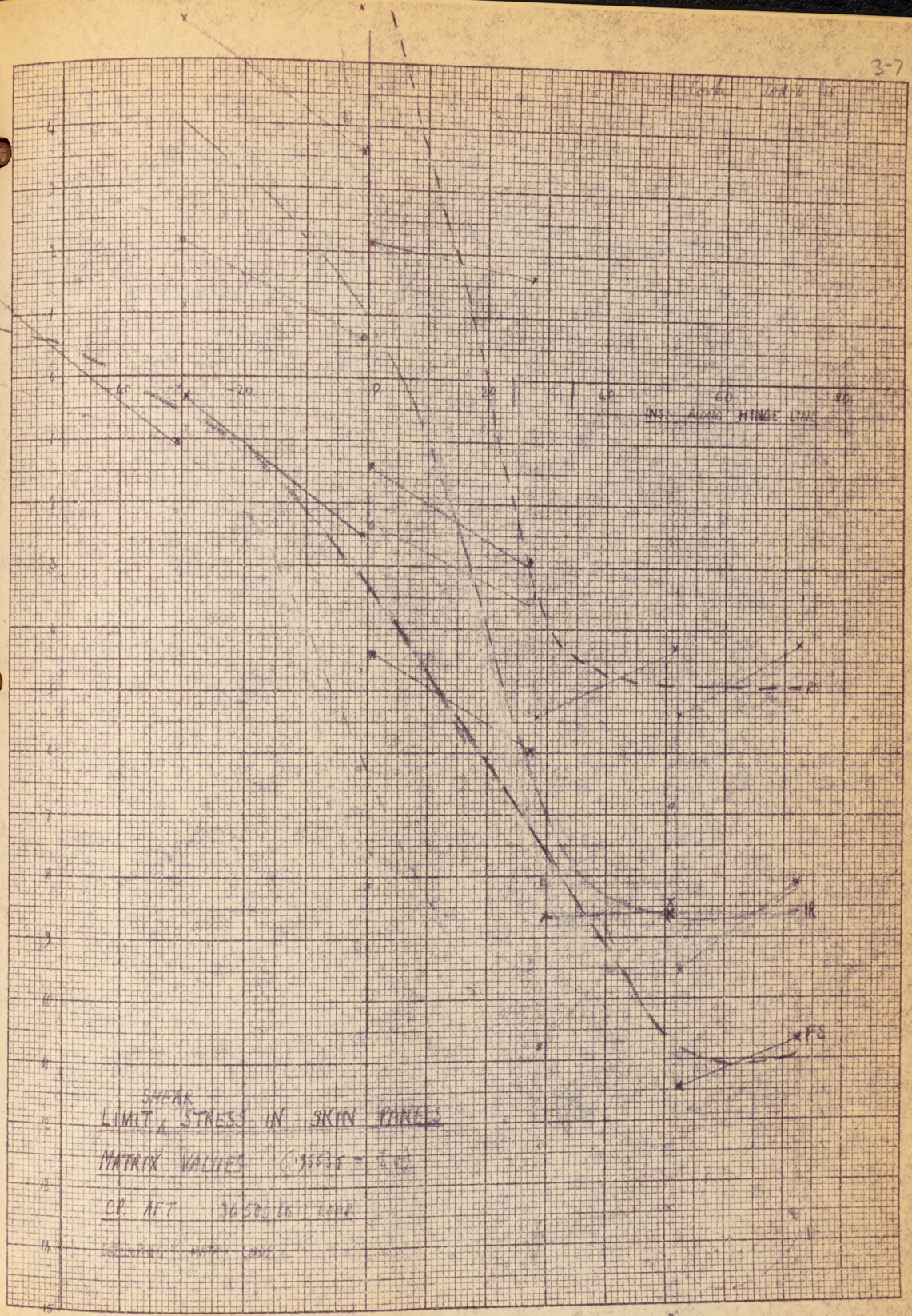
9	10	11	12	13	14	15	16	17	18	19
	STN INCHES FROM H.L	ult σ ksi	t_{in}	y_{in}	MOMENT PER INCH $\sigma t_y = M$		$G \times 1.03$ $\sigma_{ave\ ult}$	CORRECTED ULT END LOAD PER IN. $\sigma_{ave} \times t_{up}$		
	1·0	44·5	·210	2·51	23 500			9.350		
	3·5	44·5	·210	2·61	24 500			9.35		
	7·0	43	·210	2·75	24 900			9.050		
	13·0	40	·210 / ·218	2·95	24 700 / 25 700			8.650 / 8.910		
	25·0	37	·218	3·35	27 000			7.100		
	34·62	36·2	·248 / ·212	3·50	27 500 / 25 900			7.900 / 7.700		
	44·0	34·6	·212	3·50	25 700			7.330		
	52·62	32·0	·212 / ·152	3·35	22 700 / 16 300			6.800 / 4.860		
	61·0	28	·152	3·00	12 200			4.260		
	70·62	20	·152 / ·078	2·25	6 810 / 3 510			3.540 / 1.820		
	75	13	·078	1·5	1530			1.010		

A. Cook JAN 5 '54

LIMIT STRESS IN SKIN PANELS (HOLE)

MATRIX VALUES ADJUSTED TO 5 H SHR STRUCTURE





SHEAR
LIMIT STRESS IN SKIN PANELS

MATRIX VALUES

CL. AFT

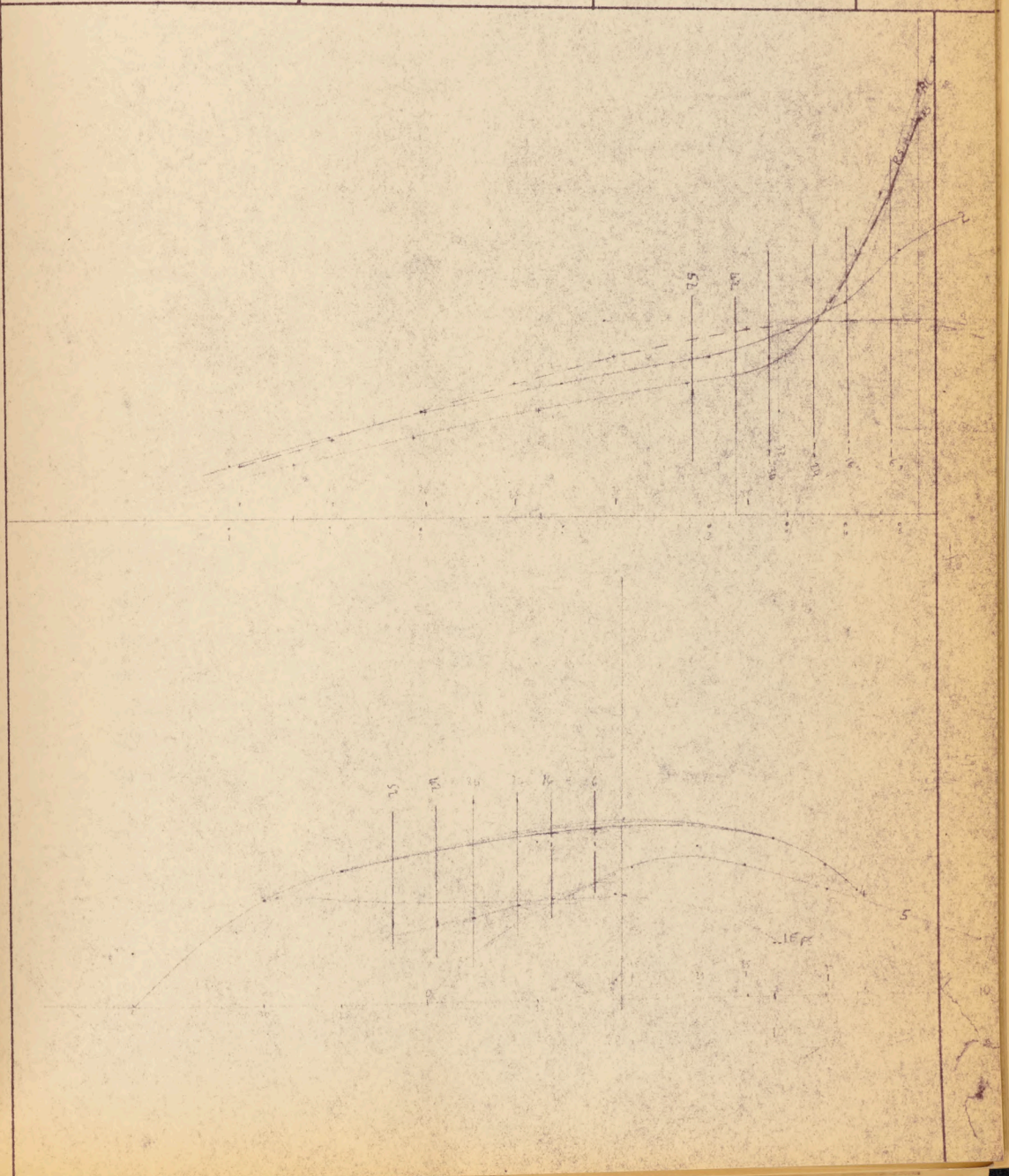
A.V.ROE CANADA LIMITED
MALTON – ONTARIO

TECHNICAL DEPARTMENT (Aircraft)

REPORT NO. _____

SHEET NO. 3-8

AIRCRAFT		PREPARED BY:	DATE:
C105	FIN σ_{ULT} STRESS ALONG SPARS (FROM STRESS MAP)	A Cooke	JAN 6
		CHECKED BY:	DATE:



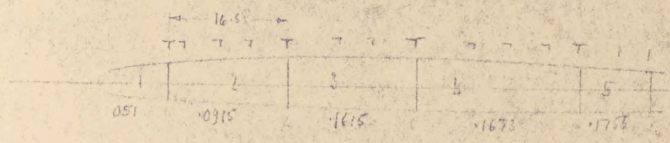
A.V.ROE CANADA LIMITED
MALTON – ONTARIO

TECHNICAL DEPARTMENT (Aircraft)

REPORT NO. 7/0583/1

SHEET NO. 3-9

AIRCRAFT		PREPARED BY:	DATE:
C105	FIN ROOT SHEARS STN X_{ann} 24·0 + 36·0	A Cooke	JAN 7 '56
		CHECKED BY:	DATE:



1	2	3	4	5	6	7	8	9	10	11
WEB No	b_F	t_F	$b_F t_F$	$b_R t_R$	$bt = 4·5$	$A_{STRINGER}$	$A_1 = 6+7$	$t_F b_R$ WEB	8-9	A_2
1 - 2	6	·051	·306	·755	1·061	·777	1·838	·051	1·787	1·674
2 - 3	8·25	·0915	·755	1·450	2·205	·979	3·184	·042	3·122	3·009
3 - 4	9·0	·1615	1·450	1·820	3·270	·979	4·249	·072	4·177	4·177
4 - 5	10·9	·1673	1·820	·830	2·650	·827	3·477	·056	3·421	3·421
5 - 6	4·75	·1755	·830	·430	1·260	·15	1·410	·025	1·385	1·385

	12	13	14	15	16	17	18	19	20	21
	σ_1 WEB	σ_2 WEB	$\sigma_1 A_1$	$\sigma_2 A_2$	$\frac{\sigma_1 A_1 - \sigma_2 A_2}{l}$	τ_{bend}	t	$\tau t \times 136$		16 + 20
1 - 2	18 000	16 000	33080	26784	700	-460	·0915	- 500	- 500	0
2 - 3	31 000	30 000	57970	90270	970	-640	·1615	- 1310	- 810	+ 160
3 - 4	36 500	35 600	155 000	149 [illegible]	700	-91[illegible]	·1673	- 2060	- 750	- 130
4 - 5	36 700	33 100	126 [illegible]	113 260	1400	-960	·1755	- 2290	- 230	+1 150
5 - 6	36 000	29 000	50 76[illegible]	40 165	1059				+ 2290	+ 3 349

		HEIGHT OF WEB	WEB SHEAR LBS
1		4·48	0
2		6·42	+ 1030
3		6·8	- 885
4		5·88	+ 6730
5		5·12	+17100

23 965

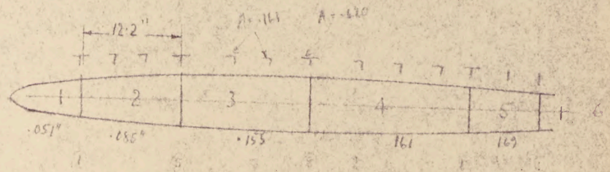
A.V. ROE CANADA LIMITED
MALTON – ONTARIO

TECHNICAL DEPARTMENT (Aircraft)

REPORT NO.	7/0563/1
SHEET NO.	3-10
PREPARED BY:	A. Cooke
DATE:	JAN 7 '56
CHECKED BY:	
DATE:	

AIRCRAFT: C 105

FIN ROOT SHEARS
STN $X_{A_{100}}$ 42.0 → 52.0



1	2	3	4	5	6	7	8	9	10	11
WEB Nº	b_F	t_F	$b_F t_F$	$b_R t_R$	$bt = 4+5$	$A_{spar\ caps}$	$A_1 = 6+7$	(b_F+b_R) ·0.006	8 − 9	A_2
1 - 2	6	·051	·306	·519	·825	·581	1·406	·022	1384	1·279
2 - 3	6·1	·085	·519	1·400	1·919	·762	2·661	·054	2·607	2·502
3 - 4	9·0	·155	1·400	1·760	3·160	·822	3·982	·072	3·910	3·910
4 - 5	10·9	·161	1·760	·800	2·560	·711	3·271	·056	3·215	3·215
5 - 6	4·75	·169	·800	·420	1·220	·150	1·370	·025	1·345	1·345

b_R 2.5"

7·25 × ·169 = 1·23

	12	13	14	15	16	17	18	19	20	21
	σ_1	σ_2	$\sigma_1 A_1$	$\sigma_2 A_2$	$\frac{\sigma_1 A_1 - \sigma_2 A_2}{\ell}$	τ	t	$\tau t \times 1.36$	q	q
1 - 2	14,300	12 200	20,100	1560	510	11 600	·085	−1340 K	−1340 K	− 700
2 - 3	28,600	27 000	76,100	6755	1050				−1160 K	− 600
3 - 4	34,800	33 100	138,000	1300	800	11 900	·155	+2500 K (−1300)	+ 620 K	+ 322
4 - 5	31 400	29 400	104,000	94[illegible]	900	8600	·161	−1880 K	+ 640 K	+ 335
5 - 6	26,400	25 1[illegible]	36,000	[illegible]	260	5400	·169	−1240 K	+ 1240 K	+ 644

	SPAR WEB TAPER	P_v	HEIGHT OF WEB	WEB 4 SHEAR lb/in	WEB SHEAR
1-2	·0083	117[illegible]	4·45	−190	− 850
2-3	·0190	14 80	6·10	+450	+2 750
3-4	·0110	15 20	6·70	+1122	+ 7 520
4-5	·0082	8 40	5·90	+1 235	+ 7 290
5-6	·0082	3 00	5·15	+ 904	+ 4 650

ΣP_v = 4310 lb

$2P_v$ = 8620

21,360 lbs
8 620
Shear reaction 29,980 lbs

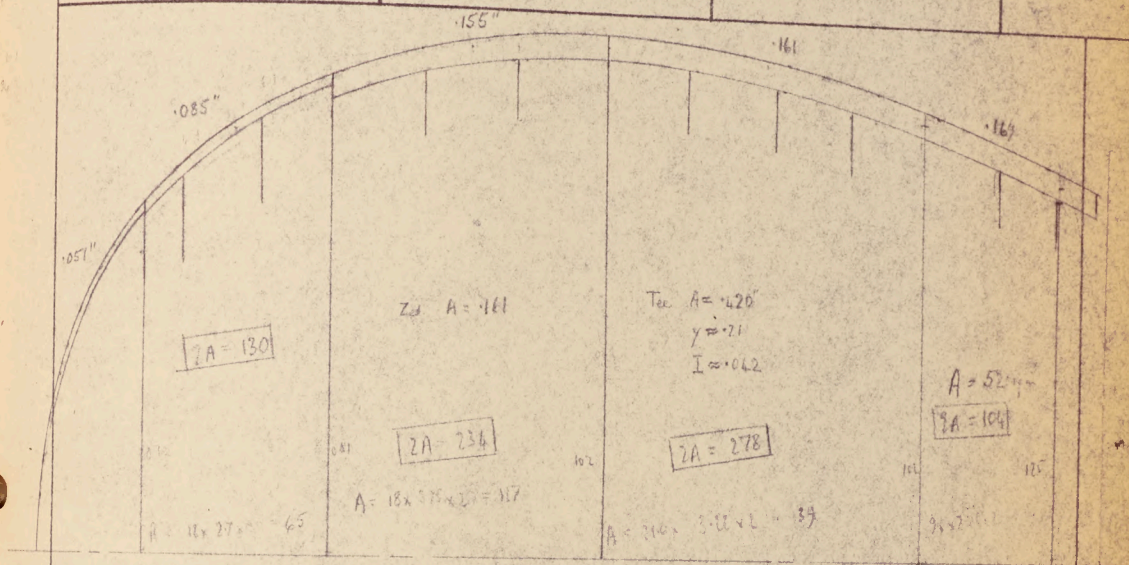
Applied shear = 32 000 lb

A.V. ROE CANADA LIMITED
MALTON — ONTARIO

TECHNICAL DEPARTMENT (Aircraft)

REPORT NO. 7/0582/1
SHEET NO. 3-11

AIRCRAFT	C 105	FIN RIB AT x_{ave} 42·00. SECTION PROPERTIES.	PREPARED BY: A. Cooke.	DATE: JAN 10 '58
			CHECKED BY:	DATE:

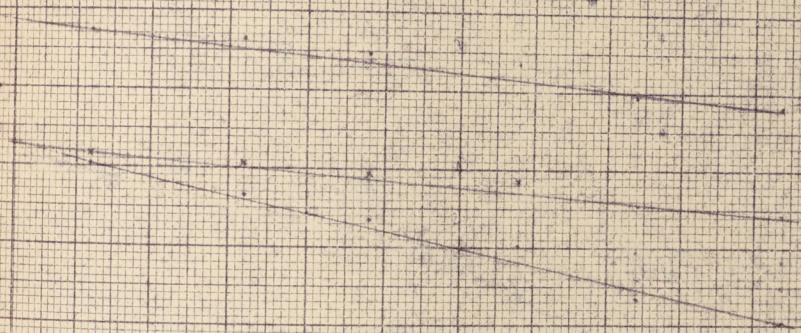


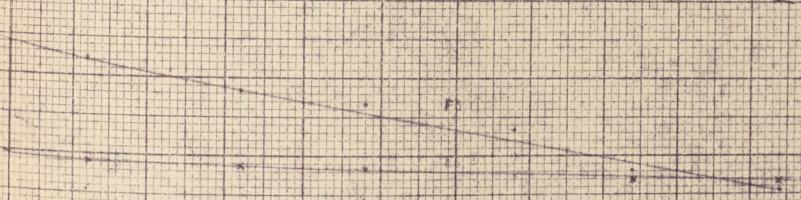
C105 FIN

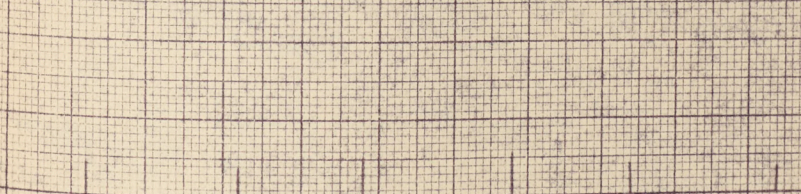
SHT. 3-12

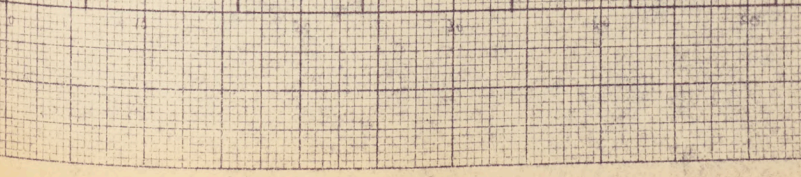
Alaska JAN 1955

SKIN & SPAR AREAS FOR FIN ROOT FAIRING WITH TAPERED TOPS & ZEDS





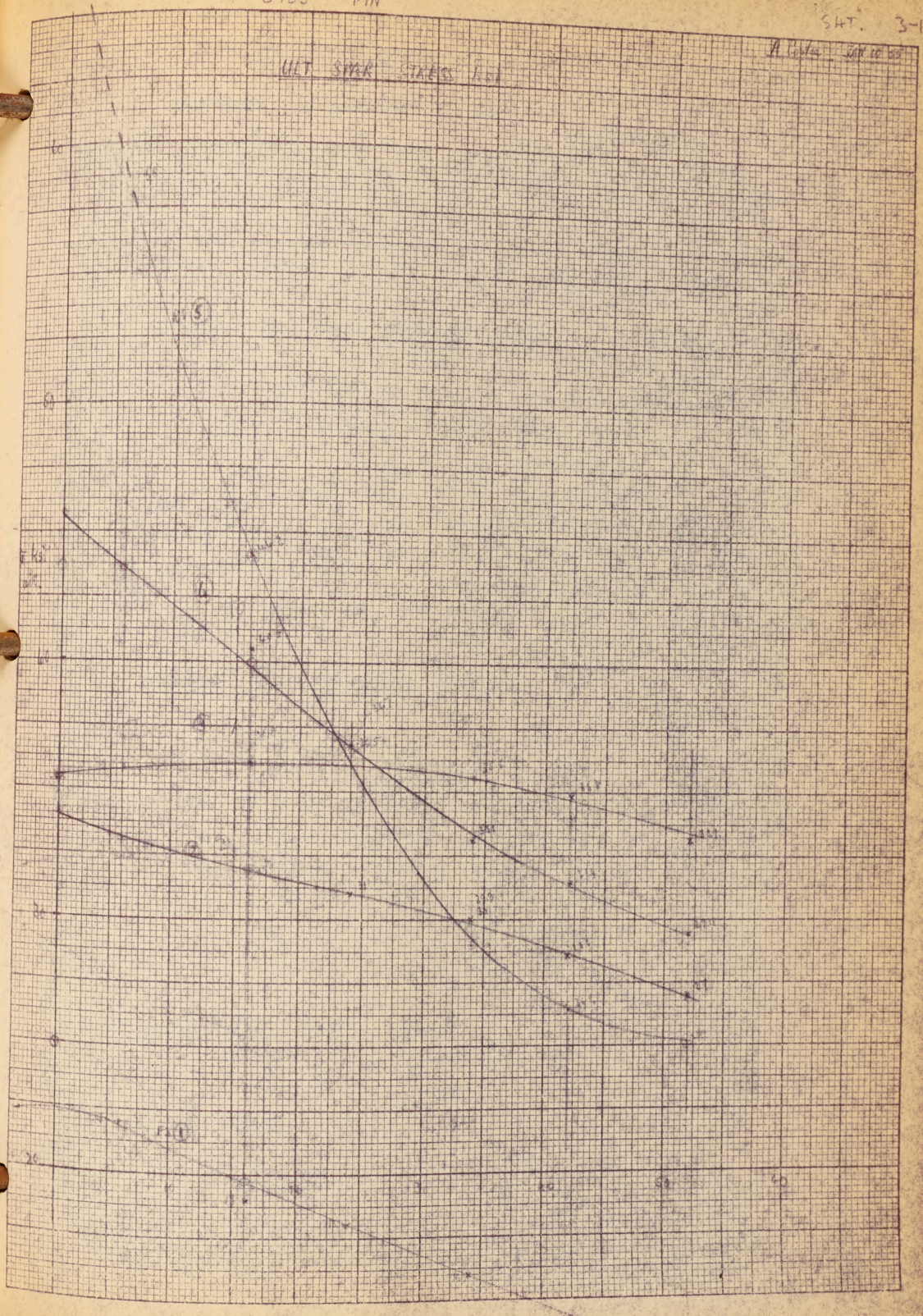




C105 FIN

SHT. 3-13

ULT SMAX STRESS FIN



KEUFFEL & ESSER CO. MADE IN U.S.A. 359-12 10 X 10 TO THE ½ INCH

A.V.ROE CANADA LIMITED
MALTON – ONTARIO

TECHNICAL DEPARTMENT (Aircraft)

REPORT NO. _____
SHEET NO. 3-14

AIRCRAFT	C105	FIN ROOT SHEARS STN 6 → 16	PREPARED BY: A Cooke	DATE: JAN 14 '55
			CHECKED BY:	DATE:

TO DETERMINE FACTOR k FOR HT TO GIVE CORRECT TORQUE.

MOMENT OF SHEAR FLOW – IN WEBS

MOMENT OF VERT. COMPT SPAR END LOAD

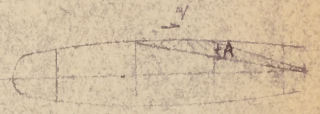
WEB No	S	Flx+Fb S'	WEB DEPTH Y	MOMENT ARM x	xq	Sxq	Syq	SPAR WEB TAPER ⊥R	Py	Px
1-2	840	−920 k	80	76	380	319 200	−349 600	·0157	727	55 350
2-3	880	−310 k	7·2	52·62	279	333 520	−117 490	·0157	1775	100 500
3-4	600	+930 k	7·3	34·62	252·7	151 620	+235 010	·0196	1880	65 790
4-5	2500	+505 k	6·3	13·0	81·9	204 750	+41 360	·0028	1350	17 000
5-6	2100	−198 k	5·2	3·5	78·2	38 220	−3 604	·0042	690	2 600
						1 047 310	−194 324K		6422	234 940

ΣPx 12 864 ΣPy 466 680

MOMENT OF SHEAR FLOW IN SKINS.

	A	q	A₀ Σq
A_1 = 6·75 × 21	141·75	− 920 k	130 454
A_2 = 3·72 × 18	66·96	− 1230 k	82 361
A_4 = 2·82 × 21·5	60·63	− 305 k	18 492
A_5 = 2·50 × 13	32·50	+ 198 k	+ 6 635
			− 224 874K

2 ΣAq 449 748K



MOMENT DUE TO TAPER OF F/S (No 16)

P_x = −46 200 × ·2374 × 5·0

P_x = −55 000 #

TOTAL EXTERNAL MOMENT = 501 680
BY CBT

1047,310 − 194 324K + 466 680 − 55000 = 449 748 K = 501 000

− 449 072 K = −959 790

K = 1·48

A.V. ROE CANADA LIMITED
MALTON – ONTARIO

TECHNICAL DEPARTMENT (Aircraft)

REPORT NO.
SHEET NO. 3-15

AIRCRAFT C105

FIN ROOT SHEARS
(15) 42.0

PREPARED BY: A Cooke
DATE: JAN 14 '55

CHECKED BY:
DATE:

To DETERMINE FACTOR 'k' FOR kT TO GIVE CORRECT TORQUE

MOMENT OF SHEAR FLOW IN WEBS

WEB No	S		WEB DEPTH y	MOMENT ARM x	xy	S.xy	P_v	$P_v x$	
1 - 2	510	-1340k	4.0	64.5	285	144,000 - 380 000k	170	11,000	
2 - 3	1050	-11[illegible]k	6.0	52.62	315	331 000 - 366 000k	1480	77,900	
3 - 4	800	+620k	6.6	34.62	229	183 [illegible] + 142 000k	1520	53,[illegible]	
4 - 5	900	+1140k	5.6	13.0	73	65 500 + 46 [illegible]k	840	10,900	
5 - 6	260	+1240k	5.0	3.5	17.5	4 500 + 21 600k	300	1,050	

728 000 - 536 000k

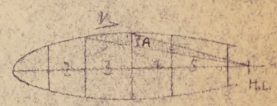
$\Sigma P_v x$ = 154,000
$\Sigma 2 P_v x$ = 308 000 ✓

MOMENT OF SHEAR FLOW IN SKINS

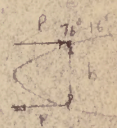
	A	q	$A_q = \frac{1}{2}T$
A_1 = 12.2 x 6.35	77.5	-1340K	-104,000 k
A_2 = 18 x 3.90	70.1	-2500K	-176,000 k
A_4 = 21.8 x 2.65	58	-1880K	-109,100 k
A_5 = 9.5 x 2.35	22.3	-1240K	-27 600 k
		ΣA_q	-416 600 k
		$\Sigma 2A_q = T$	-833 200

728 000 956 100

728,000 – 1 369 000 k



Total moment by EBT = 308500 lb. 32 900 all shear force lb.



Moment due to taper of FS

P = -14 300 x .2374

M = -3 400 x 4.4 = -15,000 lb in

728 000 + 308 000 – 15 000 – 1369,000 k = 308 500

712 500 = 1 369 000 k

$k = \frac{712\ 500}{1\ 369\ 000}$

k = ·52

A.V. ROE CANADA LIMITED
MALTON – ONTARIO

TECHNICAL DEPARTMENT (Aircraft)

REPORT NO. 7/0583/1
SHEET NO. 3-16

AIRCRAFT	C 105	FIN ROOT SHEARS. MATRIX SHEAR CORRECTION	PREPARED BY: A Cooke	DATE: JAN 17 '55
			CHECKED BY:	DATE:

STN X_{R110} 16·0 → 24·0

MOMENT OF SHEAR FLOW IN WEBS

WEB N°	$\frac{\sigma_A \cdot t_A}{t_s} S$	$T' \times 10^4$ S'	WEB DEPTH y	MOMENT ARM x	xy	S_{xy}	S'_{xy}	SPAR WEB TAPER + 10	P_y	$P_y x$
1 - 2	700	−1070 k	4·48	72·5	324·8	227,400	−347 536k	·018	680	49,300
2 - 3	300	− 570 k	7·0	52·62	368·3	331,470	−209 931k	·018	1880	98,925
3 - 4	690	+730 k	7·1	34·62	245·8	169,600	+179 434k	·0123	2080	69,240
4 - 5	1750	+425 k	6·1	13·0	79·3	138,770	+ 33 703k	·0068	1170	15,210
5 - 6	1500	+485 k	5·16	3·9	18·06	27,090	+ 8 759k	·0032	518	1,813
R3						894,330	−335 570k		6248	234,488
									ΣP_x = 12496	468,976

MOMENT OF SHEAR FLOW IN SKINS.

	A	q	$A_q = qT$
A_2 = 6·75 × 19·0	128	− 1070	−137 000 k
A_3 = 3·9 × 18	70	− 1640	− 115 000 k
A_4 = 2·75 × 21·5	59	− 910	− 54 000 k
A_5 = 2·5 × 13	32·5	− 485	− 15 800 k
			−321 800 k

ΣA_q = −643 600 k

T_{y_1} = 325 000 × ·136 = 440 000
F = 27 2[illegible] × ·136 = 37 000 lbs

τ	t	$\tau t \times 10^4$	S_{xy} or S'_{xy}	S_{xy} or S'_{xy}
−8300	·075	− 1070 k		−1070 k
−7300	·165	− 1640		− 570 k
−3900	·171	− 910 k		+ 730 k
−2000	·175	− 485 k		+ 425 k
				+ 485 k

$894\,330 - 335\,570k - 643\,600k + 468\,976 - 40\,000 = 440\,000$

$883\,306 = +979\,170k$

$k = \frac{883}{979} = \underline{\underline{\cdot 91}}$

MOMENT DUE TAPER AT F.S.

P_y = 37 800 × ·2374 × 6·48
P_x = −40 800 lbs

A.V. ROE CANADA LIMITED
MALTON – ONTARIO

TECHNICAL DEPARTMENT (Aircraft)

REPORT NO.	7/0583/1
SHEET NO.	3-17
PREPARED BY:	A Cooke
DATE:	JAN 18 '55
CHECKED BY:	
DATE:	
AIRCRAFT	C 105

FIN ROOT SHEARS
MATRIX SHEAR CORRECTION

STN X_{RAD} 24 → 34

MOMENT OF SHEAR FLOW IN WEBS

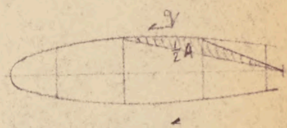
WEB Nº	S	S' (T t×1.36)	WEB DEPTH y	MOMENT ARM x	xy	S_{xy}	S'_{xy}	SPAR WEB TAPER	P_v	$P_v x$
1 - 2	700	-1 190 k	4.48	69.12	309.66	216 760	-368 690 k	·02	662	46 000
2 - 3	970	- 800 k	6.42	52.62	337.82	327 660	-270 260 k	·02	1940	102 000
3 - 4	700	+ 630 k	6.80	34.62	235.4	166 780	+148 300 k	·0147	2200	76 200
4 - 5	1400	+ 410 k	5.88	13.0	76.44	107 020	+ 31 360 k	·0082	1040	13 500
5 - 6	1059	+ 950 k	5.12	3.5	17.92	18 977	+ 17 020 k	·0082	415	1460
						835.197	-442 090k		6257	239 160

$2P_{vx}$ 478 320

MOMENT OF SHEAR FLOW IN SKINS.

		A	q	$A_q = \frac{1}{2}T$
A_1	6.75 × 16.5	111	-1 190 k	-132 000 k
A_3	3.95 × 18	71	-1 990 k	-141 000 k
A_4	2.75 × 21.5	59	-1 360 k	- 80 000 k
A_5	2.5 × 13	32.5	- 950 k	- 31 000 k
				-384 000 k

$\Sigma 2A_q = -768\ 000\,k$



$T_{34} = 390\ 000$ lb.in

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

$$-1\ 210\ 090\,k \quad = -889\ 320$$

$$k = \cdot 733$$

T	t	q with shr. T t × 1.36	Spar web q
-9600	·0915	-1,190 k	-1 190 k
-9100	·1615	-1,990 k	- 800 k
			+ 630 k
-6000	·1673	-1,360 k	+ 410 k
-4000	·1755	- 950 k	+ 950 k

MOMENT DUE TAPER OF FS

$P_x = -32\ 200 \times \cdot 2374 \times 4.48$

$P_z = -34\ 200$ lb.in

A.V.ROE CANADA LIMITED
MALTON – ONTARIO

TECHNICAL DEPARTMENT (Aircraft)

REPORT NO. 7/0583/1
SHEET NO. 3-18

AIRCRAFT: C 105

FIN ROOT SHEARS
MATRIX SHEAR CORRECTION

PREPARED BY: A Cooke
DATE: JAN 18 '55
CHECKED BY:
DATE:

STN 0 → 6

WEB No	S'	xy	S' xy	
1 – 2	−720 k	380	− 273 600 k	−5000
2 – 3	− 10 k	379	− 3 790 k	−3000
3 – 4	+966 k	253	+ 244 400 k	+1600
4 – 5	+ 604 k	82	+ 49 530 k	+4400
5 – 6	− 840 k	18.2	− 15 290 k	
			+ 1 250 k	

τ	t	q ult. lb/in τt × 1.36	[illegible] web q
−5 400	.098	−720 k	−720 k
−3 200	.168	−730	− 10
+1 000	.174	+ 236	+966
+3 400	.182	+840	+604
			− 840

MOMENT DUE TO TAPER OF F.S.

$P_x = 46\,200 \times .2374 \times 5.0$

$P_x = -55\,000$ lb in

	A	q	$A_q = \frac{1}{2}T$
A_2 6.75 × 21	141.8	−720 k	−152 000 k
A_3 3.72 × 18	66.96	−730 k	− 48 800 k
A_4 2.82 × 21.5	60.6	+ 236	+ 14 300 k
A_5 2.50 × 13	32.5	+ 840	+ 27 000 k
			− 109 500 k

$\Sigma 2A_q = -219\,000$ k lb in

$2P_{x} = 468\,480$ lb in

$S_{xy} = 1,047,310$ lb in

$T_c = 501,000$ lb in

[illegible]

1047,310 + 468,480 − 501,000 − 55,000 = +217 750 k

959 790 = 217 750 k

K = 4.4

[illegible]

959 790 = 132 500 k

7.2 = K

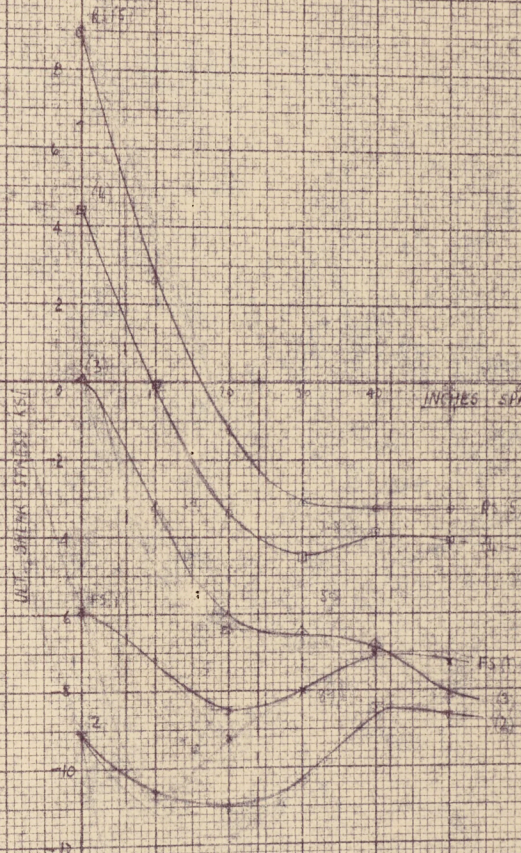
C 105 FIN.

3-19

A Cook JAN 19 65

ULT. SKIN PANEL SHEAR STRESS

CORRECTED FROM MATRIX VALUES & GAGE TORQUE EXP. TUBE



A.V. ROE CANADA LIMITED
MALTON – ONTARIO

TECHNICAL DEPARTMENT (Aircraft)

REPORT NO. _____

SHEET NO. 3-20

AIRCRAFT		PREPARED BY:	DATE:
C 105	FIN ROOT SHEARS STN 0→6	A. Cooke.	JAN 20 '55
		CHECKED BY:	DATE:

T	t	Tt x 136	Spread y	ay	Moment of shear flows about axis	A	A_y
-5000	1098	-670 k	-670 k	380	+255 000	141·8	-95,000
-3000	168	-684 k	-14 k	379	- 5,300	66.96	-45,600
+1480	176	+325 k	+1019 k	253	+256,000	60·6	+20,300
+6400	182	+1090 k	+755 k	82	+ 62,000	32·5	+35,500
			-1090 k	18·2	- 19,800		
				T_{xx}	+ 37,900 k	ΣA_y	-85,200

$T = 2A_y$ -170,600

-132,500 k

A.V.ROE CANADA LIMITED MALTON – ONTARIO **TECHNICAL DEPARTMENT (Aircraft)**		REPORT NO. SHEET NO. 3-21	
AIRCRAFT C 105	FIN ROOT SHEARSTRESS WEBS	PREPARED BY: A Cooke	DATE: JAN 19 55
		CHECKED BY:	DATE:

6·0 → 16 k = 1·48 of Jan 6th & graph Jan 5th

WEB Nº	S	S'	S_T WEB SHEAR FLOW	WEB DEPTH	WEB t
1 – 2	840	− 1360	− 520	5·0 5·1	
2 – 3	880	− 460	+ 420	7·2	
3	600	+ 1380	+ 1 980	7·3	
4	2500	+ 750	+ 3 250	6·3	
5	2100	− 294	+ 1 806	5·2	

0 – 6 k = 1·27 of Jan 18.

WEB Nº	S	S'	S_T WEB SHEAR FLOW	WEB DEPTH	ULT SHEAR FORCE	
						3050
1	840	−920	− 80	5·0 5·1		11,400
2	880	− 14	+ 866	7·2		12,000
3	600	−1230	− 630	7·3		6,050
4	2500	+ 770	+3 270	6·8		13,510
5	2100	−1070	+ 1 030	[illegible]		11,500
	5410		+ 6340			

57,500 ult. F. see Jan 27th.

F = 29·3 × 1·36
= 39·9

16 → 24 k = ·91

WEB Nº	S	S'	S_T WEB SHEAR FLOW	WEB DEPTH	ULT SHEAR FORCE
1	700	− 970	−270	4·5	− 1 220
2	900	− 520	+ 380	6·7	2 550
3	690	+ 660	+ 1350	7·0	9 500
4	1750	+ 385	+ 2135	5·92	12 600
5	1500	+ 440	+ 1940	5·25	10,200

ΣF = 33 630 (90%

F = 27·8 × 1·36
= 37·7

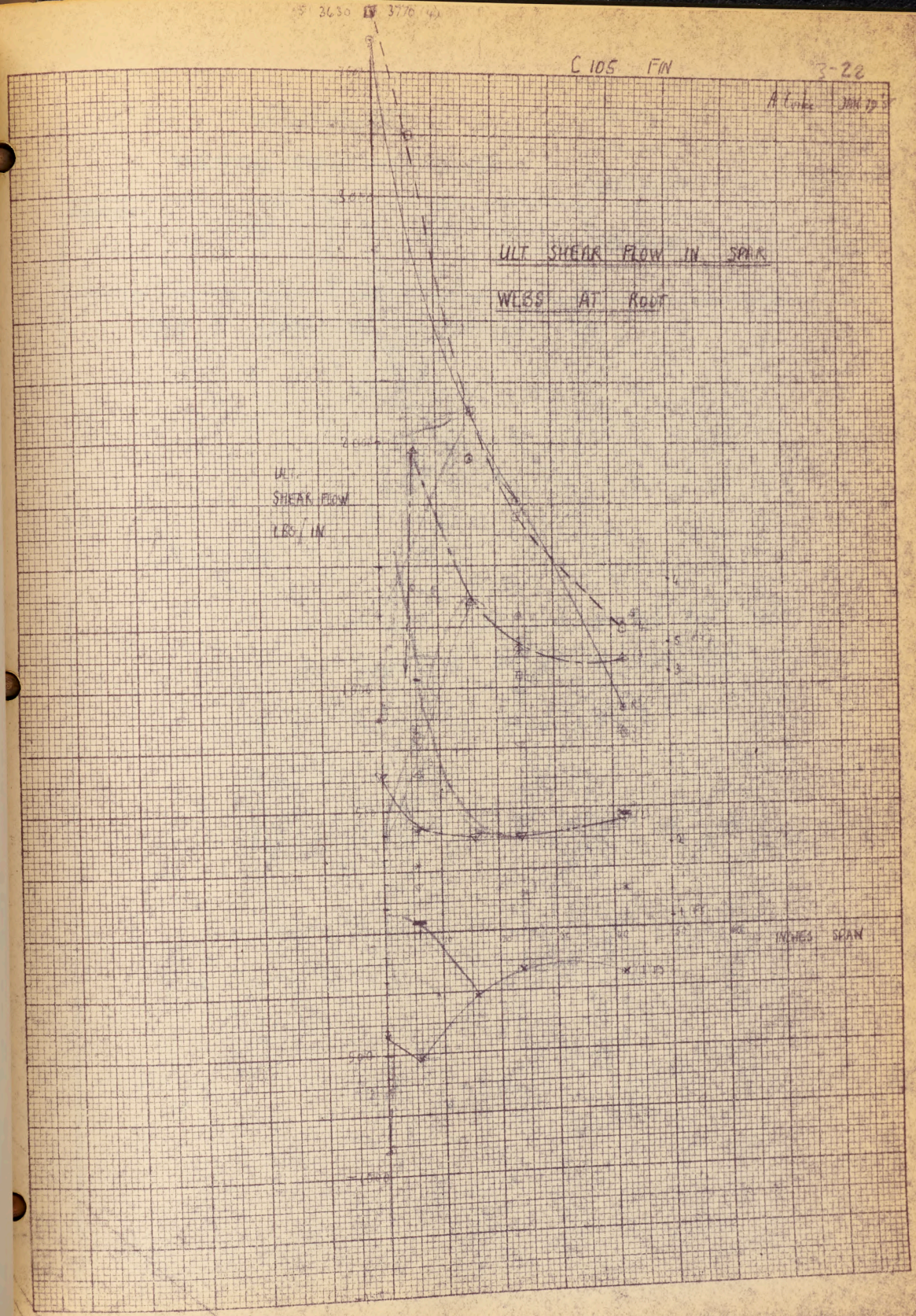
24 → 34 k = ·733 of Jan 18

WEB Nº	S	S'	S_T WEB SHEAR FLOW	WEB DEPTH	ULT SHEAR FORCE
1	700	− 870	−170	4·4	− 750
2	970	− 590	+380	6·37	2 410
3	700	+ 460	+ 1160	6·77	7 840
4	1400	+ 300	+ 1700	5·82	9 900
5 6	1059	+ 700	+ 1 759	5·1	9 000

ΣF = 28 400 78%

F = 26·6 × 1·36
= 36·6

C 105 FIN 3-28

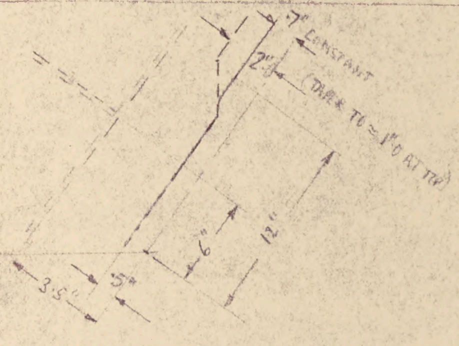

ULT SHEAR FLOW IN SPAR WEBS AT ROOT
ULT. SHEAR FLOW LBS/IN
INCHES SPAN

A.V. ROE CANADA LIMITED
MALTON – ONTARIO

TECHNICAL DEPARTMENT (Aircraft)

REPORT NO. 7/0583/1	SHEET NO. 3-23	
AIRCRAFT C 105	FIN. ROOT SHEARS. STN 0 → 6.	
PREPARED BY: A. Corke	DATE: JAN 19 '55	
CHECKED BY:	DATE:	

AREA OF REAR SPAR + EFFECTIVE SKIN



FOR S.A. CALCS SKIN WIDTHS AT REAR SPAR TAKEN AS

4·75" FORWARD & 2·5" AFT OF SPAR DATUM + ·15" CAP AREA

∴ at Stn 0. t = 6 × ·0038 + ·122 = ·18415

Area = 7·25 × ·18415 + ·15

= 1·3351 + ·15

Area = 1·485 sq in

A.V.ROE CANADA LIMITED
MALTON – ONTARIO

TECHNICAL DEPARTMENT (Aircraft)

REPORT NO. 7/0583/1

SHEET NO. 3-24

AIRCRAFT		PREPARED BY:	DATE:
C105	FIN ROOT SHEAR STRESS WEBS	A Cooke	JAN 19 '55
		CHECKED BY:	DATE:

STN. 42·0 k = ·52

WEB No	S	S'	S_T WEB SHEAR FLOW	S	WEB SHEAR FLOW	h	F
1	510	− 700	−190	690	−10	4·2	−42
2	1050	− 600	+450	960	+ 360	5·7	2 050
3	800	+ 320	+1120	750	+ 1070	6·35	6 800
4	900	+ 333	+1233	710	+ 1440	5·5	7 900
5	260	+ 643	+ 303	260	+ 1200	4·8	5 800

ΣF 22500 ✓

STN. 0 k 1·27

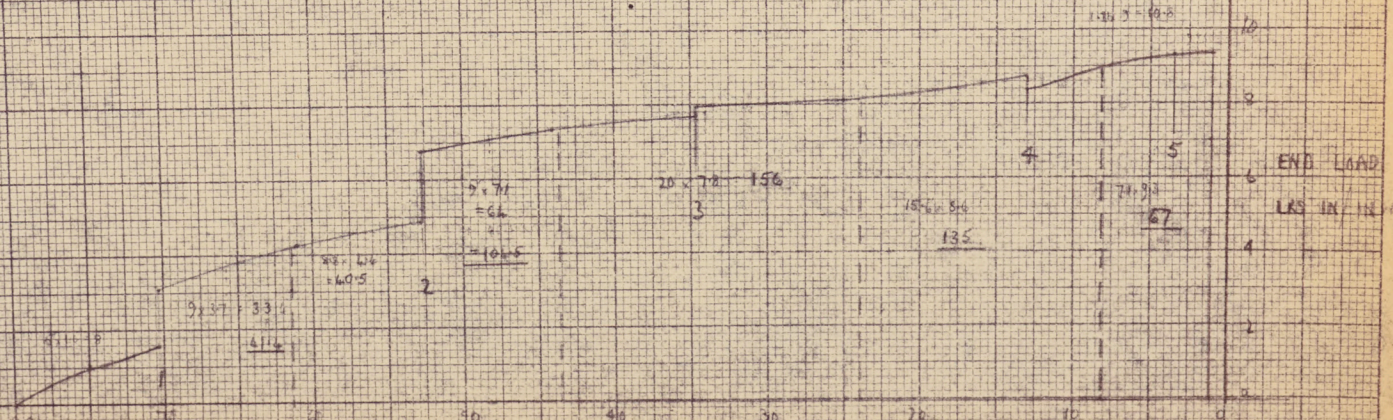
k 3·6

WEB No	S	S'	S_T WEB SHEAR FLOW	S'	S_T
1	500	−920	−420	− 2600	− 2180
2	660	− 19	+ 646	− 36.	+ 620
3	330	−1230	−900	+ 3450	+ 3780
4	3000	+ 770	+ 3770	+ 2170	+ 5170
5	4700	−1070	+ 3630	− 3000	+ 1700

23700 × 1·36 = 32 000.

C 105 FIN

G_{xy} = CORRECTED UNIT END LOAD PER INCH AT SIN P.E

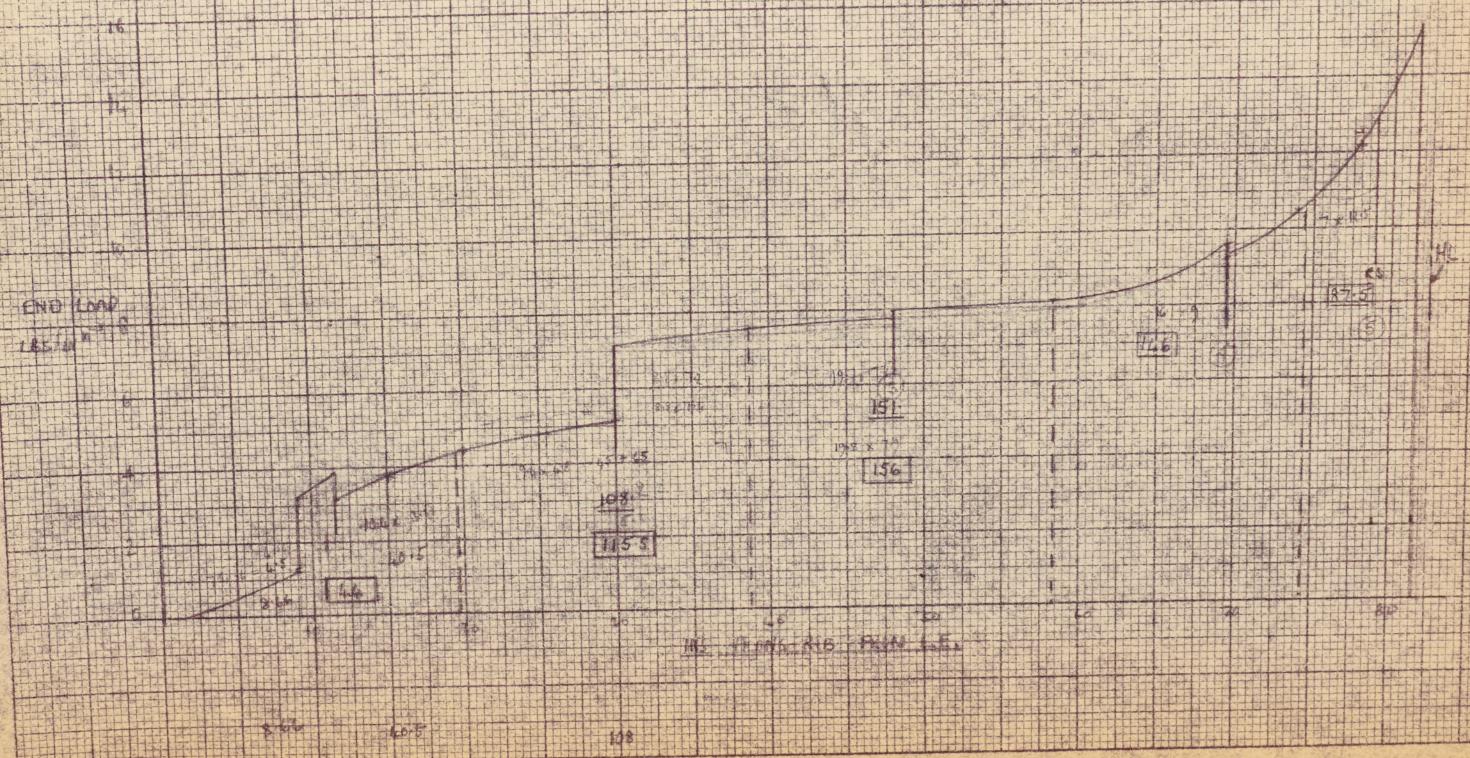


C 105 FIN

A. Cook JAN 21 '55

σ_{cor} = CORRECTED ULT END LOAD PER INCH

AT STN 6.0"



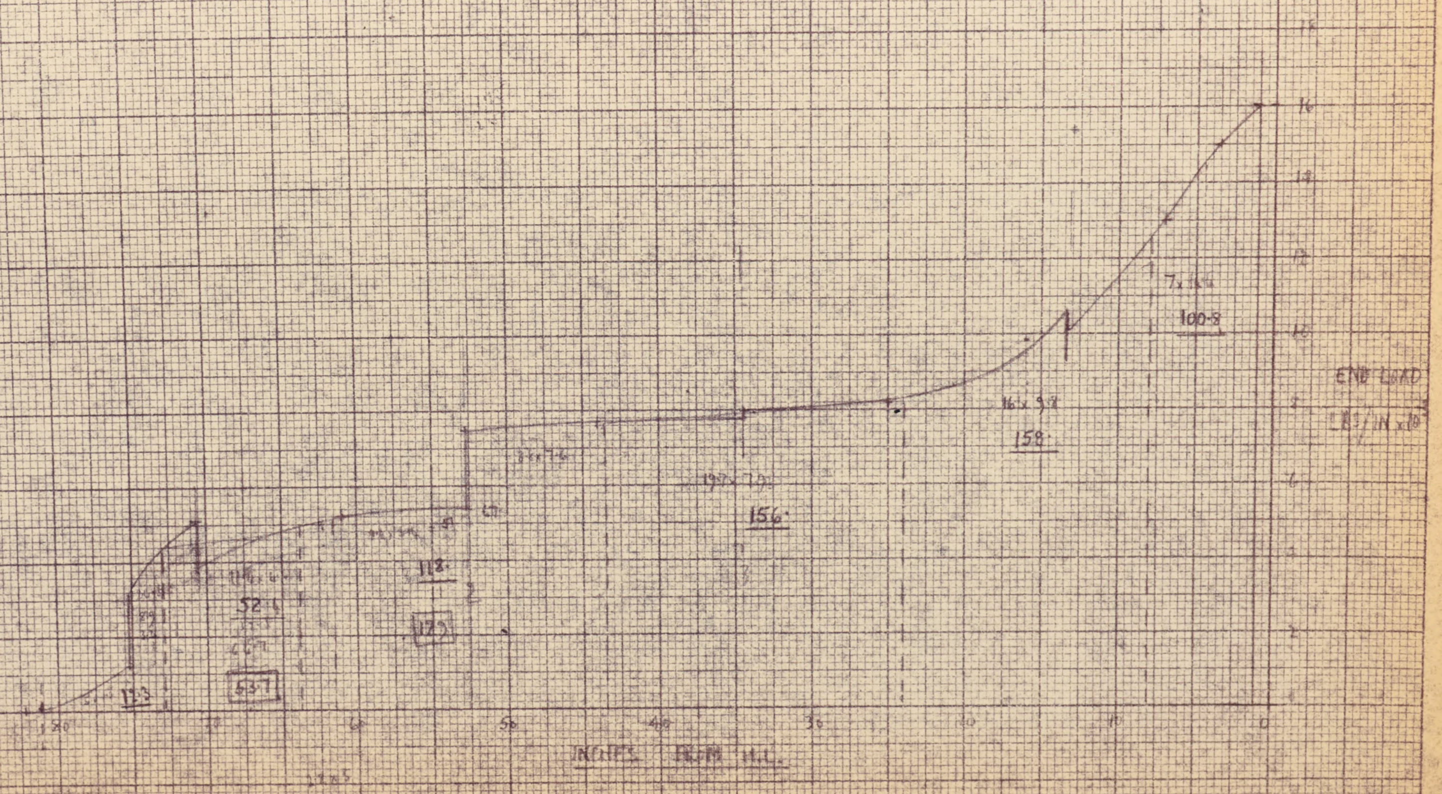
3-26

C 105 FIN

A. Cotton JAN 31 '55

$\sigma_{ult} \times t$ = CORRECTED ULT END LOAD PER INCH

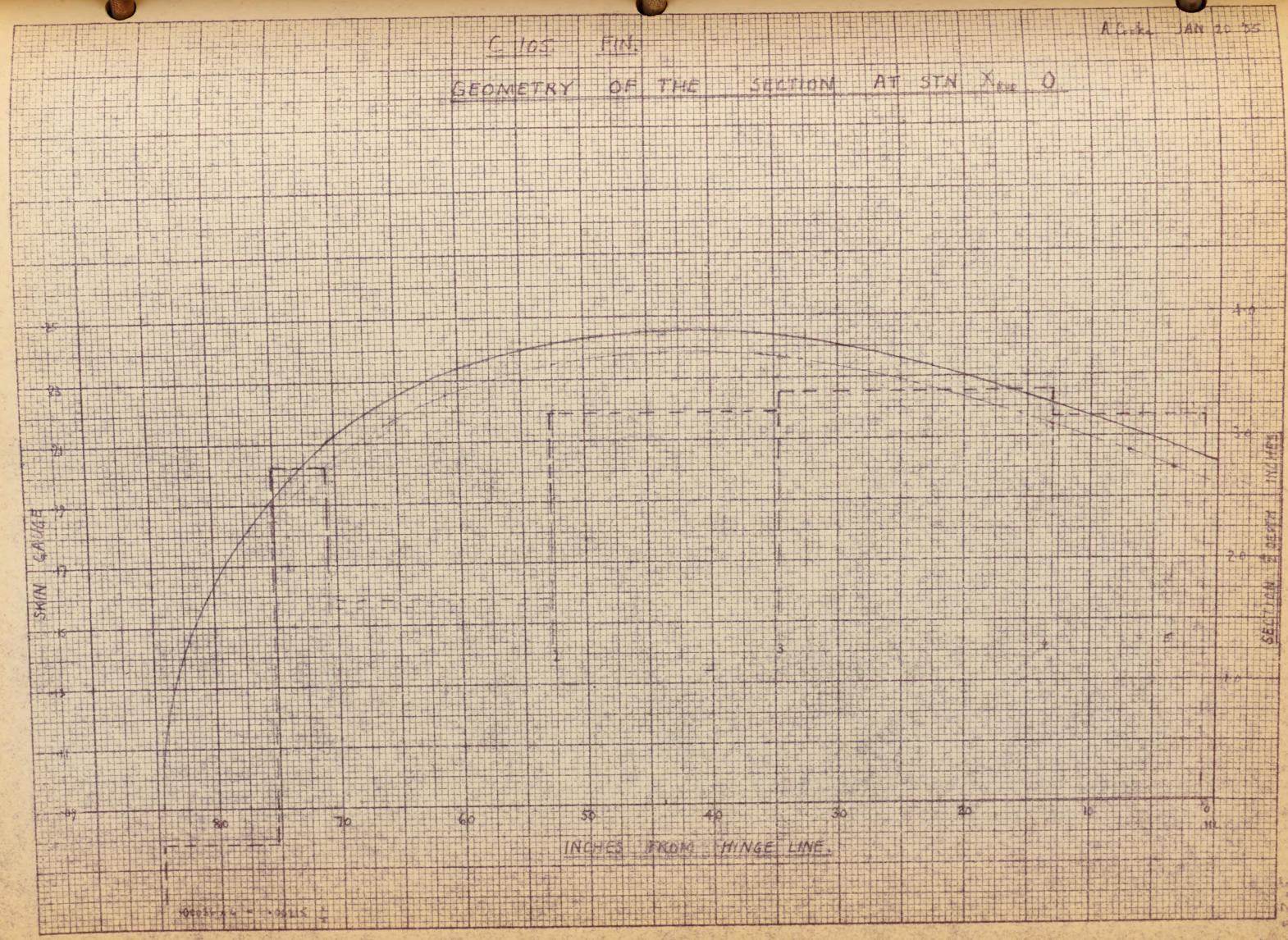
STN 0



C 105 FIN

GEOMETRY OF THE SECTION AT STN X_{FUS} 0

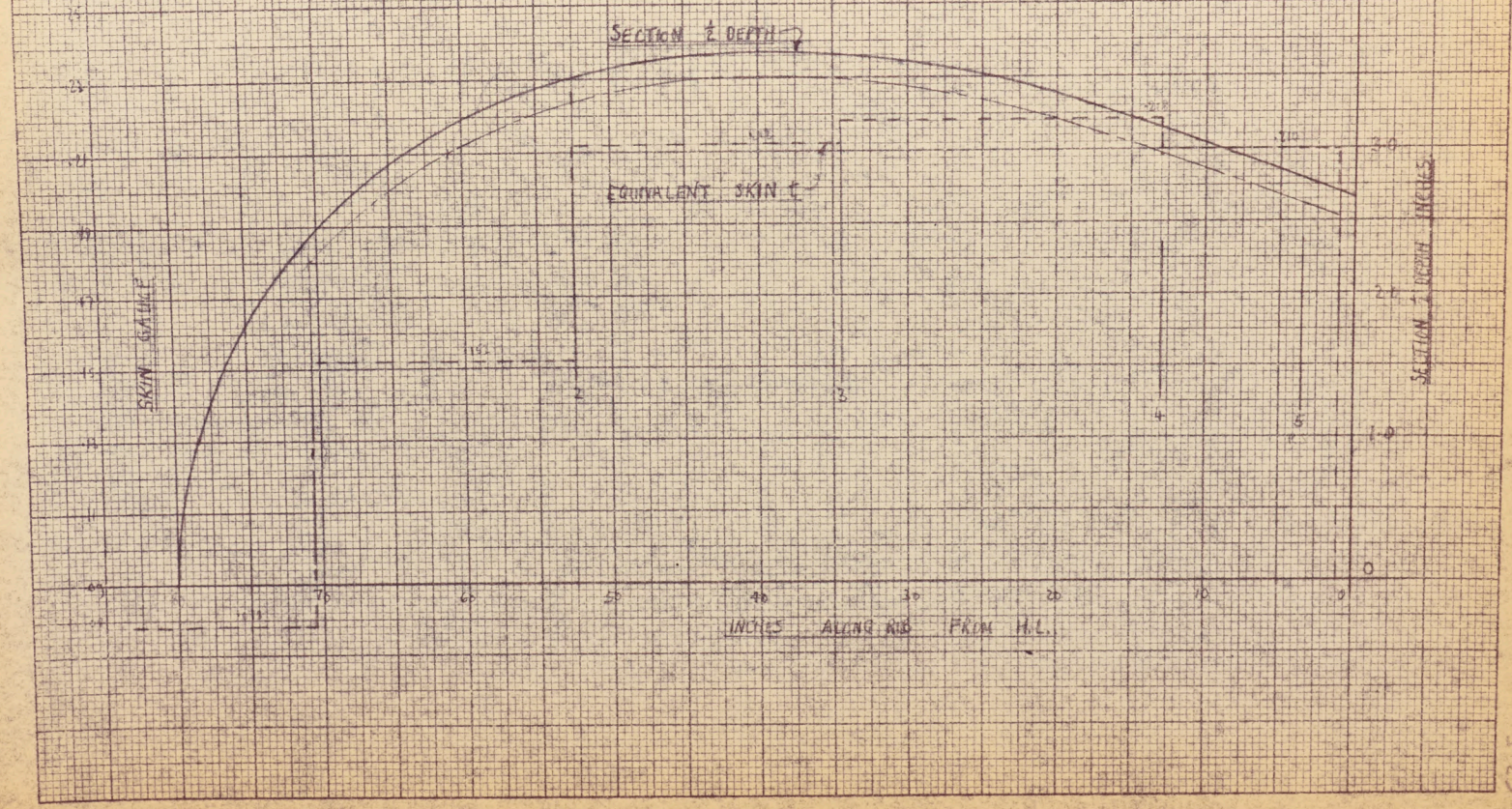
A.C.L. JAN 20 '55



AC 1166 JAN 24 55

C105 FIN

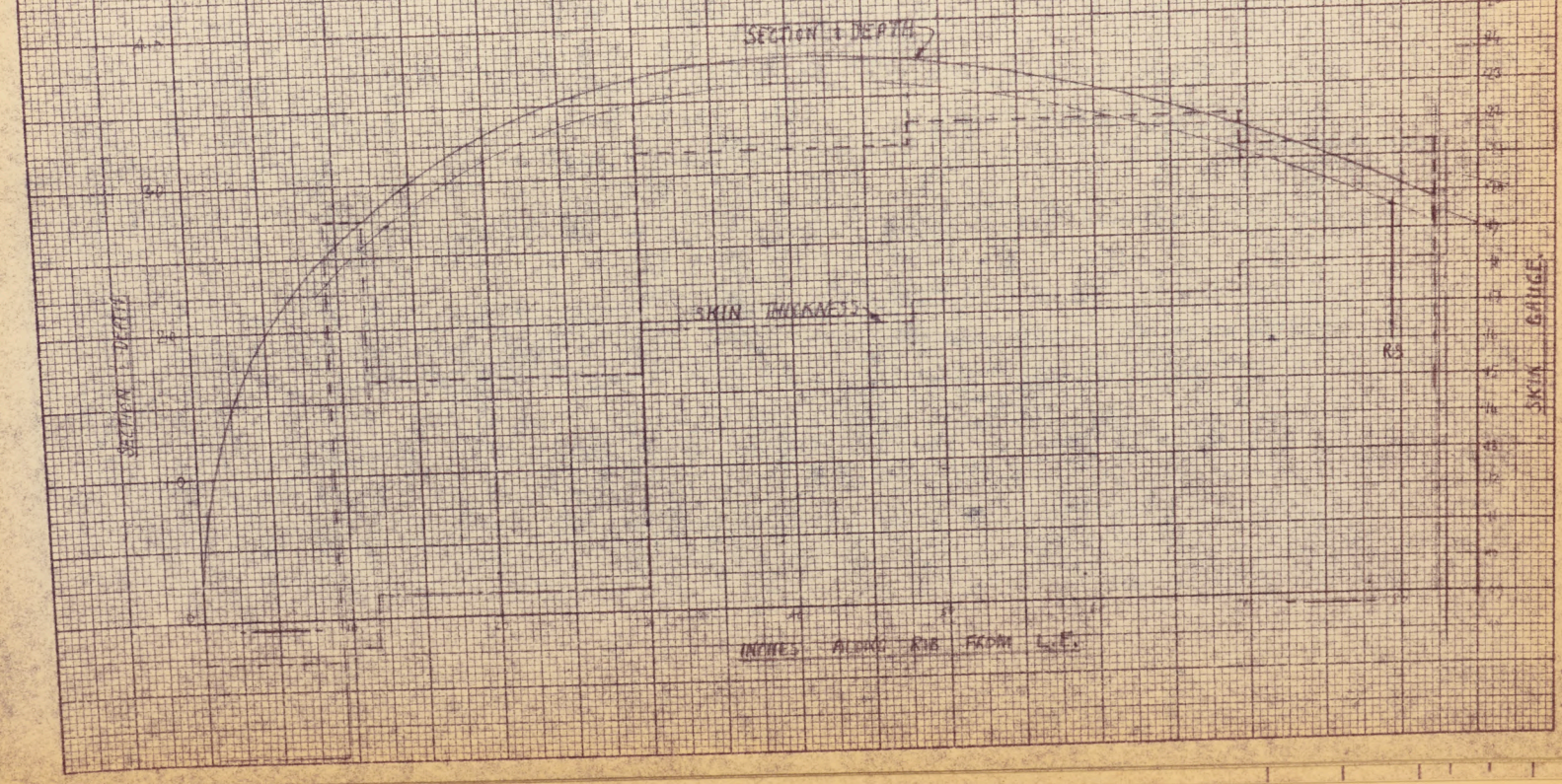
GEOMETRY OF STN x_{RDN} 160"



62-2

C 105 FIN.

GEOMETRY OF THE SLANTED MAIN RIB AT STN. 6.00"

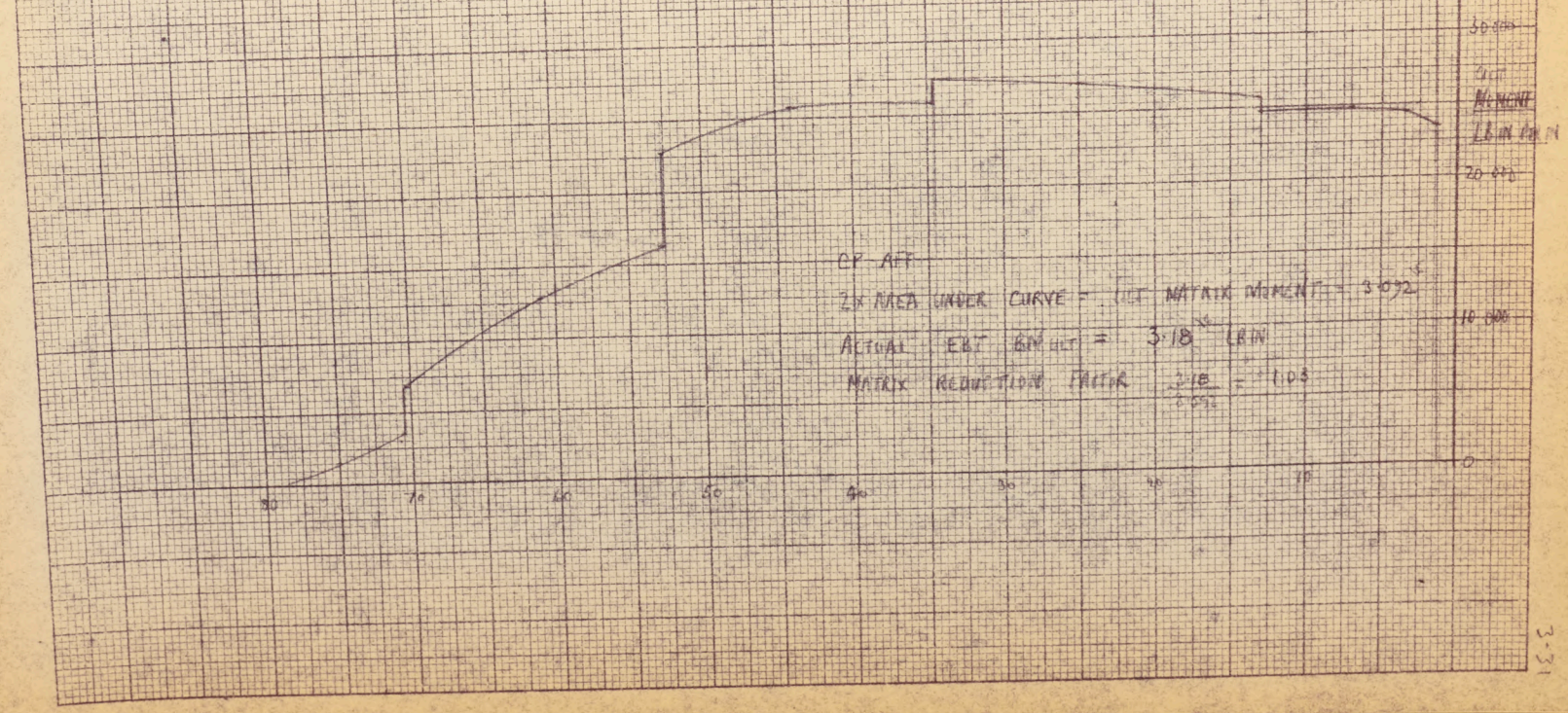


KEUFFEL & ESSER CO. MADE IN U.S.A.

C 105 FIN

A Cook JAN 24 '58

MOMENT PER INCH AT STN 160
AT ULT LOAD



CF AFT

2x AREA UNDER CURVE = ULT MATRIX MOMENT = 3092 IN LBS

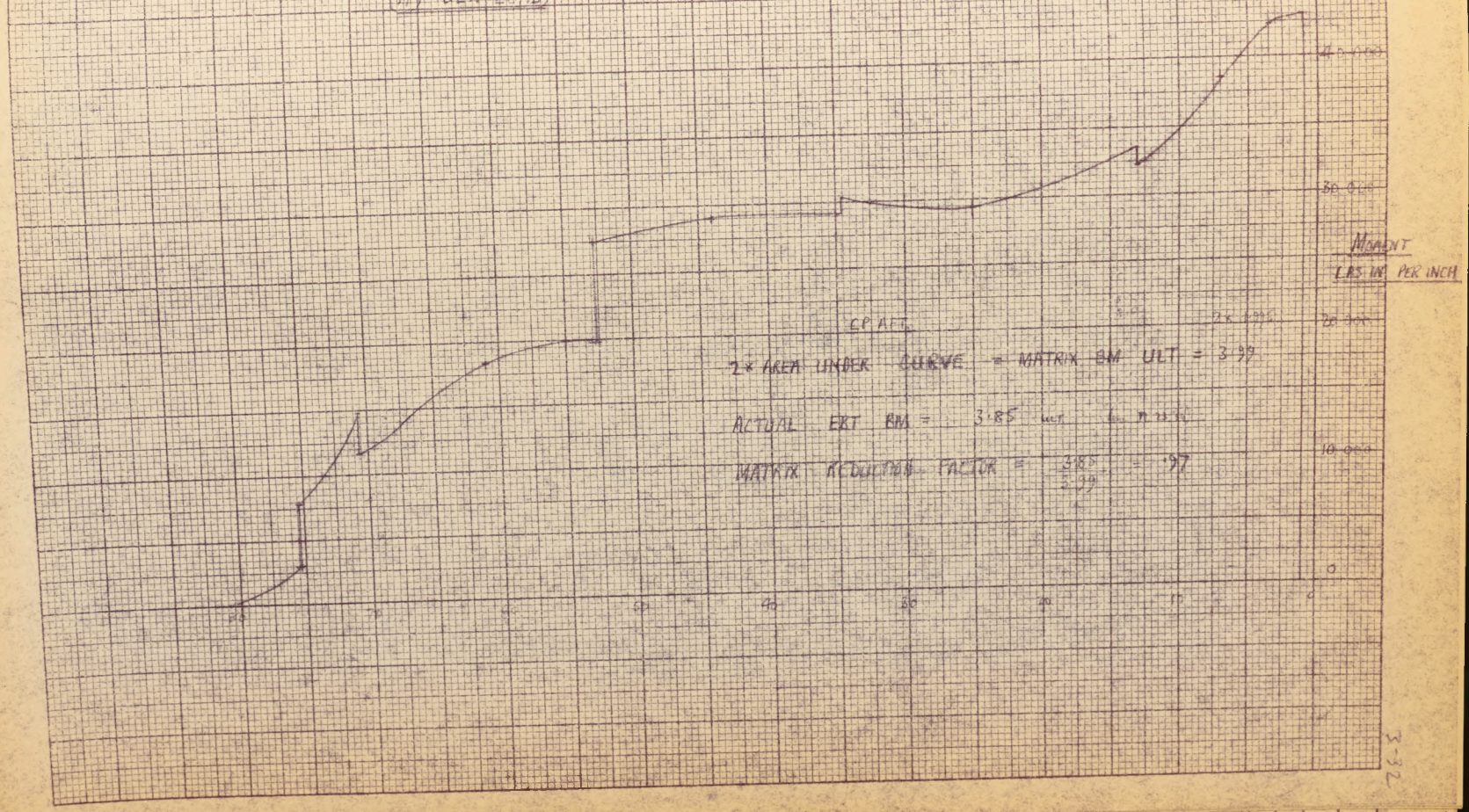
ACTUAL EBF BM ULT = 3.18 LBS IN

MATRIX REDUCTION FACTOR $\frac{3.18}{3092}$ = 1.05

C 106 FIN.

MOMENT PER INCH AT STN. 0

(AT ULT. LOAD)



CP AFT

2 × AREA UNDER CURVE = MATRIX BM ULT = 3.99

ACTUAL ERT BM = 3.85

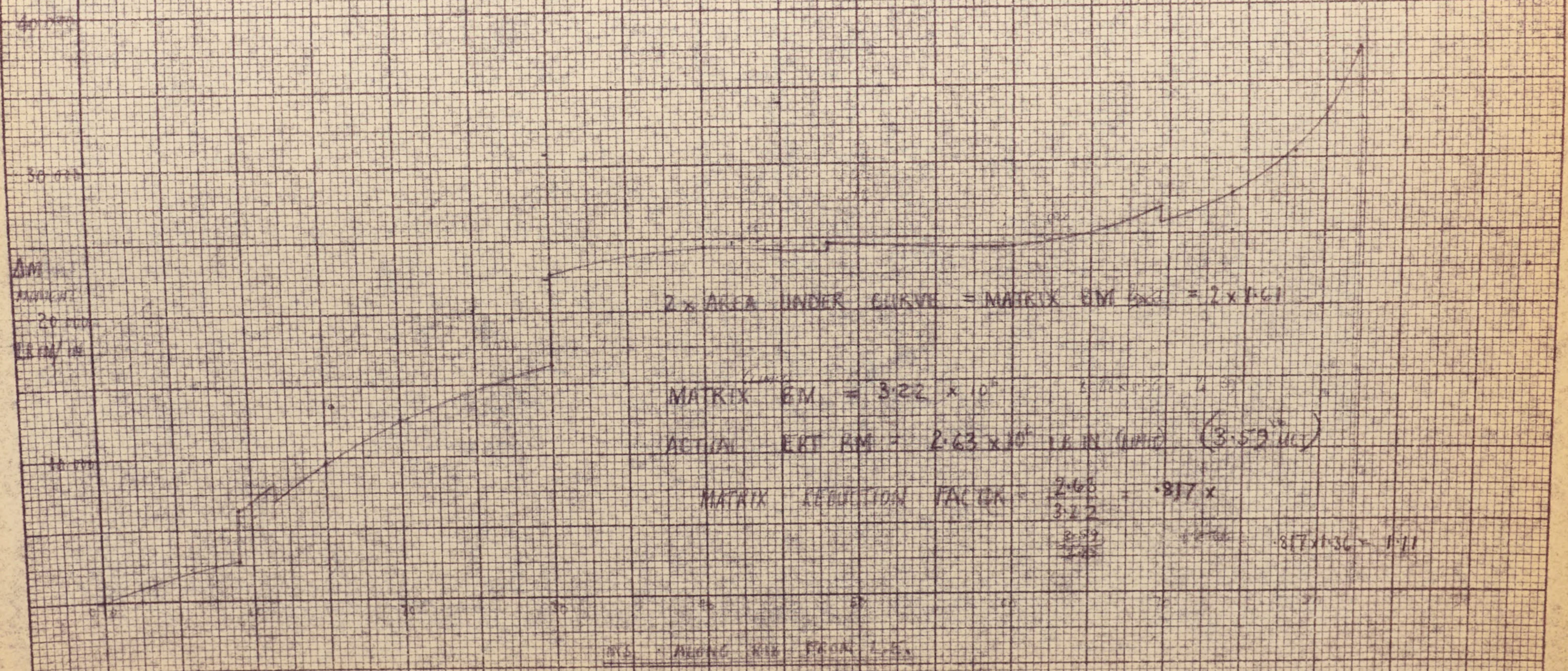
MATRIX REDUCTION FACTOR = $\frac{3.85}{3.99}$ = .97

A Cooke JAN 6 '65

C105 FIN

MOMENT PER INCH AT LIMIT LOAD

AT RR STN 6.00



2 x AREA UNDER CURVE = MATRIX BM = 2 x 1.61

MATRIX BM = 3.22 x 10^6

ACTUAL EXT BM = 2.63 x 10^6 LB IN (LIMIT) (3.59 ULT)

MATRIX REDUCTION FACTOR = $\frac{2.63}{3.22}$ = .817 x

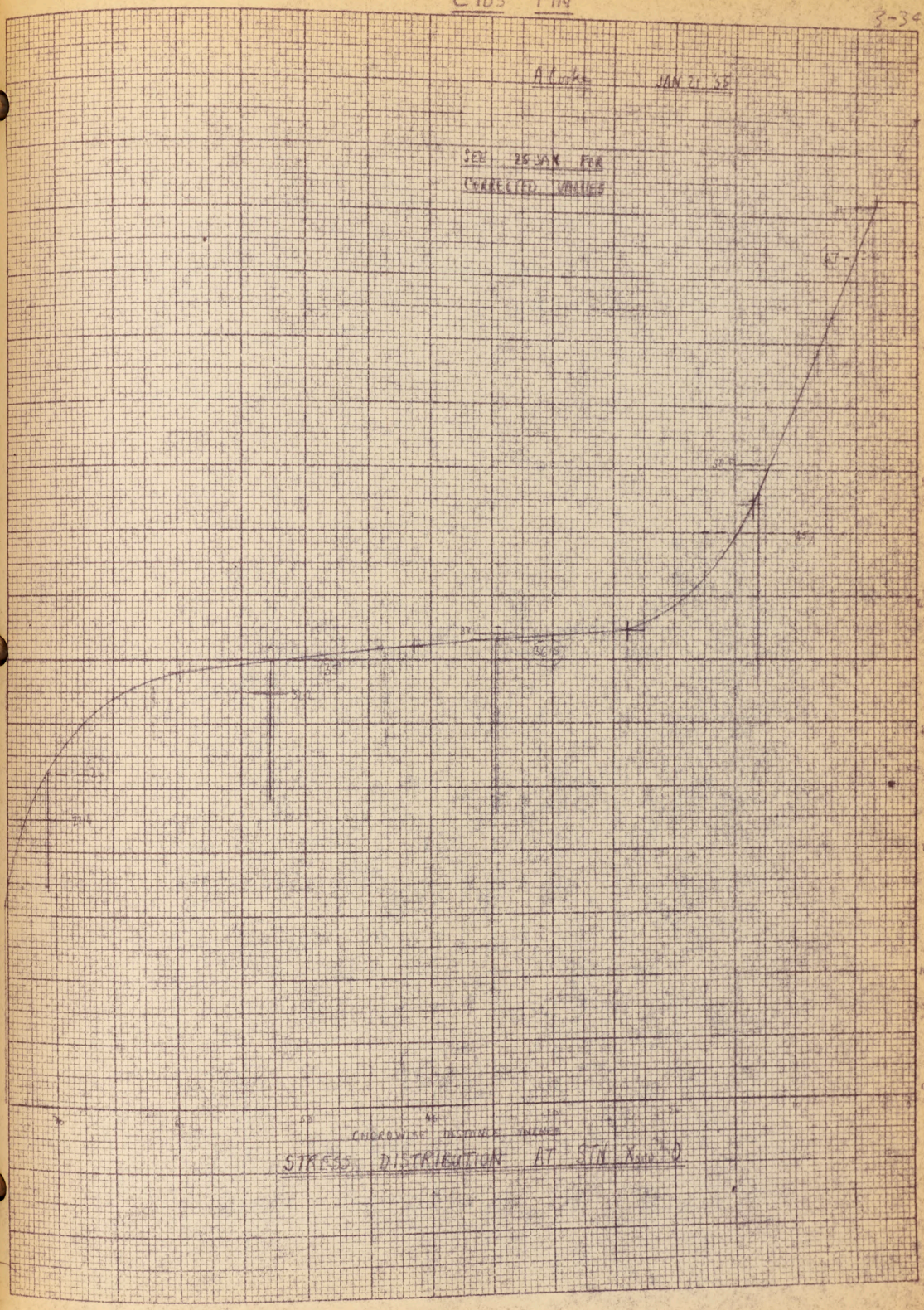
.817 x 1.36 = 1.11

C105 FIN

3-34

A Cooke JAN 21 '58

SEE 25 JAN FOR CORRECTED VALUES

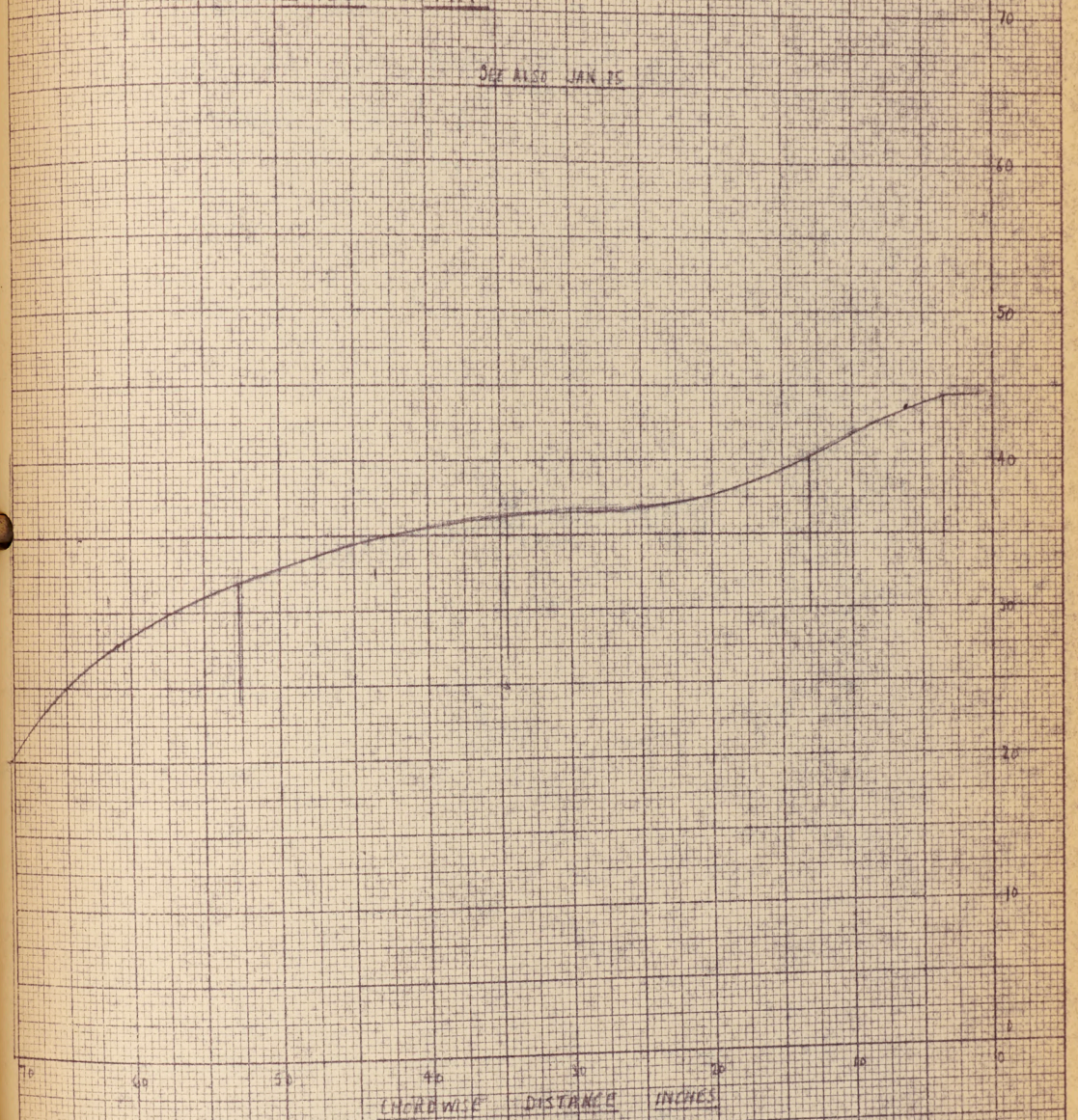


STRESS DISTRIBUTION AT STN X = 0

A Cooke JAN 24 '55

C 105 FIN

SEE ALSO JAN 25

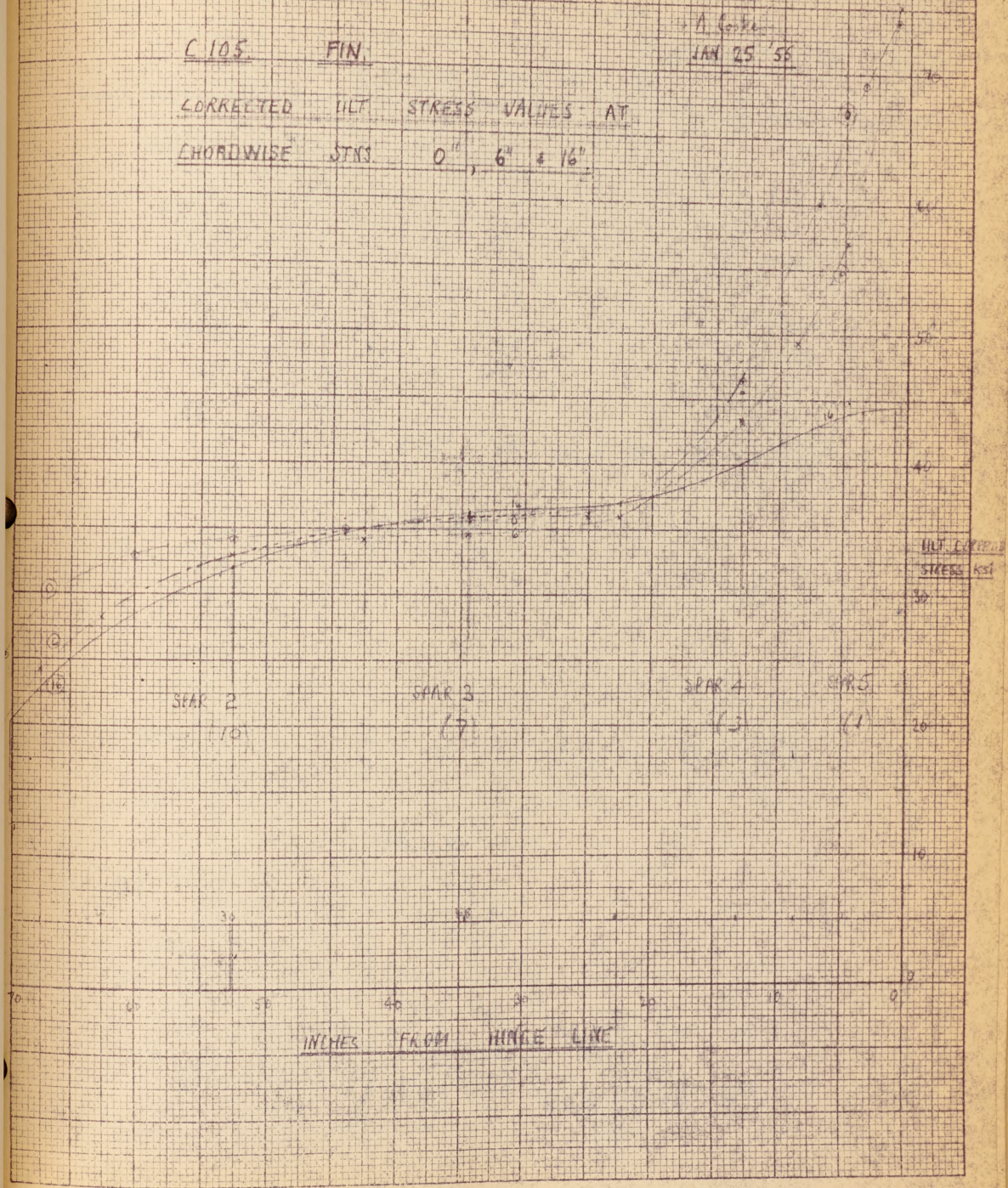


STRESS DISTRIBUTION AT STN x_{eln} 160"

C 105 FIN.

A. G. K.
JAN 25 '56

CORRECTED HLT STRESS VALUES AT CHORDWISE STNS 0", 6" & 16"



A.V. ROE CANADA LIMITED
MALTON – ONTARIO

TECHNICAL DEPARTMENT (Aircraft)

REPORT NO. _____
SHEET NO. 3-37

AIRCRAFT		PREPARED BY: A Cooke	DATE: JAN 25
C105	FIN ROOT SHEARS. CORRECTION TO σ_A END LOADS AT 16·0, 60 & 0	CHECKED BY:	DATE:

CHECK ON BM AT STN 16·00

SPAR	σA	h	$\sigma A \times h = M$
1	42·5	4·5	192
2	107·8	6·7	720
3	158	7·0	1110
4	138	5·92	820
5	69	5·24	361
			3·198

Actual EBT BM = 3·18" σ_A ✓ × 1·0057

STN 6·00

SPAR	σA	h	$\sigma A \times h = M$	σA_{corr}
1	48	4·65	223·2	49·1
2	115·5	7·0	808·5	118·
3	156	7·12	1110·72	160
4	146	6·2	905·2	149·9
5	87·5	5·3	463·75	89·7
			3 511·37	

Actual EBT BM = 3·59" σ_A × 1·0224

STN 0

SPAR	σA	h	$\sigma A \times h = M$
1	53·7	4·75	255·08
2	129	7·2	928·8
3	156	7·32	1141·92
4	158	6·2	979·6
5	100·8	5·5	554·40
			3 859·80

Actual EBT BM = 3·85" σ_A ✓ × 1·0025

A.V.ROE CANADA LIMITED
MALTON – ONTARIO

TECHNICAL DEPARTMENT (Aircraft)

REPORT NO. _____

SHEET NO. 3-32

AIRCRAFT		PREPARED BY: A Cooke	DATE: JAN 26 '55
C 105	FIN ROOT SHEARS	CHECKED BY:	DATE:

CHECK ON BM AT STN 24·0

SPAR	σA	h	σA×h = M	σA corr
1	32·2	4·4	142·56	33·8
2	97	6·37	617·89	102
3	150·5	6·77	1018·88	158
4	126	5·82	733·32	132
5	51	5·1	260·1	53·5
			2 772·75	

Actual EBT BM = 2.910^{16} × 1·0495

STN 34·0

SPAR	σA	h	σA×h = M	σA corr
1	25·6	4·3	110·08	27·5
2	86·9	6·6	621·4	92·9
3	145	6·55	949·75	154·5
4	111	5·65	627·15	118
5	40	4·93	197·2	43
			2 405·58	

Actual EBT BM = 2.57^{16} × 1·0685

STN 42·0

SPAR	σA	h	σA×h = M	σA corr
1	20·5	4·2	86·10	22
2	78	5·75	448·50	83
3	138	6·35	876·30	148
4	103	5·5	566·5	110
5	36	4·8	172·8	38·5
			2 150·2	

Actual EBT BM = 2·298 × 1·0687

A.V. ROE CANADA LIMITED
MALTON – ONTARIO

TECHNICAL DEPARTMENT (Aircraft)

REPORT NO. _____

SHEET NO. 3-33

AIRCRAFT		PREPARED BY: A Cooke	DATE: JAN 26 '55
C 105	FIN ROOT SHEARS. STN. O 6.	CHECKED BY:	DATE:

see also Jan 20 & 18 for other stns.

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

WEB	S_{lbs}	x_y	S_{xy}	SPAR WEB THICK"	P_v	$P_v x$	x
1	950	380	316 000	.115	840·	64.000	76·0
2	2250	379	852 750	.063	2020·	106.000	52·6
3	0	253	0	.116	1810·	63 000	34·6
4	2000	82	164 000	.063	1300·	16 800	13·
5	2210	18·2	40 222	.0082	830·	2.900	3·5
			+ 1 372 972 lbs		ΣP_v = 6800	252 700	
					ΣP_v = 13 600 lbs	+ 505 400 lbs = $\Sigma P_v x$	

MOMENT OF SHEAR FLOW IN SKINS $\Sigma 2A_q$ = −441 740 k
" " " " IN WEBS $\Sigma s'_{xy}$ = −196 324 k
−638 064 k lbs

MOMENT OF TAPER AT FS. P_x = −55 000 lbs

EXTERNAL SHEAR TORQUE = 501 000 LB IN

1 372 972 + 505 400 − 55 000 − 644 072 k = 501,000 lbs
= 644 072 k
1 322 372
2·05 = k

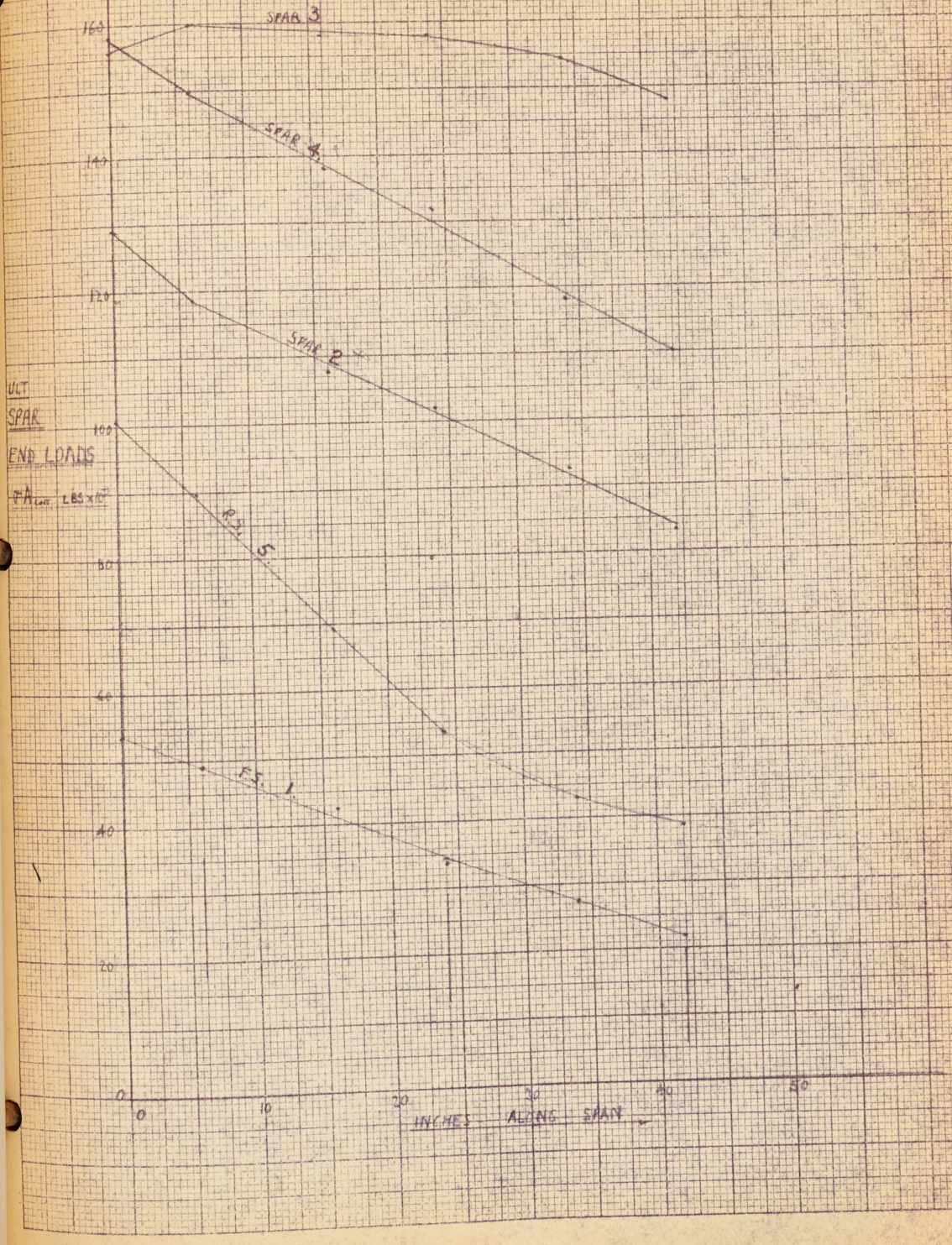
SPAR WEB SHEAR FLOW (STN 6·0)

WEB	S'	S' x 2·05	S	WEB SHEAR FLOW	WEB DEPTH "y"	WEB SHEAR FORCE
1	−920k	− 1890	950	− 940	5·	− 4 700
2	−310k	− 630	2 250	+1 620	7·2	+ 11 600
3	+950k	+ 1910	0	+1 910	7·3	+ 13. 900
4	+505k	+ 1040	2 000	+3 040	6·3	19 100
5	−198k	− 405	2 210	+1 805	5·2	+ 9 400
					F	+ 49 300
					P_v	+ 13 600
						62 900

EXTERNAL SF = 40,000 ULT LBS

C105 FIN A. Clarke JAN 27 55

ULT. SPAR END LOADS



A. V. RO

TEC

AIRCRAFT

WEIGHT

C. G. POSIT

C 105 FIN

ROOT SHEAR FLOWS

	1	2	3	4	5	6	7	8	9	10	11
	F.S. (1) σA	$\frac{\sigma_1 A_1 - \sigma_2 A_2}{\ell}$	(2) σA	$\frac{\sigma_1 A_1 - \sigma_2 A_2}{\ell}$	(3) σA	$\frac{\sigma_1 A_1 - \sigma_2 A_2}{\ell}$	(4) σA	$\frac{\sigma_1 A_1 - \sigma_2 A_2}{\ell}$	R.S. (5) σA	$\frac{\sigma A_1 - \sigma_2 A_2}{\ell}$	
STN 0	53·7		129·		156·3		158·		100·8		
6	48·9	800	118·5	1750	160·	− 620	150·	133·0	89·2	1970	
16	40·9	800	109	960	158·8	+ 110	139	111·0	69·	1970	
24	34·5	800	101	960	158	110	130	111·0	53·5	1970	
34	27·5	700	91·0	960	154	400	119	111·0	43	1050	
42	22	690	84	960	148	750	110	111·0	38·5	560	
52											

FORM 1343

A. V. ROE CANADA LIMITED

MALTON, ONTARIO

TECHNICAL DEPT. (AIRFRAME)

REPORT NO. -

SHEET - 3-42

DATE - JAN 27 '55

AIRCRAFT - C 105

WEIGHT -

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

PREPARED BY - A Corke

9	10	11	12	13	14	15	16	17	18	19
R.S.										
σA	$\sigma A_1 - \tau_2 A_2$									
100.8										
89.2	1970									
69	1970									
53.5	1970									
43	1050									
38.5	560									

A.V. ROE CANADA LIMITED
MALTON — ONTARIO

TECHNICAL DEPARTMENT (Aircraft)

REPORT NO. _____
SHEET NO. 3-43

AIRCRAFT		PREPARED BY:	DATE:
C 105	FIN ROOT SHEARS STN 0-6	A Parke	JAN 27 55
		CHECKED BY:	DATE:

x = Moment arm about H.L.
h = depth of spar

full depth typ. $\frac{h-h_1}{h_2}$

SPAR WEB	S	h	x	Sh	Shx	SPAR WEB TAPER	P_v	P_{vx}
1	800	4.65	76	3 700	281 200	.0135	660	50 160
2	1750	7.0	52.6	12 200	641 720	.0355	4 240	223 020
3	-620	7.2	34.6	- 4 450	- 153 970	.0230	3 670	126 980
4	1330	6.25	13	8 200	106 600	.0185	2 780	36 160
5	1970	5.4	3.5	10 100	35 350	.0167	1 490	5,215
				29 750	910 900		12 840	441, 515
				42 590	1352. 415			

EST. F-40 acft

if k = 2.6

SPAR WEB	S	S' web	S+S'	h	(S+S')h
1	800	-1700	-1100	4.65	- 5100
2	1750	- 290	+ 1460	7.0	+ 10 300
3	-620	+ 2400	+ 1780	7.2	+ 12 800
4	1330	+ 1630	+ 2960	6.25	+ 17 000
5	1970	- 1660	+ 310	5.4	+ 1 670
					+36 760

assume k = 1.0

	S	S'	S+S'	(S+S')h
1	800	- 790	10	46
2	1750	- 120	1 630	11 400
3	- 620	+ 1 004	384 *	2 750
4	1330	+ 596	1 926 *	11 800
5	1970	- 690	1 280 *	6 906
				32 896

* Assume 2000 lbs per in in these 2 spars
* Check for 1780 lbs per in

A.V. ROE CANADA LIMITED
MALTON – ONTARIO

TECHNICAL DEPARTMENT (Aircraft)

REPORT NO. _____

SHEET NO. 3-94

AIRCRAFT		PREPARED BY:	DATE:
C 105	FIN ROOT SHEARS	A Cooke	JAN 27 '58
		CHECKED BY:	DATE:

SKIN SHEARS

AT 5·0"

	LIMIT SHEAR STRESS T	t	T x t of skin	web. S	hx	S x hx
1	-5 900	·098	- 790 k	- 790 k	353·4	-279 186 k
2	-4 000	·165	- 910 k	- 120 k	368·2	- 44 134 k
3	+ 400	·174	+ 94 k	+1 004 k	249·1	+250 096 k
4	+2 800	·132	+ 690 k	+ 596 k	79·95	+ 47 650 k
5				- 690 k	18·9	- 13 041 k
						- 38 665 k

MOMENT OF SKIN SHEAR FLOWS.

	A	q	Aq
A_2 = 6·75 x 21	141·8	-790	- 112 022 k
A_3 = 3·72 x 18	66·96	-910	- 60 934 k
A_4 = 2·82 x 21·5	60·6	+ 94	+ 5 696 k
A_5 = 2·50 x 13	32·5	+ 690	+ 22 425 k
			- 144 835 k

$T \cdot 2A_q = -289\,670$ k

38 665

$-328\,335$ k = $-797\,434$

k = 2·428

MOMENT DUE TO TAPER OF F.S.

$P_x = -48\,900 \times \cdot 2376 \times 4·65$

$= -53\,981$

$P_{vx} = +441{,}515$ ✓

$S_{hx} = +910\,900$

$T_c = -501\,000$ ✓

A. V. ROE CANADA LIMITED MALTON – ONTARIO **TECHNICAL DEPARTMENT (Aircraft)**		REPORT NO. 7/0583/1 SHEET NO. 3-45	
AIRCRAFT C105	FIN SKIN SHEAR FLOWS FROM MATRIX	PREPARED BY: A Cooke	DATE: FEB 1st '55
		CHECKED BY:	DATE:

CORRECTED FROM MATRIX VALUES + Jan 18 — E.B.T. VALUES.

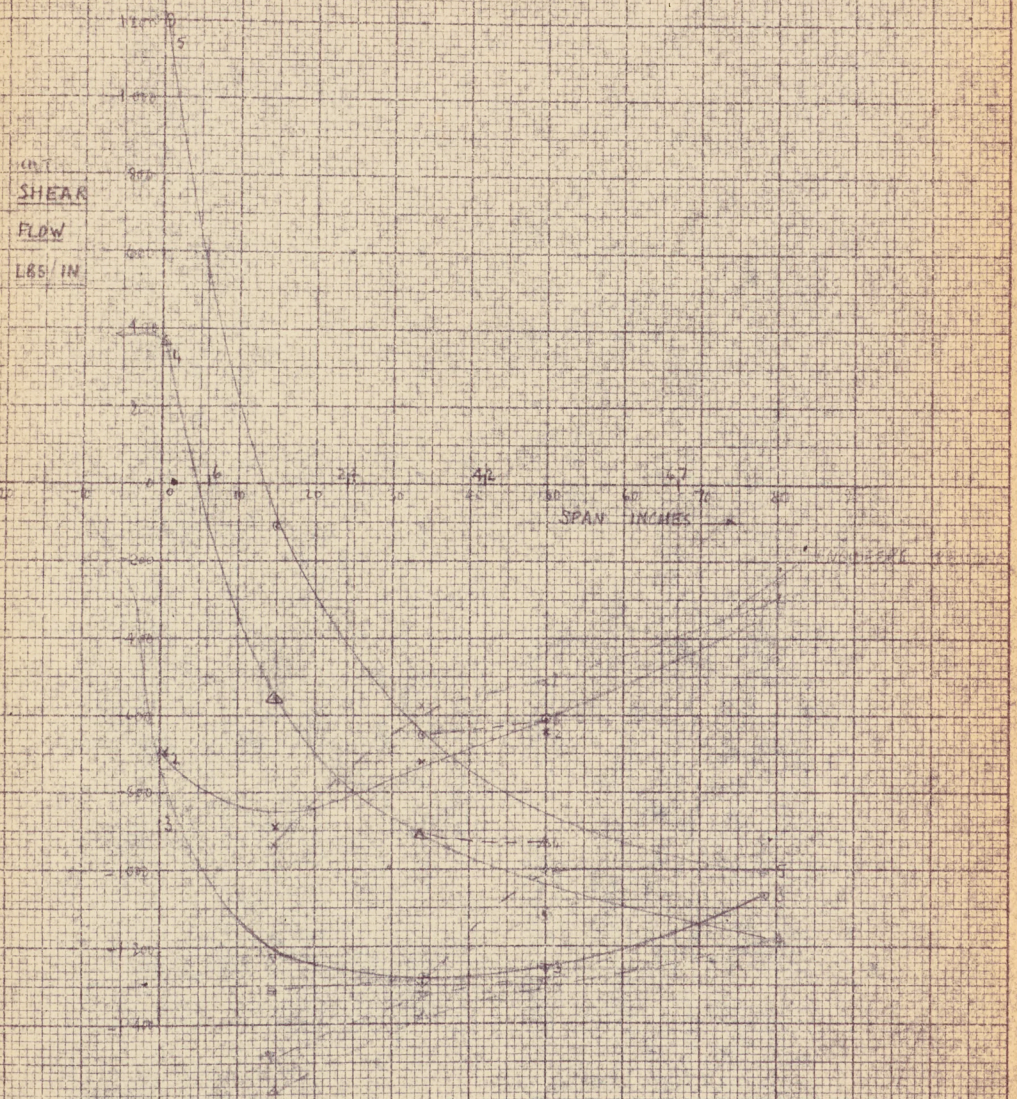
PANEL		ULT. MEAN STRESS	MEAN t	ULT. MEAN SHEAR FLOW	E.B.T. ULT MEAN SHEAR FLOW
42-60	5-4	-3 700	·165	- 610	+ 1078
"	4-3	- 5 900	·158	- 935	all 1300
"	3-2	- 8 600	·150	- 1260	+ 1295
	2-1	- 7 900	·081	- 640	509
24-42	5-4	- 3 800	·172	- 651	1248
	4-3	- 5 500	·165	- 910	1394
	3-2	- 8 200	·158	- 1300	1320
	2-1	- 8 100	·089	- 720	567
6-24	5-4	- 600	·178	- 107	1321
	4-3	- 3 500	·170	- 560	1597
	3-2	- 7 500	·166	- 1230	1489
	2-1	- 9 400	·095	- 890	907
-23-6	5-4	+ 6 600	·183	+ 1200	1011
(s.o.d)	4-3	+ 2 100	·176	+ 370	1208
	3-2	- 4 500 → 0	·170	- 770 → 0	1072
	2-1	- 7 000 → 0	·100	- 700 → 0	[illegible]

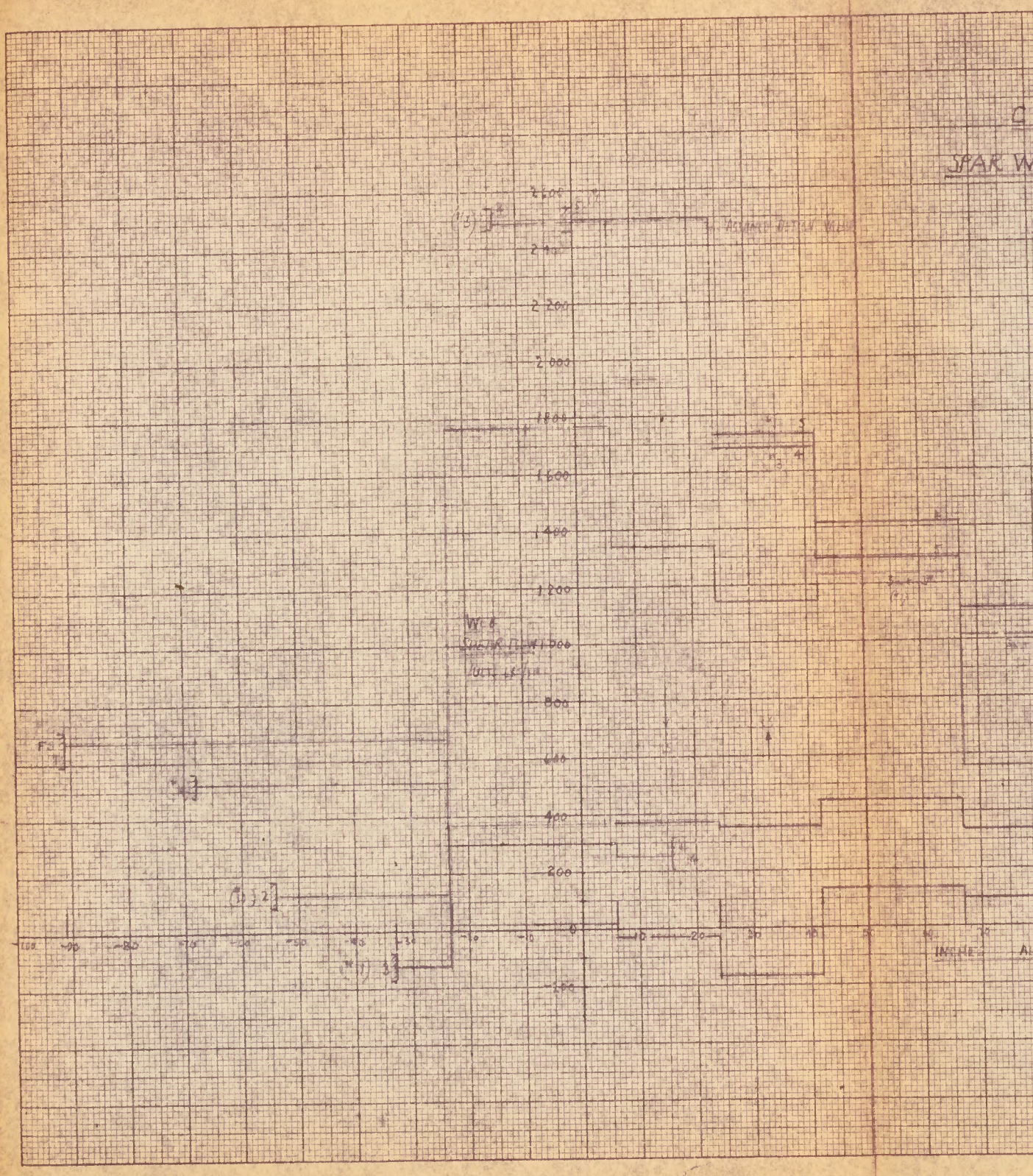
C 105 FIN

A.C.W.
FEB. 6 '58

ULT SKIN SHEAR FLOWS

FAIRING OF MATRIX & EST VALUES

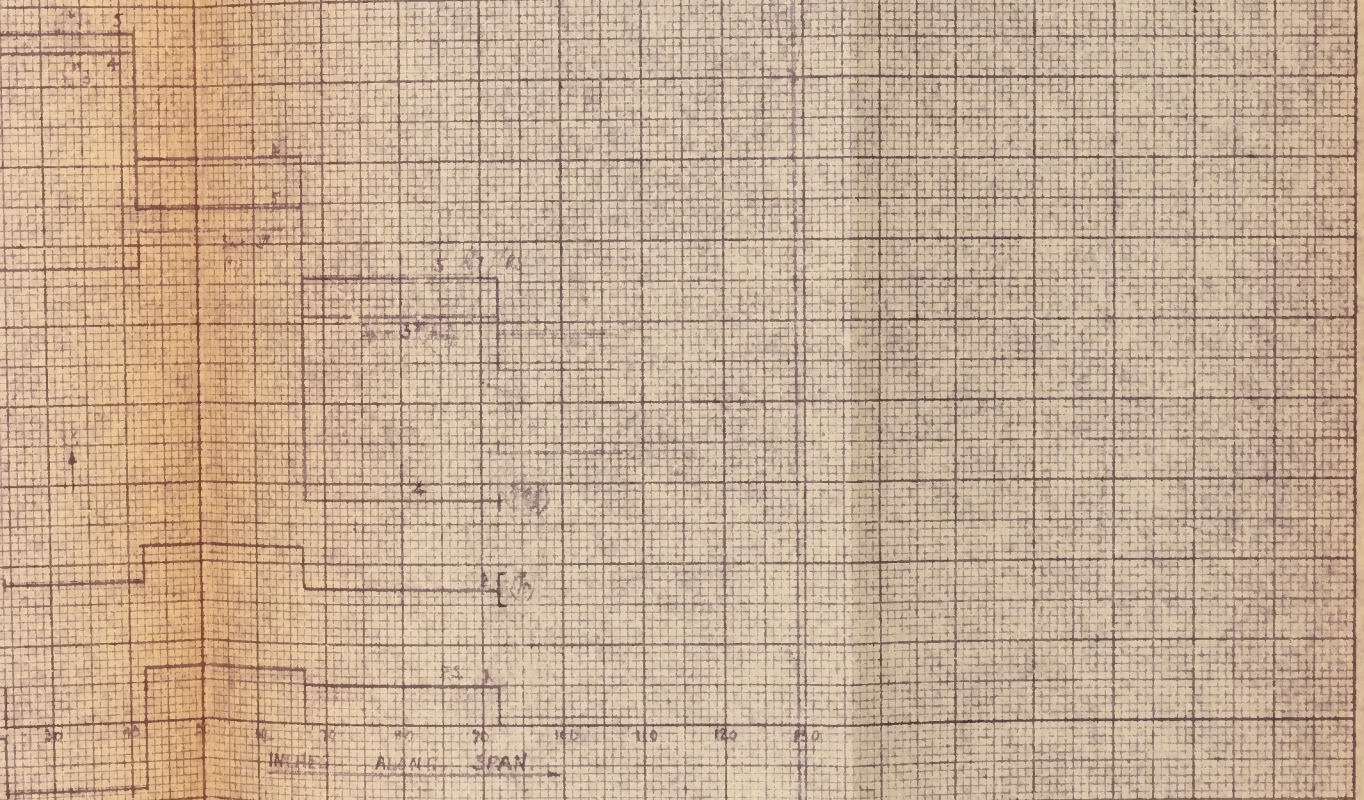


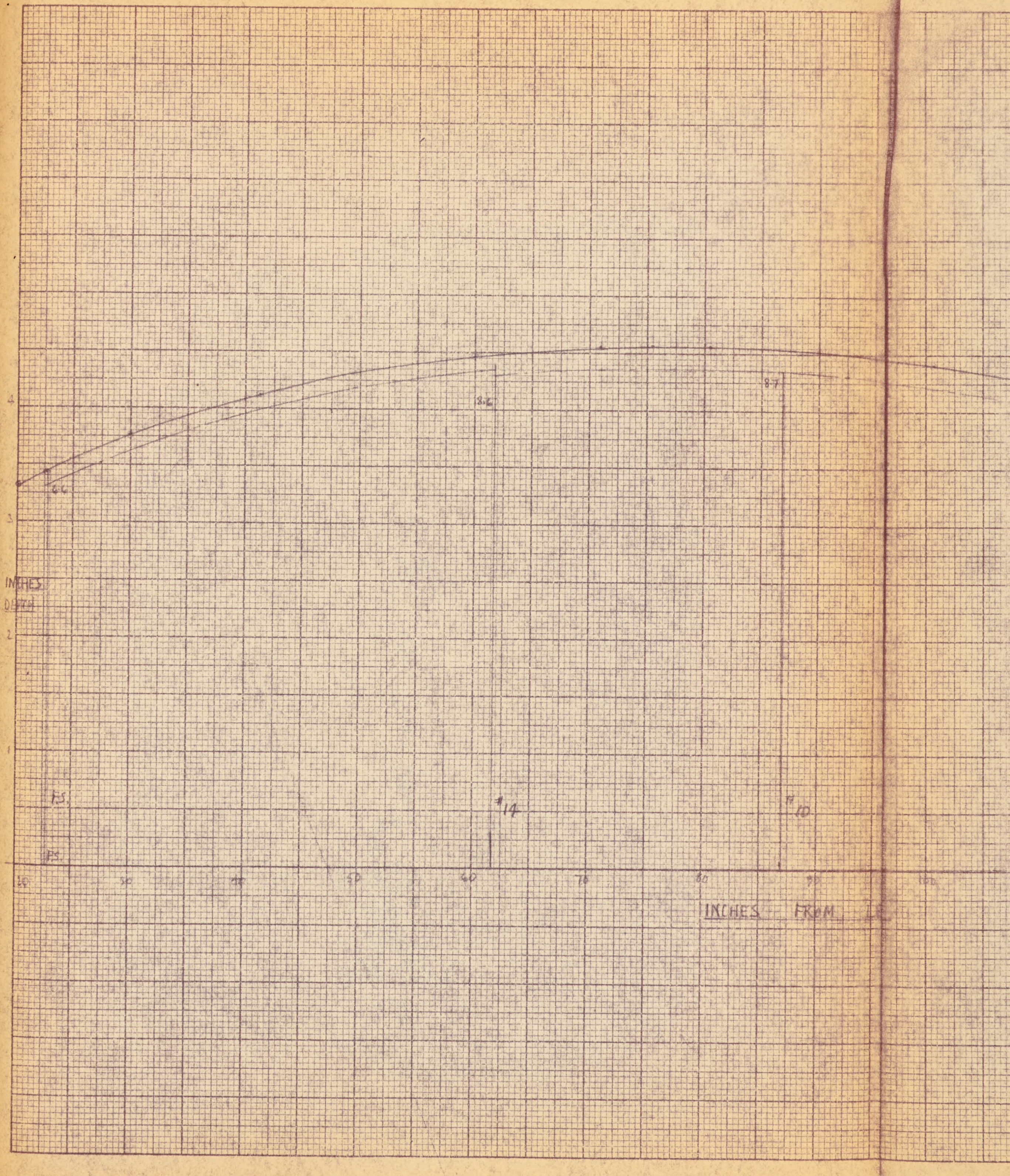

SPAR W
2 400
2 200
2 000
1 800
1 600
1 400
1 200
800
600
400
200
0
-200
-90
-80
-70
-60
-50
-40
-30
-20
-10
0
10
20
30
40
50
INCHES

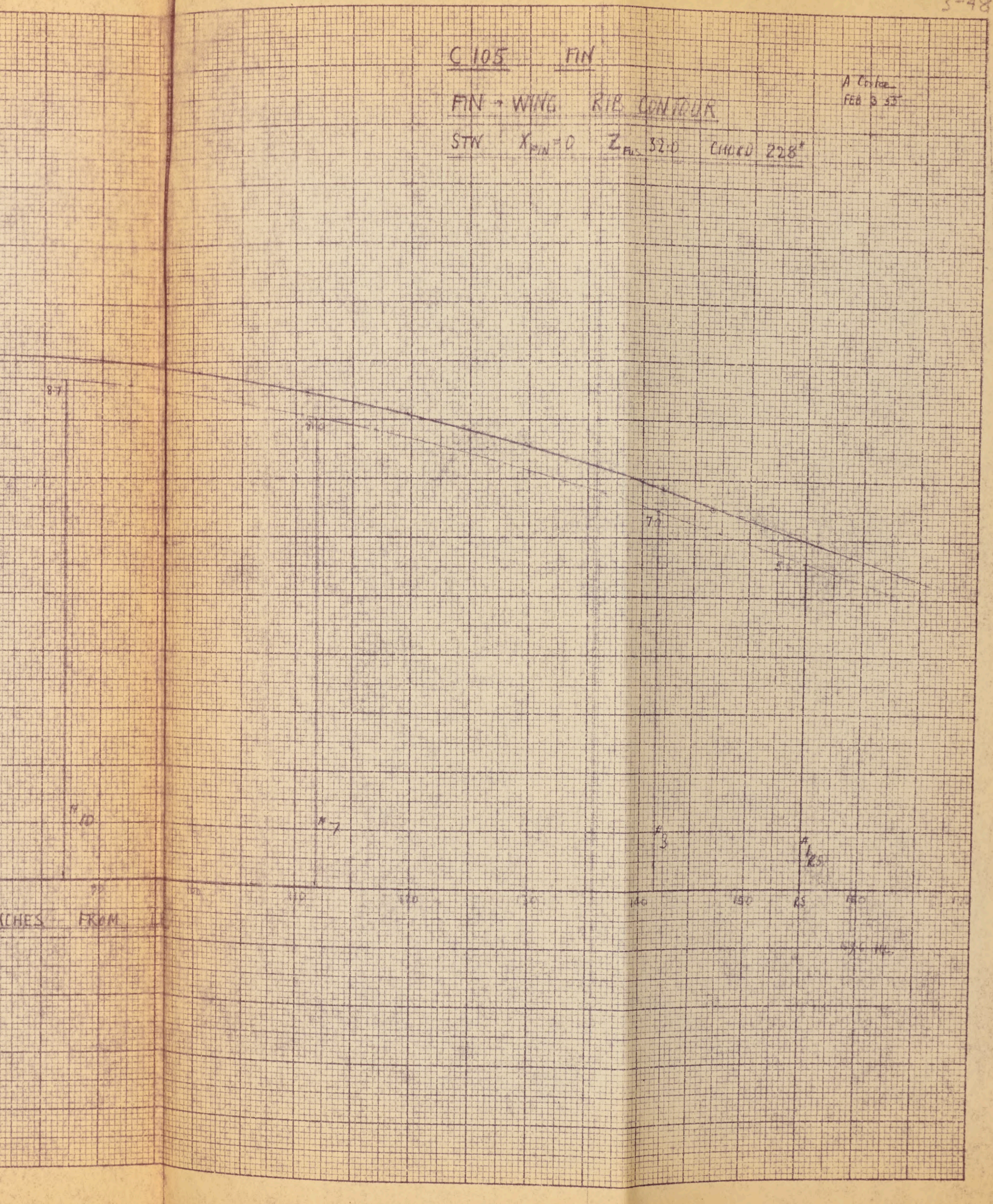
C 105 FIN

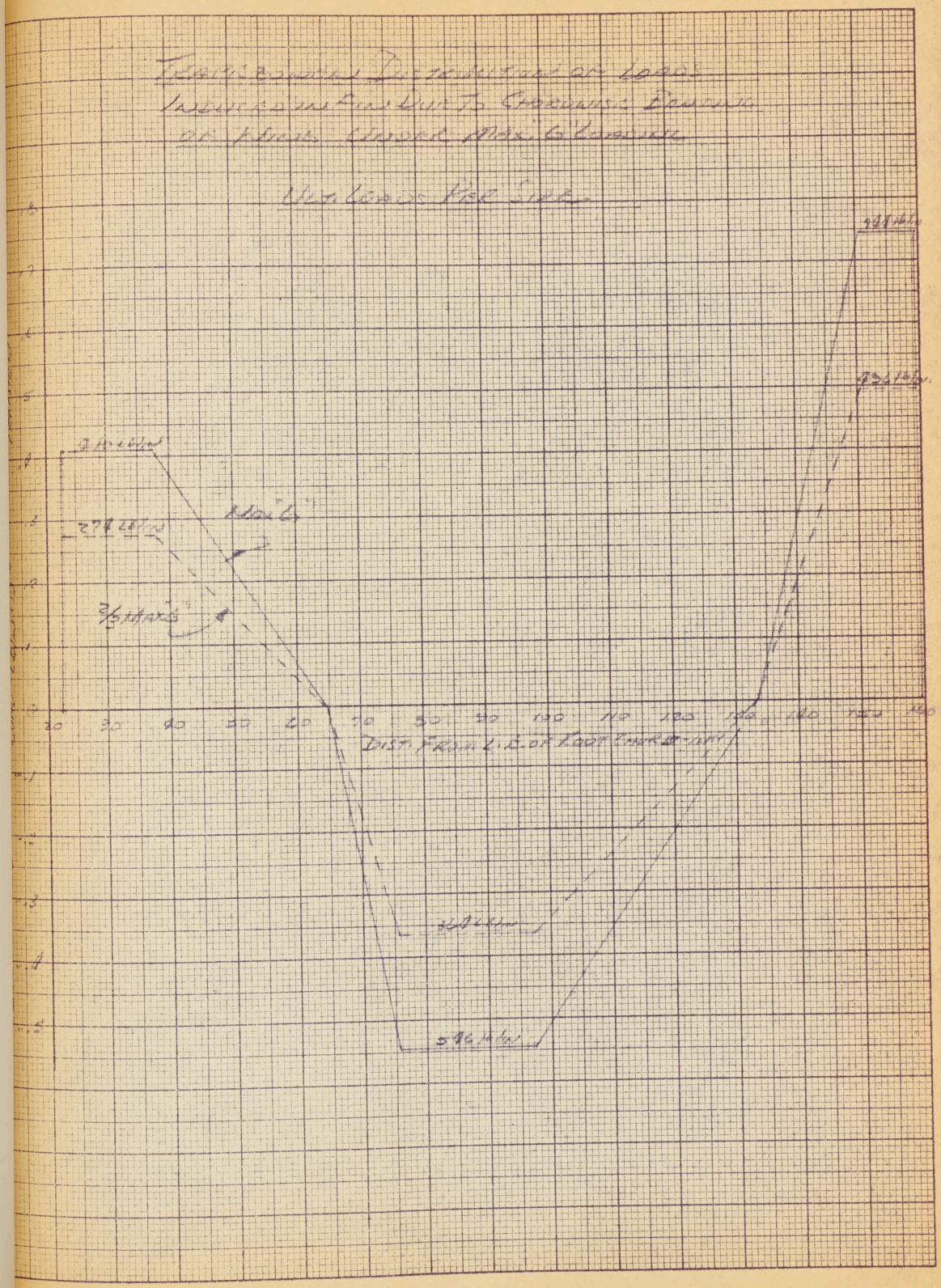
SPAR WEB SHEAR FLOWS DLT

A Cole
FEB 1 '55




INCHES
DEPTH
4
3
2
1
8.6
8.7
F.S.
F.S.
#14
#10
20
30
40
50
60
70
80
90
100
INCHES FROM


C 105 FIN
FIN → WING RIB CONTOUR
STW X FIN = 0 Z FUS 32.0 CHORD 228"
A Costae
FEB 3 53
ACHES FROM


Dist. From L.E. of Roof Curve