DUBLIN COUNTY COUNCIL

REG. REF: 91A/1266.

DEVELOPMENT: Grain Store.

LOCATION: Greenoge, Rathcreedan, Rathcoole.

APPLICANT: John Gargan.

DATE LODGED: 31.7.91.

The Newcastle Road is a very heavily trafficked District Distributor route leading to the Naas Dual Carriageway. Traffic speeds are very high at off peak periods.

The site fronts onto a gradual curve which has a full centreline.

Roads would be totally opposed to any increase in turning movements on the road particularly by slow moving articulated vehicles.

However, there is an existing gate on the road frontage and the applicant has stated that the proposed grain store will cut down on traffic movements due to elimination of double handling of grain.

If a grant of permission is considered it should be subject to:-

1) Grain store to be used for storage of agricultural produce of farm and ancillary agricultural inputs only.

2) Location of gateway and all boundary treatment including setback of new fence and levelling of verges to be agreed on site with the Roads Department Engineer. A drawing to be submitted for compliance.

TR/BMcC
18.9.91.

PLANNING DEPT.
DEVELOPMENT CONTROL SECT
Date 23.09.91
Time 1.00

SIGNED: [signature] ENDORSED: [signature]

DATE: 18/9/91 DATE: 18/9/91

Mary Galvin.

DUBLIN COUNTY COUNCIL

PLANNING AND BUILDING CONTROL DEPARTMAENT

DUBLIN COUNTY COUNCIL
- 9 SEP 1991
ENVIRONMENTAL HEALTH OFFICERS

Senior Environmental Health Officer,
33 Gardiner Place.

Register Reference : 91A/1266 Date : 1st August 1991

PLANNING DEPT.
DEVELOPMENT CONTROL SECT
Date 2.10.91
Time 10.00

Development : Grain Store

LOCATION : Greenoge, Rathcreedan, Rathcoole

Applicant : John Gargan

App. Type : PERMISSION/BUILDING BYE-LAW APPROVAL

Planning Officer :

Date Recd. : 31st July 1991

Attached is a copy of the application for the above development .Please ensure that your report is received within 5 weeks from 31st July 1991.

Yours faithfully,

.....

for PRINCIPAL OFFICER

There is insufficient information to deal with this plan. Applicant has indicated on both the application form and attached specifications the method of drainage to be main Co. Council drainage, and on plan drawing number G 2/P01 has indicated a septic tank proposal; said suitability, specifications etc. of which are not submitted. Similarly, applicant has proposed water supply to be main Co. Council supply, yet Engineers Report shows no such supply in the area, and only a limited supply from nearest mains.

Jackie Kelly EHO

for John O'Kelly SEHO 26/9/91

P/4465/91

COMHAIRLE CHONTAE ÁTHA CLIATH

Record of Executive Business and Manager's Orders

Register Reference : 91A/1266 Date Received : 31st July 1991

Correspondence Name and Address : O'Connor Sutton Cronin, 25 Lower Mount Street, Dublin 2.

No Services in Area

CONTRIBUTION:
Standard: NIL
Roads: Agri-use
S. Serv:
Open Space:
Other:
SECURITY:
Bond / C.I.F.:
Cash:

Development : Grain Store

Location : Greenoge, Rathcreedan, Rathcoole

Applicant : John Gargan

App. Type : Permission

Zoning :

Floor Area : Sq.metres

(NP/DK)

Report of the Dublin Planning Officer dated 18th September, 1991.

This is an application for PERMISSION for a grain store at Greenoge, Rathcreedan, Rathcoole.

The site is located in an area zoned 'B' - "to protect and provide for the development of agriculture" in the Development Plan.

The applicant is a major land owner in the area and owns considerably more land than in the area shown in red on lodged plans.

Floor area of proposed building is stated to be 2,119 sq. m. and the building is to be used for grain storage.

The Department of Defence state no objection to the development provided:

a. It is reduced to 11 m. in height;
b. No activity on the site will give rise to bird hazard for aircraft.

Sanitary Services Engineer report noted.

Roads Engineer report noted.

The lodged plans show a height of structure of 12 m. from the floor level to ridge.

The proposed structure is framed in reinforced concrete with 6 m. high concrete walls and metal cladding and metal deck roofing over. Public water connection is proposed for toilets.

COMHAIRLE CHONTAE ÁTHA CLIATH

Record of Executive Business and Manager's Orders

Reg.Ref: 91A/1266

Page No: 0002

Location: Greenoge, Rathcreedan, Rathcoole

The proposed development is considered acceptable.

I recommend that a decision to GRANT PERMISSION be made under the Local Government (Planning and Development) Acts, 1963-1990 subject to the following (12) conditions:-

C O N D I T I O N S / R E A S O N S

01 The development to be carried out in its entirety in accordance with the plans, particulars and specifications lodged with the application save as may be required by the other conditions attached hereto.
REASON:To ensure that the development shall be in accordance with the permission and that effective control be maintained.

02 That before development commences, approval under the Building Bye- Laws be obtained and all conditions of that approval be observed in the development.
REASON:In order to comply with the Sanitary Services Acts, 1878-1964.

~~03 That a financial contribution in the sum of £_____ be paid by the proposer to Dublin County Council towards the provision of public water supply in the area of the development and which will facilitate the proposed development. This contribution to be paid prior to the commencement of development on site.
REASON: In the interest of the proper planning and development of the area.~~

3 ~~04~~ That the requirements of the Supervising Environmental Health Officer be ascertained and strictly adhered to in the development.
REASON: In the interest of health.

4 ~~05~~ That the water supply and drainage arrangements, including the disposal of surface water, be in accordance with the requirements of the County Council.
REASON: In order to comply with the Sanitary Services Acts, 1878-1964.

5 ~~06~~ That no advertising sign or structure be erected except those which are exempted development, without prior approval of Planning Authority.
REASON: In the interest of the proper planning and development of the area.

6 ~~07~~ Details of metal roof decking and cladding including colour to be agreed with the Planning Authority prior to commencement of development.

1

COMHAIRLE CHONTAE ÁTHA CLIATH

Record of Executive Business and Manager's Orders

Reg.Ref: 91A/1266

Page No: 0003

Location: Greenoge, Rathcreedan, Rathcoole

REASON: In the interest of visual amenity.

7 ~~08~~ That the height of the structure be reduced to a maximum of 11 metres over ground level.
REASON: To limit interference with air traffic. Details to be agreed with the Department of Defence.

8 ~~09~~ No activity to take place on the site that would give rise to bird hazard for aircraft.

~~09~~ REASON: In the interest of the proper planning and development of the area.

9 ~~10~~ Details of landscaping and boundary treatment to be agreed with the Planning Authority prior to commencement of development.

~~10~~ REASON: In the interest of the proper planning and development of the area.

10 ~~11~~ That the requirements of the Chief Fire Officer be ascertained and strictly adhered to in the development. In this regard the nearest County Council watermain is 400 m. from the entrance to the site and is a 100 m.m. watermain and fire fighting capacity would be very limited.
REASON: In the interest of safety and to prevent a fire hazard.

11 ~~12~~ Details of vehicular entrance to the site to be agreed with the Roads Engineer prior to commencement of development.

~~12~~ REASON: In the interest of the proper planning and development of the area.

12 ~~13~~ That the proposed structure and yard be used for purposes as described in letter of application and for purposes relative to the applicants land holding in the area.

~~13~~ REASON: In the interest of the proper planning and development of the area.

NOTE: Compliance with one or more of the conditions of this permission may result in material alterations to the development as initially proposed and, accordingly, may require the submission of a further planning application.

COMHAIRLE CHONTAE ÁTHA CLIATH

Record of Executive Business and Manager's Orders

Reg.Ref: 91A/1266

Page No: 0004

Location: Greenoge, Rathcreedan, Rathcoole

Endorsed:-.....
for Principal Officer

.....
for Dublin Planning Officer

Order: A decision pursuant to Section 26(1) of the Local Government (Planning and Development) Acts, 1963-1990 to GRANT PERMISSION for the above proposal subject to the (12) conditions set out above is hereby made.

Dated : 25 September 1991 K.O'Sullivan
ASSISTANT CITY & COUNTY MANAGER

to whom the appropriate powers have been delegated by order of the Dublin City and County Manager dated 4 September, 1991.

DUBLIN COUNTY COUNCIL

REG. REF: 91A/1266.

DEVELOPMENT: Grain Store.

LOCATION: Greenoge, Rathcreedan, Rathcoole.

APPLICANT: John Gargan.

DATE LODGED: 31.7.91.

The Newcastle Road is a very heavily trafficked District Distributor route leading to the Naas Dual Carriageway. Traffic speeds are very high at off peak periods.

The site fronts onto a gradual curve which has a full centreline.

Roads would be totally opposed to any increase in turning movements on the road particularly by slow moving articulated vehicles.

However, there is an existing gate on the road frontage and the applicant has stated that the proposed grain store will cut down on traffic movements due to elimination of double handling of grain.

If a grant of permission is considered it should be subject to:-

1) Grain store to be used for storage of agricultural produce of farm and ancillary agricultural inputs only.

2) Location of gateway and all boundary treatment including setback of new fence and levelling of verges to be agreed on site with the Roads Department Engineer. A drawing to be submitted for compliance.

TR/BMcC
18.9.91.

PLANNING DEPT.
DEVELOPMENT CONTROL SECT
Date 18.09.91
Time 3.15

SIGNED: [signature] ENDORSED: [signature]

DATE: 18/9/91 DATE: 18/9/91

Mary Galvin. 88+ cmo.

DUBLIN COUNTY COUNCIL

PLANNING AND BUILDING CONTROL DEPARTMAENT

Senior Engineer,
Sanitary Services Dept.

Register Reference : 91A/1266 Date : 1st August 1991

Development : Grain Store

LOCATION : Greenoge, Rathcreedan, Rathcoole

Applicant : John Gargan

App. Type : PERMISSION/BUILDING BYE-LAW APPROVAL

Planning Officer :

Date Recd. : 31st July 1991

Attached is a copy of the application for the above development. Your report would be appreciated within the next 28 days.

DUBLIN CO. COUNCIL
16 AUG 1991
SAN. SERVICES

DUBLIN CO. C L
SANITARY SERVICES
- 5 SEP 1991
Returned:

Date received in Sanitary Services .....

FOUL SEWER

No foul sewer requirements indicated.

SURFACE WATER

Soakpit proposal - refer to O.S.L. Dept.

PLANNING DEPT.
DEVELOPMENT CONTROL SECT
Date 10.09.91
Time 9.30

30/8/91.

J.R.
2/9/91

PLANNING DEPT.
DEVELOPMENT CONTROL SECT
Date 10.09.91
Time 9.30

Register Reference : 91A/1266 Date : 1st August 1991

ENDORSED _____ DATE _____

WATER SUPPLY... ~~Recommend Refusal~~ There is no C to
water main in the area nearest one is 400 m
approx from entrance to the site if a 100 mm main
& fire fighting capacity would be very limited.

Refer to C.F.O. 4/8/91
19/8/91

ENDORSED ~~[illegible]~~ DATE 2/9/91

Dublin County Council Comhairle Chontae Atha Cliath Planning Department

Block 2
Irish Life Centre
Lower Abbey Street
Dublin 1
Telephone (01) 724755
Fax No. 724896

FAX TRANSMISSION
To 385953

Our Ref. 91A/1266
Your Ref.
Date 2.10.91

DATE: 2.10.91 TIME: 10.30 Approx.

FROM: Les. Doyle — Appeals Section.

TO: J.P. Moran — Lands Branch.

NO. OF PAGES: 4
(incl. cover sheet)

COMMENTS: Copy of Planning decision as requested per Telephone call this morning.

DUBLIN COUNTY COUNCIL

Tel. 724755 (ext. 262/264)

PLANNING DEPARTMENT,
BLOCK 2,
IRISH LIFE CENTRE,
LR. ABBEY STREET,
DUBLIN 1.

Notification of Decision to Grant Permission/[redacted]

Local Government (Planning and Development) Acts, 1963-1983

To: O'Connor Sutton Cronin,
25 Lower Mount Street,
Dublin 2.

Decision Order Number and Date: P/4465/91 - 25.09.1991

Register Reference No.: 91A/1266

Planning Control No.:

Application Received on: 31.07.1991

Applicant: John Gargan.

In pursuance of its functions under the above-mentioned Acts, the Dublin County Council, being the Planning Authority for the County Health District of Dublin, did by Order dated as above make a decision to grant Permission/[redacted] for:-
proposed grain store at Greenoge, Rathcreedan, Rathcoole.

SUBJECT TO THE FOLLOWING CONDITIONS

CONDITIONS	REASONS FOR CONDITIONS
1. The development to be carried out in its entirety in accordance with the plans, particulars and specifications lodged with the application, save as may be required by the other conditions attached hereto.	1. To ensure that the development shall be in accordance with the permission and that effective control be maintained.
2. That before development commences, approval under the Building Bye-Laws be obtained, and all conditions of that approval be observed in the development.	2. In order to comply with the Sanitary Services Acts, 1878-1964.
3. That the requirements of the Supervising Environmental Health Officer be ascertained and strictly adhered to in the development.	3. In the interest of health.
4. That the water supply and drainage arrangements, including the disposal of surface water, be in accordance with the requirements of the County Council.	4. In order to comply with the Sanitary Services Acts 1878-1964.
5. That no advertising sign or structure be erected, except those which are exempted development, without prior approval of the Planning Authority.	5. In the interest of the proper planning and development of the area.

Signed on behalf of the Dublin County Council

For Principal Officer

25th September, 1991.

Date

IMPORTANT: Turn overleaf for further information

CONDITIONS	REASONS FOR CONDITIONS
6. Details of metal roof decking and cladding including colour to be agreed with the Planning Authority prior to commencement of development.	6. In the interest of visual amenity.
7. That the height of the structure be reduced to a maximum of 11 metres over ground level.	7. To limit interference with air traffic. Details to be agreed with the Department of Defence.
8. No activity to take place on the site that would give rise to bird hazard for aircraft.	8. In the interest of the proper planning and development of the area.
9. Details of landscaping and boundary treatment to be agreed with the Planning Authority prior to commencement of development.	9. In the interest of the proper planning and development of the area.
10. That the requirements of the Chief Fire Officer be ascertained and strictly adhered to in the development. In this regard the nearest County Council watermain is 400 m. from the entrance of the site and is a 100 m.m. watermain and fire fighting capacity would be very limited.	10. In the interest of safety and the avoidance of fire hazard.
11. Details of vehicular entrance to the site to be agreed with the Roads Engineer prior to commencement of development.	11. In the interest of the proper planning and development of the area.
12. That the proposed structure and yard be used for purposes as described in letter of application and for purposes relative to the applicants land holding in the area.	12. In the interest of the proper planning and development of the area.

NOTE:

If there is no appeal to An Bord Pleanala against this decision PERMISSION/APPROVAL will be granted by the Council as soon as may be after the expiration of the period for the taking of such appeal. If every appeal made in accordance with the Acts has been withdrawn, the Council will grant the PERMISSION/APPROVAL after the withdrawal.

An appeal against the decision may be made to An Bord Pleanala. The applicant may appeal within one month from the date of receipt by him of this notification. ANY OTHER PERSON may appeal within twenty-one days beginning on the date of the decision.

An appeal shall be in writing and shall state the subject matter and grounds of the appeal. It should be addressed to:—

An Bord Pleanala, Blocks 6 and 7, Irish Life Centre, Lower Abbey Street, Dublin 1.

(1) An appeal lodged by an applicant or his agent with An Bord Pleanala will be invalid unless accompanied by a fee of £36 (Thirty-six Pounds). (2) A party to an appeal making a request to An Bord Pleanala for an Oral Hearing of an appeal must, *in addition* to (1) above, pay to An Bord Pleanala a fee of £36 (Thirty-six Pounds). (3) A person who is not a party to an appeal must pay a fee of £10 (Ten Pounds) to An Bord Pleanala when making submissions or observations to An Bord Pleanala in relation to an appeal.

Approval of the Council under Building Bye-Laws must be obtained and the terms of the approval must be complied with in the carrying out of the work before any development which may be permitted is commenced.

FUTURE PRINT LTD.

DUBLIN COUNTY COUNCIL

Tel. 724755 (ext. 262/264)

PLANNING DEPARTMENT,
BLOCK 2,
IRISH LIFE CENTRE,
LR. ABBEY STREET,
DUBLIN 1.

Notification of Decision to Grant Permission/[redacted]

Local Government (Planning and Development) Acts, 1963-1983

To O'Connor Sutton Cronin,
25 Lower Mount Street,
Dublin 2.

Decision Order Number and Date P/4465/91 - 25.09.1991

Register Reference No. 91A/1266

Planning Control No.

Application Received on 31.07.1991

Applicant John Gargan.

In pursuance of its functions under the above-mentioned Acts, the Dublin County Council, being the Planning Authority for the County Health District of Dublin, did by Order dated as above make a decision to grant Permission/[redacted] for:-

proposed grain store at Greenoge, Rathcreedan, Rathcoole.

SUBJECT TO THE FOLLOWING CONDITIONS

CONDITIONS	REASONS FOR CONDITIONS
NOTE: Compliance with one or more of the conditions of this permission may result in material alterations to the development as initially proposed and, accordingly, may require the submission of a further planning application.	

Signed on behalf of the Dublin County Council

For Principal Officer

Date 25th September, 1991.

IMPORTANT: Turn overleaf for further information

Dublin County Council Comhairle Chontae Atha Cliath **Planning Department**

Bloc 2, Ionad Bheatha na hEireann,
Block 2, Irish Life Centre,
Sraid na Mainistreach Iacht,
Lower Abbey Street,
Baile Atha Cliath 1.
Dublin 1.
Telephone. (01)724755
Fax. (01)724896

Register Reference : 91A/1266 Date : 27th September 1991

Dear Sir/Madam,

Development : Grain Store

LOCATION : Greenoge, Rathcreedan, Rathcoole

Applicant : John Gargan

App. Type : PERMISSION/BUILDING BYE-LAW APPROVAL

I wish to inform you that by Order dated 26.09.91 it was decided to GRANT PERMISSION for the above proposal.

This decision,together with the conditions/reasons attached thereto, is recorded in the Planning Register kept at this office in accordance with Section 8 of the Local Government(Planning and Development)Act 1963. This register may be inspected during office hours [9.00a.m.- 12.30p.m. 2.15p.m. - 4.30p.m.] and interested party may obtain a certified copy of an entry therein on payment of a fee of £5 in respect of each entry.

It should be noted that the proposer may appeal to An Bord Pleanala against the decision or any conditions attached to the Council's decision within one month beginning on the day of receipt by him of the Council's decision. Any other person may appeal to An Bord Pleanala within three weeks beginning on the date of decision. Interested parties are advised to consult the Planning Authority or An Bord Pleanala to ascertain if an appeal has been lodged by the applicant.

All appeals against decisions of the Planning Authority and all correspondence in relation to new and existing appeals should be addressed to The Secretary, An Bord Pleanala, Blocks 6 & 7 Irish Life Centre, Lower Abbey Street, Dublin 1.(Tel.728011). Any appeal made to An Bord Pleanala will be invalid unless the correct fee is received by An Bord Pleanala within the statutory appeal period. The fee in respect of an appeal by an applicant for permission relating to commercial development is £100; any other appeal is £50.

Submissions or observations made to An Bord Pleanala by or on behalf of a person (other than the applicant) as regards an appeal made by another person must be accompanied by a fee of £15.

Yours faithfully,

J.P. Moran,
Executive Officer,
Department of Defence,
Park House, Dublin 7.

.....

for PRINCIPAL OFFICER

TELEPHONE: Dublin (01) 771881
TELEX: 31444 DEPHEI
FAX NO: 385953
TAGHAIRT:
Reference

AN ROINN COSANTA
(Department of Defence)
TEACH NA PÁIRCE
(Park House)
BAILE ÁTHA CLIATH, 7
(Dublin, 7)

Mary Gallin -

2/50719

3 September, 1991.

Dear Sir,

Re: Planning Applications which might Affect the Use of Casement Aerodrome, Baldonnel, Co. Dublin

I am directed by the Minister for Defence to refer to applications:

91A/1206 - Portland Ltd., 3 Rock Mountain, Ballyedmonduff

No objection is seen to this proposal provided the mast is marked and lighted with one fixed low intensity red light such as GEC Model ZA 760.

91A/1266 - J. Gargan, Greenoge, Rathcoole

No objection is seen to this development provided:

(a) it is reduced to 11M in height and
(B) no activity on the site will give rise to bird hazard for aircraft.

Yours sincerely,

JOHN P MORAN
EXECUTIVE OFFICER

The Secretary
Dublin County Council
Planning Department
Irish Life Mall
Lower Abbey Street
Dublin 1

BC9

BYE LAW APPLICATION FEES

REF. NO.: 91A/266 CERTIFICATE NO.: 15929B

PROPOSAL: Grain Store

LOCATION: Grain Store in Greenogue, Rathcreedan

APPLICANT: John Gorgan

	1	2	3	4	5	6	7
CLASS	DWELLINGS/AREA LENGTH/STRUCTURE	RATE	AMT. OF FEE REQUIRED	AMT. LODGED	BALANCE DUE	RED. FEE APPL.	AMT. OF RED. FEE
A	Dwelling (Houses/Flats)	@ £55					
B	Domestic Ext. (Improvement/ Alts.)	@ £30					
C	Building for office or other comm. purpose	@ £3.50 per M^2 or £70		N.B. AGRICULTURAL USE.			
D	Building or other structure for purposes of agriculture 2125.0 m²	@ £1.00 per M^2 in excess of 300 M^2 Min. £70	300	£300			
E	Petrol Filling Station	@ £200					
F	Dev. of prop. not coming within any of the forgoing classes	£70 or £9 per .1 hect. whichever is the greater					

Column 1 Certified: Signed: [signature] Grade: D/TC Date: 6/8/91

Column 1 Endorsed: Signed: [signature] Grade: _____ Date: _____

Columns 2,3,4,5,6 & 7 Certified: Signed: [signature] Grade: S.O Date: 6/8/91

Columns 2,3,4,5,6 & 7 Endorsed: Signed: _____ Grade: _____ Date: _____

LOCATION GOVERNMENT (PLANNING AND DEVELOPMENT) ACTS, 1963 TO 1982

ASSESSMENT OF FINANCIAL CONTRIBUTION

EG. REF.: 91A/1266

CIT. REG.:

ERVICES INVOLVED: WATER/FOUL SEWER/SURFACE WATER

REA OF SITE:

LOOR AREA OF PRESENT PROPOSAL: 22874 Ft²

J.Y. 6/8/91

EASURED BY:

HECKED BY:

ETHOD OF ASSESSMENT:

OTAL ASSESSMENT

ANAGER'S ORDER NO: P/ /
DATED

NTERED IN CONTRIBUTIONS REGISTER:

EVELOPMENT CONTROL ASSISTANT GRADE

PLANNING APPLICATION FEES

Reg. Ref.....91A/1266 Cert. No....26221.....

PROPOSAL.....Grain Store.....

LOCATION....Grain Store to Greenogue Rathcreedan.....

APPLICANT....John Gargan.....

CLASS	DWELLINGS/AREA LENGTH/STRUCT.	RATE	AMT. OF FEE REC.	AMOUNT LODGED	BALANCE DUE	BALANCE PAID
1	Dwellings	@£32				
2	Domestic,	@£16				
3	Agriculture 2125.0m²	@50p per m2 in excess of 300m2. Min. £40	£150	£150		
4	Metres	@£1.75 per m2 or £40		N.B. AGRICULTURAL USE		
5	x .1 hect.	@£25 per .1 hect. or £250				
6	x .1 hect.	@£25 per .1 hect. or £40				
7	x .1 hect.	@£25 per .1 hect. or £100				
8		@£100				
9	x metres	@£10 per m2 or £40				
10	x 1,000m	@£25 per £1000m or £40				
11	x .1 hect.	@£5 per .1 hect. or £40				

Column 1 Certified:Signed:.....Grade D/T.....Date..6/8/91...

Column 1 Endorsed:Signed:.....Grade.....Date.....

Columns 2,3,4,5,6 & 7 Certified:Signed:.....Grade S.O Date 6/8/91

Columns 2,3,4,5,6 & 7 Endorsed:Signed:.....Grade.....Date.....

SOUTH DUBLIN COUNTY COUNCIL

MEETING OF PLANNING AND DEVELOPMENT COMMITTEE HELD ON 21/1/97

FILE DISCUSSED: S91A/1266/EP

RECOMMENDATIONS: Cllr. C. Quinn noted refusal to continue

COMMENTS:

SOUTH DUBLIN COUNTY COUNCIL
COMHAIRLE CHONTAE ÁTHA CLIATH THEAS

Bosca 4122,
Lár an Bhaile, Tamhlacht,
Baile Átha Cliath 24.

Telefon: 01-462 0000
Facs: 01-462 0104

PLANNING
DEPARTMENT
P.O. Box 4122,
Town Centre, Tallaght,
Dublin 24.

Telephone: 01-462 0000
Fax: 01-462 0104

NOTIFICATION OF DECISION TO REFUSE EXT. OF DURATION OF PERMISSION
LOCAL GOVERNMENT (PLANNING AND DEVELOPMENT) ACTS, 1963 TO 1993

Decision Order Number 2437	**Date of Decision** 17/12/96
Register Reference 91A/1266/EP	**Date** 31st October 1996

Applicant John Gargan,

Development Grain store.

Location Greenoge, Rathcreedan, Rathcoole, Co. Dublin.

Dear Sir/Madam,

I refer to your application for extension of duration of permission to erect a grain store at Greenoge, Rathcoole (91A/1266/EP refers). An extension of time cannot be granted on this instance for the following reason:

Reasons

1 Having regard to the fact that significant works have not been carried out pursuant to planning permission Ref. 91A/1266 coupled with the date of the expiration of that permission, it is considered that the application for the extension of the duration of the period of planning permission (Ref. 91A/1266) does not meet with the requirements of S(4) of the Local Government (Planning and Development) Act 1982, and particularly S(4)(1)(c) of the said Act and associated Regulations. As such, the development if it were to proceed at this stage would represent unauthorised development within the meaning of the

John Gargan,
Rathcreedan,
Rathcoole,
Co. Dublin.

NOTES

(A) REFUND OF FEES SUBMITTED WITH A PLANNING APPLICATION

Provision is made for a partial refund of fees in the case of certain repeat applications submitted within a period of twelve months where the full standard fee was paid in respect of the first application and where both applications relate to developments of the same character or description and to the same site. An application for a refund must be made in writing to the Planning Authority and received by them within a period of two months beginning on the date of Planning Authority's decision on the second application. For full details of fees, refunds and exemptions the Local Government (Planning & Development) Regulations, 1994 should be consulted.

(B) APPEALS

1. An appeal against the decision may be made to An Bord Pleanala. The applicant or ANY OTHER PERSON may appeal within ONE MONTH beginning on the date of this decision. (N.B. Not the date on which the decision is sent or received).

2. Every appeal must be made in writing and must state the subject matter and full grounds of appeal. It must be fully complete from the start. Appeals should be sent to:–

   The Secretary,
   An Bord Pleanala,
   Floor 3, Block 7,
   Irish Life Centre,
   Lower Abbey Street,
   Dublin 1.

3. An appeal lodged by an applicant or his agent or by a third party with An Bord Pleanala will be invalid unless accompanied by the prescribed fee. A schedule of fees is at 7 below.

4. A party to an appeal making a request to An Bord Pleanala for an oral Hearing of an appeal must, in addition to the prescribed fee, pay to An Bord Pleanala a further fee (see 7 (g) below).

5. A person who is not a party to an appeal must pay a fee to An Bord Pleanala when making submissions or observations to An Bord Pleanala in relation to an appeal.

6. If the Council makes a decision to grant permission/approval and there is no appeal to An Bord Pleanala against this decision, PERMISSION/APPROVAL will be granted by the Council as soon as may be after the expiration of the period for the taking of such an appeal. If every appeal made in accordance with the Acts has been withdrawn, the Council will grant the PERMISSION/APPROVAL as soon as may be after the withdrawal.

7. Fees payable to An Bord Pleanala are as follows:

   (a) Appeal against a decision of a Planning Authority on a planning application relating to commercial development, by the person by whom the application was made £200.00

   (b) Appeals other than an appeal mentioned at (a) £100.00

   (c) Reference £100.00

   (d) Request for a determination £100.00

   (e) Reduced Fee £50.00

   (f) Submissions or observations £30.00

   (g) Request for an oral hearing £50.00

If in doubt regarding any of the above appeal matters, you should contact An Bord Pleanala for clarification at:

Telephone 01-872 8011.

SOUTH DUBLIN COUNTY COUNCIL
COMHAIRLE CHONTAE ÁTHA CLIATH THEAS

Bosca 4122,
Lár an Bhaile, Tamhlacht,
Baile Átha Cliath 24.

Telefon: 01-462 0000
Facs: 01-462 0104

PLANNING
DEPARTMENT
P.O. Box 4122,
Town Centre, Tallaght,
Dublin 24.

Telephone: 01-462 0000
Fax: 01-462 0104

REG REF. 91A/1266/EP

Local Government (Planning and Development) Acts, 1963 to 1993 and associated Regulations. In this regard that Planning Authority is of the opinion that substantial works were not carried out pursuant to the grant of permission during the life of the permission.

Yours faithfully,

.....

for Senior Administrative Officer

NOTES

(A) REFUND OF FEES SUBMITTED WITH A PLANNING APPLICATION

Provision is made for a partial refund of fees in the case of certain repeat applications submitted within a period of twelve months where the full standard fee was paid in respect of the first application and where both applications relate to developments of the same character or description and to the same site. An application for a refund must be made in writing to the Planning Authority and received by them within a period of two months beginning on the date of Planning Authority's decision on the second application. For full details of fees, refunds and exemptions the Local Government (Planning & Development) Regulations, 1994 should be consulted.

(B) APPEALS

1. An appeal against the decision may be made to An Bord Pleanala. The applicant or ANY OTHER PERSON may appeal within ONE MONTH beginning on the date of this decision. (N.B. Not the date on which the decision is sent or received).

2. Every appeal must be made in writing and must state the subject matter and full grounds of appeal. It must be fully complete from the start. Appeals should be sent to:–

   The Secretary,
   An Bord Pleanala,
   Floor 3, Block 7,
   Irish Life Centre,
   Lower Abbey Street,
   Dublin 1.

3. An appeal lodged by an applicant or his agent or by a third party with An Bord Pleanala will be invalid unless accompanied by the prescribed fee. A schedule of fees is at 7 below.

4. A party to an appeal making a request to An Bord Pleanala for an oral Hearing of an appeal must, in addition to the prescribed fee, pay to An Bord Pleanala a further fee (see 7 (g) below).

5. A person who is not a party to an appeal must pay a fee to An Bord Pleanala when making submissions or observations to An Bord Pleanala in relation to an appeal.

6. If the Council makes a decision to grant permission/approval and there is no appeal to An Bord Pleanala against this decision, PERMISSION/APPROVAL will be granted by the Council as soon as may be after the expiration of the period for the taking of such an appeal. If every appeal made in accordance with the Acts has been withdrawn, the Council will grant the PERMISSION/APPROVAL as soon as may be after the withdrawal.

7. Fees payable to An Bord Pleanala are as follows:

   (a) Appeal against a decision of a Planning Authority on a planning application relating to commercial development, by the person by whom the application was made £200.00

   (b) Appeals other than an appeal mentioned at (a) £100.00

   (c) Reference £100.00

   (d) Request for a determination £100.00

   (e) Reduced Fee £50.00

   (f) Submissions or observations £30.00

   (g) Request for an oral hearing £50.00

If in doubt regarding any of the above appeal matters, you should contact An Bord Pleanala for clarification at:

Telephone 01-872 8011.

P/2437/96

Comhairle Chontae Atha Cliath Theas

Record of Executive Business and Manager's Orders

Register Reference: 91A/1266/EP **App. Date:** 31st October 1996

Submission: **Dated:**

Correspondence Name and Address John Gargan,
Rathcreedan,
Rathcoole,
Co. Dublin.

Development Grain store.

Location Greenoge, Rathcreedan, Rathcoole, Co. Dublin.

Applicant John Gargan,

App. Type Extension Of Duration Of Permission

Zoning

Final Grant Order

Dated

(DC/SW)

This is an application to extend the duration of a planning permission for a grain store at the above location. Planning permission for the development expires on the 18th December, 1996.

I visited the site on the 13th December and noted that the only works carried out on the site was the stripping of the top soil and the storage of that top soil at the western boundary of the site. It is my opinion that whilst it may be argued that development on the site has commenced, no substantial works have been carried out pursuant to the permission and that having regard to the very limited, if any works which have been carried out, it is unlikely that the development would be completed within a reasonable period of time.

Comhairle Chontae Atha Cliath Theas

Record of Executive Business and Manager's Orders

REG. REF.91A/1266/EP
LOCATION

I note from the application form submitted with the application that the applicant states that the substantial works carried out before the permission expired are "foundations, structural steel and roof".

Having regard to the above it is my opinion that the application does not comply with the requirements of S(4) of the Local Government (Planning and Development) Act, 1982 and associated Regulations.

I recommend that a decision to Refuse Ext of Duration Of Permission be made under the Local Government (Planning and Development) Acts, 1963-1993, for the following (1) reason(s) :-

Reason(s)

1 Having regard to the fact that significant works have not been carried out pursuant to planning permission Ref. 91A/1266 coupled with the date of the expiration of that permission, it is considered that the application for the extension of the duration of the period of planning permission (Ref. 91A/1266) does not meet with the requirements of S(4) of the Local Government (Planning and Development) Act 1982, and particularly S(4)(1)(c) of the said Act and associated Regulations. As such, the development if it were to proceed at this stage would represent unauthorised development within the meaning of the Local Government (Planning and Development) Acts, 1963 to 1993 and associated Regulations. In this regard the Planning Authority is of the opinion that substantial works were not carried out pursuant to the grant of permission during the life of the permission.

Comhairle Chontae Atha Cliath Theas

Record of Executive Business and Manager's Orders

REG. REF.91A/1266/EP
LOCATION

.....
for County Planning Officer

Endorsed: .....
Senior Administrative Officer

ORDER: ~~Decision~~ pursuant to Section 4 of the Local Government (Planning and Development) Act 1982, the application to extend the period for which the above mentioned planning permission has effect is hereby refused for the (one) reason set out above. ~~No investigation.~~

Dated: 17th December 1996

Approved Officer

to whom the appropriate powers have been delegated by order of the County Manager dated 01.11.1996.

(01) 8042000
Fax (01) 8042800
V.A.T. No. IE 6517956C

Paulm

AN ROINN COSANTA
(DEPARTMENT OF DEFENCE)
TEACH NA PÁIRCE
(PARK HOUSE)
BAILE ÁTHA CLIATH 7
(DUBLIN 7)

Taghairt:
Reference: 2/50719

Dear Sir,

Re: Planning Applications which might affect the use of Casement Aerodrome, Baldonnel, Dublin 22

I am directed by the Minister for Defence to refer to the following planning applications;

S96A/561 **Mr C McCarthy, Greenogue, Rathcoole : Erection 2 Bungalows together with 2 septic tanks..** SW 3.12.96

S96A/572 **Kellard Homes, Access of roundabout on Fortunestown Way opposite Brookfield at Gibbons, Jobstown, Tallaght : residential development consisting of 112 nr 3 bedroom semi detached, associated siteworks and public open space on site of area 10 acres.** MO 3.12.96

S96B/432 **Dr L Lynch, Coolmine, Rathcoole : extension to house** 3.12.96 MO

S96A/556 **Mr W. Dowling, Bedlesshill, Old Naas Road, Clondalkin : 6 nr Light industrial units, relocation of entrance and retention of 4 light industrial units.** SW 3.12.96

No objection is seen to these developments provided they do not exceed 15m in height above ground level.

S96B/425 **F.Daly, 118 Forest Hills, Rathcoole, Co. Dublin : porch veranda and bay window to front and retention of garage to rear.** MO 3.12.96

No objection is seen to this development provided it does not exceed 15m in height above ground level and to note that the site is located in an area in which the level of aircraft noise without adequate sound insulation will be intrusive.

91A/1266\EP **John Gargan, Rathcreedon, Rathcoole, Co. Dublin : grain store** 3.12.96 MO

No objection is seen to this development provided it does not exceed 15m in height above ground level and provided no activity on the site will give rise to bird hazard for aircraft.

Yours sincerely,

MARIAN LYNCH
PROPERTY MANAGEMENT
27 November 1996

The Secretary,
South Dublin County Council,
Planning Department,
P.O. Box 4122,
Town Centre,
Tallaght,
Dublin 24.

MK 2/12/96

SOUTH DUBLIN COUNTY COUNCIL

MEETING OF PLANNING AND DEVELOPMENT COMMITTEE HELD ON 19.11.96

FILE DISCUSSED: 91A/1266/EP

RECOMMENDATIONS: Cllr. C O'Connor noted this application

COMMENTS:

SOUTH DUBLIN COUNTY COUNCIL
COMHAIRLE CHONTAE ÁTHA CLIATH THEAS

Bosca 4122,
Lár an Bhaile, Tamhlacht,
Baile Átha Cliath 24.

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PLANNING
DEPARTMENT
P.O. Box 4122,
Town Centre, Tallaght,
Dublin 24.

Telephone: 01-462 0000
Fax: 01-462 0104

Date : 15th November 1996

LOCAL GOVERNMENT (PLANNING AND DEVELOPMENT) ACTS,1963-1993

Register Reference : 91A/1266/EP/C1

Development : Grain store. Compliance re. Condition Nos. 3, 4 & 11.

Location : Greenoge, Rathcreedan, Rathcoole, Co. Dublin.

Applicant : John Gargan,
Rathcreedan, Rathcoole, Co. Dublin.

App. Type : Compliance with Conditions

Dear Sir/Madam,

With reference to the above, I acknowledge receipt of your submission to comply with conditions received on 11/11/96.

Yours faithfully,

M. Kelly
.....
for SENIOR ADMINISTRATIVE OFFICER

O'Connor Sutton Cronin,
Consulting Civil and Structural Engineers,
2 Holles Street,
Dublin 2.

bioCYCLE LTD. WASTE WATER TREATMENT SYSTEMS
Unit 107, Baldoyle Industrial Estate, Dublin 13.
Dublin Office: Tel: 01-8391000 Fax: 01-8391998
Limerick Office: Tel/Fax: 061-331336
Cork Office: Tel/Fax: 021-831554
Armagh Office: Tel/Fax: 0801- 861-538329.

Ref: 5494

31st October 1996

O'CONNOR SUTTON CRONIN
04 NOV 1996
RECEIVED

Attention Mr Kevin Cronin

O' Connor Sutton Cronin
Consulting Civil & Structural Engineers
2 Holles Street
Dublin 2.

RE: BIOCYCLE WASTE WATER TREATMENT SYSTEM FOR GRAIN STORE, RATHCOOLE.

Dear Mr Cronin,

Further to your recent correspondence, we are pleased to provide a proposal for the above site as follows:

11 NOV 1996
REG. No. SI 168/1256

Hydraulic Flow

2 Full Time Staff @ 45 L/person/day = 90 L/day

Organic Load

2 Full Time Staff @ 18 g/person/day = 0.036 kg/day

Based on the above figures which indicate a maximum hydraulic flow of 90 litres per day and an organic load of 0.036 kgs, we propose a Biocycle Waste Water Treatment System with a capacity of 5,200 litres as specified in Agrément Certificate No. 96/0033.

Based on your reported percolation test results, a sub-surface irrigation area comprising of 20 linear metres should be used for disposal of the daily volume of effluent from the Biocycle Unit. The sub-surface irrigation trench should be constructed as per Fig. 8 of the Irish Agrément Certificate No 96/0033. The bottom of the bed of washed pebble into which the irrigation pipe is placed should be 1 metre above the highest water table level that will occur on the site. It is important that the irrigation trenches are laid level.

The irrigation area should be located on the site according to the guidelines given in Table 1 of the Agrément Certificate. The setback distances in relation to wells, both on the site and on any adjacent properties, are of particular importance. Figures 6 and 7 of the Argément Certificate show typical layouts of the irrigation area.

Directors:
F. Cavanagh (Managing)
B. McGonagle (Operations)

Project Manager:
T. Killarney B.E., M.I.E.I.

Technical:
P.Mahon B.Sc., AfI IEI

Sales:
A. Twomey M.M.I.I.
M. Dowdall

Administration:
S. Elmes A.I.T.I.
J.Cavanagh

Reg No. 148490. Reg. Office: Unit 107, Grange Way, Baldoyle Industrial Estate, Dublin 13.

Printed on recycled paper

Alarm System

Within the Biocycle System three alarms are installed as warning devices. An alarm panel (audio/visual), is supplied to be installed within the premises. The alarm panel is fitted with three indicator lights, an audio alarm and a mute switch. The alarm will sound and individual warning lights will light up under the following circumstances.

1. The high WATER level alarm - is activated if the water level within the treatment system rises above normal operational level for any reason.

2. The AIR pressure alarm - is activated in the event of any malfunction of the aeration system.

3. Power alarm - is activated if the circuit breaker on the power supply trips for any reason.

The mute switch allows the audio alarm once detected to be muted until the fault is rectified.

Biocycle undertake to maintain the system free of charge for the first twelve months and there after we provide a maintenance contract to service and inspect the system twice a year. On each service visit a detailed Maintenance Report Form is completed and a copy of this is sent to the Local Authority.

When applying for planning permission for a Biocycle system we recommend that the following documentation be submitted in order to enable the planning authority make a full evaluation of your submission:

1. A copy of this proposal including a copy of Agrément Certificate No. 96/0033.

2. A copy of a fully completed Site Assessment report Form duly signed by a qualified individual.

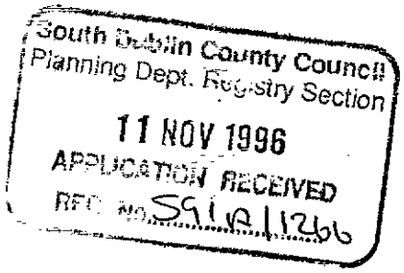
3. A site drawing showing the complete development, including the extent and layout of the irrigation area. This site drawing should also clearly indicate all site features such as gradients, proposed and existing wells, water courses, site boundaries etc.

A Purchase/Maintenance Agreement Form can be provided if requested by the local authority.

We have enclosed for your appraisal costs for the above and should you require any additional information regarding the foregoing please do not hesitate to contact the undersigned.

Yours faithfully,

Colum Smith



O'CONNOR SUTTON CRONIN
Consulting Civil and Structural Engineers

2 HOLLES STREET, DUBLIN 2.
Telephone: 661 8677 Fax: 661 8820
Compuserve: 101610,3631 Internet: 101610.3631@compuserve.com

I.S./ISO 9001/EN 29001

91/1266/EP

Chief Planning Officer
South Dublin County Council
Town Centre
Tallaght
Dublin 24

8th October 1996

KC/DMS

PROJECT NO. G2

SOUTH DUBLIN COUNTY COUNCIL
1 NOV 1996
PLANNING DEPT.

RE: PROPOSED GRAIN STORE, RATHCOOLE
REFERENCE DECISION ORDER P5853/91

Dear Sir,

Please find enclosed drawings to comply with conditions No. 3,4 and 11 of Grant Order No. P5853/91 of 18th December 1991 as follows:-

1. 4 No. copy drawing G2/PO4B.

2. Also enclosed are 4 No. copy proposals from Biocycle Waste Water Treatment System.

As this work is due to commence, we wish to comply fully with the above mentioned conditions and your earliest response to same would be appreciated.

Yours faithfully,

pp D. Smith
KEVIN CRONIN
For O'Connor Sutton Cronin

Encl. 4 No. copy drawings G2/PO4B.
4 No. copy proposals.

5

CC Mr John Gargan

O'Connor Sutton Cronin and Associates Limited

Directors:
John V. O'Connor — Master of Science (Management), Chartered Engineer, Fellow of the Institution of Structural Engineers, Fellow of the Institution of Engineers of Ireland, Barrister-at-Law, Member of the Association of Consulting Engineers of Ireland.
Pearse C. Sutton — Bachelor of Science (Engineering), Diploma in Environmental Engineering, Chartered Engineer, Member of the Institution of Engineers of Ireland, Member of the Association of Professional Engineers of Saskatchewan, Canada, Member of the Institution of Structural Engineers, Member of the Association of Consulting Engineers of Ireland.
Kevin A. Cronin — Bachelor of Science (Engineering), Chartered Engineer, Member of the Institution of Engineers of Ireland, Member of the Institution of Structural Engineers, Diploma in Project Management, Member of the Association of Consulting Engineers of Ireland.

SOUTH DUBLIN COUNTY COUNCIL
COMHAIRLE CHONTAE ÁTHA CLIATH THEAS

Bosca 4122,
Lár an Bhaile, Tamhlacht,
Baile Átha Cliath 24.

Telefon: 01-462 0000
Facs: 01-462 0104

PLANNING
DEPARTMENT
P.O. Box 4122,
Town Centre, Tallaght,
Dublin 24.

Telephone: 01-462 0000
Fax: 01-462 0104

Date : 1st November 1996

LOCAL GOVERNMENT (PLANNING AND DEVELOPMENT) ACTS,1963-1993

Register Reference : 91A/1266/EP

Development : Grain store.

Location : Greenoge, Rathcreedan, Rathcoole, Co. Dublin.

Applicant : John Gargan,
Rathcreedan, Rathcoole, Co. Dublin.

App. Type : Extension Of Duration Of Permission

Dear Sir/Madam,

With reference to the above, I acknowledge receipt of your application for an extension of duration of permission received on 31st October 1996.

Yours faithfully,

.....
Senior Administrative Officer

John Gargan,
Rathcreedan,
Rathcoole,
Co. Dublin.

COMHAIRLE CHONTAE ATHA CLIATH THEAS

(SOUTH DUBLIN COUNTY COUNCIL)

P.O. Box 4122,
Town Centre,
Tallaght,
Dublin 24
Tel. 462 0000

30 OCT 1996

91A/1266.

APPLICATION FOR EXTENSION OF DURATION OF PLANNING PERMISSION

1. Name and address of applicant for extension of permission : JOHN GARGAN RATHCREEDAN RATHCOOLE CO DUBLIN

2. Location of structure or land to which the permission relates : GREENOGE RATHCREEDAN RATHCOOLE CO. DUBLIN

3. The development to which the permission relates : GRAIN STORE.

4. Particulars of the interest held in the structure or land by the applicant : OWNER

5. Planning reference number and date of permission sought to be extended : ~~P/1994~~ P/5853/91 - 18/DEC/1991 To. JULY 1997

6. In the case of an outline permission the planning reference number of any subsequent approval or approvals : /

7. Date permission will cease or has ceased to have effect : 18/DEC/1996

8. Date development commenced : —

9. Particulars of the substantial works carried out before the permission expired : FOUNDATIONS STRUCTURAL STEEL & ROOF

10. Period by which the permission is sought to be extended : 6 MONTHS

11. Date on which the development is expected to be completed : JUNE 1997

12. Amount of fee enclosed : ✓
note: fee payable is £4[illegible]

SOUTH DUBLIN COUNTY COUNCIL
Planning Dept. Registry Section
31-10-1996

13. Signature of applicant (or his agent) : (JOHN GARGAN)

14. Address to which notifications should be sent : RATHCREEDAN
RATHCOOLE
CO DUBLIN.

NOTE:
In accordance with Section 4 of the Local Government (Planning and Development) Act, 1982, a Planning Authority shall extend a permission as appropriate provided the application is made in accordance with Regulations made under the Act and the Authority are satisfied in relation to the permission that:-

1. The development to which such permission relates commenced before the expiration of the appropriate period sought to be extended, and
2. Substantial works were carried out pursuant to such permission during such period, and
3. The development will be completed within a reasonable time.

COMHAIRLE CHONTAE ATHA CLIATH THEAS

(SOUTH DUBLIN COUNTY COUNCIL)

P.O. Box 4122,
Town Centre,
Tallaght,
Dublin 24
Tel. 462 0000

91A/1266.

APPLICATION FOR EXTENSION OF DURATION OF PLANNING PERMISSION

1. Name and address of applicant for extension of permission : JOHN GARGAN RATHCREEDAN RATHCOOLE CO DUBLIN

2. Location of structure or land to which the permission relates : GREENOGE RATHCREEDAN RATHCOOLE CO. DUBLIN

The development to which the permission relates : GRAIN STORE.

4. Particulars of the interest held in the structure or land by the applicant : OWNER

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7. Date permission will cease or has ceased to have effect : 18/DEC/1996

[illegible] commenced :

8. Particulars of the substantial works carried out before the permission expired : FOUNDATIONS STRUCTURAL STEEL & ROOF

10. Period by which th[illegible]mission is [illegible]ght to be extended : 6 MONTHS

11 Date on which the development is expected [illegible]e completed : JUNE 1997

12 [illegible]nount of fee en[illegible] ✓

note. fee payable is £

SOUTH DUBLIN COUNTY COUNCIL
Planning Dept. Registry Section
31-10-1998

13. Signature of applicant (or his agent) : (JOHN GARGAN)

14. Address to which notifications should be sent :

RATHCREEDAN
RATHCOOLE
CO DUBLIN.

NOTE:
In accordance with Section 4 of the Local Government (Planning and Development) Act, 1982, a Planning Authority shall ex[illegible] a permission as appropriate provided the application is made in accordance with Regulations made under the Act and [illegible] Authority are satisfied in relation to the permission that:-

1. The development to which such permission relates commenced before the expiration of the appropriate period sought to be extended, and
2. Substantial works were carried out pursuant to such permission during such period, and
3. The development will be completed within a reasonable time.

DUBLIN COUNTY COUNCIL

Tel. 724755 (ext. 262/264)

PLANNING DEPARTMENT,
BLOCK 2,
IRISH LIFE CENTRE,
LR. ABBEY STREET,
DUBLIN 1.

Notification of Decision to Grant Permission/[redacted]

Local Government (Planning and Development) Acts, 1963-1983

To O'Connor Sutton Cronin,
25 Lower Mount Street,
Dublin 2.

Decision Order Number and Date P/4465/91 - 25.09.1991

Register Reference No. 91A/1266

Planning Control No.

Application Received on 31.07.1991

Applicant John Gargan.

In pursuance of its functions under the above-mentioned Acts, the Dublin County Council, being the Planning Authority for the County Health District of Dublin, did by Order dated as above make a decision to grant Permission/[redacted] for:- proposed grain store at Greenoge, Rathcreedan, Rathcoole.

SUBJECT TO THE FOLLOWING CONDITIONS

CONDITIONS	REASONS FOR CONDITIONS
1. The development to be carried out in its entirety in accordance with the plans, particulars and specifications lodged with the application, save as may be required by the other conditions attached hereto.	1. To ensure that the development shall be in accordance with the permission and that effective control be maintained.
2. That before development commences, approval under the Building Bye-Laws be obtained, and all conditions of that approval be observed in the development.	2. In order to comply with the Sanitary Services Acts, 1878-1964.
3. That the requirements of the Supervising Environmental Health Officer be ascertained and strictly adhered to in the development.	3. In the interest of health.
4. That the water supply and drainage arrangements, including the disposal of surface water, be in accordance with the requirements of the County Council.	4. In order to comply with the Sanitary Services Acts 1878-1964.
5. That no advertising sign or structure be erected, except those which are exempted development, without prior approval of the Planning Authority.	5. In the interest of the proper planning and development of the area.

Signed on behalf of the Dublin County Council .....
For Principal Officer

Date 25th September, 1991.

IMPORTANT: Turn overleaf for further information

CONDITIONS	REASONS FOR CONDITIONS
6. Details of metal roof decking and cladding including colour to be agreed with the Planning Authority prior to commencement of development.	6. In the interest of visual amenity.
7. That the height of the structure be reduced to a maximum of 11 metres over ground level.	7. To limit interference with air traffic. Details to be agreed with the Department of Defence.
8. No activity to take place on the site that would give rise to bird hazard for aircraft.	8. In the interest of the proper planning and development of the area.
9. Details of landscaping and boundary treatment to be agreed with the Planning Authority prior to commencement of development.	9. In the interest of the proper planning and development of the area.
10. That the requirements of the Chief Fire Officer be ascertained and strictly adhered to in the development. In this regard the nearest County Council watermain is 400 m. from the entrance of the site and is a 100 m.m. watermain and fire fighting capacity would be very limited.	10. In the interest of safety and the avoidance of fire hazard.
11. Details of vehicular entrance to the site to be agreed with the Roads Engineer prior to commencement of development.	11. In the interest of the proper planning and development of the area.
12. That the proposed structure and yard be used for purposes as described in letter of application and for purposes relative to the applicants land holding in the area.	12. In the interest of the proper planning and development of the area.

NOTE:

If there is no appeal to An Bord Pleanala against this decision PERMISSION/APPROVAL will be granted by the Council as soon as may be after the expiration of the period for the taking of such appeal. If every appeal made in accordance with the Acts has been withdrawn, the Council will grant the PERMISSION/APPROVAL after the withdrawal.

An appeal against the decision may be made to An Bord Pleanala. The applicant may appeal within one month from the date of receipt by him of this notification. ANY OTHER PERSON may appeal within twenty-one days beginning on the date of the decision.

An appeal shall be in writing and shall state the subject matter and grounds of the appeal. It should be addressed to:— An Bord Pleanala, Blocks 6 and 7, Irish Life Centre, Lower Abbey Street, Dublin 1.

(1) An appeal lodged by an applicant or his agent with An Bord Pleanala will be invalid unless accompanied by a fee of £36 (Thirty-six Pounds). (2) A party to an appeal making a request to An Bord Pleanala for an Oral Hearing of an appeal must, *in addition* to (1) above, pay to An Bord Pleanala a fee of £36 (Thirty-six Pounds). (3) A person who is not a party to an appeal must pay a fee of £10 (Ten Pounds) to An Bord Pleanala when making submissions or observations to An Bord Pleanala in relation to an appeal.

Approval of the Council under Building Bye-Laws must be obtained and the terms of the approval must be complied with in the carrying out of the work before any development which may be permitted is commenced.

FUTURE PRINT LTD.

DUBLIN COUNTY COUNCIL

Tel. 724755 (ext. 262/264)

PLANNING DEPARTMENT,
BLOCK 2,
IRISH LIFE CENTRE,
LR. ABBEY STREET,
DUBLIN 1.

Notification of Decision to Grant Permission/[redacted]

Local Government (Planning and Development) Acts, 1963-1983

To O'Connor Sutton Cronin,
25 Lower Mount Street,
Dublin 2.

Decision Order Number and Date P/4465/91 - 25.09.1991
Register Reference No. 91A/1266
Planning Control No.
Application Received on 31.07.1991

Applicant John Gargan.

In pursuance of its functions under the above-mentioned Acts, the Dublin County Council, being the Planning Authority for the County Health District of Dublin, did by Order dated as above make a decision to grant Permission/[redacted] for:-

proposed grain store at Greenoge, Rathcreedan, Rathcoole.

SUBJECT TO THE FOLLOWING CONDITIONS

CONDITIONS	REASONS FOR CONDITIONS
NOTE: Compliance with one or more of the conditions of this permission may result in material alterations to the development as initially proposed and, accordingly, may require the submission of a further planning application.	

Signed on behalf of the Dublin County Council ..... For Principal Officer

Date 25th September, 1991.

IMPORTANT: Turn overleaf for further information

CONDITIONS	REASONS FOR CONDITIONS

NOTE:

If there is no appeal to An Bord Pleanala against this decision PERMISSION/APPROVAL will be granted by the Council as soon as may be after the expiration of the period for the taking of such appeal. If every appeal made in accordance with the Acts has been withdrawn, the Council will grant the PERMISSION/APPROVAL after the withdrawal.

An appeal against the decision may be made to An Bord Pleanala. The applicant may appeal within one month from the date of receipt by him of this notification. ANY OTHER PERSON may appeal within twenty-one days beginning on the date of the decision.

An appeal shall be in writing and shall state the subject matter and grounds of the appeal. It should be addressed to:— An Bord Pleanala, Blocks 6 and 7, Irish Life Centre, Lower Abbey Street, Dublin 1.

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FUTURE PRINT LTD.

Dublin County Council Comhairle Chontae Atha Cliath **Planning Department**

Building Control Department,
Liffey House,
Tara Street,
Dublin 1.
Telephone:773066

Bloc 2, Ionad Bheatha na hEireann,
Block 2, Irish Life Centre,
Sraid na Mainistreach Iacht,
Lower Abbey Street,
Baile Atha Cliath 1.
Dublin 1.
Telephone. (01)724755
Fax. (01)724896

Register Reference : 91A/1266 Date : 1st August 1991

LOCAL GOVERNMENT (PLANNING AND DEVELOPMENT) ACTS, 1963 TO 1990

Dear Sir/Madam,

DEVELOPMENT : Grain Store

LOCATION : Greenoge, Rathcreedan, Rathcoole

APPLICANT : John Gargan

APP. TYPE : PERMISSION/BUILDING BYE-LAW APPROVAL

With reference to the above, I acknowledge receipt of your application received on 31st July 1991.

Yours faithfully,

.....

for PRINCIPAL OFFICER

O'Connor Sutton Cronin,
25 Lower Mount Street,
Dublin 2.

Dublin County Council
Comhairle Chontae Átha Cliath

Planning Application Form/
Bye - Law Application Form

PLEASE READ INSTRUCTIONS AT BACK BEFORE COMPLETING FORM. ALL QUESTIONS MUST BE ANSWERED.

1. Application for Permission [✓] Outline Permission [ ] Approval [ ] Place ✓ in appropriate box.
Approval should be sought only where an outline permission was previously granted. Outline permission may not be sought for the retention of structures or continuances of uses.

2. Postal address of site or building ..... NEW GRAIN STORE, GREENOGE, RATHCREEDAN, RATHCOOLE
(If none, give description sufficient to identify).....

3. Name of applicant (Principal not Agent)..... MR JOHN GARGAN

Address..... Tel. No.....

4. Name and address of ..... O CONNOR SUTTON CRONIN
person or firm responsible for preparation of drawings ..... 25 LOWER MOUNT ST DUBLIN 2 Tel. No 609977

5. Name and address to which ..... O CONNOR SUTTON CRONIN
notifications should be sent ..... 25 LOWER MOUNT ST DUBLIN 2

APPLICATION. 300 N 45477

6. Brief description of ..... GRAIN STORE AGRICULTURAL BUILDING
proposed development

7. Method of drainage ..... COUNTY COUNCIL 8. Source of Water Supply ..... COUNTY COUNCIL

9. In the case of any building or buildings to be retained on site, please state:-
(a) Present use of each floor or use when last used. .....
(b) Proposed use of each floor .....

FEE PAID £150 DATE 31/7 N 44386

10 Does the proposal involve demolition, partial demolition or change of use of any habitable house or part thereof? .....

11.(a) Area of Site ..... 40760 Sq. m.

Irish (b) Floor area of proposed development ..... 2119 Sq. m.

Irish (c) Floor area of buildings proposed to be retained within site ..... Sq. m.

12.State applicant's legal interest or estate in site (i.e. freehold, leasehold, etc.) ..... FREE HOLD

18/7/91

RECEIVED
31JUL1991
PLANNING DEPT.

13.Are you now applying also for an approval under the Building Bye Laws?
Yes [✓] No [ ] Place ✓ in appropriate box.

14.Please state the extent to which the Draft Building Regulations have been taken in account in your application.
Cognisance Was Taken of the DRAFT BUILDING REGULATIONS

15.List of documents enclosed with application. LETTER, CHEQUES FOR BYELAW & PLANNING PERMISSION AD FROM PAPER, STRUCTURAL CALCULATIONS SPECIFICATIONS, DRAWINGS

DUBLIN COUNTY COUNCIL — Permission sought for grain store at Greenoge, Rathcreedan, Rathcoole, for Mr. John Gargan.

16.Gross floor space of proposed development (See back) ..... 2119 Sq. m.

No of dwellings proposed (if any) ..... NONE Class(es) of Development ..... CLASS 3, CLASS D

Fee Payable £..... 450 Basis of Calculation ..... £300 for BYE LAWS, £150 FOR PLANNING

If a reduced fee is tendered details of previous relevant payment should be given

Signature of Applicant (or his Agent) ..... Kevin Cronin Date 31/7/91

FOR OFFICE USE ONLY

Application Type ..... P/B
Register Reference 91A/1266
Amount Received £..... 2.36.16.4
Receipt No .....
Date 21-9

31/7

LOCAL GOVERNMENT (PLANNING & DEVELOPMENT) REGULATIONS 1977 to 1984.

Outline of requirements for applications for permission or Approval under the Local Government (Planning & Development) Acts 1963 to 1983. The Planning Acts and Regulations made thereunder may be purchased from the Government Publications Sa[illegible] Office, Sun Alliance House, Molesworth Street, Dublin 2.

1. Name and Address of applicant.

2. Particulars of the interest held in the land or structure, i.e. whether freehold, leasehold, etc.

3. The page of a newspaper, circulating in the area in which the land or structure is situate, containing the required statutory notice. The newspaper advertisement should state after the heading Co. Dublin.

   (a) The address of the structure or the location of the land.
   (b) The nature and extent of the development proposed. If retention of development is involved, the notice should be worded accordingly. Any demolition of habitable accommodation should be indicated.
   (c) The name of the applicant.

   NB. Applications must be received within 2 weeks from date of publication of the notice.

4. Four (4) sets of drawings to a stated scale must be submitted. Each set to include a layout or block plan, proposed and existing services to be shown on this drawing, location map, and drawings of relevant floor plans, elevations, sections, details of type and location of septic tank (if applicable) and such other particulars as are necessary to identify the land and to describe the works or structure to which the application relates (new work to be coloured or otherwise distinguished from any retained structures). Buildings, roads, boundaries and other features bounding the structure or other land to which the application relates shall be shown on site plans or layout plans. The location map should be of scale not less than 1: 2500 and should indicate the north point. The site of the proposed development must be outlined in red. Plans and drawings should indicate the name and address of the person by whom they were prepared. Any adjoining lands in which the applicant has an interest must be outlined in blue.

5. In the case of a proposed change of use of any structure or land, requirements in addition to 1, 2, & 3 are.
   (a) a statement of the existing use and the proposed use, or, where appropriate, the former use and the use proposed.

   (b) (i) Four (4) sets of the drawings to a stated scale must be submitted. Each set to consist of a plan or location map (marked or coloured in red so as to identify the structure or land to which the application relates) to a scale of not less than 1:2500 and to indicate the North point. Any adjoining lands in which the application has an interest must be outlined in blue.

   (ii) A layout and a survey plan of each floor of any structure to which the application relates.

   (c) Plans and drawings should indicate the name and address of the person by whom they were prepared.

6. Applications should be addressed to: Dublin County Council, Planning Department, Irish Life Centre, Lr. Abbey Street, Dublin 1, Tel. 724755.

SEPTIC TANK DRAINAGE: Where drainage by means of a septic tank is proposed, before a planning application is considered, the applicant may be required to arrange for a trial hole to be inspected and declared suitable for the satisfactory percolation of septic tank effluent. The trial hole to be dug seven feet deep at or about the site of the septic tank. Septic tanks are to be in accordance with I.I.R.S. S.R. 6:75.

INDUSTRIAL DEVELOPMENT:

The proposed use of an industrial premises should, where possible, be stated together with the estimated number of employees, (male and female). Details of trade effluents, if any, should be submitted.

Applicants to comply in full with the requirements of the Local Government (Water Pollution) Act,1977 in particular the licencing provisions of Sections 4 and 16.

PLANNING APPLICATIONS

CLASS NO.	DESCRIPTION	FEE
1.	Provision of dwelling — House/Flat.	£32.00 each
2.	Domestic extensions/other improvements.	£16.00
3.	Provision of agricultural buildings (See Regs.)	£40.00 minimum
4.	Other buildings (i.e. offices, commercial, etc.)	£1.75 per sq. metre (Min. £40.00)
5.	Use of land (Mining, deposit or waste)	£25.00 per 0.1 ha (Min £250.00)
6.	Use of land (Camping, parking, storage)	£25.00 per 0.1 ha (Min. £40.00)
7.	Provision of plant/machinery/tank or other structure for storage purposes.	£25.00 per 0.1 ha (Min. £100.00)
8.	Petrol Filling Station.	£100.00
9.	Advertising Structures.	£10.00 per m² (min £40.00)
10.	Electricity transmission lines.	£25.00 per 1,000m (Min. £40.00)
11.	Any other development.	£5.00 per 0.1 ha (Min. £40.00)

BUILDING BYE-LAW APPLICATIONS

CLASS NO.	DESCRIPTION	FEE
A	Dwelling (House/Flat)	£55.00 each
B	Domestic Extension (improvement/alteration)	£30.00 each
C	Building — Office/ Commercial Purposes	£3.50 per m² (min. £70.00)
D	Agricultural Buildings/Structures	£1.00 per m² in excess of 300 sq. metres (min. - £70.00) (Max. - £300.00)
E	Petrol Filling Station	£200.00
F	Development or Proposals not coming within any of the foregoing classes.	£9.00 per 0.1 ha (£70.00 min.) Min. Fee £30.00 Max. Fee £20,000

Cheques etc. should be made payable to: Dublin County Council.

Gross Floor space is to be taken as the total floor space on each floor measured from the inside of the external walls.

For full details of Fees and Exemptions see Local Government (Planning and Development) (Fees) Regulations 1984.

COMHAIRLE CHONTAE ÁTHA CLIATH

PAID BY — **DUBLIN COUNTY COUNCIL**

46/49 UPPER O'CONNELL STREET, DUBLIN 1.

RECEIPT CODE

CASH
CHEQUE
M.O.
B.L.
I.T.

BYE LAW APPLICATION

REF. No. N 45422

£300.00

Received this 31st day of July 1991

from John D + Francis M Corgan

the sum of three hundred ——— Pounds

——— Pence, being £300 Cr 481

application at Greenogue, Rathcoole

Class D

Michael O'Hara
Cashier

S. CAREY
Principal Officer

COMHAIRLE CHONTAE ÁTHA CLIATH

RECEIPT CODE

PAID BY

DUBLIN COUNTY COUNCIL

46/49 UPPER O'CONNELL STREET

DUBLIN 1.

issue of this receipt is not an acknowledgement that the fee is the prescribed application

CHEQUE

N 44386

€150.00

Received this 31st day of July 19 91

from John D. & Teresa M. Egan

the sum of One hundred and fifty Pounds

Pence, being fee for planning application at Grange, Rathcoole

Class 3

Michael Ah Cashier

S. CAREY
Principal Officer

O'CONNOR SUTTON CRONIN

Consulting Civil and Structural Engineers

25 LOWER MOUNT STREET, DUBLIN 2.

Telephone: 609977
Fax: 609414

Attention:
The Chief Planning Officer,
Dublin County Council,
Planning Department,
Irish Life Centre,
Lr. Abbey Street,
Dublin 1

Y COUNCIL
istry Section
COPIED
31 JUL 1991
REG No. 91A/1266
APPLICATION TYPE O/P/A/BBL
No L.D 8

30 July 1991

KC/fo'k

RE: PROPOSED GRAIN STORE, BREENOGUE, RATHCREDAN, RATHCOOLE CO DUBLIN - FOR MR JOHN GARGAN:

Dear Sirs,

We enclose for Planning & Bye-Law Approval 4 copies of the following documents:

1. Completed Application Forms
2. Cheques payable to Dublin County Couuncil
   (a) Bye-Law £300 (Farm Buildings)
   (b) Planning Permission £150 (Farm Buildings)
3. Advertisement in National Press dated Thursday, 18 July 1991.
4. Structural Calculations.
5. Specification for
   (a) Ground Floor and Site Works
   (b) Cast-in-Situ Concrete
   (c) Precast Concrete Specification
   (d) Development Work

O'Connor Sutton Cronin and Associates Limited

Directors:

John V. O'Connor	Master of Science, Chartered Engineer, Fellow of the Institution of Structural Engineers. Fellow of the Institution of Engineers of Ireland, Barrister-at-Law.
Pearse C. Sutton	Bachelor of Science (Engineering), Chartered Engineer, Member of the Institution of Engineers of Ireland, Member of the Association of Professional Engineers at Saskatchewan, Canada, Member of the Institution of Structural Engineers.
Kevin A. Cronin	Bachelor of Science (Engineering), Chartered Engineer, Member of the Institution of Engineers of Ireland, Member of the Institution of Structural Engineers.

6. Drawings:

G2/P01	Ground Floor Plan
G2/P02	Elevations
G2/P03	Typical Sections
G2/P04	Site Plan
G2/P05	RC Details
G2/P06	RC Details
G2/P07	Site Location Map
G2/P08	Roof Plan
G2/P09	Standard Drawing Details

The purpose for the building is for grain storage. At present our Client has to rent storage facilities away from his farm hence having lorries transporting the grain from his yards to the temporary storage and transporting back same when required by him. Hence when this grain store is erected it will cut-down on this double handling and hence a reduction in heavy traffic.

If you require any further information or assistance, please do not hesitate to contact us.

Please forward all correspondence to Mr Tony O'Herlihy.

With every good wish.

KEVIN CRONIN
For O'Connor Sutton Cronin

Encls:

O'CONNOR SUTTON CRONIN

Consulting Engineers

25 LOWER MOUNT STREET, DUBLIN 2.

O'CONNOR SUTTON CRONIN

Consulting Civil and Structural Engineers

25 LOWER MOUNT STREET, DUBLIN 2.

Telephone: 609977
Fax: 609414

GROUND FLOOR SLAB SPECIFICATION FOR GRAIN STORE, RATHCOOLE.

O'Connor Sutton Cronin and Associates Limited

Directors:

John V. O'Connor	Master of Science, Chartered Engineer, Fellow of the Institution of Structural Engineers, Fellow of the Institution of Engineers of Ireland, Barrister-at-Law.
Pearse C. Sutton	Bachelor of Science (Engineering), Chartered Engineer, Member of the Institution of Engineers of Ireland, Member of the Association of Professional Engineers at Saskatchewan, Canada, Member of the Institution of Structural Engineers.
Kevin A. Cronin	Bachelor of Science (Engineering), Chartered Engineer, Member of the Institution of Engineers of Ireland, Member of the Institution of Structural Engineers.

GROUND FLOOR SLAB
SPECIFICATION

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1.0 GENERAL

1.0 SCOPE

This specification covers a method of laying a ground bearing concrete floor slab. Unless another method has been agreed with the Engineer its clauses shall be binding. 1.01

It is intended that the Contractor shall achieve a standard which shall allow either of the following uses. 1.02

1. As a finished floor

2. Allowing clay, terrazzo or concrete tiles to be laid directly without a concrete levelling screed being used.

3. Allowing flexible finishes e.g. rubber, linoleum cork or vinyl asbestos to be laid with the use of no more than a latex underlaiment.

It is not intended that this Specification shall cover a concrete slab with a monolithically applied finish. 1.03

Where it is intended to use a 50mm. finishing screed this specification shall generally apply except that a tamped finish only should be used. 1.04

1.1 FLOOR COMPOSITION

The floor shall consist of an in-situ reinforced concrete slab laid on a sub base. 1.11

The sub base consist of a layer of fine sand on a layer of hard-core. 1.12

The reinforcement in the slab, the thickness of the slab and the thickness of the hard-core shall be as shown in the Engineer's drawing. 1.13

1.2 DEFINITION OF TERMS

The term 'Engineers' in this 1.21

specification shall mean John V. O'Connor & Associates.

The term 'Contractor' in this specification shall mean the main contractor appointed for the project. 1.22

1.3 **RESPONSIBILITY**

Approval by the Engineer shall not relieve the Contractor of his responsibility for the quality of materials and for the strength durability and appearances of the finished concrete.

2. **MATERIALS AND EQUIPMENT**

Materials used in the manufacture of the conform to the Engineer's Concrete Specification. 2.0 GENERAL

2.1 **BASE CONCRETE**

The base concrete shall be grade 30 with a minimum cement content of 325g/m3. The water cement shall be such as to give a maximum slump of 50mm. 2.1

2.2 **FILL MATERIALS**

The particle size distribution, determined in accordance with BS 1377, shall be within the grading envelopes indicated in figure 1 for each granular material. 2.2.1 GRADED

Type 1 and 2 fill materials shall be free of organic and noxious material and shall be one of crushed slag, well burned non-plastic shale, or natural sand and/or gravel. 2.2.2 PERMITTED MATERIALS.

Hard-core shall consist of only Type 1 or type 2 materials or broken brick free from plaster, dust loan, wood, rubbish or organic materials. All pieces shall be less than 150mm in any direction. 2.2.3.HARDCORE

(i) Fill shall not include material which is susceptible to attack from chemicals in the ground or surface water giving rise to a health hazard or damaging the structure of the 2.2.4. EXCLUDED MATERIALS

fill.

(ii) Materials which in combination with the ground or surface water give rise to an aggressive environment for the building structure will not be permitted.

Sand for blinding hard-core fill shall comply with the requirements of BS 882, Table 5, Type C or M. — 2.2.5 SAND BLINDING.

All fill materials shall be non-frost susceptible as defined in Road Research Laboratory Report No SR 829. — 2.2.6 FROST SUSCEPT-IBILITY.

Fill materials shall not contain more 9.5% by dry weight of sulphate determined in accordance with Test 9 of BS 1377. — 2.2.7 SULPHATE CONTENT.

The material passing the 425 micron BS sieve when tested in accordance with BS 1377, shall be non-plastic for Type 1 granular material and shall have a plasticity index of less than 6 for Type 2 granular material. The amount of material retained on the sieve shall be reported for each test. — 2.2.8 PLASTICITY OF FINES.

Except for well-burnt non plastic shale and crushed brick, fill material shall have ten per cent fines value of 5 or more when tested in accordance with Section 8 of BS 812: Part 3. — 2.2.9 CRUSHING RESISTANCE

At least 21 days before any filling is started the Contractor shall submit full details of the source and types of his proposed filling materials together with 25kg representative samples of each type from each source. At the same time, the Contractor shall deliver to the agreed laboratory sufficient representative samples of each material for the specified tests. — 2.2.10 SUBMISSION OF FILL MATERIAL SAMPLES.

No fill shall be placed in water. — 2.2.11 PLACING OF FILL

Compaction of fill — 2.2.12

At least 14 days before starting any filling, the Contractor shall submit full — 2.2.13 COMPACTION PLANT

Note: In no circumstances should heavy compacting plant be operated close to adjoining building foundations where damage may occur. The contractor shall be responsible for any damage which may occur to adjoining property resulting from these operations.

Where specified on the Drawings the surface of binding hard-core full shall be blinded with sand, moistened as necessary, before the final rolling, to produce a flat smooth surface. 2.2.15 BINDING OF HARD-CORE FILL MATERIAL.

The Contractor shall provide protection and place and compact full against structures. Membranes or buried services in sequence and manner which will ensure stability and avoid damage. The Contractor shall design any temporary support necessary to ensure stability during filling and submit details thereof. 2.216 FILL

For Type 2 granular material the moisture content during spreading and compaction shall be maintained within a range between two per cent below to one percent above the optimum moisture content for compaction determined from BS 1377, Test 14. 2.2.17 MOISTURE CONTENT

No frozen materials or materials containing ice shall be used for filling. Fill shall not be placed on a frozen surface. 2.2.18 COLD WEATHER WORKING

Any material which has been effected by frost shall be removed and after thawing re-compacted in accordance with Clause 3.6

Performance and Tests. 2.2.19

The following tests shall be carried out on all proposed fill materials at the rate of one test for each representative sample. 2.2.20 TESTING OF FILL MATERIALS

BS 1377 Test 7 - Determination of the particle size distribution. BS 1377, Test 2, 3 & 4 - Determination of the plasticity index (of material passing the 425 micron BS sieve % of material

retained to be reported.

BS 1377, Test 9 - Determination of the total sulphate content. The following tests may be required for certain materials as directed:

BS812, Part 1, Section 6 - Description and Classification.

BS812, Part 3, Section 8 - Determination of the ten per cent fines value.

Road Research Laboratory Report No LR90, freezing test.

BS1377, Test 14 - Determination of the dry density/moisture content relationship of granular soil (vibrating hammer method).

BS 1377, Test 16 - Determination of the California Bearing Ratio.

2.2.21 TOLERANCES

The permissible deviations of the formation levels as defined in clause 1.1.3 from the position shown or calculable from the Drawings and with reference of the nearest datum level shall be as follows:

Beneath mass concrete foundations +/- 25mm

Beneath ground-bearing slabs and R.C. foundations. +/- 15mm

Beneath road construction. +/- 25mm

Embankment and cutting slopes. +/- 50mm

2.3 FORMWORK

2.3.1 Forms shall be made of steel and edges shall be truly square. Approval of other systems may be granted upon written permission by the Engineer.

2.4 VIBRATOR

2.4.1 A vibrator screeder may be used provided that care is taken to ensure that an upward camber greater than the tolerance limit is not built into the floor.

2.4.2 A poker vibrator must be used at corners

and edges of the bay.

3. CONSTRUCTION

All concrete shall be poured under cover 3.0.1. GENERAL

3.1 SUB BASE

The layer of hard-core shall be consolidated using a mechanical roller. This should be blinded and rolled with a layer of fine sand. 3.1.1

Joints in the polythene must be made with a double fold or lapped at least 100mm and sealed with a moisture resistant adhesive. 3.1.2

3.2 BASE SLAB

The floor shall be cast in long strips of any with a width suitable for use of a screeder. The concrete shall be thoroughly vibrated particularly at edges and corners. 3.2.1

This slab be reinforced with a top layer of mesh as shown on the relevant drawing. 3.2.2

3.3 FINISH

After the initial set has taken place i.e. (when the floor can be walked on without deep imprint) the surface shall be power floated for the first time using a mechanical disc trowel. 3.3.1

At least one further trowelling is required at an of 1 1/2 hours to 2 hours using a rotary blade type trowelling machine. The final trowelling should be carried out at such a time that considerable pressure is required to make any impression on the surface. A steel trowel finish by hand should be used at all edges and corners. 3.3.2

Care should be exercised when trowelling to avoid bringing an excess of laitance to the surface. 3.3.3

Any laitance appearing should be removed and not trowelled back into the topping. 3.3.4

The Engineer will be prepared to consider the use of vacuum de-watering process provided the Contractor has experience in this process. 3.3.5

The Engineer will be prepared to consider the use of surface grinding as an alternative to Mechanical Trowelling if the Contractor has experience in this process. 3.3.6

3.4 CURING

Framework shall be left in position for a minimum 48 hours. 3.4.1

The concrete shall be cured for at least 7 days by keeping the surface continuously wet and covering with polythene or straw matting. Alternatively an approved curing agent may be used. 3.4.2

3.5 JOINTS

The location of all joints shall be shown in the Engineer's Floor Drawing. 3.5.1

The construction of all joints shall be as shown in the Engineers Floor Drawing. 3.5.2

Sawing of joints may be carried out up to 1 week after casting the slab. 3.5.3

All joints shall be sealed off with an approved sealing the joints shall be taped on both sides to ensure a mushroom head on the sealer. 3.5.4

Sealing of sawn joints shall be carried out immediately the joints are formed. 3.5.5

3.6 PRECAUTIONS

The following areas are those which cause the greatest problems in completed slabs. 3.6.1

(a) Lack of proper curing.

(b) Incorrect timing of power floating.

(c) Use of screeds with rounded edges.

(d) Lipping of concrete over screeds.

(e) Improper vibrator at edges and corners.

4. TOLERANCES

4.0 VARIATION OF PLAN

Variation in construction bay width on plan. In any metre length +/-5mm. Maximum for 12.00 metres or more +/-12mm. 4.01

4.1 VARIATION FROM SPECIFIED LEVEL

Variation from level specified for floor shall generally be +/-3mm in any 3 metre length. 4.1.1

Variation from level for sub base shall be +0 ; -25m

O'CONNOR SUTTON CRONIN

Consulting Engineers

25 LOWER MOUNT STREET, DUBLIN 2.

O'CONNOR SUTTON CRONIN

Consulting Civil and Structural Engineers

25 LOWER MOUNT STREET, DUBLIN 2.

Telephone: 609977
Fax: 609414

PRECAST CONCRETE SPECIFICATION FOR GRAIN STORE, RATHCOOLE.

O'Connor Sutton Cronin and Associates Limited

Directors:

John V. O'Connor — Master of Science, Chartered Engineer, Fellow of the Institution of Structural Engineers. Fellow of the Institution of Engineers of Ireland, Barrister-at-Law.

Pearse C. Sutton — Bachelor of Science (Engineering), Chartered Engineer, Member of the Institution of Engineers of Ireland, Member of the Association of Professional Engineers at Saskatchewan, Canada, Member of the Institution of Structural Engineers.

Kevin A. Cronin — Bachelor of Science (Engineering), Chartered Engineer, Member of the Institution of Engineers of Ireland, Member of the Institution of Structural Engineers.

PRECAST CONCRETE SPECIFICATION

1. DESIGN, SUPPLY, DELIVERY AND ERECTION OF PRECAST CONCRETE UNITS.

1.1 RELATED SPECIFICATION.

1.1.1 SPECIFICATION

This specification is to be read in conjunction with any relevant clauses in the specification for In-situ Concrete, which if not attached, can be inspected at the Engineers' office.

1.1.2 CODES OF PRACTICE.

Comply with the requirements and recommendations of B.S.C.P. 8110 and other relevant Standards and Codes of Practice unless otherwise specified.

Precast concrete shall comply with the requirements for cast in-situ concrete of the Engineers Specification "cast In-Situ Work - Concrete" except where modified by this Specification, and with the Engineers other Specifications as appropriate.

1.1.3 PRECAST SUB-CONTRACTOR

Where precast concrete work is carried out off-site by a Sub-Contractor he shall be an experienced approved Contractor and the requirements of the Specification shall apply fully to the Sub-Contractor and to his precasting works and operations.

1.2 WORK TO BE EXECUTED.

1.2.1 GENERAL

The work to be executed shall be the design, detailing, supply, delivery to site and erection in positions to be agreed with the General Contractor of precast floor and roof units to support the loading shown on the Architects' and Engineers' drawings or as otherwise described.

1.3 TENDER.

1.3.1 GENERAL

The precast unit subcontract shall be in accordance with the Standard Form of Contract.

The Tender shall be submitted on the form of Tender(s) supplied and shall be an accurate lump sum based on the drawings and specifications supplied with

(d) Details of all in-situ concrete make-up areas including schedules of reinforcement to such areas.

(e) In-situ structural toppings including weights of reinforcement.

(f) Maximum size(s) and location(s) of service holes which can be accommodated through the units.

(g) Maximum camber of units.

(h) Maximum differential camber between units.

(i) Limits on dimensional tolerances for lengths, widths, thicknesses and twist.

(j) Maximum bow.

(k) Minimum seatings.

(l) Maximum creep of units expected in Precast Beams. Precast manufacturer to ensure creep of roof beams is compatible with roof covering.

(m) Type of ceiling hangers to be used, their method of fixing and number required per m2.

(n) Details of any timber inserts or other fixings.

(o) Details of special units required to form solid ends (such as flanges for tee beams) where asked for by the Engineer or where required by the Contractors' design.

(p) Details of any special precautions necessary in lifting and erecting.

1.3.4 DEFECTIVE WORK

Any units not complying with the information supplied shall be classed as defective.

1.3.5 PROCUREMENT PERIOD

This shall be in accordance with the dates provided in the letter of invitation to tender.

1.3.6 PROGRAMME

The supplier will be expected to comply with a programme of work to be compiled by the General Contractor. Any costs incurred by delays in delivering materials or by the supply of any defective material shall be borne by the precast sub-contractor.

1.3.7 SITE VISIT

Before submitting his Tender the Tenderer shall visit the site. The Tender shall include any costs likely to be incurred in gaining access to the site with plant and materials.

The Tenderer shall note in his Tender the necessity for removal of overhead wires or of any item likely to increase the cost of the work, including any beams or walls necessary for the support of floor or roof units extra to those shown on the Engineers framing drawings.

Any points not so noted and itemised cost figures not included shall be deemed to be covered in the Tender figure.

1.3.8 ENGINEERS DRAWINGS

All drawings relating to the contract will be available for inspection by the Tenderer at the Engineers' office during normal office hours.

It will therefore be assumed that in submitting his Tender the Tenderer has sufficient knowledge of all relevant parts of the substructure and superstructure.

1.4 DESIGN & DETAILING OF UNITS.

1.4.1 DESIGN

The design of the flooring and roofing units shall be to B.S. 8110 and shall be the sole responsibility of Supplier who shall nevertheless satisfy the Engineer that all units are structurally adequate to support the loads given over the required spans.

Superimposed load and directions of the span will be indicated by the Engineer.

Frames and slabs shall be designed to support not less than their own self-weight plus the imposed dead, live

and wind loadings specified on the drawings (or if not so specified, appropriate to details or features indicated on the Architects' or Engineers' drawings.

Floor finishes, types of ceilings, the construction and height of any walls which have to be carried on the units, together with the sizes and positions of any rooflights, trap doors or other openings will be indicated on the Architects' drawings.

All metal trimmer shoes, bearing plates etc. shall be galvanised to B.S. 729 with a minimum coating of 750g/m2.

1.4.2 INFORMATION REQUIRED

The Supplier shall be responsible for the submission of the following information to the Engineer to obtain all approvals of calculations and drawings to meet the General Contractors' programme and obtaining of appropriate local authority approvals:-

(a) Detailed calculations in duplicate of the units being supplied including deflection calculations. Calculations for prestressed concrete sections should include full calculations for all prestressed losses in accordance with B.S. 8110. Calculations are to include all relevant load cases which are encountered from casting position, through erection to final proposed use.

(b) Details of the materials being used in the units including strength for concrete, reinforcement and prestressing materials.

(c) Details of the cube results obtained during the manufacture of the units.

(d) Duplicate copies of all drawings and details for vetting.

1.4.3 DETAILING OF UNITS

Full working details shall be provided by the Supplier before the work is put in hand. These shall include:-

(a) Full reinforcement detail drawings and prestress profile drawings including end block details shall be provided to the Engineer prior to fabrication. Bar bending schedules accompanying the above drawings must also be submitted.

(b) Layouts showing clearly the position of each unit in the work at 1 in 100 scale. These shall be supported by marking each unit delivered to site clearly to show its position in the works and which way up and which way round units are to be fixed. The layout shall be such that fixing on site is practicable and does not involve any costs which have not been itemised in the tender.

(c) Details of all trimmings for services, access holes etc. These shall be positioned from the services drawings.

(d) Details of all builders' work required, including propping layouts, details of all in-situ concrete required in the floors (such as structural toppings in-situ make-up), schedules of reinforcement to such in-situ work, grouting-in where necessary, including the application and amount of grout per m2.

(e) Details of special units required to form solid end/bearing pads where asked for by the Engineer or where required by the Supplier.

(f) Detailing of any hangers necessary to support ceilings etc., such as hangers to be supplied by the Supplier.

(g) Details of any timber inserts or other fixing provisions. These shall be either clearly visible or their positions shall be clearly marked on the concrete units.

(h) Details of any special precautions in lifting and erecting.

(i) Description of the general stability of the precast frame with details of proposed arrangements of any temporary bracing and times of removal of bracing. Temporary bracing of precast frames shall be carried out by the precast sub-contractor.

(j) Dimensioned detail drawings to 1 to 20 scale minimum of all connections and bearing types.

1.5 **TOLERANCES.**

Units shall be made to a tolerance to enable each to be fixed in its position in the work. This may mean that some units will need closer tolerances than those recommended in B.S. 8110. Units not complying to the tolerances given in B.S. 8110 (where appropriate) shall be classed as defective.

Comply with the recommendations of B.S.C.P. 8110 for permissible deviations. Otherwise comply with the recommendations of B.S. 5606. Make provision for checking of tolerances by the Engineer as instructed.

Level all units at their bearings to plus or minus 10mm; confine difference in soffit level between adjoining units to 6mm. Comply with the deflection limits quoted in B.S.C.P. 8110 Part 2, Clause 3.2.1.2; assume brittle partitions and finishes unless otherwise instructed.

1.6 **SUPERVISION.**

The Tender shall be deemed to cover the costs of all site visits by the Contractor to ensure the satisfactory erection and completion of the flooring. Such supervision shall be carried out by a responsible person, capable of deciding whether or not any item of the site works connected with the flooring has been carried out satisfactorily.

1.7 **FIRE RATING.**

Ascertain and comply with the Architects required fire rating.

1.8 SUPPLIERS CONDITIONS AND SPECIFICATION.

No conditions requested by the Precast Supplier with his Tender shall over-ride any clause in this specification. No guarantee which attempts to limit the Suppliers' responsibilities below those stated in this Specification shall be accepted.

Should a Supplier require modification of any Clause in this specification he shall apply in writing to the Engineer before submitting his Tender. Standard conditions printed on the Tenderers' Tender Documents shall not be deemed to constitute an application in writing, and shall not form a part of the contract unless with the prior written agreement of the Engineer.

Any costs incurred because products do not give the performance claims in the Suppliers trade literature shall be recoverable from the Supplier. Examples of such claims are that units will satisfactorily take plaster direct to their soffits, that electrical conduit can be readily passed through units, thermal insulation values, density, fair-faced soffit, etc.

1.9 CONCRETE DURABILITY.

Use concrete grades in compliance with Table 3.4 of B.S.C.P. 8110. Concrete exposed to the weather shall be deemed to be subject to "severe" exposure.

1.10 REINFORCEMENT.

Provide manufacturers' certificates to prove compliance with the Specification.

1.11 PRESTRESSING WIRES OR STRANDS.

Provide manufacturers' certificates to prove compliance with the Specification.

1.12 **ADDITIVES.**

Do not use admixtures.

1.13 **QUALITY CONTROL.**

Test concrete as specified.

2. ERECTION OF PRECAST FLOORING AND ROOFING UNITS.

2.1 RESPONSIBILITY

The precast unit Tenderer shall be responsible for fixing all floor and roof units in their final positions in the works. Details of the units to be erected shall be outlined in the proposed Suppliers' Tender Documents.

2.2 **TENDER.**

The rates for precast units shall include the cost of lifting into their final positions, whether this be based on hiring a private crane or renting cranage from the General Contractor. It shall be the Tenderers' responsibility to agree rates with the General Contractor should he wish to rent the use of the crane. No dispute over this shall affect the cost of the work to the Employer.

2.2.2 INFORMATION REQUIRED.

The Tenderer shall include in his Tender information enabling any costs incidental to the erection of the units to be accurately assessed and supplied by the General Contractor. Examples of such items to be included:-

(a) Work involved in gaining access to the site e.g. widening openings, etc.

(b) Necessity for removing overhead wires.

(c) Areas, including a brief specification, for any hard-standing required. This shall include proposed location(s) of crane for erection of units.

(d) Details of any ramps required between changes in levels.

(e) Storage area.

(f) Labour that is to be supplied by the General Contractor.

(g) Need for power, water etc.

(h) Access within the building (may be limited).

(i) Access around the building (may be limited).

Any points not so noted shall be deemed to be included in the Tenderers' own Tender Figure.

2.3 **TEMPORARY WORKS.**

The Tenderer shall be fully responsible for the design, detailing and supply of all temporary works used in erecting the precast units. Full details of such temporary works shall be approved by the Engineer before the work commences.

2.4 **QUALITY ACCEPTANCE.**

The Tenderer shall be responsible for fixing units in their final position, to the Engineers' satisfaction. Units may not be cut on site or altered in any way without the Engineers' prior written approval.

2.5 **FOLLOWING ERECTION.**

Following lining, levelling and plumbing of frames, the Tenderer shall complete all connections including grouting.

Following erection and levelling of floor units the Main Contractor shall grout and pack the space between units with an approved mortar or concrete mix. Where the units are designed to act compositely with a structural screed, the Main Contractor shall prop the precast units in accordance with the requirements of the specialist supplier (who shall state his requirements at the time of tendering) and the grouting between units and the screeding shall be one operation using concrete Mix E. (See

general concrete spec). Structural screeds shall be reinforced with A142 mesh with 300 overlaps at joints.

Do not carry out this grouting when the temperatures in the joints is below 5 degrees centigrade.

2.6 SITE DIMENSIONS.

It shall be the Tenderers responsibility to take sufficient dimensions before the units are manufactured to ensure that units delivered to site will fit without any cutting, notching, etc., on site.

This requirement shall not be nullified because of any theoretical dimensions given on the Engineers or Architects drawings.

3. TOLERANCES.

3.1 MANUFACTURING TOLERANCES.

3.1.1 DIMENSIONS.

The permissible deviations from the dimensions shown for precast concrete units shall be plus/minus 5mm.

3.1.2 BOW

The permissible deviation in bow in the surfaces of precast concrete units shall be 1:400 or 20mm, whichever is the lesser.

3.1.3 TWIST

The permissible deviation for any corner measured from the plane containing the other three corners shall be 5mm.

3.1.4 LOCAL IRREGULARITIES.

The permissible deviation from a 1.5m straight edge placed in any position on a nominally plane surface of a precast concrete units shall be 5mm.

3.1.5 INSERTS

The permissible deviation from that shown for the location of inserts in precast concrete units shall be 3mm.

3.2 ERECTION TOLERANCES.

3.2.1 LEVEL AND POSITION ON

Notwithstanding the tolerances permitted for manufacture of precast concrete

units, the permissible deviation for the location of precast concrete units shall be as follows;

PLAN.

Level: For any nominally horizontal surface when measured from the nearest reference level shall be plus/minus 5mm.

The permissible deviation for abrupt changes in a nominally continuous surface at the junction of two precast concrete units shall be plus/minus 3mm.

3.2.2 DEVIATIONS AT JUNCTIONS AND JOINTS

The maximum permissible deviation from the specified relationship of any two surfaces at a junction or a joint shall be plus/minus 3mm.

Notwithstanding the tolerances permitted for the manufacturing of precast concrete units, the permissible deviation from plumb of the upper and lower edges of any nominally vertical surface shall be 1:400 or 20mm whichever is the lesser.

3.2.3 PLUMBNESS

4.0 COMPOSITE FLOORS.

Composite floors comprising in-situ concrete poured onto temporarily propped thin precast planks or slabs, with or without infill blocks or void formers shall be designed by the Tenderer in accordance with the requirements and recommendations of B.S.C.P. 8110 and the Tenderer shall supply the precast planks or slabs. Composite floors shall satisfy the following requirements.

(a) The precast planks shall contain integral and projecting reinforcement as required by the structural design of the slab to ensure composite action.

4.1.1 GENERAL.

(b) The Tenderer shall design and detail the composite slabs and shall schedule all reinforcement required by the design including loose reinforcement i.e. continuity steel, top steel, bearing improvement bars, distribution steel etc. but the

Contractor and the Tenderer may make their own arrangements regarding who supplies the loose reinforcement.

Any additional reinforcement which may be detailed by the Engineer to be incorporated within the floor slab for other purposes shall not be taken into account by the Tenderer in his design of the composite slabs without the Engineers' approval.

In voided or ribbed work where the thickness of topping is less than 50mm provide reinforcement as per B.S.C.P. 8110, Part 1, Clause 3.6.6.2.

(c) The Main Contractor shall contract with Specialist supplier on the basis that the requirements of this Specification shall be met in full. Where responsibility for any operation or other requirement is not specified or implied then the Main Contractor and the Specialist Supplier shall determine between themselves which of them is responsible subject to the Engineers approval.

(d) The Main Contractor shall erect the precast planks or slabs (with temporary propping incorporating not less than that recommended by the Specialist Supplier), provide edge shuttering, fix loose reinforcement, de-prop and carry out all other operations to enable the composite slabs to be constructed and shall pour, compact and finish the floor slabs homogeneously with the supporting beams.

(e) All site work shall be in accordance with the Engineers' Specifications and with the Specialist Suppliers written instructions and recommendations unless otherwise specified; any conflict in requirements shall be referred to the Engineer for clarification.

(f) The extent of the composite floor shall be as shown on the drawings.

4.1.2 SUPPORTS

Supporting beams and walls are shown on the Engineers' drawings and shall be designed and detailed by the Engineer for incorporation in the works. No other supports may be assumed in designing the composite slabs and slab thicknesses shall be as specified on the Engineers' drawings unless otherwise stated at time of tender.

4.2 DESIGN AND DETAILS.

4.2.1 INFORMATION

At time of tender the Tenderer shall point out if beams or supports will be required other than those shown on the Engineers' drawings and shall state the slab thickness quoted for if they vary from those shown on the Engineers' drawings.

Subsequent to order the Tenderer shall provide two copies of all detailed design calculations together with detail and layout drawings and schedules to the Architect and Engineer for approval, in advance of any manufacturing work, inclusive of the following:-

(a) Design strengths for concrete and reinforcement.

(b) General Arrangement drawings to 1 : 100 scale min showing layout and dimensions.

(c) Dimensioned detail drawings to 1 : 20 scale min of bearings etc.

(d) Detailed reinforcement drawings at 1 : 100 scale min with comprehensive sections at 1 : 50 scale min and detailed reinforcement bending schedules.

(e) Requirements/arrangements for lifting, stacking and propping and times for removal of propping.

(f) Proposed location of all construction

and other joints.

Notwithstanding the above, the Tenderer shall remain solely responsible for the technical adequacy and correctness of the design in accordance with the Specifications.

4.2.2 STABILITY

The floor slabs shall be designed and detailed by the Specialist Supplier to satisfy the requirements of B.S.C.P. 8110, Clause 3.1.4.3 and 3.12.3 relating to stability ties in the horizontal plane. Allow for accommodating the horizontal tying-in of vertical ties as required and specified by the Engineer.

4.2.3 LOADINGS

The composite slabs shall be designed to support not less than their own self weight plus the dead and imposed loadings specified on the drawings (or if not so specified, appropriate loadings assessed in accordance with the relevant British Standards) with full allowance for the weight of partitions where shown on the Architects' drawings and for any other loadings appropriate to details or features indicated on the Architects' or Engineers' drawings.

4.3 **FINISHES HORIZONTAL SHEAR.**

Type B finish to B.S.C.P. 8110, Clause 6.10.3 required to the soffit of all planks.

The Specialist Supplier shall ensure that the contact surface between the in-situ concrete and the precast planks can resist the applied horizontal shear stresses as per B.S.C.P. 8110. Test results may be required to justify claimed permissible shear stresses.

4.4 **MATERIALS AND WORKMANSHIP.**

Workmanship shall comply with the requirements of the Engineers' Specifications. Adequate supervision shall be provided at all stages of transporting and placing concrete, vibration, curing etc. Particular attention is drawn to the need to form

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SITE DEVELOPMENT WORKS SPECIFICATION FOR GRAIN STORE RATHCOOLE

O'Connor Sutton Cronin and Associates Limited

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SPECIFICATION FOR SITE DEVELOPMENT WORKS.

COMPLIANCE WITH DUBLIN COUNTY COUNCIL SPECIFICATION

All materials, methods and details of construction and workmanship embodied in the site development works and not covered by this document shall comply with the current relevant specification of the Dublin County Council.

CLEANING OF ROADS

Roads, lanes and public property adjacent to the site, or which form part of the site if littered with mud, clay or any material which has been deposited there as a result of the Contractor's operations shall be thoroughly cleaned by him immediately and as often as requested by the Engineer or his Representative.

Note. Litter etc. includes spillage from material carried out on the wheels of vehicles.

CONCRETE SEWER PIPES

Concrete sewer pipes and fittings shall comply with the requirements of I.S.6 and shall be of spigot and socket type with flexible joints unless otherwise stated.

CONCRETE SURFACE WATER PIPES.

Unreinforced concrete surface water pipes and fittings shall comply with the requirements of I.S.6.

CONCRETE SADDLES

Concrete saddles shall be special castings and shall comprise a section of pipe socket with concrete flanges. They shall be cast as one piece. The flanges shall be placed so as to ensure that the end of the saddles does not project into the sewer.

HARD P.V.C. WATERMAINS

Hard P.V.C. pressure pipes and specials shall be Class C and shall comply with I.S.S. No. 123.

All P.V.C. bends shall be factory made to standard radii and shall be of the same class as the pipeline. Approved cast iron patent specials such as "Wavintee", "Wavin Hydrant Bends" and "Wavin CI Flanged Tailpieces" shall be used where applicable. Otherwise all tees and tapers shall be of standard flanged cast

iron specials complying with B.S.S. No. 2035. Materials, workmanship, thickness and coating of the specials shall be in accordance with B.S.S. No. 78.

MANHOLE COVERS AND FRAMES

Manhole covers and frames shall be Dublin County Council standard pattern cast-iron circular and square covers and frames complying with I.S. 261 (1984) Grade A "Cast Manhole Covers, Road Gully Gratings and Frame for Drainage Purposes". Where manhole covers are sited in roads, non-rock covers shall be used.

Circular cover and frame shall weigh not less than 242 kg. Square cover and frame shall weigh not less than 233 kg. All manhole covers shall have appropriate lettering as specified, embodied in the casting.

MANHOLE STEP RUNGS

Manhole Step Rungs shall be manufactured from mild steel and be of shape and dimensions as detailed on the Drawings. All rungs shall be hot-dip galvanized by the process described in B.S. 1247 or be subjected to such other protective process as may be approved by the Engineer.

GULLY FRAMES AND GRATINGS

Gully gratings, frames and seal chambers shall be cast-iron fabricated to Dublin County Council standard patterns and complying with I.S. 261 Grade A. Gully grating frame and hinge pin complete shall weigh not less than 82 kg.

SLUICE VALVES AND STOPCOCKS

These shall comply fully with B.S. 1218 and shall have flanged ends, except where otherwise specified.

They shall be of Blakenborough Grade "A" construction standard, or approved equivalent. The manufacturers test certificate of each valve used in the works shall be produced if required. The valves shall open clockwise. Spindle caps shall be square.

Stopcocks, shall comply with the latest issue of the specifications of the Standing Committee of Water Regulations of the British Waterworks Association and shall be stamped with the standardisation mark prescribed by the committee.

HYDRANTS

All hydrants shall comply with B.S. 750 for Underground Fire Hydrants, and unless otherwise specified shall be of the B.S. type 2 screw-down steamline pattern, with round thread screwed outlet as manufactured by Glenfield or approved equivalent. Cast

iron riser pieces shall be fitted to hydrants so that outlet is not more than 300 below cover level.

SURFACE BOXES AND INDICATOR PLATES

All covers to stopcocks, valves, hydrants shall be of cast iron to the Dublin County Council pattern. The designation of each type of fitting and the date shall be shown on each cover in accordance with standard practice.

Marker plates for valves shall be of cast iron, 200 mm square, with appropriate letters in relief. The plates shall be painted with black bitumastic paint and the letters in relief shall then be painted with white enamel paint. The indicating letters shall be as follows:
Sluice Valve "V", Air Valve "A.V.", Scour Valve "Sc.V.".
Indicator plates for Hydrants, marked H and with the distance to the main stated, shall be of the most recent Dublin County Council Specification for same as obtainable from the Sanitary Services Department.

HARDCORE

Hardcore for filling shall consist of broken stone or other material of approved quality graded from 100 mm to 50 mm.

ROAD SUB BASE

Road sub base material shall be frost resistant crushed rock complying with the requirements of the Department of the Environment Specification for Road Works, Clause 804 Type B which grading limits are:

Sieve Size	Percentage of Mass Passing
75 mm	100
37.5 mm	85 - 100
10 mm	40 - 80
5 mm	25 - 48
600 um	8 - 22
75 um	0 - 10

ROAD SURFACING MATERIALS

Road Surfacing materials shall be dense bitmacadam complying with B.S. 1621.

Wearing base material shall be 14 mm nominal size dense wearing course in accordance with B.S. 1621.
Asphalt shall comply with the relevant British Specifications.

PIPE BEDDING MATERIAL

Granular bedding Type A shall consist of pea gravel pebble or broken stone and it shall be of clean, hard, cubical material. Grading sizes shall be as follows:

For watermains: pea gravel 8 mm size.
For sewer pipes up to 450 diameter: 5 mm to 12 mm size.
For sewer pipes 525 mm diameter and greater: 5 mm to 20 mm size.

EXCAVATION BELOW DEPTH NECESSARY

Where the Contractor excavated in trenches below the depths necessary for the work, the excess excavation shall be made good at the Contractor's expense with leanmix concrete or granular bedding depending on the pipeline bedding material being used.

SOFT SPOTS

All soft places, faults etc., that appear in the bottom of the trench shall be excavated to the depth directed by the Engineer, and filled in with gravel or other suitable granular fill, well compacted into place. Payment for such excavation and fill will be made at the rates entered in the Bill of Quantities.

TRENCH WIDTHS

From the bottom of the trench to a level 190 millimetres above the crown of the pipe trench widths shall not be less than the minimum nor greater than the maximum figures shown in Appendix 1 at the end of this Specification. Where the Contractor excavates the trench to a width greater than the maximum figure from the bottom of the trench to a level 190 mm above crown of pipe, and in the opinion of the Engineer such extra width will result in more load being placed on the pipe than it can safely carry the Contractor shall provide at his own expense any extra items which the Engineer may direct. Such items may include substitution of a higher class of pipe, extra granular bed cradle and surround, or extra concrete bed, cradle and surround with or without reinforcement. Any delay costs resulting from such delay shall be the responsibility of the Contrctor. The minimum width is that width between the faces of the soil required to ensure the correct placing and compaction of bedding materials equally on either side of the pipe with sheeting and supports outside this width. The maximum width is that width between the faces of the soil which has been used in the structural design of the pipeline and it includes an allowance for sheeting and tolerance.

LAYING AND JOINING OGEE UNREINFORCED CONCRETE PIPES

Ogee concrete pipes and specials as specified shall be laid true to line and level on cleaned concrete bed, each pipe being

separately boned between slight rails. Pipes shall not be laid until the concrete in the bed is set and hard; in any event not earlier than 24 hours after bed has been compacted.

All unreinforced pipes with cover less than 1.2 m in roads or verges or 900 mm in fields shall be surrounded in concrete.

The joints shall be thoroughly cleaned and wetted before laying and cement motar as specified shall be applied evenly to the ends for jointing so as to completely fill the joint. The pipes shall then be properly drawn together and the outside of the joint shall be neatly pointed.

Special care shall be taken to see that any excess of cement mortar, etc. is neatly cleaned off as each joint is being made and any earth, cement or other material thoroughly cleaned out of the pipeline as work proceeds. A properly fitting plug shall be removed only when pipe laying is proceeding. The trenches, pipes and joints shall be kept free from water until the joints are thoroughly set.

LAYING AND JOINTING OF PIPES ON GRANULAR BED

The pipes with flexible joints shall be laid, true to line and level and firmly supported over its full length on a carefully compacted Type A granular bed of the thickness shown on the drawing. The thickness of the granular bed shall be increased in rock or rocky soils as detailed.

Jointing of the pipes shall be strictly in accordance with the manufacturers instructions. After jointing the pipes Type A granular material shall be brought up to half the diameter of the pipe in the case of flexible jointed concrete pipes and to a level of 190 mm above the crown of the pipe in the case of Asbestos Cement pipes. The material should be well compacted over the sidefill but only slightly tamped over the pipe. Above these levels Type B selected backfill shall be placed to a level 300 mm above the crown of the pipes, as specified in Clause 419. Heavy rammers or rollers shall not be allowed until the crown of the pipe is protected by at least 1 m of fill.

For the compaction of sands and gravels, vibratory methods shall be used; backfill material should be within 2% of optimum moisture content.

Care shall be exercised at all times to avoid disturbing the true line and level of the pipeline. Fill material shall not be dropped into the trench on to the pipe - it shall be directed to either side of the pipe.

HANDLING AND STORAGE OF PIPES AND APPURTENANCES

Pipes shall be handled with care at all times, and protected from

accidental damage. They shall not be roughly handled or thrown from trucks or into trenches.

Where pipes must be lifted by a crane suitable rope or canvas slings should be used. WIRE ROPES OR CHAIN SLINGS SHALL NOT BE USED.

Pipes transported on trucks or carts shall not overhang by more than 1.3 m.

Pipes shall be stored on level ground, parallel to one another, and not more than three deep for pipes up to 225 m sizes. Larger pipes should preferably be stored in single layers.

Joints and other fittings shall be handled with care and safeguarded from accidental damage. Rubber rings shall not be allowed to come in contact with oils and grease, and should be stored in a cool, dry, dark place.

TEMPORARY STOPPERS

Junction pipes which are laid but not immediately connected up shall be fitted with approved temporary stoppers or seals and the position of all such junctions shall be clearly defined both on the record plan and the ground. The marking on the ground shall be effected in the first instance by stakes, properly marked and labelled and by surface marking the channel of the concrete carriageway and footpath when the latter is being constructed.

SURFACE WATER GULLIES AND CONNECTIONS

Surface water gullies shall comprise a rectangular chamber built of 215 mm concrete blockwork in cement-mortar on Class B concrete bed with sump, surmounted at surface level by standard dished, gully grating and frame, as specified, carefully set to level on the blockwork in the channel.

Alternatively the rectangular chamber may be constructed in Class B mass concrete 225 mm thick. A high degree of surface finish will be demanded. Any damage caused by withdrawal of forms of deformation of chamber shall be made good to the Engineer's satisfaction at the Contractor's expense.

Subject to the Engineer's prior agreement, precast concrete chambers may be used.

In every case the chamber shall be of a depth such that the surface of the bed is 380 mm under the invert of the outgoing pipe.

Outlets from sides of chamber shall be of 150 mm diamtere pipes bedded and surrounded in concrete, Grade C20/20

The outlet pipe from the chamber shall be as high as possible above sump level to facilitiate rodding and shall be trimmed to the inside face of the wall of the chamber which it is build.

Every gully shall be so arranged that transverse bars of grating are at right angles to line of road and that hinged end of grating is on side of approaching traffic.

MANHOLES

All sewer manholes shall be constructed to the details and internal dimensions stated on the drawings and they shall be watertight.

All foul sewers manholes shall comprise of a rectangular chamber built of 225 mm thick. Class A mass concrete fair faced internally, free from honeycombing and to a high standard of surface finish.

On surface water sewers not exceeding 600 mm diameter manholes may be as for foul sewers but a rectangular chamber built of 225 mm concrete blockwork in cement mortar and rendered internally and externally will be accepted as an alternative.

Manholes on surface water sewers 762 mm diameter and greater shall be cast in situ Class A concrete as detailed on the drawings complete with handrails and safety chains.

All pipes shall be neatly build in, cut to form channels and benched in concrete Class B. Manhole roofs shall be 150 mm or 225 mm thick reinforced concrete Class A having square opening surmounted by stardard pattern cover and frame, as specified firmly set in cement mortar. A single arched ring of brick shall be formed around each pipe where pipes are built into blockwork.

In all manholes where the depth of invert exceed 1 metre below the finished surface of the carriageway or ground level round rungs as specified and detailed shall be built in at the spacing stated.

Where new pipelines are to be connected to existing manholes, the Contractor shall make necessary neat openings in manholes walls, carefully build in new pipes, seal openings around same and effect necessary alterations in existing benching, etc. all to the satisfaction of the Engineer.

Adams type heavy duty round manhole covers must be fitted on any manhole over which vehicular traffic may travel - that is manholes in carriageways, lanes and vehicular entrances across footpaths.

BENCHING IN MANHOLES AND RAMPS

Benching and ramps shall be constructed in Grade C20/20 concrete. They shall be rubbed up and finished with a 2 to 1 sand cement mortar, with steel float finish.

TESTING OF PIPELINES

All sewers, manholes, chambers and other work shall be absolutely watertight. In order to make sure of this, the sewers shall be subjected to a watertest or airtest. No sewer shall be covered up until it has satisfactorily passed the test and the sewer may be retested after backfilling if required by the Engineer.

The pipe shall be tested in sections (e.g. between manholes) in the presence of the Engineer's Representative and the Dublin County Council Inspector. In the case of a watertest each section of pipeline shall be tested by filling with water under a head of 1.2 m above the pipe soffit at the high end and not more than 6 metres at the lower end. A period of 60 minutes will be allowed for absorption and the test will be applied for a further 30 minutes. The maximum allowable water loss per 100 linear metres per millimeetre of nominal bore of pipeline shall be:

0.06 litres per hour for pipes up to 300 mm diameter
0.12 litres per hour for jpipes exceeding 300 mm diameter.

In the case of an airtest a pressure of 100 millimetres head of water as indicated on a U-tube shall be applied. After a period of stabilization, stipulated by the Engineer the air pressure shall not fall to less than 75 millimeter head of water during a period of 5 minutes.

Infiltration Test: Sewers and manholes shall be tested for infiltration after backfilling. All inlets to the system shall be effectively closed and the residual flow shall be deemed to be infiltration. The maximum allowable infiltration rates per 100 linear metres per millimetre of nominal bore of pipeline shall be:

0.08 litres per hour for pipes up to 750 mm diameter.
0.16 litres per hour for pipes exceeding 750 mm diameter.
5.00 litres per hour per manhole.

BACKFILLING OF TRENCHES

No turf, topsoil or other unsuitable material shall be used to refill trenches. Material removed from old road surface shall be retained for temporary surfacing of trenches.

Unless otherwise directed by the Engineer, trenches shall be refilled with approved material from trench excavation but not before the work has been measured and approved by the Engineer.

Where trench excavation material is unsuitable it shall be run to spoil and replaced with suitable material.

No backfill shall be placed in trenches containing water.

In the case of pipes which are not surrounded with concrete or granular material the first layer of filling material (type B backfill) shall be free from large lumps and stone and shall not be thrown directly on the pipes but placed and packed with care around the pipes to a height of 300 mm above the pipe crown.

In backfilling trenches under carriageways, grass verges, footpaths, paved areas and elsewhere as directed the backfill material shall be deposited in layers not exceeding 225 mm thickness and compacted in an approved manner by power rammer, vibro tamper or vibrating place compactor. Power rammers may not be used within 450 mm of the top of the pipes and care must be taken not to damage the pipeline when using the mechanical compactors on the lower backfill layers.

Backfilling in paths, verges and other paved areas shall be brought up to formation level. In carriageways the backfilling shall be brought up to 900 mm below formation level thereafter road sub base material shall be placed and compacted in individual 150 mm thick layers up to road formation level.

In trenches, in fields and open country backfill material above 300 mm over the crown of the pipe may be placed by machine provided the method of operation ensures that the material slides or rolls into position and does not drop from a height. The top backfilling level in fields shall be 150 mm below the original surface.

The Contractor will not be permitted to use plant or any method of backfilling trenches which would render it impossible to fill and compact in 225 mm layers as specified.

The Contractor shall maintain the surface of refilled trench level with adjoining surfaces free from pot holes, depressions, etc. pending construction of new road surfacing, footpaths or other works.

SEWERS AND DRAINS TO BE LEFT CLEAN

As completed, each section of sewer and drain shall be left clean and free for from obstruction and at the time of completion of all works covered by the Contract, the Contractor shall ensure to the satisfaction of the Engineer that all sewers and drains in the area covered by the Contract, are clean and completely free from obstructions. If rodding and flushing fail to remove any obstruction such as mortar, mixer washings, grout, clay deposits, etc. which have been formed in the pipelines, manholes and gully catchpits, the Contractor shall at his own expense, open up and

relay affected work.

SURFACE RESTORATION

Field, road and other surfaces interfered with by the Contractor's plant or operations shall be fully restored to the satisfaction of the Engineer and any deficiency in surfacing material necessary for their complete restoration shall be supplied by the Contractor free of charge. All breeches in hedges, damage to gates and the like shall be made good by the Contractor without extra charge.

In surface restoration in fields the area to be restored shall be covered with a layer of good vegetable soil to an even surface and to a depth of not less than 150 mm before sowing is commenced. The ground shall be cleared of all weeds and the soil raked to a fine tilth and lightly rolled with a light roller. At the proper season the area shall be sown with perennial rye-grass and white clover seed, in the proportion of 22 kg of clover seed and 415 kg of rye-grass seed per hectare, and rolled where ordered, the sowing to be repeated at the Contractor's own cost in case of failure.
The cost of cartage of soil or sods from the points at which they have been set aside to the points of deposit shall be held to be included in the Contractor's rates for surface restoration in fields.

DRAINAGE PIPELINES, SERVICE DUCTS AND OTHER PIPELINES CROSSING UNDER ROADS.

All drainage pipelines, sub-drainage, gully and house connections, watermain and service crossings and ducts for services within the formation area should be fully completed and backfilled before preparation and treatment of the formation commences.

The Contractor shall maintain close liaison with Public Utility Services and shall give them ample notice to lay their service on the site of the proposed carriageway and complete their backfilling up to the level of the top of the pipe two weeks in advance of the preparation of the formation.

Ducts to carry cables shall be laid under the carriageway, where required. Type of duct and duct sizes are shown on the drawings together with details of size of duct, type of surround and backfilling of trench.

A record of the positions of all house drain connections, pipeline crossings, service crossings and ducts, measured from the nearest manhole, along with their description shall be kept by the Contractor. The concrete channels on each side of the carriageway shall be marked, when constructed, to show the position and description of the connection crossing or duct.

PREPARATION AND TREATMENT OF ROAD SUB GRADE

Preparation and surface treatment of the formation shall be carried out only after the work specified in the previous Clause is completed and the sequence of operations shall be as follows:

(a) All surfaces below roads shall be well cleaned off, freed from mud and slurry.

(b) The surface shall be compacted by 4 passes of a smooth wheeled roller of 8 to 10 tonnes or equivalent.

(c) The formation shall be regulated and trimmed as necessary to a uniform and even surface parallel to to the longitudinal and transverse shape of the carriageway.

(d) The trimmed formation shall be finally rolled by 1 pass of a 2.5 tonne smooth wheeled roller or equivalent. Construction of the sub base will follow immediately the completion of the formation.

(e) If the completed formation is not immediately covered with sub base material it shall be protected by surface dressing at the Contractor's own expense.

Construction traffic will not be allowed to travel on the completed formation.

The Engineer shall have power to limit the extent of formation exposed at any time.

Soft spots which appear during excavation and compaction of the sub-grade shall be cut out as directed by the Engineer's Representative or the Dublin County Council Inspector and shall be filled and compacted in 150 mm layers for such extra excavation and fill shall be made at the appropriate rates in the Bill of Quantities.

The Contractor must programme and carry out all the works within the carriageway area so that there will be no deterioration in the sub grade strength at formation level caused by the ingress of moisture during the works or by his operations or plant. The Contractor must at his own expense rectify any such deterioration that occurs.

Each portion of the prepared road formation must be inspected, tested and passed by the Engineer's Representative and Dublin County Council Inspector prior to placing the sub-base. The Contractor must make all necessary arrangements to have this inspection carried out and no claims will be allowed for delays on the Council's part to carry out the inspection.

If the Contractor allows the moisture content of the sub grade to

increase such that the rolled sub-base does not pass the inspection by the Engineer's representative or the Dublin County Council Inspector prior to placing the road base the Contractor shall be required to remove, replace or otherwise improve the sub-base and underlying sub-grade, without extra charge so that the requirements of the Engineer and Dublin County Council are satisfied.

ROAD SUB-BASE

The Contractor shall roll in crushed rock sub-base material as specified to obtain a satisfactory base. The material shall be spread uniformly over the formation to give a minimum compacted depth of 200 mm, and shall consist of material as specified earlier under Road Sub Base, P.3.

Sub-base material shall be compacted in a minimum of two layers. Type of compacting equipment, depth of compacted layer, number of passes and other constructional requirements shall be agreed with the Engineer and shall comply with Clause 802 D.O.E. Specification for Road Works.

The minimum thickness of the sub-base for roads may be varied by the Engineer on the basis of the C.B.R. tests on the formation, to remove unsuitable sub grade material, on inspection of the exposed formation or to give a minimum depth of excavation below original ground level.

The sub-base, shall be maintained at the Contractor's expense, free from ruts, undulations, loose material, depressions and other defects and shall be surface dressed, if necessary, to protect the surface against ingress of moisture until the road base is placed thereon.

The finished surface of compacted sub-base shall be parallel to proposed finished surface of carriageway.

The road sub-base must be fully prepared for inspection and testing by the Engineer's Representative and the Dublin County Council Inspector before road base construction commences. The sub-base surface layer, after compaction, must be well closed, free from movement under compaction plant and from compaction planes, ridges, cracks or loose material. The Contractor's attention is directed to the provisions of the final two paragraphs under Preparation and treatment of Road Sub Grade on P.10

FLEXIBLE ROAD SURFACING

The methods and temperatures of transporting, laying and compacting of the flexible surfacing shall comply with Clauses 705 D.O.E. Specification and B.S. 4987 and B.S. 5594 and B.S. 1621.

The Contractor shall provide a thermometer for the Resident Engineer's use during work involving laying of bituminous materials.

After compacting the total thickness of the surfacing shall be within the tolerances tipulated. When required by the Engineer, the Contractor shall cut out and reinstate sufficient areas of surfacing, each area to measure not less than 300 mm x 300 mm to enable actual thicknesses to be ascertained by direct measurement. If the total thickness of the compacted surfacing is found to be deficient, the Contractor shall take out, remove and lay new surfacing of prescribed thickness over the affected areas at his own expense.

TACK COAT

Where it is necessary to use a tack coat it shall consist of a cationic bitumen emulsion spread uniformly without pooling, preferably by a pressure sprayer at a rate of 0.35 to 0.45 litres per square metre or as directed.

HORIZONTAL ALIGNMENTS, SURFACE LEVELS AND SURFACE REGULARITY OF PAVEMENT COURSES

The accuracy of surface of the various layers of carriageway construction shall meet the tolerances specified in clause 701 of the D.O.E. Specification for Road Works and the rectification of areas not meeting these tolerances shall be as specified in the clause at the Contractor's expense.

The material to be used in correcting the deficiency in the formation where it is too low shall be road sub base material.

In addition the accuracy of the top surface finish of carriageways shall be checked continuously by means of a 3.0 m long straight edge supplied by the Contractor and laid longitudinally. The departure from the true surface when tested with the straight edge shall not exceed 6 mm for rigid and flexible pavements. If the surface tolerances required by this clause are not met the Engineer shall direct that the defective areas be removed and reconstructed to the correct level at the Contractor's expense.

COLD WEATHER WORK

The provision of Clause 702 of the Department of the Environment Specification for Road Works shall be applied.

USE OF SURFACES BY CONSTRUCTION PLANT

Construction traffic will not be allowed on the completed formation and traffic movement on the road sub base must be kept

to the minimum.

Constructional traffic used on pavements under construction shall be suitable in relation to the courses it traverses so that damage is not caused to the sub-grade.

TRENCHES FOR WATERMAINS

The minimum depth of the trench shall be such that the cover on the pipes measured from the final ground surface to the top of the pipe barrel shall not be less than 900 mm in fields, 1.0 m in roads and 750 mm under the road surface in footpaths.

Trench shall be excavated to a depth of 100 mm below the bottom of the barrel of the pipe.

ADDITIONAL EXCAVATION IN SOLID ROCK

Where the bottom of the trench is in solid rock shall be excavated to a depth of 150 mm below the bottom of the barrel of the pipe and the layer of granular bedding shall be 150 mm deep so that the pipe may be worked into its true line and level and firmly bedded as previously described.

BEDDING, HANDLING JOINTING AND LAYING OF WATERMAINS

Pipes should be laid true to line and level, firmly supported over their full length on a bed of granular material 100 mm deep below the barrel of the pipe. The trenches shall be so graded so that each pipe shall slope upwards in the direction of the air valve serving the section of the line so that no air pockets may be formed. After jointing, granular material should be brought up to a level of 150 mm above the crown of the pipe. Above this level Type B selected backfill shall be placed to a level of 300 mm above the crown of the pipe. Above this level normal backfilling may be used.

The handling, laying and jointing of asbestos cement pipes shall be strictly in accordance with the manufacturer's recommended procedures. Handling and laying of UPVC pipes, shall be in accordance with the Recommendations of the Institute of Industrial Research and standards S.R.3.

Bends, cast iron specials and special asbestos cement/cast iron and UPVC/cast iron connector pieces shall be as recommended by the appropriate pipe manufacturer.

CONCRETE ANCHOR BLOCKS

In-situ concrete anchor blocks. Class C mix shall be placed at all changes in direction at blank ends.

Valves and hydrants shall be supported in such a way that

operating torques are not transmitted to the pipelines.

The blocks shall be taken 150 mm below the pipe invert for the full width of the trench and shall encase the pipes to 150 mm over the top of the barrel. The minimum length of anchor block shall be 600 mm for pipes up to 150 mm diameter and 750 mm for pipes 200 mm diameter and greater.

VALVE AND HYDRANT CHAMBERS

Every valve and hydrant shall be surrounded by a rectangular chamber as detailed on the drawings.

The chamber shall have a 150 mm thick base of Class A concrete, and the chamber walls shall be 225 mm thick blockwork. The wall shall be arranged to straddle the pipe without bearing on it. The walls of the chamber shall be corbelled in at the top or a precast cover of Class A concrete 100 mm thick having an opening of the same size as the inside of the surface box shall be provided.

The surface box shall be accurately set to conform to the surface of the adjoining around and shall be surrounded by Class "C" concrete, cast in a rectangular mould to the external dimensions of the chamber and finished off 50 mm below the permanent ground level.

Alternatively precast concrete chambers, or in situ concrete chambers may be used where these meet with the approval of the Engineer.

Air valves and hydrants shall be raised on extension pieces when necessary.

DRY CHAMBER FOR STOPCOCK

The dry chamber for service stopcocks shall be constructed in 215 mm x 110 mm x 75 mm brick on a 150 mm thick concrete base slab. The brick shall be bedded in mortar, and the chamber brought up to within 150 mm of ground level. The C.I. surface box in a 150 mm cover slab as before. A 150 mm thick concrete base slab shall be used as for the brickwork chamber.

The water supply to the building shall be metered.

TESTING OF PIPELINES

Watermains shall be inspected before backfilling and shall be cleared of debris before testing in accordance with the requirements of the Dublin County Council in the presence of the Dublin County Council Inspector and/or the Engineer's Representative.

Tests shall be applied to sections of pipeline not exceeding 1000 metres in length. On completion of the whole watermain the test will be repeated on the full lengths of the system.

When testing, the pipeline shall be filled with water and all air released. The pipeline shall be kept under nominal pressure for a period of 24 hours to allow for absorption. Thereafter for a period of 20 minutes the pipeline shall be tested under 13.97 bar (200 psi or 1.379 N/mm sq.).

The Contractor shall ensure that the pipeline is properly supported, anchored and weighed down before commencing the tests and shall provide all equipment and labour necessary for carrying out the test.

In the event of a test failure the Contractor shall locate and remedy the defect to the Engineer's satisfaction and shall retest until a satisfactory test is obtained all at his own expense.

BACKFILLING TRENCHES

Backfilling of trenches shall be as previously specified on P.8.

PLACEMENT OF VALVE COVERS ETC.

All manhole covers, valve covers and other inspection covers shall be so bedded on a sound foundation as to conform as nearly as possible to the existing level of carriageway, footpath or verge surface.

FLUSHING AND STERILIZATION

Flushing and sterilization of the watermain pipelines shall be carried out by the Dublin County Council Watermains Section. The Contractor will be required to provide all necessary attendances on the County Council. Once the flushing and chlorination has been completed the Contractor will not be allowed to interfere with the watermain but will remain responsible for all defects in his workmanship and materials until the end of the maintenance period.

CONNECTION TO COUNTY COUNCIL MAINS AND SEWERS

The actual connections to the Dublin County Council owned (taken in charge) watermains, surface and foul sewers shall be carried out by Dublin County Council. The Contractor will be required to provide attendances on the County Council.

OCTOBER 1990

O'Connor Sutton Cronin
Consulting Engineers,
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Dublin 2.

A P P E N D I X 1.

NOMINAL INTERNAL Diameter mm	MINIMUM TRENCH Width mm	MAXIMUM TRENCH Width mm
100	450	650
150	500	700
225	600	800
300	700	900
375	950	1150
450	1050	1250
525	1150	1350
600	1250	1450
675	1350	1550
750	1400	1600
825	1500	1700
900	1950	2150
1050	2100	2300
1200	2300	2500
Above 1200	Outside diameter of pipe plus 800 mm	Outside diameter of pipe plus 1000 mm

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CAST IN-SITU CONCRETE SPECIFICATION FOR GRAIN STORE, RATHCOOLE.

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CAST IN-SITU WORK - CONCRETE

1.1 TOLERANCES FOR FINISHED WORK

1.2 PAD FOUNDATION

The permissible deviation for concrete foundations shall be

Plan Dimensions ; + 75mm
- 25mm

Vertical Dimensions ; +/- 15mm

Where formwork is not used a larger positive deviation for plan dimensions may be approved.

1.3 ELEMENTS ABOVE FOUNDATIONS

The permissible dimensional deviation for structural concrete elements above foundations shall be as follows:

Level: For any nominally horizontal surface when measured from the nearest reference level +/- 6mm.

Position on Plan: For the position of any nominally vertical surface at the lower edge when measured horizontally from the nearest reference line + 5mm.

1.4 PLUMBNESS

The permissible deviation from plumb of the upper and lower edges of any nominally vertical surface shall be 1 : 400 or +/- 20mm.

1.5 CROSS SECTION OF ELEMENTS

The permissible deviation of cross sectional dimensions of elements from those shown on the drawings shall be + 10mm, - 5mm, unless otherwise indicated on the drawings.

1.6 DEVIATION JUNCTIONS

The permissible deviation for abrupt changes in a nominally continuous surface at the junction of two concrete elements shall be +/- 3mm.

The maximum permissible deviation from the specified relationship of any two surfaces at a junction shall be +5mm.

1.7 BOW

The permissible deviation due to bow in the surfaces of columns, walls and beams shall be 1:400 or 20mm (the lesser of).

1.8 BULGING AND AND LOCAL IRREGULARITIES

The permissible deviation for bulging and local irregularities in the surface shall be +/- 5mm.

It is the Contractors responsibility to check that the above mentioned tolerances are sufficient to accommodate fittings, prefabricated items, window frames, lift shafts, etc. and he shall work to reduce tolerances when required for these items.

1.9 TOLERANCES GENERAL

2. FORMWORK

2.1 JOINT FILLERS

Movement joint fillers shall comply with ASTM D1751.

2.1.1 MOVEMENT JOINT FILLERS

Type : cork where specified

Movement joint fillers shall comply with ASTM D1752

2.1.2 MOVEMENT JOINT

Type : Flexcell or other approved where specified

Bituminous movement joint fillers shall comply with ASTM D394.

2.1.3 MOVEMENT JOINT FILLERS

Type : Asphalt mastic composition where specified.

Use a release agent, marked as such, compatible with the formwork, the concrete being used, with the finish specified and approved by the engineer.

2.2 RELEASE AGENTS

2.3 DESIGN AND CONSTRUCTION GENERALLY.

The design, erection and removal of formwork shall be the responsibility of the Contractor.

2.3.1 FORMWORK

Design and construct the formwork to produce hardened concrete to the tolerances, levels and finishes specified and to withstand the worst combination of:

2.3.2 FORMWORK DESIGN

1. Total weight of formwork, reinforcement and concrete.
2. Hydrostatic pressure of plastic concrete.
3. Construction loads, including static and dynamic effects of placing, compacting and construction traffic.

4. Wind and snow loads.

The Contractor shall make allowances for any settlement or deflection of formwork likely to arise during construction so that the hardened concrete conforms accurately to the drawings and unless specified otherwise to the tolerances set out in B.S. 5606.

Where neighbouring buildings or elements of neighbouring buildings are to be used for formwork support, then the Contractor is responsible to provide temporary shoring to these elements to ensure overstressing of these elements does not occur during concreting operations - notwithstanding the above concrete pours should be limited to ensure overstressing does not occur.

Provide the following formwork details prior to fabrication.

2.3.3. FORMWORK DETAILS

1. Surface finish.

2. Means of sealing joints.

No metal part of any device for locating shall remain within the concrete providing cover to the reinforcement. The material and position of any ties passing through the concrete shall be fit for their purpose. Any holes left after removal of ties shall be filled with concrete or mortar to approved composition.

2.3.4 METAL PARTS

Do not use removable through fixings unless agreed with the Engineer.

2.3.5 REMOVABLE THROUGH FIXINGS

Do not use twisted wire ties as through fixings.

2.3.6 TWISTED WIRE TIES

Carry down formwork to a foundation or such other construction that is sufficiently strong to provide effective support without causing excessive stress or movement in that foundation or construction.

2.3.7 FORMWORK SUPPORT

Design and construct the formwork so that striking will not subject the structure to shock, overloading or damage. 2.3.8 FORMWORK STRIKING

Where kickers are used, cast monolithically with the lower construction, but concrete to have wall or column strength. 2.3.9 KICKERS

Kickers shall not be less than 75mm in height. 2.3.10 KICKERS HEIGHT

Construct formwork with no soffit camber, unless otherwise shown on the drawings. 2.3.11 CAMBER

Where cambers are used the finished dimension of the concrete shall be that specified on the drawing.

Design and construct the formwork and joints between the formwork and completed work to achieve the specified finish. 2.3.12 JOINTS

Provide formwork for concrete below ground level in the following locations 2.3.12 EXTERNAL WALL FACES

1. Columns and walls

2. Bases where specified

2.4 PREPARATION

Store and use release agents in accordance with the manufacturer's written instructions. Use the same release agent throughout the entire area of only one finish. Release agents to be approved by the Engineer. 2.4.1 RELEASE AGENTS

2.5 JOINTS, INSERTS, HOLES AND CHASES

Form construction or day joints in the following positions, unless otherwise shown on the drawings. 2.5.1 CONSTRUCTION JOINTS NORMAL

Beams : To be approved by the Engineer.

Suspended Slabs : To be approved by the Engineer.

Columns and Walls : 50mm below the junction of the vertical member and the soffit of beams, haunch or slab, and at positions defined by kickers where used.

The Contractor shall obtain approval for his proposal for forming and preparing construction joints before work starts.

Where the Contractors proposals result in alterations to the reinforcement the Contractor shall be responsible for providing full revised details for approval prior to the work commencing on site.

Obtain approval for the position and design of construction or day joints not described in the contract documents. 2.5.2 CONSTRUCTION JOINTS, APPROVAL.

Form construction or day joints in accordance with the following criteria. 2.5.3 CONSTRUCTION JOINTS, SIZE OF SINGLE OPERATION

1. Maximum area 200m2

2. Maximum length 50m

Form construction or day joints with rigid stop boards. 2.5.4 CONSTRUCTION JOINTS.

Expansion joints shall be positioned and formed in accordance with the details shown on the drawings. Expansion joints shall be kept free of all deleterious material. 2.5.5 EXPANSION JOINTS

Fix or box out for inserts in accordance with the drawings or as instructed, prior to placing the concrete. 2.5.6 INSERTS

Form holes and chases in accordance with the drawings or as instructed, prior to placing the concrete. The position of all holes, chases etc., are subject to the Engineers approval. They shall be formed as work proceeds and shall not be cut after pouring. 2.5.7 HOLES AND CHASES

Do not cut cast concrete without written instructions. 2.5.8 HOLES AND CHASES CUTTING OUT

2.6 PLACING PERMANENT FORMS

Fix movement joint fillers rigidly to resist deformation during placing of the concrete where specified. The joint filler shall provide complete separation between adjacent members.

2.6.1 MOVEMENT JOINT FILLERS

2.7 STRIKING

Strike all formwork other than permanent forms without disturbing, damaging or overloading the concrete structure.

2.7.1 STRIKING

The stability of the structure and the protection of the concrete after striking the formwork shall remain the responsibility of the Contractor.

2.7.2 STABILITY AND PROTECTION STRIKING

The minimum period for retaining formwork in position before striking shall not be less than indicated in the following table.

2.7.3 MINIMUM PERIODS

TYPE OF FORMWORK	CEMENT TYPE			
	NORMAL PORTLAND CEMENT		RAPID HARDENING PORTLAND CEMENT	
	MEAN AIR SHADE TEMPERATURE		MEAN AIR SHADE TEMPERATURE	
	7oC	16oC	7oC	16oC
Vertical facing to columns walls and beams	12 hrs	12 hrs	12hrs	12hrs
Soffit facing to slabs	5 days	3 days	4 days	2 days
Supports to slabs	12 days	10 days	10 days	8 days
Soffit facing to beams	5 days	3 days	4 days	2 days
Supports to beams	18 days	15 days	15 days	12 days

Periods during which the air shade temperature remain below 3oC shall not be taken into account. Providing always that the minimum periods before striking are as in the tables, the

actual times of striking shall remain the responsibility of the Contractor.

Where the Contractor can submit evidence that the performance of the structure will not be adversely affected by reducing the specified periods before striking, reduced striking times may be approved. 2.7.4 EARLY STRIKING

Re-propping shall not be permitted unless approval is obtained. 2.7.5 PROPPING

2.8 CONCRETE FINISHES

Care shall be taken to prevent the staining and disfiguring of finished work such as fair faced concrete and brickwork. Any damage shall be made good at the Contractor's expense. 2.8.1 STAINING

Formwork shall be designed to give the specified surface finish as specified by the Engineer. If no specific finish is required by the Engineer the finish shall be type A as specified in Section 6 of B.S. 8110. 2.8.2 SURFACE FINISH

The Contractor shall not proceed with cladding, rendering, rubbing down or making good of concrete surfaces until he receives the Engineer's permission to do so and he shall not under any circumstances apply cement slurry or any other coating to the concrete surface as struck from the shuttering or do anything else which would hinder the proper inspection of the concrete surfaces by the Engineer. Failure to comply with this clause shall classify the concrete as defective. 2.8.3 QUALITY

3. REINFORCING

3.1 STEEL PRODUCTS

Hot rolled mild steel plain or deformed shall comply with B.S. 4449. 3.1.1 MILD STEEL BARS

Hot rolled high yield steel bars shall comply with B.S. 4449. 3.1.2 HIGH YIELD HOT ROLLED DEFORMED BARS

Cold worked high yield steel bars shall 3.1.3 HIGH YIELD

be deformed and shall comply with B.S. 4461. — COLD DEFORMED

Steel fabric shall comply with B.S. 4483 — 3.1.4 STEEL FABRIC

Hard drawn mild steel wire for concrete reinforcement shall comply with B.S. 4482. — 3.1.5 HARD DRAWN STEEL WIRE

Use annealed iron tying wire of not less than 1.14mm diameter. — 3.1.6 IRON TYING

Provide manufacturer's test certificate for — 3.1.7 CERTIFICATES

1. Hot rolled mild steel to B.S. 4449.
2. Hot rolled high yield steel to B.S. 4449.
3. Cold worked high yield steel to B.S. 4461.

3.2 SPACERS

Use ordinary spacers as necessary to support reinforcement in position. Use special spacers to support reinforcement where such are shown on the drawings and schedules. Steel chairs shall be used in the spacing of top reinforcement in slabs and be of suitable strength and number to hold the reinforcement in its correct position. The supply of steel chairs shall be the responsibility of the Contractor and will not be detailed on the reinforcement schedules. — 3.2.1 SPACERS GENERALLY

Use 1 : 2 cement-sand mortar cover spacers complete with fixing wire for all reinforcement of 20mm and greater in beams and slabs. Where spacer blocks are required in exposed concrete they shall be made from materials used in the surrounding concrete. — 3.2.2 MORTAR COVER SPACERS

Use approved plastic cover spacers for providing support for bars of 16mm or less in slabs. — 3.2.3 PLASTIC COVER SPACERS

Obtain approval for the use of proprietary fixing for reinforcement. — 3.2.4 PROPRIETARY FIXINGS

Obtain approval for the use of proprietary couplers for reinforcement. — 3.2.5 PROPRIETARY COUPLERS

3.3 TOLERANCES

The permissible deviation for cover to reinforcement shall be +/- 5mm from that specified. The permissible deviation for the location of reinforcement shall be 25mm provided the permissible deviation for cover is not exceeded. — 3.3.1 TOLERANCES

3.4 QUALITY CONTROL

Select in accordance with B.S. 4449 bar samples of the following types for testing from material to be used in the Works. — 3.4.1 BAR SAMPLES

Arrange for the following tests by an approved testing authority. — 3.4.2 TESTING SAMPLES NAMED AUTHORITY

1. Mild steel to confirm to B.S. 4449
2. High Yield steel to confirm to B.S. 4449.

including the delivery of the samples to the testing authority.

Arrange that the testing authority shall furnish copies of the test results directly to the Structural Engineer. — 3.4.3 REPORTING OF TEST RESULTS

3.5 PREPARATION

Handle reinforcement so as not to impair its qualities or cause permanent deformation. Store reinforcement clear of the ground on a clean site and with adequate protection to prevent deterioration. — 3.5.1 HANDLING AND STORING

Store reinforcement which has been cut and bent for each portion of the Works in clearly identified STORAGE and in separate bundles. — 3.5.2 IDENTIFIED STORAGE

All reinforcement shall be free of loose mill scale, loose rust, oil, grease, release agents and other deleterious materials at the time of placing — 3.5.3 CLEANLINESS

concrete.

Prevent projecting reinforcement from causing rust staining of exposed concrete surfaces. The ends of any tying wire are to be turned into the concrete and all steel used in the fabrication and positioning of reinforcement and shuttering shall have the minimum cover equal to that specified to the main reinforcement.

3.5.4 RUST STAINING

3.6 CUTTING & BENDING

Cut and bend reinforcement in accordance with B.S. 4466 and the schedule provided, except where specific conditions require a closer tolerance.

3.6.1 GENERALLY

Do not cold bend high yield reinforcement when the air shade temperature is below 5°C unless approval is obtained. Do not cold bend mild steel reinforcement when the air shade temperature is below 0°C unless approval is obtained.

3.6.2 COLD WEATHER BENDING

Do not heat cold worked steel reinforcement.

3.6.3 COLD WORKED STEEL

Do not rebend or remove bends from bars without approval.

3.6.4 REBENDING

3.7 FIXING

Place and fix securely all reinforcement in the positions indicated on the drawings. Support top reinforcement in slabs at not more than 1m centres. Fix cover spacers to maintain the specified concrete cover except where other methods are required.

3.7.1 GENERALLY

Do not, without approval, form laps in reinforcement other than those shown on the drawings.

3.7.2 LAPS

Fix reinforcement adequately with tying wire of approved proprietary fixings.

3.7.3 FIXING/TIES

No metal part of any device for fixing reinforcement shall remain within the concrete provided as cover to the reinforcement unless otherwise shown on the drawings.

3.7.4 FIXING/COVER

Weld mild steel reinforcement in accordance with B.S. 5135. Do not weld without approval.

3.7.5 WELDING

4. CONCRETING

4.1 MATERIALS

Provide details of proposed aggregates for approval. Do not use unapproved aggregrate.

4.1.1 AGGREGATE

Coarse and fine aggregrates from natural sources for concrete shall comply with BS822.

4.1.2 COARSE AND FINE AGGREGRATES

Aggregrates of which only the grading does comply with I.S. 5 may be approved.

4.1.3 GRADING

The chloride content of aggregrate shall be such that the total chloride content of the concrete mix shall not exceed the limits in table 6.4 of B.S. 8110. The Contractor shall provide confirmation of compliance at intervals of one month or less during the supply of concrete to the works.

4.1.4 AGGREGRATES-CHLORIDE CONTENT

Aggregrates for steam cured concrete shall be free from chlorides.

4.1.5 AGGREGRATES FOR PRESTRESSED OR STEAM CURED CONCRETE

The drying shrinkage of concrete made with natural aggregates shall not exceed .03% determined in accordance with B.S. 1881.

4.1.6 NATURAL AGGREGRATES SHRINKAGE

The constituent materials in concrete mixes designated with reference 'X' in Table of clause 4.2.8 shall comply with one of the following requirements.

4.1.7 ALKALI - SILICA REACTION (ACR) RESISTANT CONCRETE

(i) Coarse aggregrates of granite or limestone in conjunction with fine aggregrates all of which are certified by an expert competent in concrete chemistry as unlikely to be reactive.

(ii) The use of 'low alkali' sulphate

resisting cement with a guaranteed alkali content not greater than 0.6%, measured as the equivalent Na2 O (mean acid-soluble alkali-level) as determined by the method of B.S. 4550 : Part 2 Clause 16.

(iii) The total equivalent Na20 (acid-soluble) alkali content from the cement shall not exceed 3Kg per cubic metre of concrete, expressed in the following terms:

Cement Content (kg/m3 concrete)	Maximum Alkali Content of Cement %
500	0.60
400	0.75
375	0.80
330	0.90
300	1.00

based on the equation :

(Maximum % acid soluble alkali content of cement) = 300 / (cement content in kg/m3)

(iv) The cementitious material shall contain by weight a minimum of either 50% ground granulated blast furnace slag or 30% pulverised fuel ash.

Evidence of compliance shall be provided.

The total water soluble sulphate content of the concrete mix expressed at SO3 should not exceed 4% S03 by mass of the cement in the mix. The sulphate content shall be calculated as the total from the various constituents on the mix. The Contractor shall provide confirmation of compliance before any concrete is supplied to the Works. 4.1.8 SULPHATES

4.2 CEMENT

Provide details of proposed cement for 4.2.1 CEMENT

approval. Do not use unapproved cements.

All portland cement used in the Works shall be obtained from a registered firm of assessed capability under the BSI scheme for Quality Assurance to B.S. 5750. The Contractor shall provide certificates of conformity in accordance with Appendix A of the Quality Assessment Schedule to B.S. 5750.

4.2.2 CEMENT MANUFACTURERS TEST CERTIFICATES

Do not use air-set cement.

4.2.3 AIR-SET CEMENT

Normal Portland Cement (NPC) shall comply with B.S. 12.

4.2.4 NORMAL PORTLAND CEMENT

Rapid Hardening Portland Cement (RHCP) shall comply with B.S. 12.

4.2.5 RAPID HARDENING PORTLAND CEMENT

Sulphate-Resisting Portland Cement (SRPC) shall comply with B.S. 4027.

4.2.6 SULPHATE RESISTING PORTLAND CEMENT.

The use of Pulverised Fuel Ash (to B.S. 3892 part 1) or Ground Granulated Blast Furnace Slag (to B.S. 6699) in combination with Portland Cement (generally to B.S. 12) as part of the concrete mix may be permitted in special circumstances subject to the written approval of the Engineer.

4.2.7 P.F.A G.G.B.F.S.

Designed mixes shall be in accordance with the following schedule.

4.2.8 DESIGNED MIXES

Mix Designation	Type	35N20	35N20	15N20
	Reference	X	A	X
Characteristic Cube strength at 28 days (MPa)		35	35	15
Cement Type (s)		NPC	NPC	NPC
Aggregrate (s)		4.1	4.1	4.1
Nominal Max Aggregrate Size (mm)		20	20	20
Minimum Cement Content (kg/m3)		325	325	275
Rate of Sampling (m3 per sample)		20	20	100
Maximum Cement Content (kg/m3		550	550	550
Workability - Slump (mm)		50	50	75

A reduction in the minimum cement content may be approved where evidence is submitted that the water cement ratio can be strictly controlled.

4.2.9 ADJUSTMENT OF DESIGNED MIXES

Concrete may be supplied ready mixed provided approval is obtained.

4.2.10 READY MIXED CONCRETE, APPROVAL OF USE.

4.3 ADMIXTURES

Do not use admixtures other than those specified without written approval from the Engineer.

4.3.1 NO ADMIXTURES

4.4 WATER

The water to be used in the mix shall be clear of harmful matter. Obtain approval of source of supply if not obtained from mains. Test to be B.S. 3148 if required. Water should be potable.

4.4.1 WATER

4.5 WORKMANSHIP GENERALLY

Accurate daily records shall be kept on site of the maximum/minimum temperatures, inclement weather periods, concrete pours and concrete cubes taken, with the identification marks noted. Keep for inspection by the Engineer.

4.5.1 RECORDS

Do not place concrete against frozen or covered surfaces.

4.5.4 FROZEN SURFACES

Do not place concrete which has a temperature in excess of 30 degrees C without approval.

4.5.5 MAXIMUM CONCRETE TEMPERATURE.

4.6 TOLERANCES, ACCEPTANCE CRITERIA

Any concrete which does not comply with the requirements of B.S. 5328 and/or this specification will not be accepted.

4.6.1 COMPRESSIVE STRENGTH

Compliance with the specified characteristic flexural strength shall be assumed if

4.6.2 FLEXURAL STRENGTH

1. The average strength determined from any group of four consecutive test results exceeds the specified characteristic strength by 0.3 MPa.

2. The strength determined from any test result is not less than the specified characteristic strength minus 0.3 MPa.

The permissible deviation for slump for designed mixes shall be +/- one third of the specified value.

4.6.3 WORKABILITY

The permissible deviation for the air determined from individual samples shall be +/- 1% of the specified value.

4.6.4 AIR CONTENT DESIGNED MIXES

4.7 QUALITY CONTROL

Take 2 samples on 100m3 of aggregrates delivered to the works and carry out the tests in accordance with B.S.822.

4.7.1 AGGREGRATE TESTING

Aggregrate for 35N20X, 15N20X, concrete to be in accordance with Clause I 4.1.7

Carry out all tests indicated below — 4.7.2 WORK TEST SCHEDULE

Test	Test Procedure	Concrete mix Designation 35N20A	35N20X	15N20X
Workability	B.S. 1881	Test	Test	Test
Entrained Air Content	B.S. 1881			
Compressive Strength Cubes	B.S. 1881	Test	Test	Test
Compressive Strength Cylinders	B.S. 1881			

Determine the workability on one specimen from each sample of fresh concrete. — 4.7.3 WORKABILITY TESTS

Determine, where specified, the entrained air content of two specimens from each sample of fresh concrete. — 4.7.4 ENTRAINED AIR

Determine the strength at 7 and 28 days of two concrete specimens from each sample. Should the 7 day crushing strength be less than 66% of the characteristic strength the Engineers are to be contacted directly by phone by the testing authority. — 4.7.5 STRENGTH TESTS MOULDED SPECIMENS

Mix Designation	Specimen	Test
35N20A	Cube	Crushing Test
35N20X	Cube	Crushing Test
15N20X	Cube	Crushing Test

Obtain concrete and prepare test specimens in accordance with B.S. 1881. — 4.7.6 SAMPLES GENERAL

Take samples of fresh concrete at the point of discharge from the mixer or ready mixed concrete delivery vehicle. — 4.7.7 TAKING OF SAMPLES

Provide suitable equipment and competent personnel to take samples and prepare for the following tests.

4.7.8 PREPARATION OF TEST SAMPLES

1. Cube crushing test.

Slump test.

Provide suitable equipment and competent personnel to carry out the following:

4.7.9 TESTING OF SPECIMENS

1. Slump test

One test shall be made from each delivery or each batch, whichever is the lesser volume.

Arrange for the following tests to be carried out by an approved testing authority.

1. Cube crushing test.

Include for the delivery of the specimens to the testing authority.

Unless directed otherwise the rate of sampling shall be the greatest of:

(a) One per 10m3 or 10 batches whichever is the lesser volume, for the first 40 samples of each grade of concrete

or

(b) One per 10m3 of concrete placed in columns or cantilevers

or

(c) One per 50m3 of concrete in beams and slabs (other than cantilevers) walls and footings.

or

(d) One per 100m3 of concrete in solid raft foundations.

or

(e) One on each day that concrete of that grade is used.

Where more than one rate of sampling is carried out on the same concrete mix the results of all cube tests from these samples shall be considered together for assessment of compliance with the strength requirements of this specification.

Arrange that copies of the test results be sent directly to the Structural Engineer. 4.7.10 REPORTING OF TEST RESULTS

Any concrete which does not comply with the requirements of B.S. 5328 and/or this specification will not be accepted. 4.7.11 COMPLIANCE

4.8 BATCHING PLANT

The tolerance of the measuring devices used for batching, cement, water or aggregrates shall be +/- 3% and for batching admixtures shall be +/- 5%. 4.8.1 MEASURING DEVICES TOLERANCES

Check the accuracy of the measuring equipment used for batching whenever required during the progress of the work. 4.8.2 MEASURING DEVICES ACCURACY

Maintain all batching plant in a clean serviceable and accurate condition. 4.8.3 BATCHING PLANT

4.9 BATCHING PREPARATION

Store different aggregrates separately on hard self-draining areas or in suitable hoppers or containers. 4.9.1 AGGREGRATE STORAGE

Cement shall be delivered in unbroken bags as dispatched by the manufacturer or in approved bulk cement delivery vehicles. 4.9.2 CEMENT DELIVERY

Store cement under weather proof conditions on a raised floor, or in suitable silos. 4.9.3 CEMENT STORAGE

4.10 BATCHING & MIXING

Measure quantities of fine and coarse aggregrates by weight or alternatively by volume using purpose made gauge boxes of appropriate sizes. 4.10.1 BATCHING

Measure quantities of cement by weight. 4.10.2 CEMENT

If using bagged cement adjust quantities to use a whole number of bags. Where cement is weighed use a separate weighing device from that used for weighing aggregates. — BATCHING

Do not use different types of cement without approval. — 4.10.3 CEMENT MIXING

Mix concrete to a uniform consistency and colour in a mixer of approved type. The minimum time of mixing after the addition of water shall be two minutes unless otherwise approved. Discharge each concrete batch completely before recharging the mixer. Do not charge the mixer over the capacity stated by the manufacturer. — 4.10.4 CONCRETE MIXING

Do not use frozen aggregrates or aggregates containing ice or frozen snow. — 4.10.5 FROZEN AGGREGRATES

4.11 TRIAL MIXES

Make trial mixes under full scale production conditions for the following mix designations with the materials proposed for use in the works, unless the mix is approved from details submitted. — 4.11.1 TRIAL MIX REQUIRE-MENTS

Mix designations: 35N20/A 35N20/X
15N20X

Trial mixes shall be made until approval is obtained. Make further trial mixes as required and obtain further approval when there is a change in the materials or in the proportions of materials used.

Carry out tests on trial mixes as indicated below

4.11.2 TESTS ON TRIAL MIXES

Test	Test Procedure	No. of tests per Trial Mix	Concrete Mix Designation
			All
Workability	B.S. 1881	1	Test
Entrained Air	B.S. 1881	1	
Compressive Strength Cubes at 28 days	B.S. 1881	3	Test

4.12 TRANSPORTING & DISCHARGE

All equipment used for transporting or discharging concrete shall be free from contamination and accumulation of hardened concrete.

4.12.1 CLEAN EQUIPMENT

Concrete shall be transported from the place of mixing to the place of final deposit within thirty minutes of discharge from the mixer/agitator by methods which will prevent segregation or loss of the ingredients. Delays may be permitted as noted in Clause 6.5.2 of B.S. 8110 : Part 1.

4.12.2 TRANSPORTING CONCRETE

Obtain approval for the method of transporting and discharging concrete in the following locations

1. Foundations, columns and walls.

4.12.3 APPROVAL OF METHOD

The discharge of ready mixed concrete transported in a truck mixer or agitating truck shall be completed within two hours from the first introduction of the mixing water to the cement and aggregrates or the introduction of cement to the aggregrates, unless otherwise approved. The discharge of ready mixed concrete transported in non-agitating equipment shall be completed within one hour from the first introduction of the mixing water to the cement and aggregrates or the introduction of cement to the

4.12.4 READY MIXED CONCRETE COMPLETION OF DISCHARGE

aggregrates, unless otherwise approved.

4.13 CONCRETE LOCATION: use concrete mix types as follows

4.13.1 LOCATION OF MIX TYPES

Mix Designation	Location
35N20X	All concrete in contact with soil
35N20A	Remainder except listed below
15N20X	Lean mix concrete below footings

4.14 **PLACING AND COMPACTING**

Formwork and excavations shall be clean and free from water at the time of placing concrete.

4.14.1 CLEANING FORMWORK AND EXCAVATIONS

Complete each unit of construction or each section of work between predetermined and approved construction joints in one operation (Without stops for meals and tea-breaks). Discharge concrete into formwork and excavations in such as way as to prevent segregation or loss of ingredients. Discharge all concrete as close as possible to its final position. Partially hardened concrete or concrete adversely affected by delay or weather shall not be used.

4.14.2 PLACING

Concrete shall be deposited in layers of not more than 600mm which shall follow one another within thirty minutes. Each layer shall be mechanically vibrated subject to the foregoing conditions. Horizontal slabs shall be laid in one operation to the full thickness and beams in one operation to the full cross section. Existing walls shall not be used as permanent shuttering.

4.14.3 COMPACTION

If required, beams can be cast up to the underside of the floor slab with the prior agreement of the Engineer to form a horizontal construction joint.

Mechanical compaction shall be carried out with approved vibration equipment and which shall not damage shuttering or

4.14.4 MECHANICAL COMPACTION

reinforcement.

Manual compaction shall be carried out with approved tools and may be used in all reinforced work and elsewhere with approval. This does not include ground floor slabs whether they contain reinforcement or not. 4.14.5 MANUAL COMPACTION

Any concrete which is in the Engineers opinion is not thoroughly compacted shall be classed as defective. 4.14.6 DEFECTIVE CONCRETE

4.15 CURING

Maintain the temperature of the concrete at not less 5° C than for at least forty-eight hours after casting, unless otherwise approved. Obtain approval of proposed methods of maintaining concrete temperatures. 4.15.1 MAINTENANCE OF CONCRETE TEMP-ERATURES

Protect the concrete from loss of moisture and from the harmful effects of weather and from traffic for periods after placing not less than those indicated in the following table and table 6.5 in B.S. 8110 : Part 1. 4.15.2 NOMINATED CURING PERIODS

Conditions under which concrete is maturing.	Minimum periods of protection for different types of cement			
	Where the average temperature of the concrete exceeds 10°C during the whole of the		Equivalent Maturity (0 degree hours). The age of the concrete in hours times the number of degrees Celcius by which the average temperature of the concrete exceeds -10°C	
	Number of days		Co hours	
	NPC	RHPC	NCP	RHCP
Damp of indoors	No special requirements			
Hot weather or drying winds	4	2	2000	1000
Conditions other than above	2	1	1000	500

4.15.3 CURING METHOD

Obtain approval for curing methods proposed for vertical and horizontal surfaces before the works are commenced. If a curing agent is proposed it shall not effect finishes if any and so confirmed in writing by the manufacturers of the curing agent and of the finishes.

4.15.4 COLD

In cold weather (i.e. below 3°C) concrete be constructed and cured in accordance with Clause 6.7, B.S. 8110. Any concrete which in the Engineer opinion is damaged by frost shall be classed as defective.

4.16 BONDING TO CAST CONCRETE

Remove all laitance and loose material as practical to expose, but not disturb, the coarse aggregate. Use wire brushing, sand blasting, high pressure water jet or needle gunning. Do not hack or hammer.

4.16.1 SURFACE PREPARATION OF CAST CONCRETE

The face of the cast concrete shall be clean and damp when placing new concrete against it.

4.16.2 CASTING PREPARATION SURFACES.

5.1 FINISHES

QUALITY CONTROL

Provide samples of finish for approval in accordance with requirements.

5.1.1 SAMPLES

Retain samples for an approval period and remove when instructed.

Prepare all samples using the proposed method of construction and using the equipment, formwork, release agent, aggregate, concrete mix, reinforcement if any, and method of obtaining finish to be used in the construction.

5.1.2 PREPARATION OF SAMPLES

5.2 FINISHES GENERALLY

Unless otherwise specified, exposed and self-finished or painted concrete surfaces shall have Type C finish as defined in B.S.C.P. 8110 clause 6.10.3; non-exposed concrete shall have Type A finish.

5.2.1 FINISHES GENERAL

Where the concrete is to be plastered or is to receive some other applied finish, provide a finish to the concrete as specified to suit the intended applied finish (or if no finish is specified provide a Type A finish).

5.2.2 PLASTERED OR APPLIED FINISH

Provide a uniform tamped finish to top unless otherwise specified.

5.2.3 TAMPED FINISH

5.3 FINISHES TO SLABS

Where the slab is to receive an applied topping.

5.3.1 APPLIED

Finish By Grinding (When Approved)

Following the compacting screeder a regulating pass shall be made with a skip float. A carefully levelled slab is a prerequisite for grinding. The grinding is carried out with a slow speed grinder while the concrete is young (2 to 7 days after laying) to produce a hard wearing floor finish with a fine "sandpaper" finish by removing the thin weak surface layer, say 1mm thick.

6. WATERTIGHT CONCRETE

GENERALLY

6.1.1 CODE OF PRACTICE

The work shall be carried out in accordance with B.S. Code of Practice 102 "Protection of Buildings Against Water from the Ground" and B.S. 5337 : 1976 "The Structural Use of Concrete for Retaining Aqueous Liquids".

6.1.2 WATERTIGHT CONSTRUCTION

Where the description of a concrete mix is qualified by the phrase "watertight construction" the Contractor shall give such special care and attention to the work at all stages that will ensure a watertight structure. Should the work fail in this respect it shall be made watertight at the Contractor's expense. Unless otherwise noted on the drawings this section specifies requirements not covered elsewhere for work in connection with basements, pits, water tanks, reservoirs and other structures where the concrete must be water resistant without the assistance of an impermeable membrane.

6.1.3 SPECIFICATION

The general specification for in-situ applies to this part of the work, together with these additional clauses. Relevant sections of CP 102 "Protection of Buildings Against Water from the Ground" and B.S. 5337 :1976, "The Structural Use of Concrete for Retaining Aqueous Liquids" shall also apply.

6.1.4 DAMP PROOFING

Damp proofing to walls shall be provided as shown on the drawings and shall be

laid and protected, temporarily and permanently, strictly in accordance with the manufacturers printed instructions.

In water-logged ground the site shall be kept free from water until the concrete has thoroughly set and the construction has advanced sufficiently to preclude flotation. 6.1.5 WATER-LOGGED GROUND

The Contractors shall ensure watertightness at spacing bolt locations. The type of spacing bolt in formwork for the walls shall be a type approved by the Engineer. 6.1.6 SPACING BOLTS

The concrete shall be 35N20X mix as specified in Clause 4.2.8. or as indicated on the drawings or otherwise specified. 6.1.7 CONCRETE MIX

Limits on cement content and water/cement ratio for the mix as shown. 6.1.8 MIX LIMITS

Reference	Cement Kg/cum	Maximum Free water/cement ratio
Reinforced concrete in sections smaller than 300m or in congested areas.	320-370	0.50
Reinforced concrete in sections 300 to 1200mm thick.	260-320	0.55
Mass concrete in thick sections.	220-260	0.60

Cement content within the above ranges shall be kept as low as possible to give specific strength and workability suitable for transport and placing conditions.

6.2 CONCRETE HANDLING AND PROTECTION

6.2.1 CONCRETE PLACING

All concrete shall be placed continuously between predetermined square butt joints. Concrete shall be deposited as near as possible to the point at which it is required and shall not be allowed to 'flow' horizontally under the action of the vibrator. Refer to Section 5 and 6 of B.S. 5337 for recommendations of workmanship.

6.3 JOINTS GENERALLY

6.3.1 JOINTS GENERALLY

In watertight construction water-bars shall be used in all construction joints and movement joints in accordance with the manufacturers instructions. The Contractor shall obtain approval for the methods to be used to maintain them in their correct locations while the concrete is being placed and during or after the removal of the formwork.

6.3.2 JOINTS POSITION

The Contractor shall submit for approval drawings indicating the positions of joints and details of water bars to be used for all watertight construction. Details shall include scheduling for all special function pieces to be used.

6.3.3 BAY LENGTHS

Bay lengths between joints shall be

limited to 5 metres unless approved otherwise. For guidance refer to Table 6, B.S. 5337.

6.3.4 SLAB AND WALL JUNCTIONS

At the junction of the floor slab and wall, a continuous upstand section of the wall shall be cast at the same time as and integrally with the floor slab. This section shall not be less 150mm in height above the slab, and not less than 150mm above a splay where used.

6.3.5 SLAB AND WALL JUNCTION CASTING

The concrete slab adjacent to the wall shall be cast against a top horizontal form or other suitable arrangements shall be made so that the junction of the base slab and wall will be cast in one.

6.4 HORIZONTAL JOINTS

6.4.1 JOINT SURFACES

The surface of the joint prior to the deposition of the next lift or section of concrete shall be free from all laitance scum. It shall show a lightly roughened texture over the full cross section of the work in which the tips of the aggregates are exposed but not be too grossly uneven as to cause porosity in the next lift or section of the concrete. The most efficient method for achieving this requirement will depend on the age of the concrete.

6.4.2 SURFACE PREPARING

Air-and-water jet or wire brushing of green concrete may be used one to three hours after compaction. Harder concrete must be lightly chipped. Chipping must not be so vigorous as to damage the projecting aggregate.

6.4.3 SURFACE CLEANING

On completion of the fixing of reinforcement and erection of formwork for the next lift of concrete, surface and joints shall be thoroughly cleaned by air-and-water jets. Excess water shall be removed and areas to be concreted left for several hours so that the joints prepared in this way shall have concrete placed and compacted without prior application of mortar.

6.4.4 PRECAUTIONS

Precaution shall be taken during assembly prior to concreting to prevent fouling of

the concrete surface.

It is particularly important to ensure that the junction between the lower edge of the formwork to the upper lift of concrete section is close fitting, since seepage of the cement passed from the newly deposited concrete will cause a consequent potential point of weakness. 6.4.5 CLOSE FIT

Continuous "I" PVC or rubber or type PVC water bar, approved type, shall be used where shown on the drawings or as directed otherwise. Unless noted otherwise water bars are to be provided in all joint slabs and vertical joints of walls in waterproofed construction. 6.4.6 WATER BARS

6.5 VERTICAL JOINTS

Vertical construction joints in walls above the kicker shall always be provided with a continuous water bar as per 6.4.6 6.5.1 JOINTS ABOVE KICKER

The water bar must be carefully fixed into the split stop end of the formwork and maintained in its correct position by wiring through the eyelet holes to the reinforcement. 6.5.2 FIXING WATER BAR

The surfaces of vertical construction shall be prepared by careful application of a surface retarder to the vertical stop-end. This stop-end shall be stripped as soon as possible (within 12 hours except in cold weather) and the surface of the concrete immediately brushed with a wire brush to expose the aggregate. 6.5.3 EXPOSING AGGREGATE

On completion of the fixing of reinforcement and erection of the formwork for the next lift of concrete preparation shall be as specified in Clause 6.4.3 6.5.4 SURFACE CLEANING

6.6 COMPACTION

At vertical joints particular care must be taken to ensure full compaction on the concrete around the water bar on both sides of the joint. 6.6.1 VERTICAL JOINTS

At horizontal joints it is of vital 6.6.2 HORIZONTAL

importance to ensure that newly placed concrete is worked up solidly against the prepared face of the joint. When casting walls, the first batches of concrete should have an increased cement content to compensate for losses on reinforcement etc.

JOINTS

6.7 CURING

In normal temperatures, wall forms shall be removed within twelve hours and removed several hours later. Further protection to the concrete shall be provided as specified in the general specification.

6.7.1 REMOVING FORMS

Cold water shall not be sprayed into a face of concrete which is hot.

6.7.2 SPRAYING

The methods of curing for various parts of the buildings or structures shall be approved before concreting commences. This will in no way relieve the Contractor of his responsibilities.

6.7.3 APPROVAL OF METHODS

6.8 INSPECTION

As early as possible after the completion of any basement or duct before backfilling behind the walls, preparation shall be made for inspection of the finished work. All openings shall be temporarily battened and made watertight for this purpose, and the collected surface water shall be removed and all surfaces dried off.

6.8.1 PREPARATION

The contractor shall allow sufficient time in his programme for completion of the inspection, and any remedial work there may be to produce a watertight construction, together with the cost of any heating etc., necessary to dry out any basement or duct.

6.8.2 ALLOWANCE

Approval given on inspection shall not relieve the contractor from his responsibility for any further defects in the concrete that occur at a later stage in the contract, and which is due to faulty construction.

6.8.3 RESPONSIBILITY

6.9 FINISHES

Refer to Clause 5 for specified finish.

6.9.1 FINISHES

All concrete surfaces, both inside and outside shall be left untouched after removal of the formwork. No rubbing up shall be done and the use of sealing liquids or other treatments shall not be permitted.

6.9.2 UNTOUCHED SURFACES

No floor or wall finishes of any kind shall be applied until inspection of any remedial work is complete and written approval is obtained. It is desirable that the application of these finishes be delayed to as late a stage as possible in the general construction and the Contractor will be required to incorporate this requirement in his general overall programme of work.

6.9.3 DELAYED FINISHES

6.10 DEFECTS

Testing for liquid retaining structures shall be in accordance with the requirement of B.S. 5337. Basements and similar shall be inspected and assessed in accordance with B.S. CP102.

6.10.1 ACCEPTANCE CRITERIA/ TESTING

If points of weakness are revealed through which the ground water has penetrated, they shall be isolated with small temporary brick-on-edge dams set in cement mortar. These shall be constructed on the slab around and below the defective points as necessary to collect the water seepage.

6.10.2 WATER PENETRATION

These defects shall be rectified by high pressure grouting or by other approved suitable methods, as directed in accordance with Section 9 of B.S. 5337.

6.10.3 REMEDIAL WORK

Approval given by the Engineer on inspection shall not relieve the contractor from his responsibility for any further defects in the concrete which occur at a later stage in the contract, and which are due to faulty construction.

6.10.4 RESPONSIBILITY

7. SLABS (NON-SUSPENDED) & PAVING AREAS

This section specifies requirements not covered elsewhere for work in connection with non-suspended slabs i.e. slabs on

7.1.1 GENERAL

hardcore sub-grade.

The slabs shall be poured on the prepared formation and construction as shown on the drawings. 7.1.2 SURFACE PREPARATION

7.2 AGGREGATES FOR HARD WEARING CONCRETE SURFACES

Aggregates from natural sources for hardwearing concrete surfaces shall comply with B.S. 1201. 7.2.1 AGGREGATES HARD WEARING SURFACES

Use approved aggregates for hard wearing concrete surfaces. 7.2.2 APPROVED AGGREGATES

7.3.1 SURFACE TREATMENT MATERIALS

Use treatment specified on drawings. 7.3.1 SURFACE TREATMENT MATERIAL

Liquid membrane forming curing compounds shall comply with ASTMC 309-58. 7.3.2 CURING COMPOUNDS

Type: To approval of Engineer.

7.4 TOLERANCES - CONCRETE FINISH

The permissible deviation for the edge of concrete slabs and paving areas as constructed and for all prescribed alignments shall not exceed +/- 10mm from the reference line indicated on the drawings. 7.4.1 HORIZONTAL ALIGNMENTS

The permissible deviation from the nominal surface of slabs and paving areas in the vertical direction shall not exceed +/- 10mm. The nominal surface shall be calculated from the concrete slab and paving area vertical profile and crossfalls. 7.4.2 SURFACE PROFILE

Notwithstanding the tolerances stated above, the permissible deviation for the surface finish of slabs and paving areas shall not in any 3m length exceed +/- 3mm from the nominal surface profile. Steps or lips at joints shall not exceed 1mm. 7.4.3 SURFACE IRREGULARITIES

7.5 SURFACE FINISH

Provide a tamped finish in the following locations: — 7.5.1 TAMPED FINISH

All external slabs or where specified on drawing.

Provide a steel hand trowelled finish where specified on drawings. — 7.5.2 HAND TROWELLED FINISH

Provide a power floated finish in all unless specified otherwise. — 7.5.3 POWER FINISH

Provide a wood floated finish followed by a brush finish to all parking floor slabs. — 7.5.4 WOOD FLOATED FINISH

Apply curing compound in accordance with manufacturer's written instructions on all slabs. — 7.5.5 CURING COMPOUND METHOD OF APPLICATION

The time of application of curing compound shall be in accordance with the manufacturer's instructions. — 7.5.6 CURING COMPOUND TIME OF APPLICATION

7.6 SURFACE GRADIENT

Unless shown otherwise on the drawings, the surface gradient of slabs and paving areas shall be 1:100. — 7.6.1 SURFACE PROFILE

7.7 SURFACE TREATMENT

Apply proprietary surface materials in accordance with the manufacturer's written instructions. — 7.7.1 SURFACE

7.8 JOINTS

Floating ground floor slabs shall unless otherwise shown on the drawings be constructed as follows. The slabs shall be poured in strips approximately 4.5m wide and the longitudinal joint between the strips shall be a straight butt joint with 50mm edge cover to the slab reinforcement; the strips shall be sawn into bays 6m long the reinforcement having been stopped 50mm each side of the — 7.8.1 JOINTS

sawn joint locations. The main wires in the mesh reinforcement shall be parallel to the longitudinal joints. Sealed expansion joints with 20mm joint filler shall be formed at walls, columns, machine bases etc. and also at expansion joints at 50m centres approximately within the slab.

Joints shall incorporate dowel bars and tie bars as indicated on the drawings.

Clean down edges of poured strips with a carborundum stone before the adjacent bay is poured. Clean off. 7.8.2 JOINT

Hot rolled mild steel dowel bars shall comply runover from new strips onto hardened adjacent strips. 7.8.3 MILD STEEL DOWEL

Screeder/compactors with vibrator attached shall be used to compact the concrete but in addition a poker vibrator shall be used to compact the edges of the slab. 7.8.4 COMPACTION

8. PERMANENT JOINTS.

8.1 JOINT FILLERS.

Fibre board joint fillers shall comply with ASTM D1751. 8.1.1 FIBRE BOARD

Type : "Flexcell" or other approved.

Use the following joint fillers: 8.1.2 JOINT FILLERS GENERAL.

Mineral fibre board.

The permissible deviation for the thickness of joint fillers shall not exceed +/- 3mm. 8.1.3 JOINT FILLERS TOLERANCES

8.2 JOINT PRIMERS.

Use a primer as recommended by the manufacturer of the associated joint sealant. 8.2.1 PRIMERS

8.3 JOINT SEALANTS.

Two part polysulphide-based sealants shall comply with B.S. 4254. 8.3.1 TWO PART POLYSULPHIDE SEALANTS

Grade : Gun grade.

One part polysulphide-based sealants shall comply with B.S. 4254.

8.3.2 ONE PART POLYSULPHIDE SEALANTS.

Type : A1 or A2

8.4 JOINTING ACCESSORIES

Use water stops in accordance with the schedule.

8.4.1 WATER STOPS

Location	Material	Description
Basement Floor Construction	PVC	External Type
Basement Wall Construction	PVC	External Type & Expansion

Use the following proprietary water stops

8.4.2 PROPRIETARY WATER STOPS

Location	Type	Manufacturer	Description
All	PVC	Services or other approved	External

O'CONNOR SUTTON CRONIN

Consulting Engineers

25 LOWER MOUNT STREET, DUBLIN 2.

O'CONNOR SUTTON CRONIN

Consulting Civil and Structural Engineers

25 LOWER MOUNT STREET, DUBLIN 2.

Telephone: 609977
Fax: 609414

STRUCTURAL CALCULATIONS
FOR
GRAIN STORE
RATHCOOLE.

O'Connor Sutton Cronin and Associates Limited

Directors:

John V. O'Connor — Master of Science, Chartered Engineer, Fellow of the Institution of Structural Engineers.

Pearse C. Sutton — Fellow of the Institution of Engineers of Ireland, Barrister-at-Law.

Kevin A. Cronin — Bachelor of Science (Engineering), Chartered Engineer, Member of the Institution of Engineers of Ireland, Member of the Association of Professional Engineers at Saskatchewan, Canada, Member of the Institution of Structural Engineers.

Bachelor of Science (Engineering), Chartered Engineer, Member of the Institution of Engineers of Ireland, Member of the Institution of Structural Engineers.

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Contract	Job ref.
Part of structure	Calc. Sheet No. A
Drawing ref. Calculations by Checked by	Date

Members ref.	CALCULATIONS	OUTPUT

INDEX

Description	–	A
Codes of Practice	–	B
Loading	–	C
RC Retaining Wall	–	01 - 08
Foundations	–	09 - 10
Portal	–	11 – 110

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Contract | Job ref.

Part of structure | Calc. Sheet No. B

Drawing ref. | Calculations by | Checked by | Date

Members ref.	CALCULATIONS	OUTPUT

Description : This Grain Store is 36m x 60m. Farm Building.

Roof - Single Skin PVC Coated Sheet

Frame - Precast Conc. by Specialist eg Concast or similar approved

Floor - 175 Power floated Slab.

Side Cladding - PVC Coated Single Skin Sheet down 3m, flashed over RC wall.

RC wall is 6m approx over FFL.

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Contract | Job ref.

Part of structure | Calc. Sheet No. C

Drawing ref. | Calculations by | Checked by | Date

Members ref.	CALCULATIONS	OUTPUT
	BS 8110 - Structural Use of Conc.	
	BS 5628 - Structural Use of Masonry	
	CP3 Chap5 - Wind Loading	
	BS449 - Structural Use of Steelwor	

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Contract: GRAIN STORE RATHCOOLE
Job ref.:
Part of structure: RETAINING WALL
Calc. Sheet No.: 1
Drawing ref.:
Calculations by: BR
Checked by:
Date: 17-4-1991

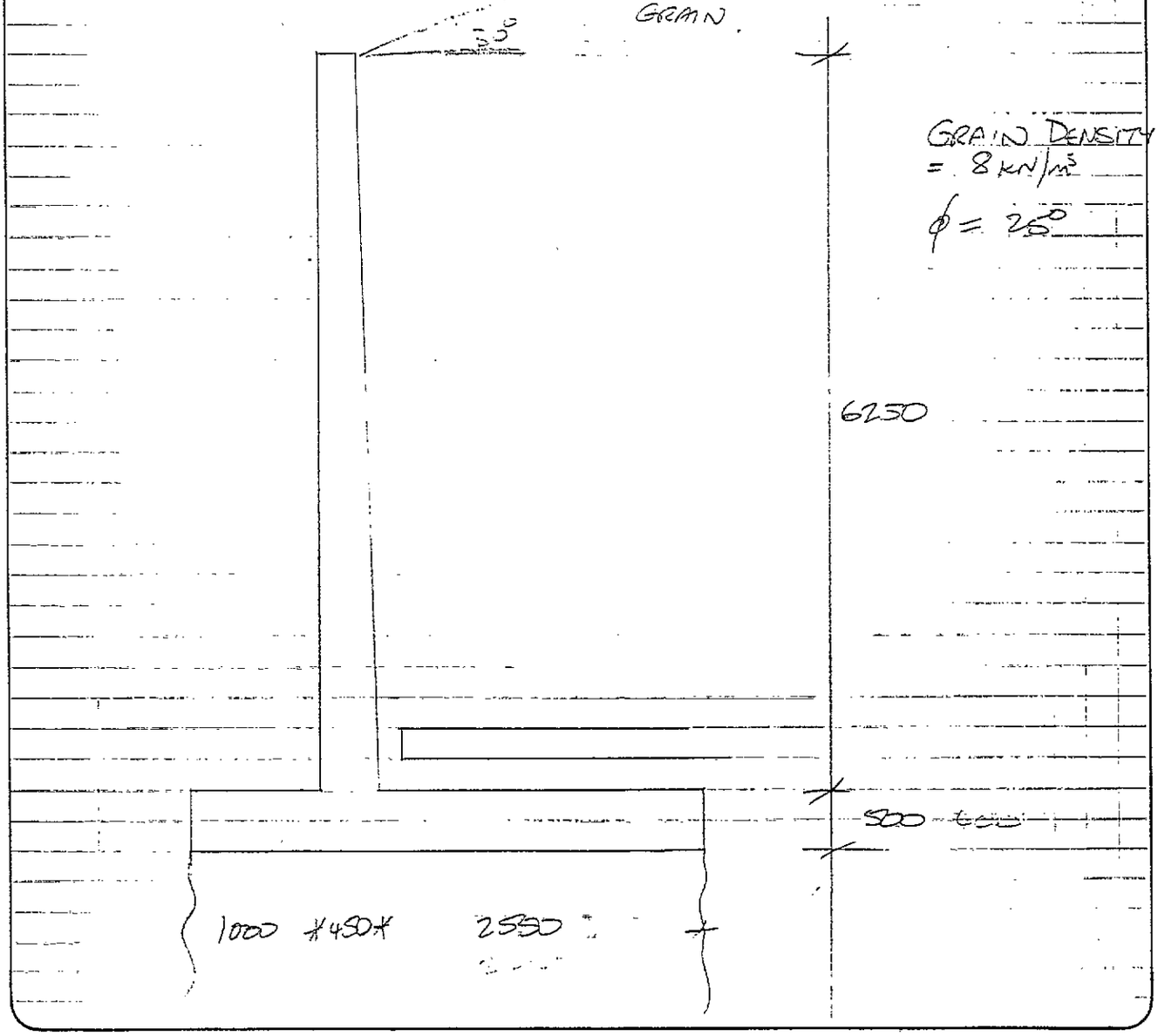
Members ref.	CALCULATIONS	OUTPUT

RETAINING WALL - CANTILEVER OPTION.

ALLOWABLE BEARING CAPACITY = 200 kN/m²

CONCRETE GRADE 35 N/mm²

COVER TO REINF'T = 40 mm



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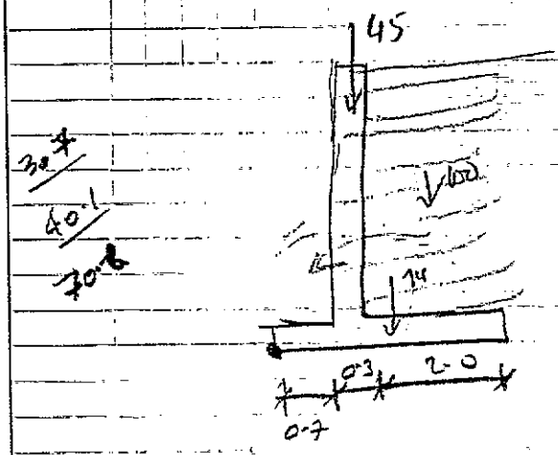
Contract | Job ref.

Part of structure | Calc. Sheet No. 02

Drawing ref. | Calculations by | Checked by | Date

Members ref. | CALCULATIONS | OUTPUT



$\Rightarrow \frac{332-165}{174} = 0.96$ $\quad e_{acc} = 0.54$

$\Rightarrow \frac{2}{3} \times \frac{174}{0.96} = 121$ ✓ SW < 150 kN/m

$\Rightarrow$ Sliding horiz = 64 kN × 1.5 = 96

20.5

$174 \times 0.4 = 69.6$ kN fails

Found to be poured against grout

$\Rightarrow 70 + 8.7 = 78$ kN

8.7 kN. | 0.4

$\Rightarrow \frac{78}{64} = \frac{1.21}{1.5} = 0.8$ fails

$\frac{18 \times 1.41 \times 0.4}{2} =$

Provide key

11. 1000

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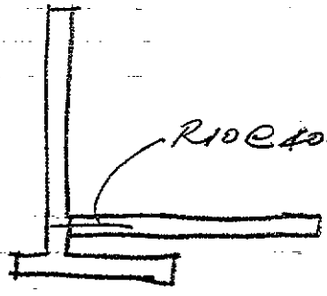
Contract | Job ref.

Part of structure | Calc. Sheet No. 09

Drawing ref. | Calculations by | Checked by | Date

Members ref. | CALCULATIONS | OUTPUT

Typ mid slab:



·175×24 = 4·2 kN/m.

⇒ perimeter = 18×4·2 = 76kN,

⇒ 76×0·4 = 30kN

⇒ 78+30 = 105kN,

⇒ $\frac{158}{96}$ = 1·13 ok.

✓ok.

⇒ Design of Slab.

h = 300

d = 300−40−10−10 = 240

f_{cu} = 30

M = 165×1·4 = 231kN.m $\frac{M}{bd^2 f_{cu}}$ = 0·13.

⇒ ~~3480~~ As Req'd = 2934. T25@175.

$\frac{M}{bd^2}$ = Make Wall 350 = h, 29 = d $\Big\}$ $\frac{M}{bd^2 f_{cu}}$ = 0.09.

As Req'd = 2237.

T25@200c/c.

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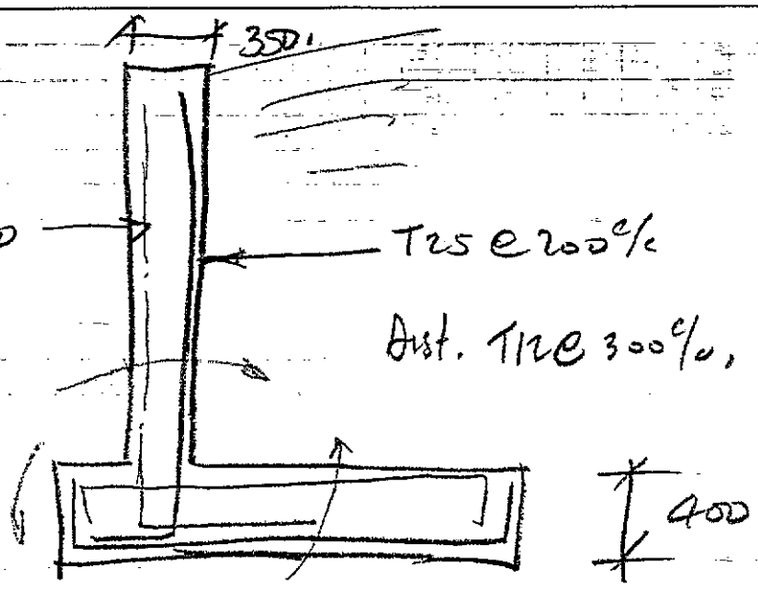
Contract | Job ref.

Part of structure | Calc. Sheet No. 014.

Drawing ref. | Calculations by | Checked by | Date

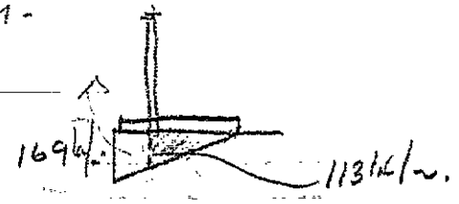
Members ref. | CALCULATIONS | OUTPUT



Base $125 \times 1.4 = 175$ kN/m. $\frac{wL^2}{2} = 350$ kN.

~~As Req'd = 2953~~ ⇒ ~~Use T25 @ 175.~~

Pressure Diag.



~~2.9.~~ Say 3m

$\frac{169 \times 0.7^2}{2} = 41$ kN.m = As Req'd = 320 Use T12 @ 300 c/c

M = 75 kN.m ⇒ As Req'd = 586 mm²/m

⇒ Use T16 @ 200 c/c.

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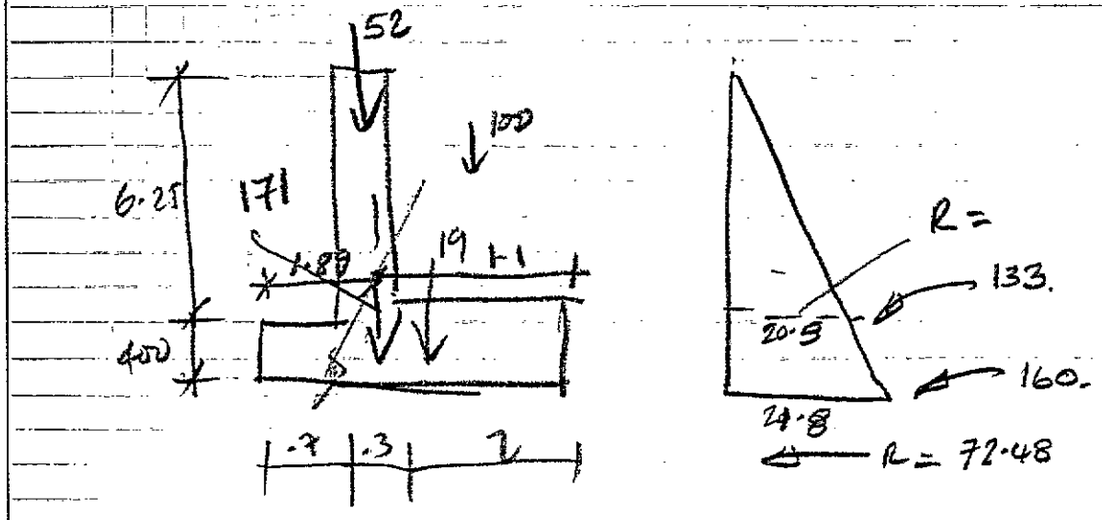
Contract | Job ref.

Part of structure | Calc. Sheet No. 84

Drawing ref. | Calculations by | Checked by | Date

Members ref. | CALCULATIONS | OUTPUT

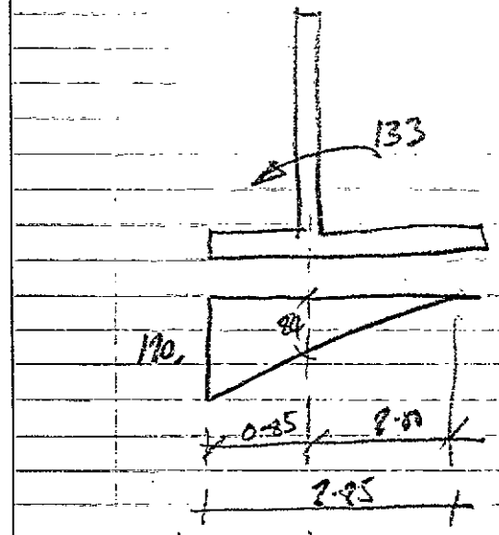


$\Rightarrow \frac{72.48 \times 2.21}{171} = 0.94$

$e_{req} = 0.55$

~~$e_{req} = (1.89 + 0.94) \cdot 1.5$~~

$\frac{171 \times 1.89 - 160}{171} = 0.95.$ $e_{req} = 0.55.$



57 ± 62

$\frac{x}{2} = \frac{120}{2.85}$

$\left(\frac{84}{2} \times 2\right)\frac{2}{3} = 57 kN.m$

$(84 \times 0.85)\frac{.85}{2} + \left(\frac{36}{2} \times .85\right)\frac{.85 \times 2}{3} =$

$31 + 9 = 40 kN.m$

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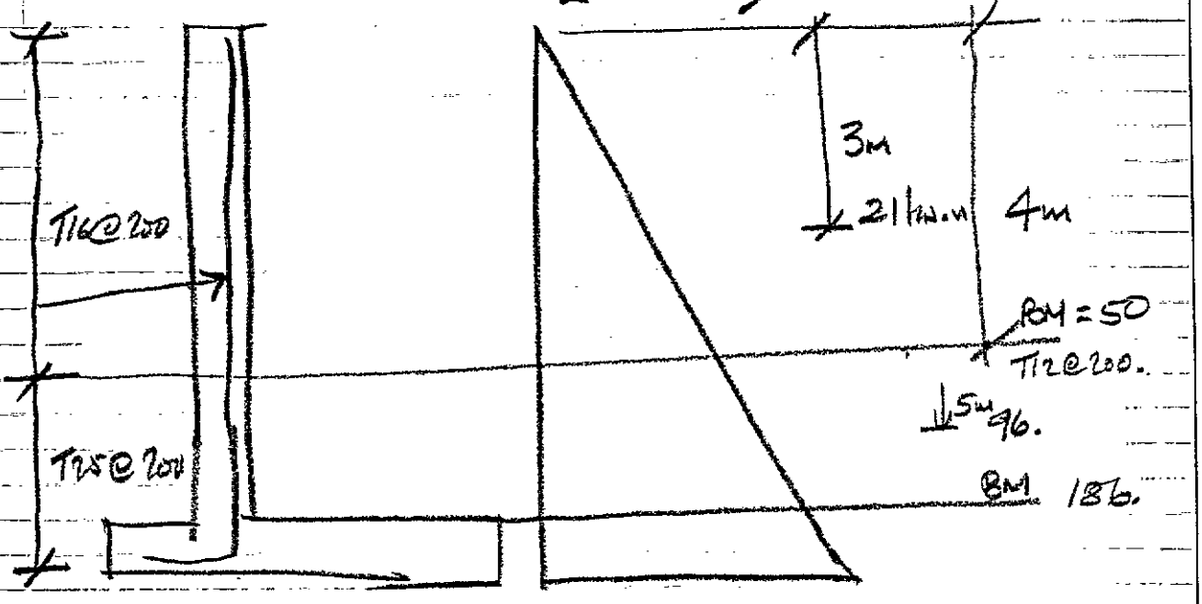
Contract | Job ref.

Part of structure | Calc. Sheet No. 05

Drawing ref. | Calculations by | Checked by | Date

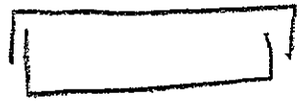
Members ref. | CALCULATIONS | OUTPUT

BM @ 3m Stem : $\frac{(8 \times 41 \times 3)}{2} 3 \times \frac{3}{3} = 14$



BM50 As Req'd = 458.

Base. T16 @ 200



Dist T12@300 c/c Typ.

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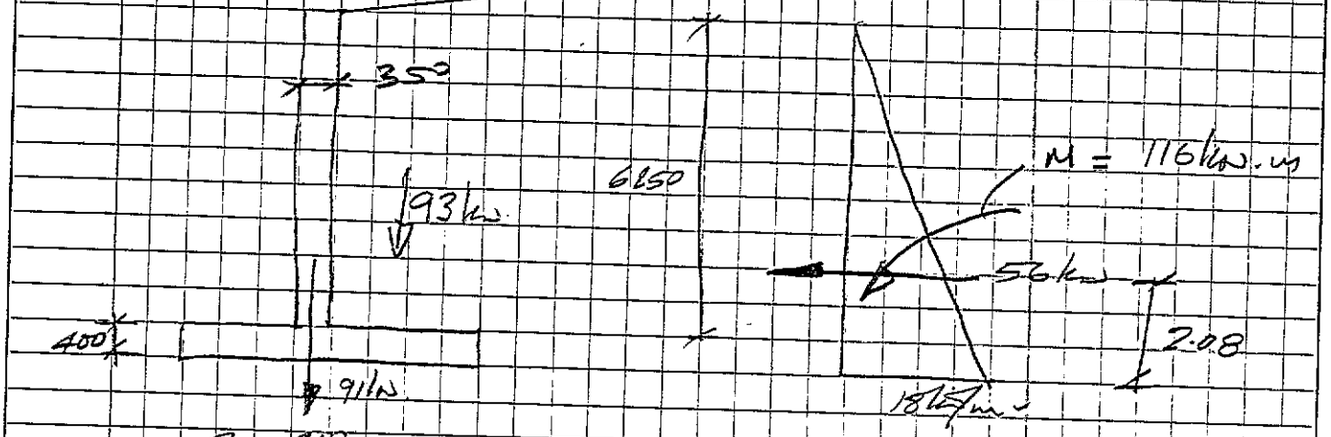
Contract | Job ref.

Part of structure | Calc. Sheet No. 07

Drawing ref. | Calculations by | Checked by | Date

Members ref. | CALCULATIONS | OUTPUT

Central Retaining Wall.

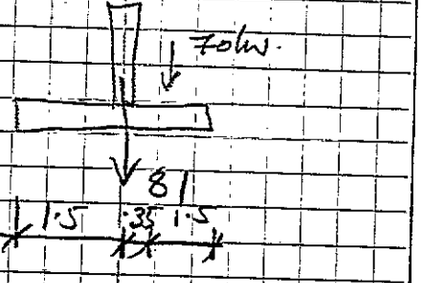


$\frac{1-\sin 25}{1+\sin 25} = \frac{0.58}{1.42} = 0.36$

Grain one side only Critical. OTM = 116kN.m.

RM = $(91 \times 2.175 + 93 \times 3.35) = 509$ kN.m. ✓

Reduce base to 1.5, 0.35, 1.5 ⇒



RM = $(81 \times 1.675 + 70 \times 2.6) = 318$ kN.m

✓ok

Check Resultant: $(318 - 116 - 56 \times .4)/151 = 1.2$m.

⇒ e/4 c = 0.48 ∠ Middle Third = .5c

⇒ Max Pressure = $\frac{151}{3.35} \pm \frac{138 \times 6}{3.35^2}$

$45 \pm 74 = 148$kN/m² < 150

✓ok.

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Contract | Job ref.

Part of structure | Calc. Sheet No. 68

Drawing ref. | Calculations by | Checked by | Date

Members ref.	CALCULATIONS	OUTPUT

Use similar Raft to Plenum Wall.
and tie into floor as per Side wall.

Raft from Well will be tied into both
Columns & Founds.

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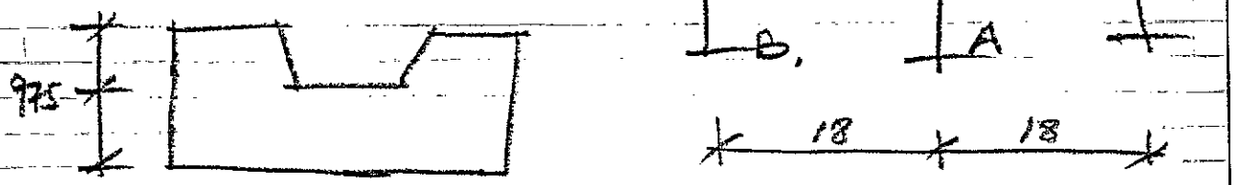
Contract | Job ref.

Part of structure | Calc. Sheet No. 609

Drawing ref. | Calculations by | Checked by | Date

Members ref.	CALCULATIONS	OUTPUT

Found Design



Found = ~~54~~

Col/Rafter = 172 $\Rightarrow \frac{442}{150} = 1750 \times 1750$ Sq.

Gutter = 30

Covering = 24

Snow (1.5 for valley) = 162 / 442 $(150 \times 1.5)\frac{0.885^2}{2} = \frac{86}{\text{~~xxxx~~}}$ k.m

$\frac{M}{\text{load/m}} = \text{~~HH3~~}\ 286$ $\frac{1}{\text{in}} = 30$

T12 @ 200 c/c Typical.

Edge Beam:

Load ~~Found~~

Found	= 54	253
Col/Rafter	= 100	
Gutter	= 30	
Covering	= 15	
Thin	= 54	

1300 Sq. beam ok.

T12 @ 200 E.W.

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Contract | Job ref.

Part of structure | Calc. Sheet No. 18

Drawing ref. | Calculations by | Checked by | Date

Members ref.	CALCULATIONS	OUTPUT

Wind pat Bases By inspection 1800 Sq.
T12 @ 200 Ctrs.

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Contract	Job ref.
Part of structure	Calc. Sheet No. GB 11
Drawing ref. Calculations by Checked by	Date

Members ref.	CALCULATIONS	OUTPUT

PORTAL FRAME DESIGN

@ 6.0M C/Cs

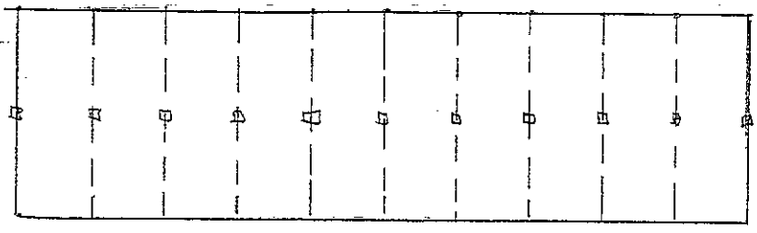
LOAD : SINGLE SKIN CLADDING + PURLINS = 0.20KN/m²

SERVICES = 0.15

0.55KN/m²

LIVE LD = 0.75KN/m²

WIND LD



10 @ 6m C/Cs = 60m

BASIC WIND SPEED = 46 m/s (RATHCOOLE)

$S_1 = 1.0$ $S_3 = 1.0$

CLASS C BUILDING >50m

CATEGORY 1 HT = 11.0M

$S_2 = 0.91$

$V_s = 46 \times 1.0 \times 0.96 \times 1.0 = 41.9 m/s$

$q = 0.614 \times 41.9^2 \times 10^{-3} = 1.1 KN/m^2$

Note Wind loading taken out thro' Retaining wall.

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Contract	Job ref.
Part of structure	Calc. Sheet No. 12
Drawing ref. Calculations by Checked by	Date

Members ref.	CALCULATIONS	OUTPUT

Sheeting Rails – R165/175 @ 1400 c/c

PURLINS – 165/157 @ 1400 c/c

$q = 1.1 V^2$ — basic wind speed.

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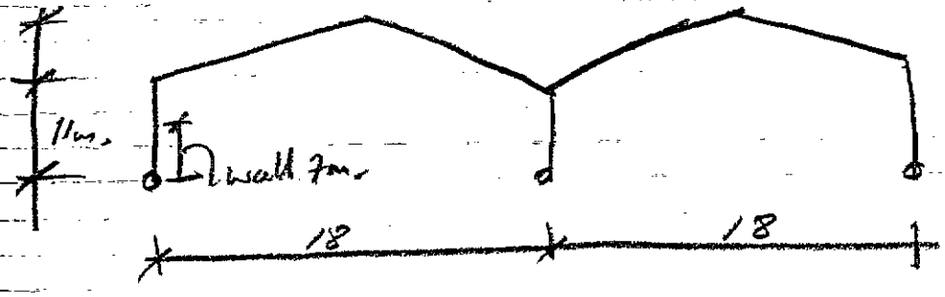
Contract	Job ref.
Part of structure	Calc. Sheet No. 13
Drawing ref. Calculations by Checked by	Date

Members ref.	CALCULATIONS	OUTPUT

PORTAL DESIGN:



Note Wall takes wind load - therefore frame designed for DL + LL only

Note This frame is to be designed by specialist & approved by O'Connor Sutton Cronin

O'Connor Sutton Cronin will be inviting 6 tenders a number of Specialist contractors to tender for the design, fabrication & erection of this concrete portal frame.

On receipt of tender & before fabrication O'Connor Sutton cronin will check drgs + calculations from successful contractor.

We have designed the frame whereas (see computer Read out attached) to enable us to go out to tender when in for Bye-law approval) otherwise if we submitted eg. Precast frame all we would be

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Contract _____ Job ref.

Part of structure _____ Calc. Sheet No. 14

Drawing ref. Calculations by Checked by Date

Members ref.	CALCULATIONS	OUTPUT

compelled to use Rein frame as
mentioned in the bye laws approval.

By Inspection of Computer programme results
the 500x300 Section G-Frame is satisfactory.

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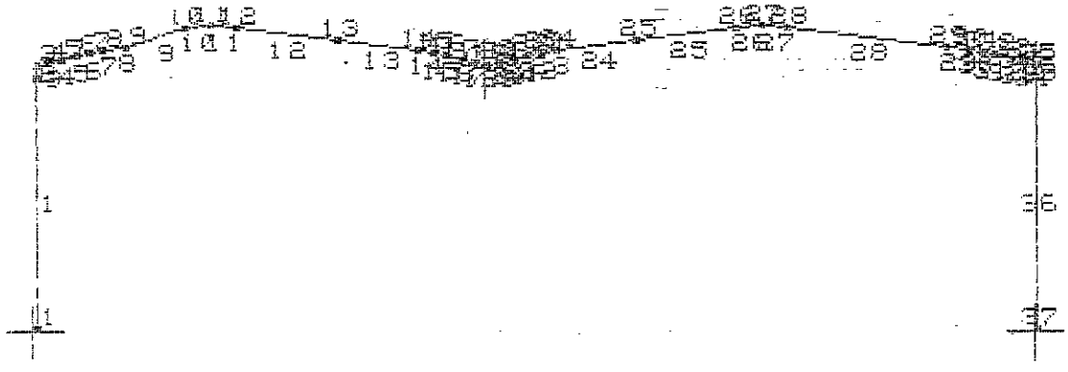
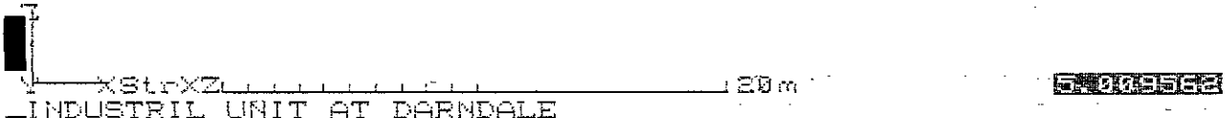
PAGE 1
JOB NO. 0
RUN NO. 1
AUTHOR D.G.
DATE 14JAN90

INDUSTRIL UNIT AT DARNDALE
TWO SPAN PRECAST CONCRETE PORTAL

EN102: PLANE FRAME ANALYSIS V4.0 (c) ENCAD SYSTEMS LTD. 1991
Units: S.I. METRIC (Concrete) Data File : grain1





INDUSTRIL UNIT AT DARNDALE

Material Properties

ENTRY NO.	TABLE REF./ DESCRIPTION	YOUNG'S MODULUS (kN/mm2)	POISSON'S RATIO	COEFFICIENT OF THERMAL EXP. (/.Deg C)	WEIGHT/UNIT VOLUME (kN/m3)
1	SI Concrete - Deg. C	30	.200	9.000E-06	24

JOINT	X (m)	Z (m)
1	.000	.000
2	.000	10.450
3	.000	10.950
4	.550	11.074
5	1.100	11.198
6	1.650	11.323
7	2.200	11.447
8	2.750	11.571
9	3.585	11.675
10	6.000	12.477
11	7.000	12.542
12	8.000	12.477
13	12.025	11.974
14	15.250	11.571
15	15.800	11.447

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Units: S.I. METRIC (Concrete) Data File : grain1

Joint Co-ordinates

JOINT	X (m)	Z (m)
16	16.350	11.323
17	16.900	11.198
18	17.450	11.074
19	18.000	10.950
20	18.550	11.074
21	19.100	11.198
22	19.650	11.323
23	20.200	11.447
24	20.750	11.571
25	23.975	11.974
26	28.000	12.477
27	29.000	12.542
28	30.000	12.477
29	36.415	11.675
30	37.250	11.571
31	37.800	11.447
32	38.350	11.323
33	38.900	11.198
34	39.450	11.074
35	40.000	10.950
36	40.000	10.450
37	40.000	.000

Section Properties

N.B. If a Shear Area value field is null (empty), shear distortions are ignored in the analysis.

SECTION NO.	REFERENCE / DESCRIPTION	AREA Ax (mm2)	Iy (mm4)	zMAX (mm)	Az SHEAR AREA (mm2)
1	COLUMN/RAFTER	1.500E+05	3.125E+09	2.500E+02	1.500E+05
2	HAUNCH	2.370E+05	1.230E+10	3.950E+02	2.370E+05
3	APEX	1.600E+05	4.509E+09	2.830E+02	1.600E+05

Member Incidences

MEMBER NO.	START NODE	END NODE	LENGTH (m)
1	1	2	10.450
2	2	3	.500
3	3	4	.564
4	4	5	.564
5	5	6	.564
6	6	7	.564
7	7	8	.564
8	8	9	.841
9	9	10	2.545
10	10	11	1.002
11	11	12	1.002

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PAGE 3
JOB NO. 0
RUN NO. 1
AUTHOR D.G.
DATE 14JAN90

INDUSTRIL UNIT AT DARNDALE
TWO SPAN PRECAST CONCRETE PORTAL

EN102: PLANE FRAME ANALYSIS V4.0 (c) ENCAD SYSTEMS LTD. 1991
Units: S.I. METRIC (Concrete) Data File : grain1

Member Incidences

MEMBER NO.	START NODE	END NODE	LENGTH (m)
12	12	13	4.056
13	13	14	3.250
14	14	15	.564
15	15	16	.564
16	16	17	.564
17	17	18	.564
18	18	19	.564
19	19	20	.564
20	20	21	.564
21	21	22	.564
22	22	23	.564
23	23	24	.564
24	24	25	3.250
25	25	26	4.056
26	26	27	1.002
27	27	28	1.002
28	28	29	6.465
29	29	30	.841
30	30	31	.564
31	31	32	.564
32	32	33	.564
33	33	34	.564
34	34	35	.564
35	35	36	.500
36	36	37	10.450

Member Details

MEMBER NO.	y AXIS FLEXURE TYPE NO.	SECTION GROUP	MATERIAL GROUP
1	FF	1	1
2	FF	1	1
3	FF	1	1
4	FF	1	1
5	FF	1	1
6	FF	1	1
7	FF	1	1
8	FF	1	1
9	FF	1	1
10	FF	1	1
11	FF	1	1
12	FF	1	1

14	FF	2	1
15	FF	2	1
16	FF	2	1
17	FF	2	1
18	FF	2	1
19	FF	2	1
20	FF	2	1
21	FF	2	1
22	FF	2	1
23	FF	2	1
24	FF	4	1
25	FF	4	1
26	FF	4	1
27	FF	4	1
28	FF	4	1
29	FF	4	1
30	FF	2	1
31	FF	2	1
32	FF	2	1

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Member Details

MEMBER NO.	y AXIS FLEXURE TYPE NO.	SECTION GROUP	MATERIAL GROUP
33	FF	2	1
34	FF	2	1
35	FF	1	1
36	FF	1	1

Support Stiffnesses
N.B. If the specified support settlements and stiffnesses conflict, then the settlements override the stiffnesses.

JOINT	KLX (kN/mm)	KLZ (kN/mm)	KRY (kNm/rad)
1	R	R	0
19	0	R	0
37	R	R	0

O'CONNOR SUTTON CRONIN

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AUTHOR D.G.
DATE 14JAN90

INDUSTRIL UNIT AT DARNDALE
TWO SPAN PRECAST CONCRETE PORTAL

EN102: PLANE FRAME ANALYSIS V4.0 (c) ENCAD SYSTEMS LTD. 1991
Units: S.I. METRIC (Concrete) Data File : grain1

Basic Load Case B1 : DL MIN
Load Groups

PLANE FRAME LOAD TYPES	VALUE 1	VALUE 2	VALUE 3	VALUE 4
JF=Joint Forces	FX	FZ		
JM=Joint Moments	MY			
F?=Point Forces	F?	L		
M%=Point Moments	M%	L		
U?=Uniformly Distributed	U?			
T?=Triangularly Distrib. Load	T?			
V?=Variably Distributed Load	V?1	L1	V?2	L2
t =Temperature Elevation	t			
g =Gravitational Loading	gX	gZ		
Pz=Prestressing Force	Pz	ezs	ezm	eze

N.B. 1. ? is one of X,Z (global directions) or x,z (member directions).
% is one of Y (global directions) or y (member directions).
2. VALUES are load intensities except that:-
L,L1,L2 are distances along the member from END1 joint.
t is the temperature elevation of the group of members in degrees.
gX,gZ are 'g' factors; gZ=-1 for normal gravity loading.
ezs,ezm,eze are tendon offsets from the centroid at the start, middle and end of the member.
3. JOINT/MEMBER LIST '9,26,2-6*2,40-30*5' means '9,26,2,4,6,40,35,30'

	TYPE	MEMBER/JOINT LIST	VALUE 1	VALUE 2	VALUE 3	VALUE 4
1	UZ	3-34	-5.1900			
2	JF	3,35	.0000	-22.0000		
3	JF	19	.0000	-22.0000		
4	Ux	1	-3.6000			
5	Ux	36	4.5900			
6	Fx	1	-67.0000	6.4500		

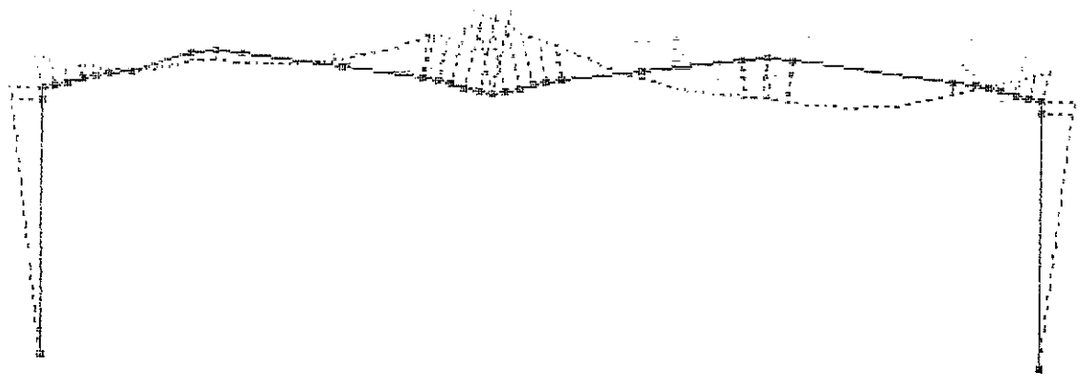
Basic Load Case B1 : DL MIN
Joint Displacements

JOINT	X LINEAR (mm)	Z LINEAR (mm)	Y ROTATION (rad)
1	.00000	.00000	-.00602
2	-45.02877	-.28040	-.00087
9	-45.34299	-.28713	-.00037
4	-45.38016	-.12835	-.00024
5	-45.40269	-.03420	-.00013
6	-45.41404	.01018	-.00005
7	-45.41709	.01832	.00000
8	-45.41466	.00242	.00004
9	-45.40711	-.07553	.00010
10	-45.45578	.04864	-.00033

14	-44.86713	5.89067	.00150
15	-45.06658	5.01257	.00172
16	-45.29513	4.00564	.00198
17	-45.55951	2.84936	.00227
18	-45.86043	1.52186	.00260
19	-46.20523	.00000	.00298
20	-45.81166	-1.75382	.00335
21	-45.37513	-3.69801	.00367
22	-44.89791	-5.80542	.00395
23	-44.39351	-8.05020	.00417
24	-43.86359	-10.40784	.00436
25	-41.69902	-27.81126	.00563
26	-39.54667	-45.11900	.00231
27	-39.42653	-46.99778	.00143
28	-39.49092	-47.96100	.00049
29	-36.62221	-24.89253	-.00668

Basic Load Case B1 : DL MIN
Joint Displacements

JOINT	X LINEAR (mm)	Z LINEAR (mm)	Y ROTATION (rad)
30	-35.91243	-19.17432	-.00694
31	-35.05032	-15.34442	-.00695
32	-34.18882	-11.51694	-.00693
33	-33.32496	-7.70944	-.00688
34	-32.47685	-3.94090	-.00679
35	-31.64213	-.23159	-.00666
36	-28.44105	-.22356	-.00616
37	.00000	.00000	-.00101



B1 : DL MIN

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INDUSTRIL UNIT AT DARNDALE
TWO SPAN PRECAST CONCRETE PORTAL

EN102: PLANE FRAME ANALYSIS V4.0 (c) ENCAD SYSTEMS LTD. 1991
Units: S.I. METRIC (Concrete) Data File : grain1

B1 : DL MIN

Sz XZ 70kN

StrXZ 20m

S 0E-002
S 0.09562

INDUSTRIL UNIT AT DARNDALE

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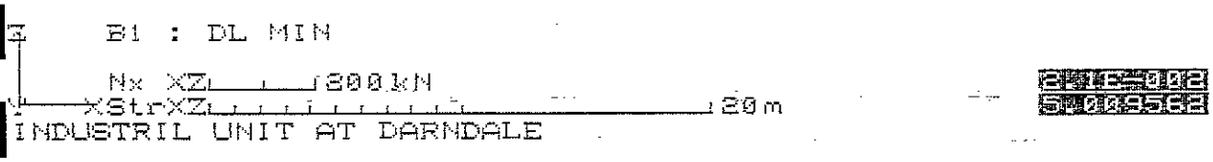
INDUSTRIL UNIT AT DARNDALE
TWO SPAN PRECAST CONCRETE PORTAL

EN102: PLANE FRAME ANALYSIS V4.0 (c) ENCAD SYSTEMS LTD. 1991
Units: S.I. METRIC (Concrete) Data File : grain1



Basic Load Case B1 : DL MIN
Member End Forces

MBR	JOINT	AXIAL Nx (kN)	SHEAR Sz (kN)	MOMENT My (kNm)
1	1	165.2012	-8.8350	.0000
1	2	60.5812	-8.8350	-92.3255
2	2	60.5812	-8.8350	-92.3255
2	3	60.5812	-8.8350	-96.7430
3	3	17.1040	35.6934	-96.7430
3	4	16.4604	32.8389	-77.4235

5	6	15.2199	27.1025	-43.6220
6	6	15.1730	27.1288	-43.6220
6	7	14.5295	24.2743	-29.1313
7	7	14.5295	24.2743	-29.1313
7	8	13.8859	21.4198	-16.2500
8	8	11.7273	22.6737	-16.2500
8	9	11.1875	18.3401	1.0055
9	9	14.5564	15.7997	1.0055
9	10	10.3940	3.2659	25.2635
10	10	9.2299	5.7888	25.2635
10	11	8.8925	.5988	28.4640
11	11	8.7402	1.7449	28.4640
11	12	9.0775	-3.4451	27.6121
12	12	9.2661	-2.9000	27.6121
12	13	11.8767	-23.7899	-26.5195

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INDUSTRIL UNIT AT DARNDALE
TWO SPAN PRECAST CONCRETE PORTAL

EN102: PLANE FRAME ANALYSIS V4.0 (c) ENCAD SYSTEMS LTD. 1991
Units: S.I. METRIC (Concrete) Data File : grain1

Basic Load Case B1 : DL MIN
Member End Forces

MBR	JOINT	AXIAL Nx (kN)	SHEAR Sz (kN)	MOMENT My (kNm)
13	13	11.8765	-23.7900	-26.5195
13	14	13.9681	-40.5276	-131.0373
14	14	17.8442	-38.9766	-131.0373
14	15	18.4878	-41.8311	-153.8172
15	15	18.4877	-41.8311	-153.8172
15	16	19.1313	-44.6856	-178.2065
16	16	19.2086	-44.6525	-178.2065
16	17	19.8573	-47.5070	-204.1966
17	17	19.7751	-47.5413	-204.1966
17	18	20.4186	-50.3958	-231.8054
18	18	20.4187	-50.3957	-231.8054
18	19	21.0623	-53.2502	-261.0234
19	19	22.9629	61.6802	-261.0234
19	20	22.3193	58.8257	-227.0525
20	20	22.3192	58.8258	-227.0525
20	21	21.6756	55.9713	-194.6908
21	21	21.7725	55.9337	-194.6908
21	22	21.1237	53.0792	-163.9478
22	22	21.0318	53.1157	-163.9478
22	23	20.3883	50.2612	-134.8056
23	23	20.3884	50.2611	-134.8056
23	24	19.7448	47.4066	-107.2728
24	24	15.0396	49.1025	-107.2728
24	25	12.9480	32.3648	25.1149
25	25	12.9483	32.3647	25.1149
25	26	10.3377	11.4749	114.0283
26	26	9.6381	12.0685	114.0283
26	27	9.3007	6.8785	123.5219
27	27	8.3320	8.0247	123.5219
27	28	8.6694	2.8347	128.9630
28	28	8.4856	3.3449	128.9630
28	29	12.6480	-29.9490	42.9661
29	29	12.6341	-29.9548	42.9661
29	30	13.1739	-34.2885	15.9373
30	30	16.4602	-32.8377	15.9373
30	31	17.1037	-35.6922	-3.3814
31	31	17.1037	-35.6922	-3.3814
31	32	17.7472	-38.5467	-24.3095
32	32	17.8139	-38.5159	-24.3095
32	33	18.4626	-41.3705	-46.8386
33	33	18.3911	-41.4023	-46.8386
33	34	19.0346	-44.2568	-70.9861
34	34	19.0347	-44.2568	-70.9861
34	35	19.6782	-47.1113	-96.7430
35	35	72.2857	8.8350	-96.7430
35	36	72.2857	8.8350	-92.3255
36	36	72.2857	8.8350	-92.3255

Basic Load Case B1 : DL MIN
Member End Stresses

MBR	JOINT	Ax AXIAL (N/mm2)	By yAXIS BENDING (N/mm2)	Ax +ABS.By (N/mm2)	Ax -ABS.By (N/mm2)
1	1	1.1013	.0000	1.1013	1.1013
1	2	.4039	-7.3860	7.7899	-6.9822
2	2	.4039	-7.3860	7.7899	-6.9822
2	3	.4039	-7.7394	8.1433	-7.3356
3	3	.0722	-3.1068	3.1790	-3.0346
3	4	.0695	-2.4864	2.5558	-2.4169

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INDUSTRIL UNIT AT DARNDALE
TWO SPAN PRECAST CONCRETE PORTAL

EN102: PLANE FRAME ANALYSIS V4.0
Units: S.I. METRIC (Concrete)

(c) ENCAD SYSTEMS LTD. 1991
Data File : grain1

Basic Load Case B1 : DL MIN
Member End Stresses

MBR	JOINT	Ax AXIAL (N/mm2)	By yAXIS BENDING (N/mm2)	Ax +ABS.By (N/mm2)	Ax -ABS.By (N/mm2)
4	4	.0695	-2.4864	2.5558	-2.4169
4	5	.0667	-1.9176	1.9844	-1.8509
5	5	.0670	-1.9176	1.9846	-1.8507
5	6	.0642	-1.4009	1.4651	-1.3366
6	6	.0640	-1.4009	1.4649	-1.3368
6	7	.0613	-.9355	.9968	-.8742
7	7	.0613	-.9355	.9968	-.8742
7	8	.0586	-.5219	.5804	-.4633
8	8	.0782	-1.3000	1.3782	-1.2218
8	9	.0746	.0804	.1550	-.0059
9	9	.0970	.0804	.1775	.0166
9	10	.0693	2.0211	2.0904	-1.9518
10	10	.0577	1.5856	1.6433	-1.5279
10	11	.0556	1.7865	1.8421	-1.7309
11	11	.0546	1.7865	1.8411	-1.7319
11	12	.0567	1.7330	1.7898	-1.6763
12	12	.0618	2.2090	2.2707	-2.1472
12	13	.0792	-2.1216	2.2007	-2.0424
13	13	.0792	-2.1216	2.2007	-2.0424
13	14	.0931	-10.4830	10.5761	-10.3899
14	14	.0753	-4.2081	4.2834	-4.1328
14	15	.0780	-4.9397	5.0177	-4.8617
15	15	.0780	-4.9397	5.0177	-4.8617
15	16	.0807	-5.7229	5.8036	-5.6422
16	16	.0810	-5.7229	5.8039	-5.6418
16	17	.0838	-6.5575	6.6413	-6.4737
17	17	.0834	-6.5575	6.6410	-6.4741
17	18	.0862	-7.4442	7.5303	-7.3580
18	18	.0862	-7.4442	7.5303	-7.3580
18	19	.0889	-8.3825	8.4713	-8.2936
19	19	.0969	-8.3825	8.4793	-8.2856
19	20	.0942	-7.2915	7.3857	-7.1973
20	20	.0942	-7.2915	7.3857	-7.1973
20	21	.0915	-6.2523	6.3437	-6.1608
21	21	.0919	-6.2523	6.3441	-6.1604
21	22	.0891	-5.2650	5.3541	-5.1759
22	22	.0887	-5.2650	5.3537	-5.1762
22	23	.0860	-4.3291	4.4151	-4.2431
23	23	.0860	-4.3291	4.4151	-4.2431
23	24	.0833	-3.4449	3.5283	-3.3616
24	24	.1003	-8.5818	8.6821	-8.4816
24	25	.0863	2.0092	2.0955	-1.9229
25	25	.0863	2.0092	2.0955	-1.9229
25	26	.0689	9.1223	9.1912	-9.0533
26	26	.0602	7.1568	7.2170	-7.0966
26	27	.0581	7.7526	7.8108	-7.6945

27	27	.0541	7.7526	7.8047	-7.7006
27	28	.0542	8.0942	8.1483	-8.0400
28	28	.0566	10.3170	10.3736	-10.2605
28	29	.0843	3.4373	3.5216	-3.3530
29	29	.0842	3.4373	3.5215	-3.3531
29	30	.0878	1.2750	1.3628	-1.1872
30	30	.0695	.5118	.5813	-.4424
30	31	.0722	-.1086	.1808	-.0364
31	31	.0722	-.1086	.1808	-.0364
31	32	.0749	-.7807	.8556	-.7058
32	32	.0752	-.7807	.8558	-.7055
32	33	.0779	-1.5042	1.5821	-1.4263
33	33	.0776	-1.5042	1.5818	-1.4266
33	34	.0803	-2.2796	2.3600	-2.1993
34	34	.0803	-2.2796	2.3600	-2.1993
34	35	.0830	-3.1068	3.1898	-3.0238
35	35	.4819	-7.7394	8.2213	-7.2575
35	36	.4819	-7.3860	7.8679	-6.9041

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Basic Load Case B1 : DL MIN
Member End Stresses

MBR	JOINT	Ax AXIAL (N/mm2)	By yAXIS BENDING (N/mm2)	Ax +ABS.By (N/mm2)	Ax -ABS.By (N/mm2)
36	36	.4819	-7.3860	7.8679	-6.9041
36	37	.8017	.0000	.8017	.8017

Basic Load Case B1 : DL MIN
Support Reactions

JOINT	X FORCE (kN)	Z FORCE (kN)	Y MOMENT (kNm)
1	8.8350	165.2012	.0000
19	.0000	143.7990	.0000
37	-8.8350	120.2512	.0000

Basic Load Case B1 : DL MIN
Load Balance

ENTRY		X LINEAR (kN)	Z LINEAR (kN)
1	EXTERNAL LOADS SUM	.0000	-429.2514
2	REACTIONS SUM	.0000	429.2514

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INDUSTRIL UNIT AT DARNDALE
TWO SPAN PRECAST CONCRETE PORTAL

EN102: PLANE FRAME ANALYSIS V4.0 (c) ENCAD SYSTEMS LTD. 1991
Units: S.I. METRIC (Concrete) Data File : grain1

Basic Load Case B2 : DL MAX
Load Groups

PLANE FRAME LOAD TYPES	VALUE 1	VALUE 2	VALUE 3	VALUE 4
JF=Joint Forces	FX	FZ		
JM=Joint Moments	MY			
F?=Point Forces	F?	L		
M?=Point Moments	M?	L		
U?=Uniformly Distributed	U?			
T?=Triangularly Distrib. Load	T?			
V?=Variably Distributed Load	V?1	L1	V?2	L2
t =Temperature Elevation	t			
g =Gravitational Loading	gX	gZ		
Pz=Prestressing Force	Pz	ezs	ezm	eze

N.B. 1. ? is one of X,Z (global directions) or x,z (member directions).
% is one of Y (global directions) or y (member directions).
2. VALUES are load intensities except that:-
L,L1,L2 are distances along the member from END1 joint.
t is the temperature elevation of the group of members in degrees.
gX,gZ are 'g' factors; gZ=-1 for normal gravity loading.
ezs,ezm,eze are tendon offsets from the centroid at the start, middle and end of the member.
3. JOINT/MEMBER LIST '9,26,2-6*2,40-30*5' means '9,26,2,4,6,40,35,30'

	TYPE	MEMBER/JOINT LIST	VALUE 1	VALUE 2	VALUE 3	VALUE 4
1	UZ	3-34	-6.6900			
2	JF	3,35	.0000	-22.0000		
3	JF	19	.0000	-22.0000		
4	Ux	1	-3.6000			
5	Ux	36	4.5900			
6	Fx	1	-67.0000	6.4500		

Basic Load Case B2 : DL MAX
Joint Displacements

JOINT	X LINEAR (mm)	Z LINEAR (mm)	Y ROTATION (rad)
1	.00000	.00000	-.00776
2	-58.03559	-.30631	-.00112
3	-58.43929	-.31428	-.00047
4	-58.48684	-.11118	-.00030
5	-58.51552	.00856	-.00017
6	-58.52978	.06413	-.00007
7	-58.53333	.07294	.00001
8	-58.52980	.05072	.00005
9	-58.51973	-.05251	.00013
[illegible]			

11	-58.61718	.64106	-.00068
12	-58.56661	1.45598	-.00095
13	-57.86321	7.18372	-.00137
14	-57.82368	7.59711	.00194
15	-58.08097	6.46432	.00222
16	-58.37577	5.16552	.00255
17	-58.71674	3.67426	.00292
18	-59.10480	1.96237	.00335
19	-59.54940	.00000	.00384
20	-59.04195	-2.26129	.00432
21	-58.47913	-4.76791	.00473
22	-57.86389	-7.48485	.00509
23	-57.21361	-10.37881	.00538
24	-56.53046	-13.41818	.00562
25	-53.74047	-35.85013	.00725
26	-50.96706	-58.15205	.00297
27	-50.81237	-60.57125	.00184
28	-50.89520	-61.81023	.00063
29	-47.19552	-32.05962	-.00861

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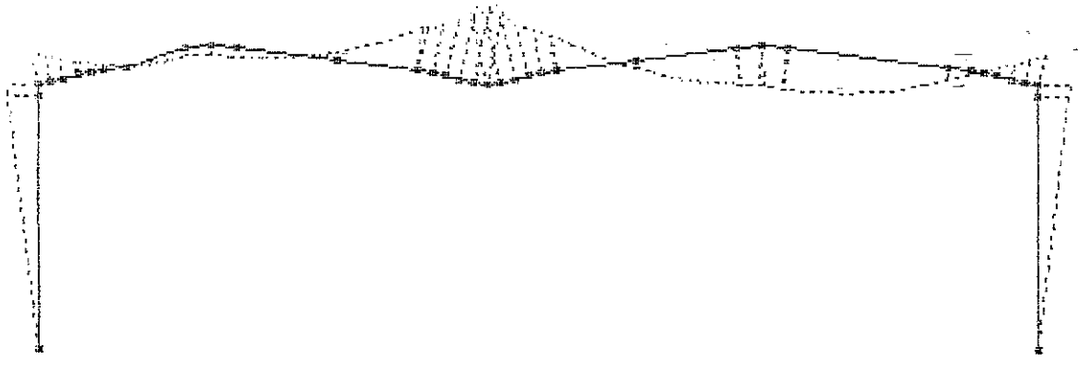
INDUSTRIL UNIT AT DARNDALE
TWO SPAN PRECAST CONCRETE PORTAL

EN102: PLANE FRAME ANALYSIS V4.0 (c) ENCAD SYSTEMS LTD. 1991
Units: S.I. METRIC (Concrete) Data File : grain1

Basic Load Case B2 : DL MAX
Joint Displacements

JOINT	X LINEAR (mm)	Z LINEAR (mm)	Y ROTATION (rad)
30	-46.28045	-24.68754	-.00895
31	-45.16903	-19.75005	-.00896
32	-44.05838	-14.81571	-.00894
33	-42.94471	-9.90716	-.00887
34	-41.85135	-5.04887	-.00875
35	-40.77528	-.26697	-.00859
36	-36.64863	-.25732	-.00794
37	.00000	.00000	-.00130



B2 : DL MAX

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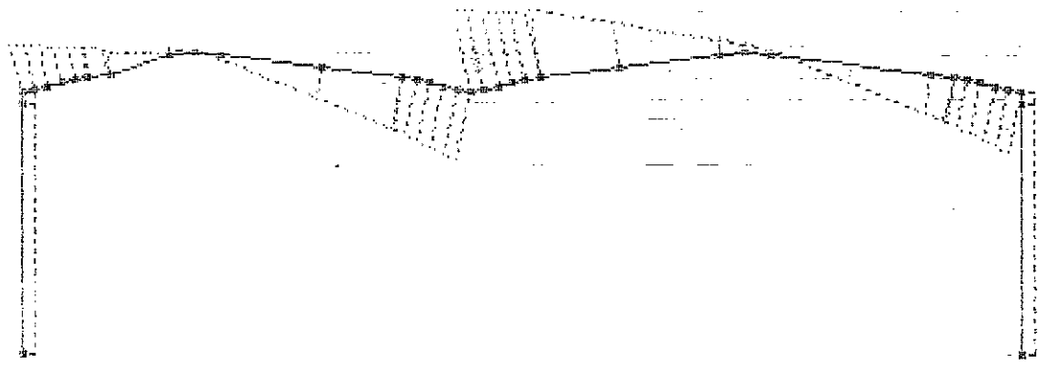
AUTHOR	D.G.
DATE	14JAN90

INDUSTRIL UNIT AT DARNDALE
TWO SPAN PRECAST CONCRETE PORTAL

EN102: PLANE FRAME ANALYSIS V4.0 (c) ENCAD SYSTEMS LTD. 1991
Units: S.I. METRIC (Concrete) Data File.: grain1



B2 : DL MAX

Sz XZ 80kN

O'CONNOR SUTTON CRONIN

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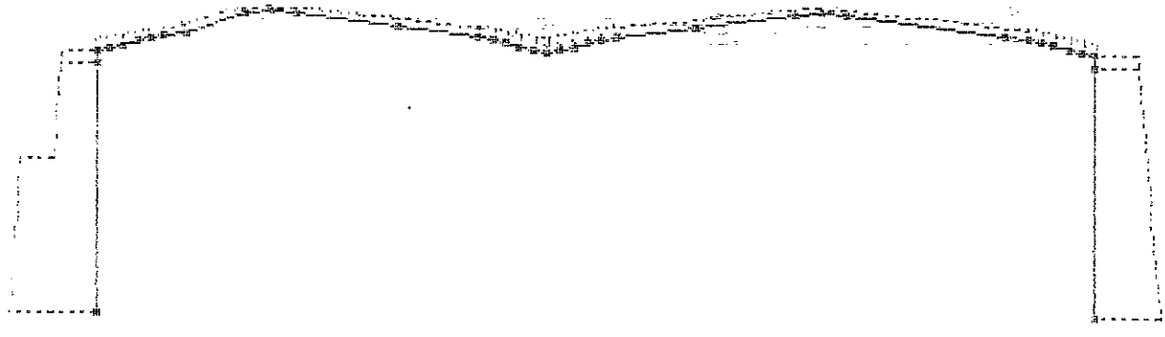
JOB NO. 0
RUN NO. 1
AUTHOR D.G.
DATE 14JAN90

INDUSTRIL UNIT AT DARNDALE
TWO SPAN PRECAST CONCRETE PORTAL

EN102: PLANE FRAME ANALYSIS V4.0
Units: S.I. METRIC (Concrete)

(c) ENCAD SYSTEMS LTD. 1991
Data File : grain1



B2 : DL MAX

Nx XZ 200kN
Str XZ 20m
INDUSTRIL UNIT AT DARNDALE

Basic Load Case B2 : DL MAX
Member End Forces

MBR	JOINT	AXIAL Nx (kN)	SHEAR Sz (kN)	MOMENT My (kNm)
1	1	176.3594	-11.3932	.0000
1	2	71.7394	-11.3932	-119.0588
2	2	71.7394	-11.3932	-119.0588
2	3	71.7394	-11.3932	-124.7554
3	3	22.0537	46.0157	-124.7554
3	4	21.2241	42.3362	-99.8487

4	4	21.2240	42.3363	-99.8487
4	5	20.3945	38.6568	-77.0166
5	5	20.4613	38.6214	-77.0166
5	6	19.6251	34.9419	-56.2708
6	6	19.5646	34.9758	-56.2708
6	7	18.7350	31.2963	-37.5885
7	7	18.7351	31.2963	-37.5885
7	8	17.9055	27.6168	-20.9807
8	8	15.1223	29.2337	-20.9807
8	9	14.4265	23.6476	1.2678
9	9	18.7703	20.3718	1.2678
9	10	13.4049	4.2154	32.5512
10	10	11.9027	7.4691	32.5512
10	11	11.4679	.7791	36.6840
11	11	11.2705	2.2570	36.6840
11	12	11.7054	-4.4330	35.5937
12	12	11.9479	-3.7301	35.5937
12	13	15.3130	-30.6575	-34.1500

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EN102: PLANE FRAME ANALYSIS V4.0 (c) ENCAD SYSTEMS LTD. 1991

Units: S.I. METRIC (Concrete) Data File : grain1

Basic Load Case B2 : DL MAX
Member End Forces

MBR	JOINT	AXIAL Nx (kN)	SHEAR Sz (kN)	MOMENT My (kNm)
13	13	15.3128	-30.6576	-34.1500
13	14	18.0089	-52.2327	-168.8489
14	14	23.0045	-50.2331	-168.8489
14	15	23.8340	-53.9126	-198.2079
15	15	23.8340	-53.9126	-198.2079
15	16	24.6635	-57.5921	-229.6414
16	16	24.7631	-57.5494	-229.6414
16	17	25.5994	-61.2289	-263.1383
17	17	25.4934	-61.2731	-263.1383
17	18	26.3229	-64.9526	-298.7217
18	18	26.3231	-64.9525	-298.7217
18	19	27.1526	-68.6320	-336.3795
19	19	29.6029	79.4998	-336.3795
19	20	28.7733	75.8203	-292.5944
20	20	28.7731	75.8204	-292.5944
20	21	27.9436	72.1409	-250.8837
21	21	28.0684	72.0924	-250.8837
21	22	27.2321	68.4129	-211.2594
22	22	27.1137	68.4600	-211.2594
22	23	26.2841	64.7804	-173.6985
23	23	26.2843	64.7804	-173.6985
23	24	25.4547	61.1009	-138.2123
24	24	19.3902	63.2873	-138.2123
24	25	16.6942	41.7120	32.4159
25	25	16.6945	41.7119	32.4159
25	26	13.3294	14.7846	146.9995
26	26	12.4280	15.5501	146.9995
26	27	11.9931	8.8601	159.2304
27	27	10.7453	10.3381	159.2304
27	28	11.1801	3.6481	166.2382
28	28	10.9435	4.3061	166.2382
28	29	16.3089	-38.6103	55.3508
29	29	16.2911	-38.6178	55.3508
29	30	16.9869	-44.2040	20.5055
30	30	21.2234	-42.3333	20.5055
30	31	22.0530	-46.0128	-4.3994
31	31	22.0529	-46.0128	-4.3994
31	32	22.8825	-49.6923	-31.3789
32	32	22.9684	-49.6527	-31.3789
32	33	23.8046	-53.3322	-60.4222
33	33	23.7124	-53.3733	-60.4222
33	34	24.5419	-57.0528	-91.5515
34	34	24.5420	-57.0528	-91.5515
34	35	25.3716	-60.7323	-124.7554
35	35	86.8253	11.3932	-124.7554
35	36	86.8253	11.3932	-119.0588

29	29	.1056	4.4281	4.5367	-4.3145
29	30	.1132	1.6404	1.7537	-1.5272
30	30	.0896	.6585	.7481	-.5690
30	31	.0931	-.1413	.2343	-.0482
31	31	.0931	-.1413	.2343	-.0482
31	32	.0966	-1.0077	1.1042	-.9111
32	32	.0969	-1.0077	1.1046	-.9108
32	33	.1004	-1.9404	2.0408	-1.8399
33	33	.1001	-1.9404	2.0404	-1.8403
33	34	.1036	-2.9401	3.0436	-2.8365
34	34	.1036	-2.9401	3.0436	-2.8365
34	35	.1071	-4.0064	4.1134	-3.8993
35	35	.5788	-9.9804	10.5593	-9.4016
35	36	.5788	-9.5247	10.1035	-8.9459

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Basic Load Case B2 : DL MAX
Member End Stresses

MBR	JOINT	Ax AXIAL (N/mm2)	By yAXIS BENDING (N/mm2)	Ax +ABS.By (N/mm2)	Ax -ABS.By (N/mm2)
36	36	.5788	-9.5247	10.1035	-8.9459
36	37	.8986	.0000	.8986	.8986

Basic Load Case B2 : DL MAX
Support Reactions

JOINT	X FORCE (kN)	Z FORCE (kN)	Y MOMENT (kNm)
1	11.3932	176.3594	.0000
19	.0000	178.9873	.0000
37	-11.3932	134.7908	.0000

Basic Load Case B2 : DL MAX
Load Balance

ENTRY		X LINEAR (kN)	Z LINEAR (kN)
1	EXTERNAL LOADS SUM	.0000	-490.1375
2	REACTIONS SUM	.0000	490.1375

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INDUSTRIL UNIT AT DARNDALE
TWO SPAN PRECAST CONCRETE PORTAL

EN102: PLANE FRAME ANALYSIS V4.0 (c) ENCAD SYSTEMS LTD. 1991
Units: S.I. METRIC (Concrete) Data File : grain1

Basic Load Case B3 : LL
Load Groups

PLANE FRAME LOAD TYPES	VALUE 1	VALUE 2	VALUE 3	VALUE 4
JF=Joint Forces	FX	FZ		
JM=Joint Moments	MY			
F?=Point Forces	F?	L		
M%=Point Moments	M%	L		
U?=Uniformly Distributed	U?			
T?=Triangularly Distrib. Load	T?			
V?=Variably Distributed Load	V?1	L1	V?2	L2
t =Temperature Elevation	t			
g =Gravitational Loading	gX	gZ		
Pz=Prestressing Force	Pz	ezs	ezm	eze

N.B. 1. ? is one of X,Z (global directions) or x,z (member directions).
% is one of Y (global directions) or y (member directions).
2. VALUES are load intensities except that:-
L,L1,L2 are distances along the member from END1 joint.
t is the temperature elevation of the group of members in degrees.
gX,gZ are 'g' factors: gZ=-1 for normal gravity loading.
ezs,ezm,eze are tendon offsets from the centroid at the start, middle and end of the member.
3. JOINT/MEMBER LIST '9,26,2-6*2,40-30*5' means '9,26,2,4,6,40,35,30'

E	TYPE	MEMBER/JOINT LIST	VALUE 1	VALUE 2	VALUE 3	VALUE 4
1	UZ	3-10,27-34	-4.5000			
2	UZ	11-26	-9.0000			

Basic Load Case B3 : LL
Joint Displacements

JOINT	X LINEAR (mm)	Z LINEAR (mm)	Y ROTATION (rad)
1	.00000	.00000	-.00635
2	-45.50700	-.09675	-.00036
3	-45.54242	-.10138	.00023
4	-45.50377	-.27964	.00039
5	-45.44779	-.53455	.00051
6	-45.37762	-.84970	.00061
7	-45.29782	-1.20984	.00068
8	-45.21101	-1.60089	.00072
9	-45.13031	-2.26931	.00082
10	-44.63789	-3.78061	.00024
11	-44.63453	-3.86773	-.00009
12	-44.61859	-3.58939	-.00048
13	-43.90066	2.24542	-.00191
14	-43.53735	5.24904	.00103

15	-43.68189	4.61694	.00132
16	-43.86596	3.80993	.00167
17	-44.09880	2.79520	.00208
18	-44.38462	1.53769	.00256
19	-44.73369	.00000	.00310
20	-44.31282	-1.87810	.00365
21	-43.82963	-4.03223	.00411
22	-43.28915	-6.42084	.00450
23	-42.70890	-9.00470	.00483
24	-42.09285	-11.74686	.00508
25	-39.50443	-32.56343	.00667
26	-37.10865	-51.83295	.00213
27	-37.00758	-53.42173	.00104
28	-37.04168	-53.91280	-.00005
29	-33.59928	-26.23197	-.00723
30	-32.83832	-20.10028	-.00738
31	-31.92387	-16.03758	-.00737
32	-31.01284	-11.98977	-.00732
33	-30.10199	-7.97494	-.00724

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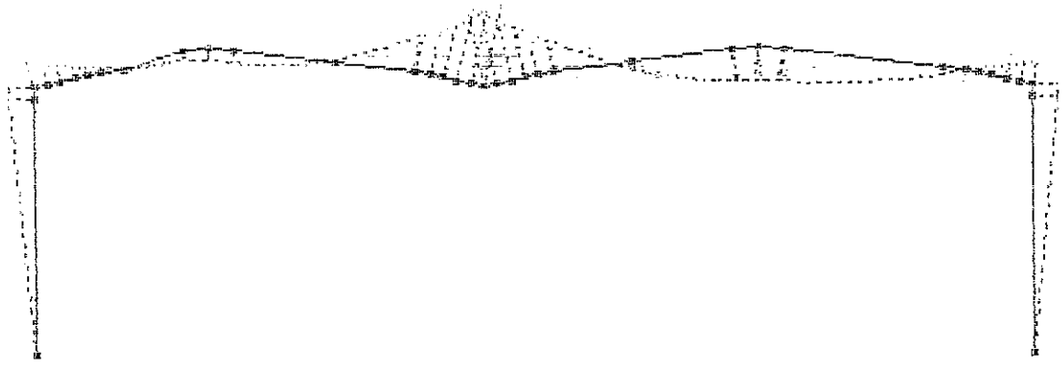
Basic Load Case B3 : LL
Joint Displacements

JOINT	X LINEAR (mm)	Z LINEAR (mm)	Y ROTATION (rad)
34	-29.21025	-4.01236	-.00713
35	-28.33494	-.12244	-.00698
36	-24.99696	-.11685	-.00639
37	.00000	.00000	-.00040



B3 : LL

My xZ 400kNm

xStrxZ 20m

INDUSTRIL UNIT AT DARNDALE

O'CONNOR SUTTON CRONIN

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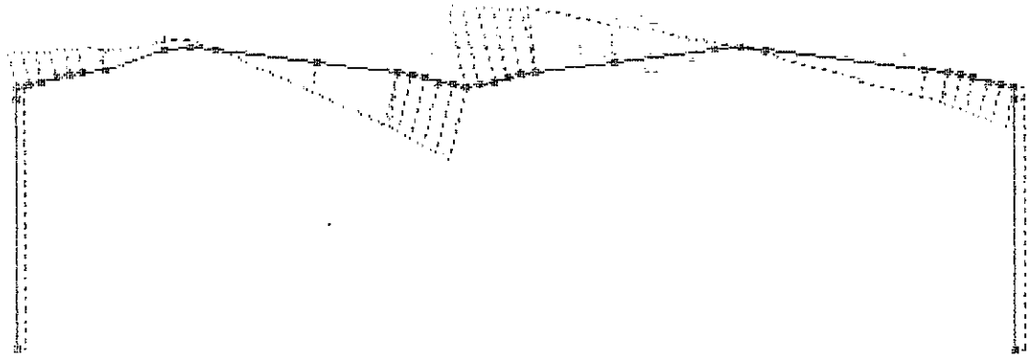
INDUSTRIL UNIT AT DARNDALE
TWO SPAN PRECAST CONCRETE PORTAL

EN102: PLANE FRAME ANALYSIS V4.0 (c) ENCAD SYSTEMS LTD. 1991
Units: S.I. METRIC (Concrete) Data File : grain1



B3 : LL

Sz XZ 100kN

X Str XZ 20m

INDUSTRIL UNIT AT DARNDALE

'CONNOR SUTTON CRONIN

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INDUSTRIL UNIT AT DARNDALE
TWO SPAN PRECAST CONCRETE PORTAL

N102: PLANE FRAME ANALYSIS V4.0
Units: S.I. METRIC (Concrete)

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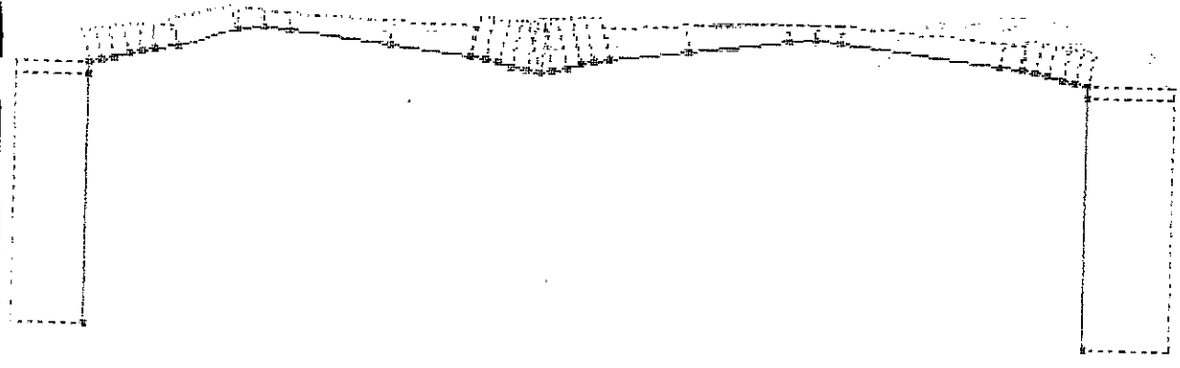
Data File : grain1



B3 : LL

Nx XZ 60kN
XStrXZ
20m

INDUSTRIL UNIT AT DARNDALE

Basic Load Case B3 : LL
Member End Forces

MBR	JOINT	AXIAL Nx (kN)	SHEAR Sz (kN)	MOMENT My (kNm)
1	1	41.6640	-10.2834	.0000
	2	41.6640	-10.2834	-107.4610
2	2	41.6640	-10.2834	-107.4610
	3	41.6640	-10.2834	-112.6027
3	3	19.1949	38.3822	-112.6027
	4	18.6369	35.9072	-91.6603

6	6	17.5742	30.9259	-53.9724
6	6	17.5207	30.9562	-53.9724
6	7	16.9627	28.4812	-37.2169
7	7	16.9627	28.4812	-37.2169
7	8	16.4047	26.0062	-21.8567
8	8	13.7860	27.4842	-21.8567
8	9	13.3180	23.7267	-.3109
9	9	17.6986	20.6661	-.3109
9	10	14.0896	9.7986	38.4506
10	10	11.1529	13.0438	38.4506
10	11	10.8604	8.5438	49.2672
11	11	9.6630	9.8779	49.2672
11	12	10.2480	.8779	54.6564
12	12	10.1778	1.4848	54.6564
12	13	14.7048	-34.7404	-12.7914

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O'CONNOR SUTTON CRONIN

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INDUSTRIL UNIT AT DARNDALE
TWO SPAN PRECAST CONCRETE PORTAL

EN102: PLANE FRAME ANALYSIS V4.0 (c) ENCAD SYSTEMS LTD. 1991
Units: S.I. METRIC (Concrete) Data File : grain1

Basic Load Case B3 : LL
Member End Forces

MBR	JOINT	AXIAL Nx (kN)	SHEAR Sz (kN)	MOMENT My (kNm)
13	13	14.7046	-34.7405	-12.7914
13	14	18.3316	-63.7653	-172.8660
14	14	24.4475	-61.6796	-172.8660
14	15	25.5635	-66.6296	-209.0368
15	15	25.5634	-66.6297	-209.0368
15	16	26.6794	-71.5797	-247.9983
16	16	26.8032	-71.5334	-247.9983
16	17	27.9282	-76.4834	-289.7409
17	17	27.7958	-76.5316	-289.7409
17	18	28.9118	-81.4816	-334.2853
18	18	28.9120	-81.4816	-334.2853
18	19	30.0280	-86.4315	-381.6204
19	19	32.0043	95.1974	-381.6204
19	20	30.8883	90.2474	-329.3431
20	20	30.8881	90.2475	-329.3431
20	21	29.7721	85.2974	-279.8565
21	21	29.9197	85.2458	-279.8565
21	22	28.7947	80.2958	-233.1717
22	22	28.6556	80.3455	-233.1717
22	23	27.5396	75.3955	-189.2678
23	23	27.5398	75.3954	-189.2678
23	24	26.4238	70.4454	-148.1550
24	24	19.4457	72.6818	-148.1550
24	25	15.8187	43.6568	-40.8999
25	25	15.8191	43.6567	-40.8999
25	26	11.2921	7.4317	144.5149
26	26	10.8308	8.0891	144.5149
26	27	10.2458	-.9109	148.1115
27	27	10.2776	.4231	148.1115
27	28	10.5700	-4.0769	146.2808
28	28	10.7937	-3.4415	146.2808
28	29	14.4027	-32.3090	30.7182
29	29	14.3878	-32.3157	30.7182
29	30	14.8558	-36.0732	1.9453
30	30	18.3083	-34.4496	1.9453
30	31	18.8663	-36.9245	-18.1752
31	31	18.8663	-36.9246	-18.1752
31	32	19.4243	-39.3996	-39.6911
32	32	19.4923	-39.3659	-39.6911
32	33	20.0548	-41.8410	-62.5926
33	33	19.9825	-41.8756	-62.5926
33	34	20.5405	-44.3506	-86.9000
34	34	20.5406	-44.3505	-86.9000
34	35	21.0986	-46.8255	-112.6027
35	35	50.3193	10.2834	-112.6027
35	36	50.3193	10.2834	-107.4610
36	36	50.3193	10.2834	-107.4610

36 37 50.3193 10.2834 .0000

Basic Load Case B3 : LL
Member End Stresses

MBR	JOINT	Ax AXIAL (N/mm2)	By yAXIS BENDING (N/mm2)	Ax +ABS.By (N/mm2)	Ax -ABS.By (N/mm2)
1	1	.2778	.0000	.2778	.2778
1	2	.2778	-8.5969	8.8746	-8.3191
2	2	.2778	-8.5969	8.8746	-8.3191
2	3	.2778	-9.0082	9.2860	-8.7305
3	3	.0810	-3.6161	3.6971	-3.5351
3	4	.0786	-2.9436	3.0222	-2.8649

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Basic Load Case B3 : LL
Member End Stresses

MBR	JOINT	Ax AXIAL (N/mm2)	By yAXIS BENDING (N/mm2)	Ax +ABS.By (N/mm2)	Ax -ABS.By (N/mm2)
4	4	.0786	-2.9436	3.0222	-2.8649
4	5	.0763	-2.3158	2.3921	-2.2396
5	5	.0765	-2.3158	2.3924	-2.2393
5	6	.0742	-1.7333	1.8074	-1.6591
6	6	.0739	-1.7333	1.8072	-1.6593
6	7	.0716	-1.1952	1.2667	-1.1236
7	7	.0716	-1.1952	1.2667	-1.1236
7	8	.0692	-.7019	.7711	-.6327
8	8	.0919	-1.7485	1.8404	-1.6566
9	9	.0888	-.0249	.1137	.0639
9	9	.1180	-.0249	.1429	.0931
9	10	.0939	3.0760	3.1700	-2.9821
10	10	.0697	2.4133	2.4830	-2.3436
10	11	.0679	3.0922	3.1601	-3.0243
11	11	.0604	3.0922	3.1526	-3.0318
11	12	.0640	3.4304	3.4945	-3.3664
12	12	.0679	4.3725	4.4404	-4.3047
12	13	.0980	-1.0233	1.1213	-.9253
13	13	.0980	-1.0233	1.1213	-.9253
13	14	.1222	-13.8293	13.9515	-13.7071
14	14	.1032	-5.5514	5.6545	-5.4482
14	15	.1079	-6.7130	6.8208	-6.6051
15	15	.1079	-6.7130	6.8208	-6.6051
15	16	.1126	-7.9642	8.0767	-7.8516
16	16	.1131	-7.9642	8.0773	-7.8511
16	17	.1178	-9.3047	9.4225	-9.1868
17	17	.1173	-9.3047	9.4220	-9.1874
17	18	.1220	-10.7352	10.8572	-10.6132
18	18	.1220	-10.7352	10.8572	-10.6132
18	19	.1267	-12.2553	12.3820	-12.1286
19	19	.1350	-12.2553	12.3903	-12.1202
19	20	.1303	-10.5765	10.7068	-10.4461
20	20	.1303	-10.5765	10.7068	-10.4461
20	21	.1256	-8.9873	9.1129	-8.8616
21	21	.1262	-8.9873	9.1135	-8.8610
21	22	.1215	-7.4880	7.6095	-7.3665
22	22	.1209	-7.4880	7.6089	-7.3671
22	23	.1162	-6.0781	6.1943	-5.9619
23	23	.1162	-6.0781	6.1943	-5.9619
23	24	.1115	-4.7578	4.8693	-4.6463
24	24	.1296	-11.8524	11.9820	-11.7228
24	25	.1055	3.2720	3.3775	-3.1665
25	25	.1055	3.2720	3.3775	-3.1665
25	26	.0753	11.5612	11.6365	-11.4859
26	26	.0677	9.0702	9.1379	-9.0025
26	27	.0640	9.2960	9.3600	-9.2319

28	28	.0720	11.7025	11.7244	-11.6305
28	29	.0960	2.4575	2.5535	-2.3614
29	29	.0959	2.4575	2.5534	-2.3615
29	30	.0990	.1556	.2547	-.0566
30	30	.0773	.0625	.1397	.0148
30	31	.0796	-.5837	.6633	-.5041
31	31	.0796	-.5837	.6633	-.5041
31	32	.0820	-1.2746	1.3566	-1.1927
32	32	.0822	-1.2746	1.3569	-1.1924
32	33	.0846	-2.0101	2.0947	-1.9255
33	33	.0843	-2.0101	2.0944	-1.9258
33	34	.0867	-2.7907	2.8774	-2.7040
34	34	.0867	-2.7907	2.8774	-2.7040
34	35	.0890	-3.6161	3.7051	-3.5271
35	35	.3355	-9.0082	9.3437	-8.6728
35	36	.3355	-8.5969	8.9323	-8.2614

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CONNOR SUTTON CRONIN

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DATE 14JAN90

NDUSTRIL UNIT AT DARNDALE
WO SPAN PRECAST CONCRETE PORTAL

EN102: PLANE FRAME ANALYSIS V4.0 (c) ENCAD SYSTEMS LTD. 1991
nits: S.I. METRIC (Concrete) Data File : grain1

Basic Load Case B3 : LL
Member End Stresses

MBR	JOINT	Ax AXIAL (N/mm2)	By yAXIS BENDING (N/mm2)	Ax +ABS.By (N/mm2)	Ax -ABS.By (N/mm2)
36	36	.3355	-8.5969	8.9323	-8.2614
36	37	.3355	.0000	.3355	.3355

asic Load Case B3 : LL
Support Reactions

OINT	X FORCE (kN)	Z FORCE (kN)	Y MOMENT (kNm)
1	10.2834	41.6640	.0000
19	.0000	190.8247	.0000
37	-10.2834	50.3193	.0000

asic Load Case B3 : LL
Load Balance

NTRY		X LINEAR (kN)	Z LINEAR (kN)
1	EXTERNAL LOADS SUM	.0000	-282.8080
2	REACTIONS SUM	.0000	282.8080

O'CONNOR SUTTON CRONIN

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AUTHOR D.G.
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INDUSTRIL UNIT AT DARNDALE
TWO SPAN PRECAST CONCRETE PORTAL

EN102: PLANE FRAME ANALYSIS V4.0 (c) ENCAD SYSTEMS LTD. 1991
Units: S.I. METRIC (Concrete) Data File : grain1

Basic Load Case B4 : WL UPLIFT ON ROOF
Load Groups

PLANE FRAME LOAD TYPES	VALUE 1	VALUE 2	VALUE 3	VALUE 4
JF=Joint Forces	FX	FZ		
JM=Joint Moments	MY			
F?=Point Forces	F?	L		
M%=Point Moments	M%	L		
U?=Uniformly Distributed	U?			
T?=Triangularly Distrib. Load	T?			
V?=Variably Distributed Load	V?1	L1	V?2	L2
t =Temperature Elevation	t			
g =Gravitational Loading	gX	gZ		
Pz=Prestressing Force	Pz	ezs	ezm	eze

N.B. 1. ? is one of X,Z (global directions) or x,z (member directions).
% is one of Y (global directions) or y (member directions).
2. VALUES are load intensities except that:-
L,L1,L2 are distances along the member from END1 joint.
t is the temperature elevation of the group of members in degrees.
gX,gZ are 'g' factors; gZ=-1 for normal gravity loading.
ezs,ezm,eze are tendon offsets from the centroid at the start, middle and end of the member.
3. JOINT/MEMBER LIST '9,26,2-6*2,40-30*5' means '9,26,2,4,6,40,35,30'

TYPE	MEMBER/JOINT LIST	VALUE 1	VALUE 2	VALUE 3	VALUE 4
1	UZ 3-35	2.0000			

Basic Load Case B4 : WL UPLIFT ON ROOF
Joint Displacements

JOINT	X LINEAR (mm)	Z LINEAR (mm)	Y ROTATION (rad)
1	.00000	.00000	.00232
2	17.34182	.03455	.00033
3	17.46112	.03620	.00014
4	17.47497	-.02289	.00009
5	17.48317	-.05702	.00005
6	17.48704	-.07192	.00002
7	17.48771	-.07282	.00000
8	17.48626	-.06440	-.00002
9	17.48289	-.03070	-.00004
10	17.49766	-.06653	.00012
11	17.50867	-.22457	.00020
12	17.49382	-.46399	.00028
13	17.28553	-2.16044	.00041
14	17.27480	-2.27535	-.00058
15	17.35193	-1.93575	-.00067

19	17.79165	.00000	-.00115
20	17.63980	.67665	-.00129
21	17.47142	1.42659	-.00142
22	17.28737	2.23933	-.00152
23	17.09287	3.10493	-.00161
24	16.88856	4.01394	-.00168
25	16.05463	10.71891	-.00217
26	15.22649	17.37831	-.00089
27	15.18041	18.09901	-.00053
28	15.20500	18.46682	-.00018
29	14.09715	9.55813	.00258
30	13.82344	7.35306	.00268
31	13.49103	5.87633	.00268
32	13.15886	4.40057	.00267
33	12.82579	2.93256	.00265
34	12.49881	1.47962	.00262

O'CONNOR SUTTON CRONIN

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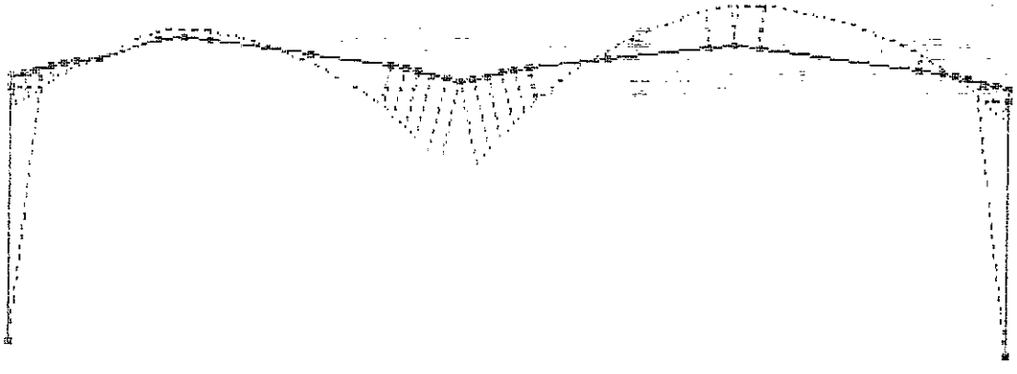
INDUSTRIL UNIT AT DARNDALE
TWO SPAN PRECAST CONCRETE PORTAL

EN102: PLANE FRAME ANALYSIS V4.0
Units: S.I. METRIC (Concrete)

(c) ENCAD SYSTEMS LTD. 1991
Data File : grain1

Basic Load Case B4 : WL UPLIFT ON ROOF
Joint Displacements

JOINT	X LINEAR (mm)	Z LINEAR (mm)	Y ROTATION (rad)
35	12.17700	.04956	.00257
36	10.94296	.04734	.00237
37	.00000	.00000	.00039



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INDUSTRIL UNIT AT DARNDALE
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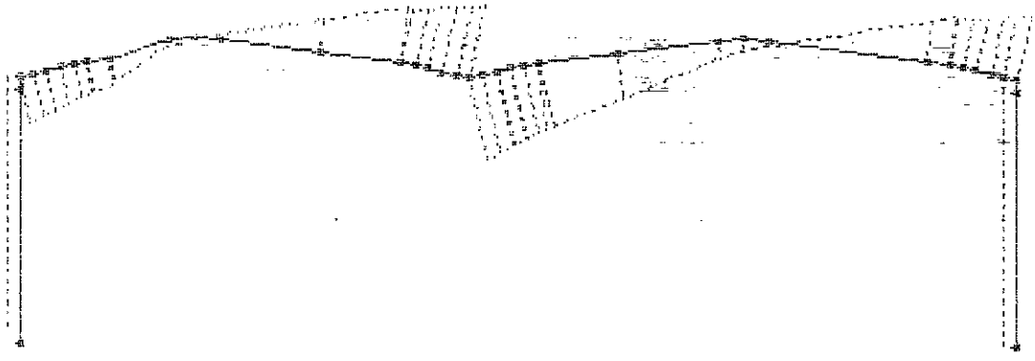

B4 : WL UPLIFT ON ROOF

Sz XZ 30kN

XStrXZ 20m

INDUSTRIL UNIT AT DARNDALE

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EN102: PLANE FRAME ANALYSIS V4.0 (c) ENCAD SYSTEMS LTD. 1991
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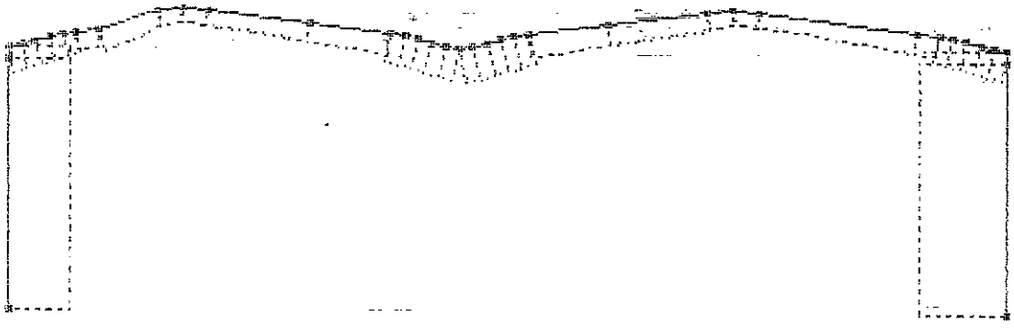

B4 : WL UPLIFT ON ROOF

Nx XZ 30kN

XStrXZ 20m

INDUSTRIL UNIT AT DARNDALE

Basic Load Case B4 : WL UPLIFT ON ROOF
Member End Forces

MBR	JOINT	AXIAL Nx (kN)	SHEAR Sz (kN)	MOMENT My (kNm)
1	1	-14.8774	3.4108	.0000
1	2	-14.8774	3.4108	35.6432
2	2	-14.8774	3.4108	35.6432
2	3	-14.8774	3.4108	37.3486
3	3	-6.5994	-13.7630	37.3486
3	4	-6.3514	-12.6630	29.8991

4	4	-6.3514	-12.6630	29.8991
4	5	-6.1034	-11.5630	23.0697
5	5	-6.1234	-11.5524	23.0697
5	6	-5.8734	-10.4524	16.8641
6	6	-5.8553	-10.4626	16.8641
6	7	-5.6073	-9.3626	11.2753
7	7	-5.6073	-9.3625	11.2753
7	8	-5.3593	-8.2625	6.3068
8	8	-4.5266	-8.7465	6.3068
8	9	-4.3186	-7.0765	-.3504
9	9	-5.6184	-6.0960	-.3504
9	10	-4.0144	-1.2660	-9.7173
10	10	-3.5636	-2.2402	-9.7173
10	11	-3.4336	-.2402	-10.9601
11	11	-3.3737	-.6827	-10.9601
11	12	-3.5037	1.3173	-10.6422
12	12	-3.5757	1.1069	-10.6422
12	13	-4.5817	9.1570	10.1748

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O'CONNOR SUTTON CRONIN

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DATE 14JAN90

INDUSTRIL UNIT AT DARNDALE
TWO SPAN PRECAST CONCRETE PORTAL

EN102: PLANE FRAME ANALYSIS V4.0 (c) ENCAD SYSTEMS LTD. 1991
Units: S.I. METRIC (Concrete) Data File : grain1

Basic Load Case 84 : WL UPLIFT ON ROOF
Member End Forces

MBR	JOINT	AXIAL Nx (kN)	SHEAR Sz (kN)	MOMENT My (kNm)
13	13	-4.5816	9.1570	10.1748
13	14	-5.3876	15.6070	50.4169
14	14	-6.8803	15.0089	50.4169
14	15	-7.1283	16.1089	59.1891
15	15	-7.1282	16.1089	59.1891
15	16	-7.3762	17.2089	68.5815
16	16	-7.4060	17.1961	68.5815
16	17	-7.6560	18.2961	78.5907
17	17	-7.6243	18.3093	78.5907
17	18	-7.8723	19.4093	89.2237
18	18	-7.8724	19.4093	89.2237
18	19	-8.1204	20.5093	100.4768
19	19	-8.8532	-23.7596	100.4768
19	20	-8.6052	-22.6596	87.3911
20	20	-8.6051	-22.6596	87.3911
20	21	-8.3571	-21.5596	74.9256
21	21	-8.3944	-21.5451	74.9256
21	22	-8.1444	-20.4451	63.0838
22	22	-8.1090	-20.4592	63.0838
22	23	-7.8610	-19.3592	51.8589
23	23	-7.8611	-19.3592	51.8589
23	24	-7.6131	-18.2592	41.2542
24	24	-5.8008	-18.9132	41.2542
24	25	-4.9948	-12.4632	-9.7336
25	25	-4.9949	-12.4631	-9.7336
25	26	-3.9889	-4.4131	-43.9612
26	26	-3.7198	-4.6422	-43.9612
26	27	-3.5898	-2.6422	-47.6111
27	27	-3.2175	-3.0847	-47.6111
27	28	-3.3475	-1.0847	-49.7002
28	28	-3.2771	-1.2817	-49.7002
28	29	-4.8811	11.5483	-16.5137
29	29	-4.8758	11.5506	-16.5137
29	30	-5.0838	13.2206	-6.0919
30	30	-6.3509	12.6607	-6.0919
30	31	-6.5989	13.7607	1.3564
31	31	-6.5989	13.7608	1.3564
31	32	-6.8469	14.8608	9.4248
32	32	-6.8725	14.8489	9.4248
32	33	-7.1225	15.9489	18.1103
33	33	-7.0950	15.9612	18.1103
33	34	-7.3430	17.0612	27.4193
34	34	-7.3430	17.0612	27.4193
34	35	-7.5910	18.1612	37.3486
35	35	-19.3860	-3.4108	37.3486

36	37	-20.3860	-3.4108	.0000

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Basic Load Case B4 : WL UPLIFT ON ROOF
Member End Stresses

MBR	JOINT	Ax AXIAL (N/mm2)	By yAXIS BENDING (N/mm2)	Ax +ABS.By (N/mm2)	Ax -ABS.By (N/mm2)
1	1	-.0992	.0000	-.0992	-.0992
1	2	-.0992	2.8515	2.7523	-2.9506
2	2	-.0992	2.8515	2.7523	-2.9506
2	3	-.0992	2.9879	2.8887	-3.0871
3	3	-.0278	1.1994	1.1716	-1.2273
3	4	-.0268	.9602	.9334	-.9870

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Basic Load Case B4 : WL UPLIET ON ROOF
Member End Stresses

MBR	JOINT	Ax AXIAL (N/mm2)	By yAXIS BENDING (N/mm2)	Ax +ABS.By (N/mm2)	Ax -ABS.By (N/mm2)
4	4	-.0268	.9602	.9334	-.9870
4	5	-.0258	.7409	.7151	-.7666
5	5	-.0258	.7409	.7150	-.7667
5	6	-.0248	.5416	.5168	-.5664
6	6	-.0247	.5416	.5169	-.5663
6	7	-.0237	.3621	.3384	-.3858
7	7	-.0237	.3621	.3384	-.3859
7	8	-.0226	.2025	.1799	-.2251
8	8	-.0902	.5045	.4744	-.5347
8	9	-.0288	-.0280	-.0008	-.0568
9	9	-.0375	-.0280	-.0094	-.0655
9	10	-.0268	-.7774	.7506	-.8041
10	10	-.0223	-.6099	.5876	-.6322
10	11	-.0215	-.6879	.6664	-.7094
11	11	-.0211	-.6879	.6668	-.7090
11	12	-.0219	-.6679	.6460	-.6898
12	12	-.0238	-.8514	.8275	-.8752
12	13	-.0305	.8140	.7834	-.8445
13	13	-.0305	.8140	.7834	-.8445
13	14	-.0359	4.0334	3.9974	-4.0693
14	14	-.0290	1.6191	1.5901	-1.6481
14	15	-.0301	1.9008	1.8707	-1.9309
15	15	-.0301	1.9008	1.8707	-1.9309
15	16	-.0311	2.2024	2.1713	-2.2335
16	16	-.0312	2.2024	2.1712	-2.2337
16	17	-.0323	2.5238	2.4915	-2.5562
17	17	-.0322	2.5238	2.4917	-2.5560
17	18	-.0332	2.8653	2.8321	-2.8985
18	18	-.0332	2.8653	2.8321	-2.8985
18	19	-.0343	3.2267	3.1924	-3.2610
19	19	-.0374	3.2267	3.1893	-3.2640
19	20	-.0363	2.8065	2.7702	-2.8428
20	20	-.0363	2.8065	2.7702	-2.8428
20	21	-.0353	2.4061	2.3709	-2.4414
21	21	-.0354	2.4061	2.3707	-2.4416
21	22	-.0344	2.0259	1.9915	-2.0602
22	22	-.0342	2.0259	1.9916	-2.0601
22	23	-.0332	1.6654	1.6322	-1.6986
23	23	-.0332	1.6654	1.6322	-1.6986
23	24	-.0321	1.3248	1.2927	-1.3570
24	24	-.0387	3.3003	3.2617	-3.3390
24	25	-.0333	-.7787	.7454	-.8120
25	25	-.0333	-.7787	.7454	-.8120
25	26	-.0266	-3.5169	3.4903	-3.5435

27	27	-.0201	-2.9882	2.9681	-3.0083
27	28	-.0209	-3.1194	3.0984	-3.1409
28	28	-.0218	-3.9760	3.9542	-3.9979
28	29	-.0325	-1.3211	1.2886	-1.3536
29	29	-.0325	-1.3211	1.2886	-1.3536
29	30	-.0339	-.4874	.4535	-.5212
30	30	-.0268	-.1956	.1688	-.2224
30	31	-.0278	.0436	.0157	-.0714
31	31	-.0278	.0436	.0157	-.0714
31	32	-.0289	.3027	.2738	-.3316
32	32	-.0290	.3027	.2737	-.3317
32	33	-.0301	.5816	.5515	-.6116
33	33	-.0299	.5816	.5517	-.6115
33	34	-.0310	.8805	.8496	-.9115
34	34	-.0310	.8805	.8496	-.9115
34	35	-.0320	1.1994	1.1674	-1.2314
35	35	-.1292	2.9879	2.8586	-3.1171
35	36	-.1359	2.8515	2.7155	-2.9874

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Basic Load Case B4 : WL UPLIFT ON ROOF
Member End Stresses

MBR	JOINT	Ax AXIAL (N/mm2)	By yAXIS BENDING (N/mm2)	Ax +ABS.By (N/mm2)	Ax -ABS.By (N/mm2)
36	36	-.1359	2.8515	2.7155	-2.9874
36	37	-.1359	.0000	-.1359	-.1359

Basic Load Case B4 : WL UPLIFT ON ROOF
Support Reactions

JOINT	X FORCE (kN)	Z FORCE (kN)	Y MOMENT (kNm)
1	-3.4108	-14.8774	.0000
19	.0000	-46.9180	.0000
37	3.4108	-20.3860	.0000

Basic Load Case B4 : WL UPLIFT ON ROOF
Load Balance

ENTRY		X LINEAR (kN)	Z LINEAR (kN)
1	EXTERNAL LOADS SUM	.0000	82.1815
2	REACTIONS SUM	.0000	-82.1815

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INDUSTRIL UNIT AT DARNDALE — AUTHOR D.G.

TWO SPAN PRECAST CONCRETE PORTAL — DATE 14JAN90

EN102: PLANE FRAME ANALYSIS V4.0 (c) ENCAD SYSTEMS LTD. 1991

Units: S.I. METRIC (Concrete) Data File : grain1

Basic Load Case B5 : DLMIN - ROOF DLMIN

Load Groups

PLANE FRAME LOAD TYPES	VALUE 1	VALUE 2	VALUE 3	VALUE 4
JF=Joint Forces	FX	FZ		
JM=Joint Moments	MY			
F?=Point Forces	F?	L		
M%=Point Moments	M%	L		
U?=Uniformly Distributed	U?			
T?=Triangularly Distrib. Load	T?			
V?=Variably Distributed Load	V?1	L1	V?2	L2
t =Temperature Elevation	t			
g =Gravitational Loading	gX	gZ		
Pz=Prestressing Force	Pz	ezs	ezm	eze

N.B. 1. ? is one of X,Z (global directions) or x,z (member directions).
% is one of Y (global directions) or y (member directions).

2. VALUES are load intensities except that:-
L,L1,L2 are distances along the member from END1 joint.
t is the temperature elevation of the group of members in degrees.
gX,gZ are 'g' factors; gZ=-1 for normal gravity loading.
ezs,ezm,eze are tendon offsets from the centroid at the start, middle and end of the member.

3. JOINT/MEMBER LIST '9,26,2-6*2,40-30*5' means '9,26,2,4,6,40,35,30'

E	TYPE	MEMBER/JOINT LIST	VALUE 1	VALUE 2	VALUE 3	VALUE 4
2	JF	3,35	.0000	-22.0000		
3	JF	19	.0000	-22.0000		
4	Ux	1	-3.6000			
5	Ux	36	4.5900			
6	Fx	1	-67.0000	6.4500		

Basic Load Case B5 : DLMIN - ROOF DLMIN

Joint Displacements

JOINT	X LINEAR (mm)	Z LINEAR (mm)	Y ROTATION (rad)
1	.00000	.00000	.00000
2	-.02520	-.19074	-.00001
3	-.02983	-.19318	-.00001
4	-.03105	-.18775	-.00001
5	-.03231	-.18218	-.00001
6	-.03360	-.17647	-.00001
7	-.03491	-.17065	-.00001
8	-.03625	-.16472	-.00001
9	-.03743	-.15521	-.00001
10	-.04781	-.12391	-.00001
11	-.04871	-.10993	-.00001

12	-.04779	-.09578	-.00001
13	-.04111	-.04244	-.00001
14	-.03750	-.01359	-.00001
15	-.03679	-.01046	-.00001
16	-.03613	-.00753	-.00001
17	-.03551	-.00480	.00000
18	-.03494	-.00228	.00000
19	-.03442	.00000	.00000
20	-.03488	.00203	.00000
21	-.03529	.00383	.00000
22	-.03564	.00541	.00000
23	-.03595	.00678	.00000
24	-.03621	.00795	.00000
25	-.03562	.00323	.00000
26	-.03212	-.02465	.00001
27	-.03154	-.03354	.00001
28	-.03213	-.04266	.00001
29	-.03857	-.09441	.00001
30	-.03908	-.09857	.00000

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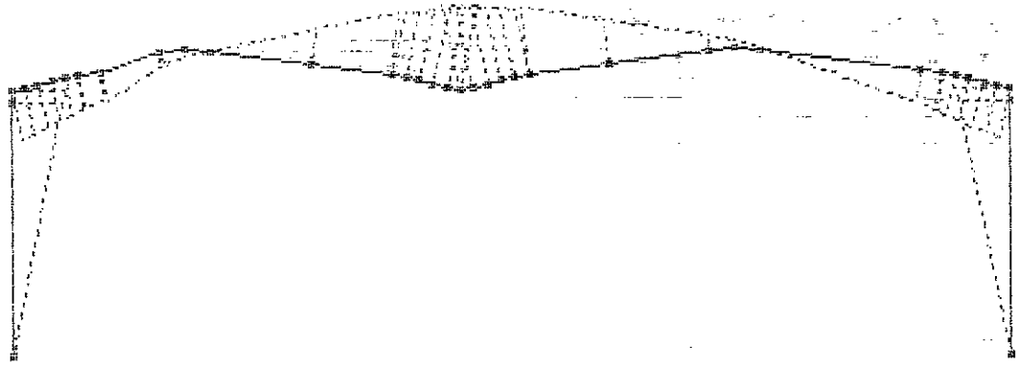
Basic Load Case B5 : DLMIN - ROOF DLMIN
Joint Displacements

JOINT	X LINEAR (mm)	Z LINEAR (mm)	Y ROTATION (rad)
31	-.03962	-.10094	.00000
32	-.04012	-.10320	.00000
33	-.04061	-.10533	.00000
34	-.04105	-.10732	.00000
35	-.04147	-.10917	.00000
36	-.04284	-.10673	.00000
37	.00000	.00000	-.00001



B5 : DLMIN - ROOF DLMIN

MY X 5.E-001 kNm

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DATE	14JAN90

INDUSTRIL UNIT AT DARNDALE
TWO SPAN PRECAST CONCRETE PORTAL

EN102: PLANE FRAME ANALYSIS V4.0 (c) ENCAD SYSTEMS LTD. 1991
Units: S.I. METRIC (Concrete) Data File : grain1

B5 : DLMIN - ROOF DLMIN

Sz XZ 3.E-002kN

INDUSTRIL UNIT AT DARNDALE

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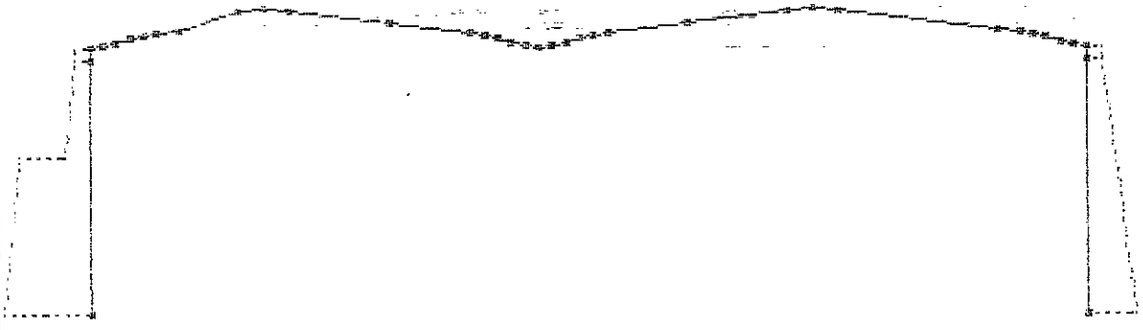
DATE	14JAN90

INDUSTRIL UNIT AT DARNDALE
TWO SPAN PRECAST CONCRETE PORTAL

EN102: PLANE FRAME ANALYSIS V4.0
Units: S.I. METRIC (Concrete)

(c) ENCAD SYSTEMS LTD. 1991
Data File : grain1



B5 : DLMIN - ROOF DLMIN

Nx XZ 200kN
StrXZ 20m

INDUSTRIL UNIT AT DARNDALE

Basic Load Case B5 : DLMIN - ROOF DLMIN
Member End Forces

MBR	JOINT	AXIAL Nx (kN)	SHEAR Sz (kN)	MOMENT My (kNm)
1	1	126.5938	.0164	.0000
1	2	21.9738	.0164	.1717
2	2	21.9738	.0164	.1717
2	3	21.9738	.0164	.1799
3	3	-.0218	-.0219	.1799
3	4	-.0218	-.0219	.1675

4	4	-.0218	-.0219	.1675
4	5	-.0218	-.0219	.1551
5	5	-.0218	-.0219	.1551
5	6	-.0218	-.0219	.1428
6	7	-.0218	-.0219	.1305
7	7	-.0218	-.0219	.1305
7	8	-.0218	-.0219	.1181
8	8	-.0195	-.0239	.1181
8	9	-.0195	-.0239	.0979
9	9	-.0238	-.0197	.0979
9	10	-.0238	-.0197	.0479
10	10	-.0181	-.0251	.0479
10	11	-.0181	-.0251	.0228
11	11	-.0147	-.0272	.0228
11	12	-.0147	-.0272	-.0044
12	12	-.0131	-.0280	-.0044
12	13	-.0131	-.0280	-.1180

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EN102: PLANE FRAME ANALYSIS V4.0 (c) ENCAD SYSTEMS LTD. 1991

Units: S.I. METRIC (Concrete) Data File : grain1

Basic Load Case B5 : DLMIN - ROOF DLMIN
Member End Forces

MBR	JOINT	AXIAL Nx (kN)	SHEAR Sz (kN)	MOMENT My (kNm)
13	13	-.0131	-.0280	-.1180
13	14	-.0131	-.0280	-.2091
14	14	-.0103	-.0291	-.2091
14	15	-.0103	-.0291	-.2255
15	15	-.0103	-.0291	-.2255
15	16	-.0103	-.0291	-.2419
16	16	-.0102	-.0292	-.2419
16	17	-.0102	-.0292	-.2584
17	17	-.0103	-.0291	-.2584
17	18	-.0103	-.0291	-.2748
18	18	-.0103	-.0291	-.2748
18	19	-.0103	-.0291	-.2912
19	19	-.0113	.0245	-.2912
19	20	-.0113	.0245	-.2774
20	20	-.0113	.0245	-.2774
20	21	-.0113	.0245	-.2636
21	21	-.0113	.0245	-.2636
21	22	-.0113	.0245	-.2498
22	22	-.0113	.0245	-.2498
22	23	-.0113	.0245	-.2360
23	23	-.0113	.0245	-.2360
23	24	-.0113	.0245	-.2221
24	24	-.0136	.0233	-.2221
24	25	-.0136	.0233	-.1465
25	25	-.0136	.0233	-.1465
25	26	-.0136	.0233	-.0520
26	26	-.0150	.0224	-.0520
26	27	-.0150	.0224	-.0295
27	27	-.0178	.0203	-.0295
27	28	-.0178	.0203	-.0092
28	28	-.0190	.0192	-.0092
28	29	-.0190	.0192	.1150
29	29	-.0189	.0192	.1150
29	30	-.0189	.0192	.1312
30	30	-.0207	.0173	.1312
30	31	-.0207	.0173	.1409
31	31	-.0207	.0173	.1409
31	32	-.0207	.0173	.1507
32	32	-.0208	.0172	.1507
32	33	-.0208	.0172	.1604
33	33	-.0207	.0173	.1604
33	34	-.0207	.0173	.1701
34	34	-.0207	.0173	.1701
34	35	-.0207	.0173	.1799
35	35	21.9786	-.0164	.1799
35	36	21.9786	-.0164	.1717
36	36	21.9786	-.0164	.1717

36 37 85.9441 -.0164 .0000

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Basic Load Case B5 : DLMIN - ROOF DLMIN
Member End Stresses

MBR	JOINT	Ax AXIAL (N/mm2)	By yAXIS BENDING (N/mm2)	Ax +ABS.By (N/mm2)	Ax -ABS.By (N/mm2)
1	1	.8440	.0000	.8440	.8440
1	2	.1465	.0137	.1602	.1328
2	2	.1465	.0137	.1602	.1328
2	3	.1465	.0144	.1609	.1321
3	3	-.0001	.0058	.0057	-.0059
3	4	-.0001	.0054	.0053	-.0055

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DATE 14JAN90

INDUSTRIL UNIT AT DARNDALE
TWO SPAN PRECAST CONCRETE PORTAL

EN102: PLANE FRAME ANALYSIS V4.0 (c) ENCAD SYSTEMS LTD. 1991
Units: S.I. METRIC (Concrete) Data File : grain1

Basic Load Case B5 : DLMIN - ROOF DLMIN
Member End Stresses

MBR	JOINT	Ax AXIAL (N/mm2)	By yAXIS BENDING (N/mm2)	Ax +ABS.By (N/mm2)	Ax -ABS.By (N/mm2)
4	4	-.0001	.0054	.0053	-.0055
4	5	-.0001	.0050	.0049	-.0051
5	5	-.0001	.0050	.0049	-.0051
5	6	-.0001	.0046	.0045	-.0047
6	6	-.0001	.0046	.0045	-.0047
6	7	-.0001	.0042	.0041	-.0043
7	7	-.0001	.0042	.0041	-.0043
7	8	-.0001	.0038	.0037	-.0039
8	8	-.0001	.0094	.0093	-.0096
8	9	-.0001	.0078	.0077	-.0080
9	9	-.0002	.0078	.0077	-.0080
9	10	-.0002	.0038	.0037	-.0040
10	10	-.0001	.0030	.0029	-.0031
10	11	-.0001	.0014	.0013	-.0015
11	11	-.0001	.0014	.0013	-.0015
11	12	-.0001	-.0003	.0002	-.0004
12	12	-.0001	-.0004	.0003	-.0004
12	13	-.0001	-.0094	.0094	-.0095
13	13	-.0001	-.0094	.0094	-.0095
13	14	-.0001	-.0167	.0166	-.0168
14	14	.0000	-.0067	.0067	-.0068
14	15	.0000	-.0072	.0072	-.0073
15	15	.0000	-.0072	.0072	-.0073
15	16	.0000	-.0078	.0077	-.0078
16	16	.0000	-.0078	.0077	-.0078
16	17	.0000	-.0083	.0083	-.0083
17	17	.0000	-.0083	.0083	-.0083
17	18	.0000	-.0088	.0088	-.0089
18	18	.0000	-.0088	.0088	-.0089
18	19	.0000	-.0094	.0093	-.0094
19	19	.0000	-.0094	.0093	-.0094
19	20	.0000	-.0089	.0089	-.0090
20	20	.0000	-.0089	.0089	-.0090
20	21	.0000	-.0085	.0084	-.0085
21	21	.0000	-.0085	.0084	-.0085
21	22	.0000	-.0080	.0080	-.0081
22	22	.0000	-.0080	.0080	-.0081
22	23	.0000	-.0076	.0075	-.0076
23	23	.0000	-.0076	.0075	-.0076
23	24	.0000	-.0071	.0071	-.0072
24	24	-.0001	-.0178	.0177	-.0179
24	25	-.0001	-.0117	.0116	-.0118
25	25	-.0001	-.0117	.0116	-.0118
25	26	-.0001	-.0042	.0041	-.0043
26	26	-.0001	-.0033	.0032	-.0034
26	27	-.0001	-.0019	.0018	-.0019

27	28	-.0001	-.0006	.0005	-.0007
28	28	-.0001	-.0007	.0006	-.0009
28	29	-.0001	.0092	.0091	-.0093
29	29	-.0001	.0092	.0091	-.0093
29	30	-.0001	.0105	.0104	-.0106
30	30	-.0001	.0042	.0041	-.0043
30	31	-.0001	.0045	.0044	-.0046
31	31	-.0001	.0045	.0044	-.0046
31	32	-.0001	.0048	.0048	-.0049
32	32	-.0001	.0048	.0048	-.0049
32	33	-.0001	.0052	.0051	-.0052
33	33	-.0001	.0052	.0051	-.0052
33	34	-.0001	.0055	.0054	-.0056
34	34	-.0001	.0055	.0054	-.0056
34	35	-.0001	.0058	.0057	-.0059
35	35	.1465	.0144	.1609	.1321
35	36	.1465	.0137	.1603	.1328

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asic Load Case B5 : DLMIN - ROOF DLMIN
ember End Stresses

MBR	JOINT	Ax AXIAL (N/mm2)	By yAXIS BENDING (N/mm2)	Ax +ABS.By (N/mm2)	Ax -ABS.By (N/mm2)
36	36	.1465	.0137	.1603	.1328
36	37	.4663	.0000	.4663	.4663

asic Load Case B5 : DLMIN - ROOF DLMIN
upport Reactions

JOINT	X FORCE (kN)	Z FORCE (kN)	Y MOMENT (kNm)
1	-.0164	126.5938	.0000
19	.0000	22.0476	.0000
37	.0164	69.9441	.0000

Basic Load Case B5 : DLMIN - ROOF DLMIN
oad Balance

ENTRY		X LINEAR (kN)	Z LINEAR (kN)
1	EXTERNAL LOADS SUM	.0000	-218.5855
2	REACTIONS SUM	.0000	218.5855

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INDUSTRIL UNIT AT DARNDALE
TWO SPAN PRECAST CONCRETE PORTAL

EN102: PLANE FRAME ANALYSIS V4.0
Units: S.I. METRIC (Concrete)

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Data File :-grainl

Combination Case C1 : 1.0*B1+1*B3;SER DLMIN +LL
Joint Displacements

JOINT	X LINEAR (mm)	Z LINEAR (mm)	Y ROTATION (rad)
1	.00000	.00000	-.01237
2	-90.53577	-.37715	-.00123
3	-90.88541	-.38851	-.00014
4	-90.88393	-.40799	.00015
5	-90.85046	-.56875	.00038
6	-90.79166	-.83952	.00055
7	-90.71491	-1.19152	.00068
8	-90.62567	-1.59847	.00076
9	-90.53742	-2.04484	.00092
10	-90.09367	-3.73197	-.00009
11	-90.11977	-3.39505	-.00062
12	-90.06432	-2.48134	-.00122
13	-88.79927	7.80893	-.00298
14	-88.40448	11.13971	.00254
15	-88.74847	9.62952	.00304
16	-89.16109	7.81557	.00365
17	-89.65831	5.64456	.00435
18	-90.24505	3.05955	.00516
19	-90.93893	.00000	.00608
20	-90.12448	-3.63192	.00700
21	-89.20476	-7.73025	.00778
22	-88.18707	-12.22625	.00845
23	-87.10240	-17.05490	.00900
24	-85.95644	-22.15470	.00944
25	-81.20345	-60.37468	.01230
26	-76.65531	-96.95195	.00444
27	-76.43411	-100.41950	-.00247
28	-76.53260	-101.87380	.00043
29	-70.22149	-51.12450	-.01391
30	-68.75076	-39.27460	-.01432
31	-66.97420	-31.38200	-.01432
32	-65.20165	-23.50671	-.01425
33	-63.42694	-15.68437	-.01412
34	-61.68710	-7.95326	-.01392
35	-59.97708	-.35403	-.01364
36	-53.43801	-.34041	-.01255
37	.00000	.00000	-.00141

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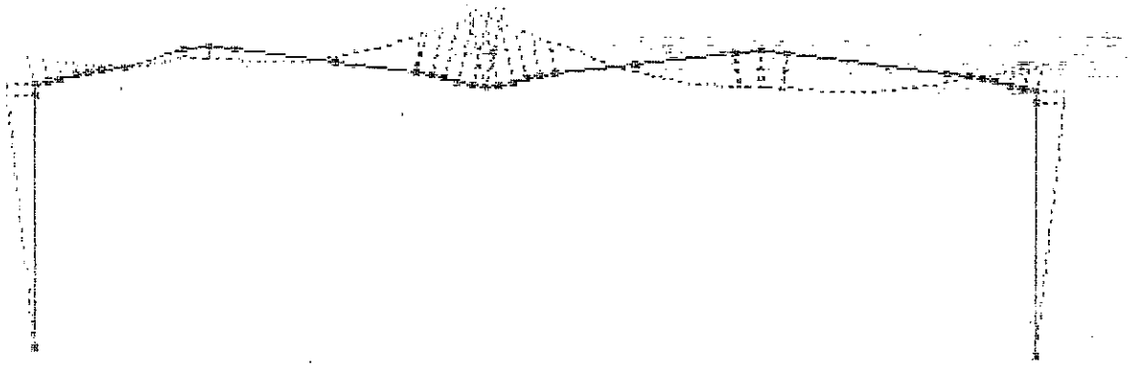
INDUSTRIL UNIT AT DARNDALE
TWO SPAN PRECAST CONCRETE PORTAL

EN102: PLANE FRAME ANALYSIS V4.0
Units: S.I. METRIC (Concrete)

(c) ENCAD SYSTEMS LTD. 1991
Data File : grain1



C1 : 1.0*B1+1*B3;SER DLMIN +LL

My XZ 700kNm

XStrXZ 20m

INDUSTRIL UNIT AT DARNDALE

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INDUSTRIL UNIT AT DARNDALE
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Units: S.I. METRIC (Concrete)

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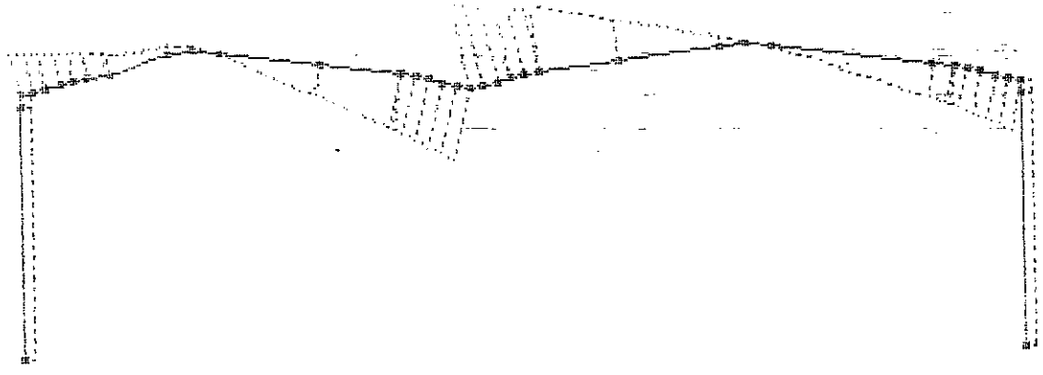
Data File : grain1



C1 : 1.0*B1+1*B3;SER DLMIN +LL

Sz XZL 200kN

XStrXZL 2.0m

INDUSTRIL UNIT AT DARNDALE

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INDUSTRIL UNIT AT DARNDALE
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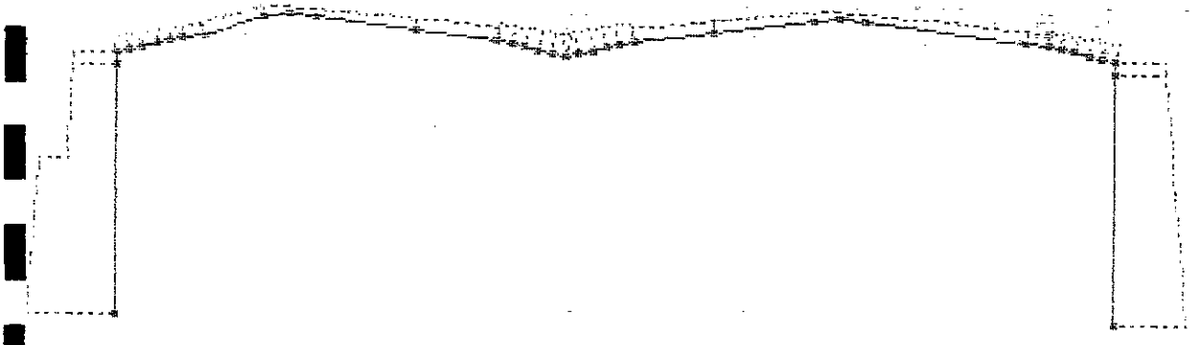
Units: S.I. METRIC (Concrete) Data File : grain1



C1 : 1.0*B1+1*B3;SER DLMIN +LL

Nx XZ 300kN
XStrXZ 80m

INDUSTRIL UNIT AT DARNDALE

Combination Case C1 : 1.0*B1+1*B3;SER DLMIN +LL
Member End Forces

MBR	JOINT	AXIAL Nx (kN)	SHEAR Sz (kN)	MOMENT My (kNm)
1	1	206.8652	-19.1183	.0000
	2	102.2452	-19.1183	-199.7865
2	2	102.2452	-19.1183	-199.7865
	3	102.2452	-19.1183	-209.3457
3	3	36.2989	74.0756	-209.3457
	4	35.0974	68.7461	-169.0839

4	4	35.0973	68.7461	-169.0839
4	5	33.8957	63.4166	-131.8269
5	5	34.0054	63.3579	-131.8269
5	6	32.7941	58.0284	-97.5944
6	6	32.6937	58.0850	-97.5944
6	7	31.4921	52.7555	-66.3482
7	7	31.4922	52.7555	-66.3482
7	8	30.2907	47.4260	-38.1068
8	9	25.5133	50.1580	-38.1068
8	9	24.5055	42.0668	.6946
9	9	32.2550	36.4658	.6946
9	10	24.4836	13.0644	63.7140
10	10	20.3828	18.8326	63.7140
10	11	19.7529	9.1426	77.7312
11	11	18.4032	11.6227	77.7312
11	12	19.3255	-2.5673	82.2685
12	12	19.4439	-1.4152	82.2685
12	13	26.5815	-58.5303	-39.3109

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EN102: PLANE FRAME ANALYSIS V4.0 (c) ENCAD SYSTEMS LTD. 1991

Units: S.I. METRIC (Concrete) Data File : grain1

Combination Case C1 : 1.0*B1+1*B3;SER DLMIN +LL
Member End Forces

MBR	JOINT	AXIAL Nx (kN)	SHEAR Sz (kN)	MOMENT My (kNm)
13	13	26.5811	-58.5304	-39.3109
13	14	32.2997	-104.2928	-303.9034
14	14	42.2917	-100.6562	-303.9034
14	15	44.0513	-108.4607	-362.8540
15	15	44.0511	-108.4608	-362.8540
15	16	45.8106	-116.2653	-426.2048
16	16	46.0118	-116.1859	-426.2048
16	17	47.7855	-123.9903	-493.9375
17	17	47.5708	-124.0729	-493.9375
17	18	49.3304	-131.8774	-566.0907
18	18	49.3307	-131.8773	-566.0907
18	19	51.0903	-139.6818	-642.6437
19	19	54.9672	156.8776	-642.6437
19	20	53.2076	149.0731	-556.3956
20	20	53.2073	149.0733	-556.3956
20	21	51.4477	141.2687	-474.5473
21	21	51.6922	141.1795	-474.5473
21	22	49.9184	133.3750	-397.1195
22	22	49.6875	133.4612	-397.1195
22	23	47.9279	125.6567	-324.0734
23	23	47.9282	125.6566	-324.0734
23	24	46.1686	117.8521	-255.4278
24	24	34.4853	121.7843	-255.4278
24	25	28.7668	76.0215	66.0148
25	25	28.7673	76.0213	66.0148
25	26	21.6298	18.9066	258.5432
26	26	20.4689	20.1576	258.5432
26	27	19.5466	5.9676	271.6334
27	27	18.6096	8.4478	271.6334
27	28	19.2394	-1.2422	275.2437
28	28	19.2792	-.0966	275.2437
28	29	27.0506	-62.2580	73.6843
29	29	27.0219	-62.2705	73.6843
29	30	28.0297	-70.3616	17.8826
30	30	34.7685	-67.2872	17.8826
30	31	35.9701	-72.6167	-21.5566
31	31	35.9699	-72.6168	-21.5566
31	32	37.1715	-77.9463	-64.0007
32	32	37.3062	-77.8819	-64.0007
32	33	38.5174	-83.2114	-109.4313
33	33	38.3735	-83.2779	-109.4313
33	34	39.5751	-88.6074	-157.8861
34	34	39.5752	-88.6073	-157.8861
34	35	40.7768	-93.9368	-209.3457
35	35	122.6050	19.1183	-209.3457
35	36	122.6050	19.1183	-199.7865
36	36	122.6050	19.1183	-199.7865

36	37	170.5705	19.1183	.0000

Combination Case C1 : 1.0*B1+1*B3;SER DLMIN +LL
Member End Stresses

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MBR	JOINT	Ax AXIAL (N/mm2)	By yAXIS BENDING (N/mm2)	Ax +ABS.By (N/mm2)	Ax -ABS.By (N/mm2)
1	1	1.3791	.0000	1.3791	1.3791
1	2	.6816	-15.9829	16.6646	-15.3013
2	2	.6816	-15.9829	16.6646	-15.3013
2	3	.6816	-16.7477	17.4293	-16.0660
3	3	.1532	-6.7229	6.8760	-6.5697
3	4	.1481	-5.4299	5.5780	-5.2818

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INDUSTRIL UNIT AT DARNDALE
TWO SPAN PRECAST CONCRETE PORTAL

EN102: PLANE FRAME ANALYSIS V4.0 (c) ENCAD SYSTEMS LTD. 1991
Units: S.I. METRIC (Concrete) Data File : grain1

Combination Case C1 : 1.0*B1+1*B3;SER DLMIN +LL
Member End Stresses

MBR	JOINT	Ax AXIAL (N/mm2)	By yAXIS BENDING (N/mm2)	Ax +ABS.By (N/mm2)	Ax -ABS.By (N/mm2)
4	4	.1481	-5.4299	5.5780	-5.2818
4	5	.1430	-4.2335	4.3765	-4.0904
5	5	.1435	-4.2335	4.3769	-4.0900
5	6	.1384	-3.1341	3.2725	-2.9958
6	6	.1379	-3.1341	3.2721	-2.9962
6	7	.1329	-2.1307	2.2636	-1.9978
7	7	.1329	-2.1307	2.2636	-1.9978
7	8	.1278	-1.2238	1.3516	-1.0959
8	8	.1701	-3.0485	3.2186	-2.8785
8	9	.1634	.0556	.2189	.1078
9	9	.2150	.0556	.2706	.1595
9	10	.1632	5.0971	5.2603	-4.9339
10	10	.1274	3.9989	4.1263	-3.8715
10	11	.1235	4.8787	5.0021	-4.7552
11	11	.1150	4.8787	4.9937	-4.7636
11	12	.1208	5.1634	5.2842	-5.0427
12	12	.1296	6.5815	6.7111	-6.4519
12	13	.1772	-3.1449	3.3221	-2.9677
13	13	.1772	-3.1449	3.3221	-2.9677
13	14	.2153	-24.3123	24.5276	-24.0969
14	14	.1784	-9.7595	9.9379	-9.5811
14	15	.1859	-11.6526	11.8385	-11.4668
15	15	.1859	-11.6526	11.8385	-11.4668
15	16	.1933	-13.6871	13.8804	-13.4938
16	16	.1941	-13.6871	13.8812	-13.4929
16	17	.2016	-15.8622	16.0638	-15.6606
17	17	.2007	-15.8622	16.0629	-15.6615
17	18	.2081	-18.1793	18.3875	-17.9712
18	18	.2081	-18.1793	18.3875	-17.9712
18	19	.2156	-20.6377	20.8533	-20.4222
19	19	.2319	-20.6377	20.8697	-20.4058
19	20	.2245	-17.8680	18.0925	-17.6435
20	20	.2245	-17.8680	18.0925	-17.6435
20	21	.2171	-15.2395	15.4566	-15.0224
21	21	.2181	-15.2395	15.4576	-15.0214
21	22	.2106	-12.7530	12.9637	-12.5424
22	22	.2097	-12.7530	12.9627	-12.5434
22	23	.2022	-10.4072	10.6095	-10.2050
23	23	.2022	-10.4072	10.6095	-10.2050
23	24	.1948	-8.2028	8.3976	-8.0080
24	24	.2299	-20.4342	20.6641	-20.2043
24	25	.1918	5.2812	5.4730	-5.0894
25	25	.1918	5.2812	5.4730	-5.0894
25	26	.1442	20.6835	20.8277	-20.5393
26	26	.1279	16.2270	16.3550	-16.0991
26	27	.1222	17.0486	17.1708	-16.9265

27	27	.1163	17.0486	17.1649	-16.9323
27	28	.1202	17.2752	17.3955	-17.1550
28	28	.1285	22.0195	22.1480	-21.8910
28	29	.1803	5.8947	6.0751	-5.7144
29	29	.1801	5.8947	6.0749	-5.7146
29	30	.1869	1.4306	1.6175	-1.2437
30	30	.1467	.5743	.7210	-.4276
30	31	.1518	-.6923	.8440	-.5405
31	31	.1518	-.6923	.8440	-.5405
31	32	.1568	-2.0553	2.2121	-1.8985
32	32	.1574	-2.0553	2.2127	-1.8979
32	33	.1625	-3.5143	3.6768	-3.3517
33	33	.1619	-3.5143	3.6762	-3.3523
33	34	.1670	-5.0703	5.2373	-4.9033
34	34	.1670	-5.0703	5.2373	-4.9033
34	35	.1721	-6.7229	6.8949	-6.5508
35	35	.8174	-16.7477	17.5650	-15.9303
35	36	.8174	-15.9829	16.8003	-15.1656

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ombination Case C1 : 1.0*B1+1*B3;SER DLMIN +LL
ember End Stresses

MBR	JOINT	Ax AXIAL (N/mm2)	By yAXIS BENDING (N/mm2)	Ax +ABS.By (N/mm2)	Ax -ABS.By (N/mm2)
36	36	.8174	-15.9829	16.8003	-15.1656
36	37	1.1371	.0000	1.1371	1.1371

ombination Case C1 : 1.0*B1+1*B3;SER DLMIN +LL
eport Reactions

JOINT	X FORCE (kN)	Z FORCE (kN)	Y MOMENT (kNm)
1	19.1183	206.8652	.0000
19	.0000	334.6237	.0000
37	-19.1183	170.5705	.0000

Combination Case C1 : 1.0*B1+1*B3;SER DLMIN +LL
oad Balance

ENTRY		X LINEAR (kN)	Z LINEAR (kN)
1	EXTERNAL LOADS SUM	.0000	-712.0594
2	REACTIONS SUM	.0000	712.0594

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INDUSTRIL UNIT AT DARNDALE
TWO SPAN PRECAST CONCRETE PORTAL

EN102: PLANE FRAME ANALYSIS V4.0 (c) ENCAD SYSTEMS LTD. 1991
Units: S.I. METRIC (Concrete) Data File : grain1

Combination Case C2 : 1.4*B1+1.6*B3:ULT DLMIN +LL
Joint Displacements

JOINT	X LINEAR (mm)	Z LINEAR (mm)	Y ROTATION (rad)
1	.00000	.00000	-.01856
2	-135.85150	-.54736	-.00179
3	-136.34810	-.56419	-.00015
4	-136.33820	-.62711	.00029
5	-136.28020	-.90316	.00063
6	-136.18390	-1.34526	.00090
7	-136.06040	-1.91009	.00109
8	-135.91810	-2.55804	.00121
9	-135.77850	-3.73664	.00145
10	-135.05870	-5.98089	-.00008
11	-135.09460	-5.52662	-.00088
12	-135.01380	-4.19176	-.00180
13	-135.09910	11.38158	-.00456
14	-132.47370	16.64540	.00376
15	-132.98420	14.40471	.00453
16	-133.59870	11.70378	.00544
17	-134.34140	8.46142	.00651
18	-135.22000	4.59091	.00773
19	-136.26120	.00000	.00913
20	-135.03680	-5.46030	.01053
21	-133.65260	-11.62879	.01172
22	-132.11970	-18.40092	.01273
23	-130.48510	-25.67780	.01357
24	-128.75760	-33.36595	.01424
25	-121.58570	-91.03725	.01855
26	-114.73920	-146.09930	.00664
27	-114.40930	-151.27170	.00366
28	-114.55400	-153.40590	.00060
29	-105.02990	-76.82069	-.02091
30	-102.81870	-59.00449	-.02153
31	-100.14870	-47.14231	-.02152
32	-97.48489	-35.30735	-.02142
33	-94.81812	-23.55311	-.02122
34	-92.20399	-11.93704	-.02091
35	-89.63490	-.52013	-.02049
36	-79.81261	-.49994	-.01884
37	.00000	.00000	-.00206

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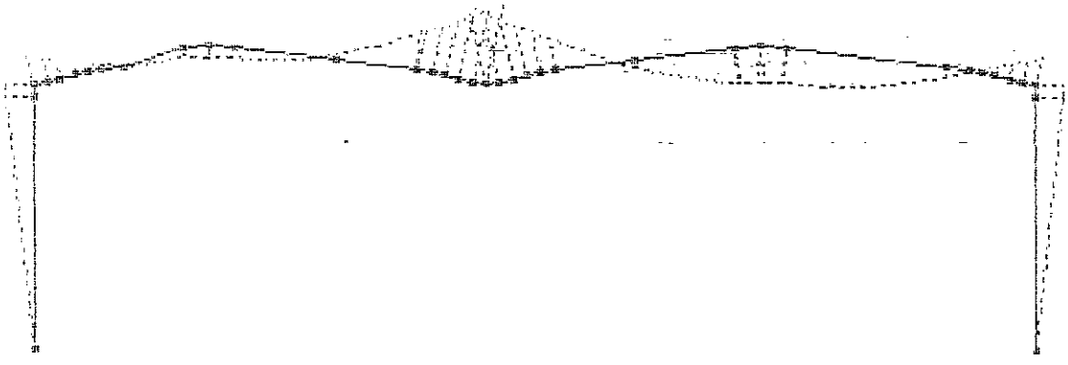
TWO SPAN PRECAST CONCRETE PORTAL

EN102: PLANE FRAME ANALYSIS V4.0 (c) ENCAD SYSTEMS LTD. 1991
Units: S.I. METRIC (Concrete) Data File : grain1



C2 : 1.4*B1+1.6*B3;ULT DLMIN +LL

My XZ 1000kNm

XStrXZ 20m

INDUSTRIL UNIT AT DARNDALE

O'CONNOR SUTTON CRONIN

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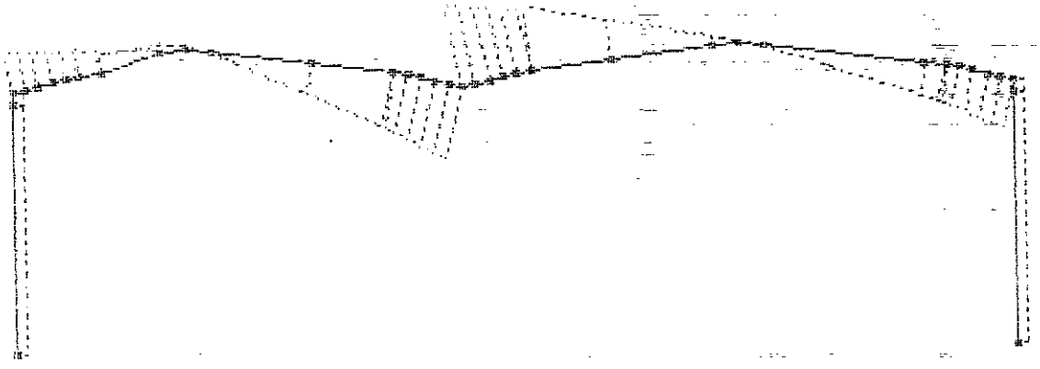
INDUSTRIL UNIT AT DARNDALE
TWO SPAN PRECAST CONCRETE PORTAL

(c) ENCAD SYSTEMS LTD. 1991

EN102: PLANE FRAME ANALYSIS V4.0
Units: S.I. METRIC (Concrete)
Data File : grain1



C2 : 1.4*B1+1.6*B3;ULT DLMIN +LL

Sz XZ 300kN
Str XZ 20m

INDUSTRIL UNIT AT DARNDALE

O'CONNOR SUTTON CRONIN

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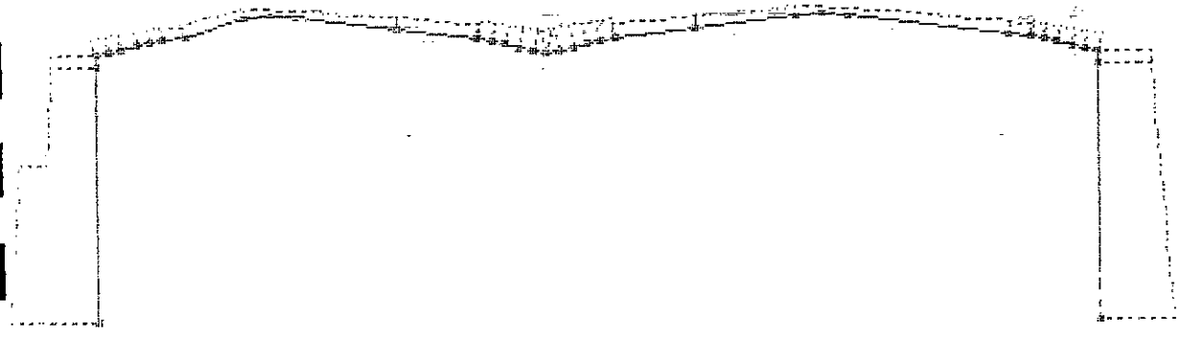
INDUSTRIL UNIT AT DARNDALE
TWO SPAN PRECAST CONCRETE PORTAL

EN102: PLANE FRAME ANALYSIS V4.0 (c) ENCAD SYSTEMS LTD. 1991
Units: S.I. METRIC (Concrete) Data File : grain1



C2 : 1.4*B1+1.6*B3;ULT DLMIN +LL

Nx XZ 300kN
XStrXZ 20m

INDUSTRIL UNIT AT DARNDALE

Combination Case C2 : 1.4*B1+1.6*B3;ULT DLMIN +LL
Member End Forces

MBR	JOINT	AXIAL Nx (kN)	SHEAR Sz (kN)	MOMENT My (kNm)
1	1	297.9441	-28.8223	.0000
1	2	151.4761	-28.8223	-301.1933
2	2	151.4761	-28.8223	-301.1933
2	3	151.4761	-28.8223	-515.6045
3	3	54.6575	111.3822	-315.6045
3	4	52.8637	103.4259	-255.0495

4	5	51.0698	95.4697	-196.9803
5	5	51.2349	95.3812	-198.9803
5	6	49.4266	87.4249	-147.4267
6	6	49.2753	87.5103	-147.4267
6	7	47.4815	79.5540	-100.3308
7	7	47.4816	79.5539	-100.3308
7	8	45.6879	71.5976	-57.7206
8	8	38.4758	75.7180	-57.7208
8	9	36.9713	63.6389	.9102
9	9	48.6967	55.1853	.9102
9	10	37.0949	20.2499	96.8898
10	10	30.7665	28.9244	96.8898
10	11	29.8262	14.5084	118.6771
11	11	27.6971	18.2474	118.6771
11	12	29.1054	-3.4186	126.1071
12	12	29.2570	-1.6843	126.1071
12	13	40.1550	-88.8905	-57.5935

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Combination Case C2 : 1.4*B1+1.6*B3;ULT DLMIN +L

Member End Forces

MBR	JOINT	AXIAL Nx (kN)	SHEAR Sz (kN)	MOMENT My (kNm)
13	13	40.1545	-88.8907	-57.5935
13	14	48.8859	-158.7630	-460.0379
14	14	64.0979	-153.2547	-460.0379
14	15	66.7845	-165.1710	-549.8029
15	15	66.7842	-165.1711	-549.8029
15	16	69.4708	-177.0874	-646.2864
16	16	69.7771	-176.9669	-646.2864
16	17	72.4854	-188.8832	-749.4607
17	17	72.1583	-189.0084	-749.4607
17	18	74.8449	-200.9247	-859.3840
18	18	74.8454	-200.9245	-859.3840
18	19	77.5320	-212.8408	-976.0253
19	19	83.3549	238.6681	-976.0253
19	20	80.6683	226.7518	-844.8224
20	20	80.6678	226.7520	-844.8224
20	21	77.9812	214.8357	-720.3375
21	21	78.3530	214.7004	-720.3375
21	22	75.6447	202.7841	-602.6017
22	22	75.2936	202.9148	-602.6017
23	23	72.6070	190.9984	-491.5563
23	23	72.6075	190.9983	-491.5563
23	24	69.9209	179.0820	-387.2299
24	24	52.1686	185.0344	-387.2299
24	25	43.4372	115.1615	100.6007
25	25	43.4381	115.1612	100.6007
25	26	32.5401	27.9555	390.8635
26	26	30.8226	29.8385	390.8635
26	27	29.4144	8.1725	409.9091
27	27	28.1089	11.9115	409.9091
27	28	29.0492	-2.5545	414.5974
28	28	29.1497	-.8236	414.5974
28	29	40.7514	-93.6230	109.3017
29	29	40.7082	-93.6418	109.3017
29	30	42.2127	-105.7209	25.4247
30	30	52.3376	-101.0920	25.4247
30	31	54.1314	-109.0483	-33.8143
31	31	54.1312	-109.0484	-33.8143
31	32	55.9250	-117.0047	-97.5391
32	32	56.1271	-116.9078	-97.5391
32	33	57.9354	-124.8642	-165.7223
33	33	57.7194	-124.9641	-165.7223
33	34	59.5132	-132.9204	-238.4205
34	34	59.5134	-132.9203	-238.4205
34	35	61.3072	-140.8766	-315.6045
35	35	181.7108	28.8223	-315.6045
35	36	181.7108	28.8223	-301.1933
36	36	181.7108	28.8223	-301.1933

Combination Case C2 : 1.4*B1+1.6*B3;ULT DLMIN +LL
Member End Stresses

MBR	JOINT	Ax AXIAL (N/mm2)	By yAXIS BENDING (N/mm2)	Ax +ABS.By (N/mm2)	Ax -ABS.By (N/mm2)
1	1	1.9863	.0000	1.9863	1.9863
1	2	1.0098	-24.0955	25.1053	-23.0856
2	2	1.0098	-24.0955	25.1053	-23.0856
2	3	1.0098	-25.2484	26.2582	-24.2385
3	3	.2306	-10.1353	10.3659	-9.9046
3	4	.2231	-8.1906	8.4137	-7.9676

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Combination Case C2 : 1.4*B1+1.6*B3;ULT DLMIN +LL
Member End Stresses

MBR	JOINT	Ax AXIAL (N/mm2)	By yAXIS BENDING (N/mm2)	Ax +ABS.By (N/mm2)	Ax -ABS.By (N/mm2)
4	4	.2231	-8.1906	8.4137	-7.9676
4	5	.2155	-6.3900	6.6055	-6.1745
5	5	.2162	-6.3900	6.6062	-6.1738
5	6	.2086	-4.7344	4.9430	-4.5259
6	6	.2079	-4.7344	4.9423	-4.5265
6	7	.2003	-3.2220	3.4223	-3.0217
7	7	.2003	-3.2220	3.4224	-3.0217
7	8	.1928	-1.8536	2.0464	-1.6609
8	8	.2565	-4.6177	4.8742	-4.3612
8	9	.2465	.0728	.3193	.1737
9	9	.3246	.0728	.3975	.2518
9	10	.2473	7.7512	7.9985	-7.5039
10	10	.1923	6.0811	6.2734	-5.8888
10	11	.1864	7.4486	7.6350	-7.2622
11	11	.1731	7.4486	7.6217	-7.2755
11	12	.1819	7.9149	8.0968	-7.7330
12	12	.1950	10.0886	10.2836	-9.8935
12	13	.2677	-4.6075	4.8752	-4.3398
13	13	.2677	-4.6075	4.8752	-4.3398
13	14	.3259	-36.8030	37.1289	-36.4771
14	14	.2705	-14.7736	15.0440	-14.5031
14	15	.2818	-17.6563	17.9381	-17.3745
15	15	.2818	-17.6563	17.9381	-17.3745
15	16	.2931	-20.7547	21.0479	-20.4616
16	16	.2944	-20.7547	21.0491	-20.4603
16	17	.3058	-24.0680	24.3739	-23.7622
17	17	.3045	-24.0680	24.3725	-23.7636
17	18	.3158	-27.5981	27.9139	-27.2823
18	18	.3158	-27.5981	27.9139	-27.2823
18	19	.3271	-31.3439	31.6710	-31.0168
19	19	.3517	-31.3439	31.6956	-30.9922
19	20	.3404	-27.1305	27.4708	-26.7901
20	20	.3404	-27.1305	27.4708	-26.7901
20	21	.3290	-23.1328	23.4618	-22.8038
21	21	.3306	-23.1328	23.4634	-22.8022
21	22	.3192	-19.3518	19.6710	-19.0327
22	22	.3177	-19.3518	19.6695	-19.0341
22	23	.3064	-15.7858	16.0921	-15.4794
23	23	.3064	-15.7858	16.0921	-15.4794
23	24	.2950	-12.4354	12.7305	-12.1404
24	24	.3478	-30.9784	31.3262	-30.6306
24	25	.2896	8.0481	8.3376	-7.7585
25	25	.2896	8.0481	8.3376	-7.7585
25	26	.2169	31.2691	31.4860	-31.0521
26	26	.1926	24.5319	24.7245	-24.3393
26	27	.1838	25.7273	25.9111	-25.5434

28	28	.1816	26.0215	26.2031	-25.8400
28	29	.1943	33.1678	33.3621	-32.9735
29	29	.2717	8.7441	9.0158	-8.4725
29	29	.2714	8.7441	9.0155	-8.4727
29	30	.2814	2.0340	2.3154	-1.7526
30	30	.2208	.8165	1.0373	-.5957
30	31	.2284	-1.0859	1.3143	-.8575
31	31	.2284	-1.0859	1.3143	-.8575
31	32	.2360	-3.1324	3.3683	-2.8964
32	32	.2368	-3.1324	3.3692	-2.8955
32	33	.2445	-5.3220	5.5664	-5.0775
33	33	.2435	-5.3220	5.5655	-5.0784
33	34	.2511	-7.6566	7.9077	-7.4055
34	34	.2511	-7.6566	7.9077	-7.4055
34	35	.2587	-10.1353	10.3939	-9.8766
35	35	1.2114	-25.2484	26.4598	-24.0370
35	36	1.2114	-24.0955	25.3069	-22.8841

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Data File : grain1

Combination Case C2 : 1.4*B1+1.6*B3;ULT DLMIN +LL
Member End Stresses

MBR	JOINT	Ax AXIAL (N/mm2)	By yAXIS BENDING (N/mm2)	Ax +ABS.By (N/mm2)	Ax -ABS.By (N/mm2)
36	36	1.2114	-24.0955	25.3069	-22.8841
36	37	1.6591	.0000	1.6591	1.6591

Combination Case C2 : 1.4*B1+1.6*B3;ULT DLMIN +LL
Support Reactions

JOINT	X FORCE (kN)	Z FORCE (kN)	Y MOMENT (kNm)
1	28.8223	297.9441	.0000
19	.0000	506.6382	.0000
37	-28.8223	248.8625	.0000

Combination Case C2 : 1.4*B1+1.6*B3;ULT DLMIN +LL
Load Balance

ENTRY		X LINEAR (kN)	Z LINEAR (kN)
1	EXTERNAL LOADS SUM	.0000	-1053.4450
2	REACTIONS SUM	.0000	1053.4450

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INDUSTRIL UNIT AT DARNDALE
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EN102: PLANE FRAME ANALYSIS V4.0 (c) ENCAD SYSTEMS LTD. 1991
Units: S.I. METRIC (Concrete) Data File : grain1

Combination Case C3 : 1*B2+1*B3;SER DLMAX +LL

Joint Displacements

JOINT	X LINEAR (mm)	Z LINEAR (mm)	Y ROTATION (rad)
1	.00000	.00000	-.01411
2	-103.54260	-.40306	-.00148
3	-103.98170	-.41566	-.00024
4	-103.99060	-.39082	.00008
5	-103.96330	-.52598	.00034
6	-103.90740	-.78557	.00054
7	-103.83110	-1.13690	.00068
8	-103.74080	-1.55017	.00077
9	-103.65000	-2.32181	.00095
10	-103.21740	-3.68210	-.00018
11	-103.25170	-3.22667	-.00077
12	-103.18510	-2.13341	-.00143
13	-101.76390	9.42914	-.00329
14	-101.36100	12.84614	.00297
15	-101.76290	11.08126	.00354
16	-102.24170	8.97545	.00422
17	-102.81550	6.46946	.00501
18	-103.48940	3.50005	.00591
19	-104.28310	.00000	.00694
20	-103.35480	-4.13939	.00797
21	-102.30880	-8.80015	.00885
22	-101.15300	-13.90569	.00959
23	-99.92250	-19.38351	.01021
24	-98.62332	-25.16504	.01070
25	-93.24490	-68.41356	.01392
26	-88.07571	-109.98500	.00510
27	-87.81995	-113.99300	.00288
28	-87.93687	-115.72300	.00057
29	-80.79479	-58.29159	-.01584
30	-79.11877	-44.78782	-.01633
31	-77.09290	-35.78763	-.01633
32	-75.07122	-26.80548	-.01626
33	-73.04670	-17.88209	-.01611
34	-71.06161	-9.06123	-.01588
35	-69.11021	-.38941	-.01556
36	-61.64559	-.37417	-.01433
37	.00000	.00000	-.00170

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DATE 14JAN90

INDUSTRIL UNIT AT DARNDALE
TWO SPAN PRECAST CONCRETE PORTAL

N102: PLANE FRAME ANALYSIS V4.0
Units: S.I. METRIC (Concrete)

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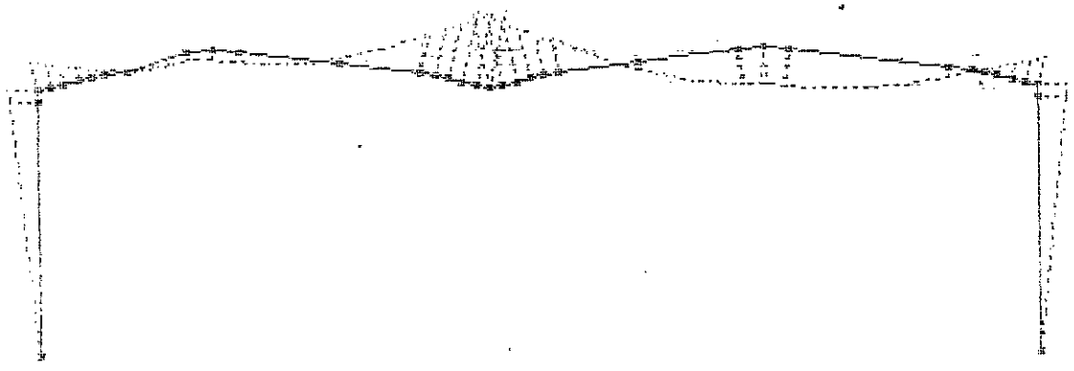
Data File : grain1



C3 : 1*B2+1*B3;SER DLMAX +LL

My XZ 800kNm

XStrXZ 20m

INDUSTRIL UNIT AT DARNDALE

O'CONNOR SUTTON CRONIN

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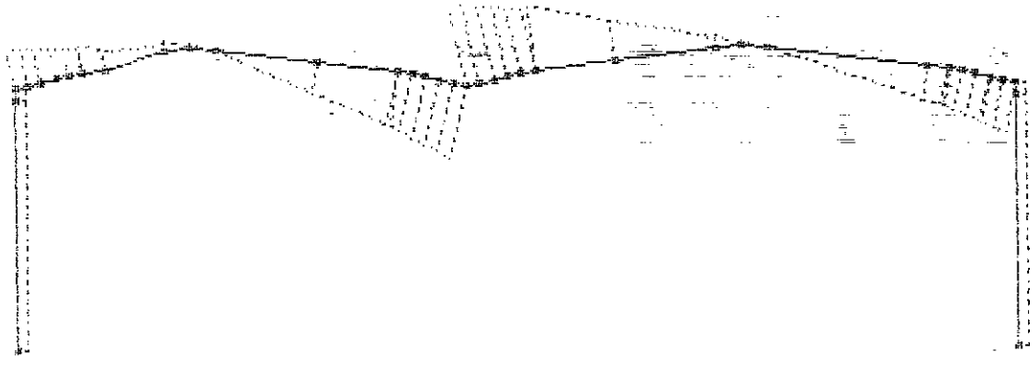
DATE	14JAN90

INDUSTRIL UNIT AT DARNDALE
TWO SPAN PRECAST CONCRETE PORTAL

EN102: PLANE FRAME ANALYSIS V4.0 (c) ENCAD SYSTEMS LTD. 1991
Units: S.I. METRIC (Concrete) Data File : grain1



C3 : 1*B2+1*B3;SER DLMAX +LL

Sz XZ 200kN

XStrXZ 20m

INDUSTRIL UNIT AT DARNDALE

O'CONNOR SUTTON CRONIN

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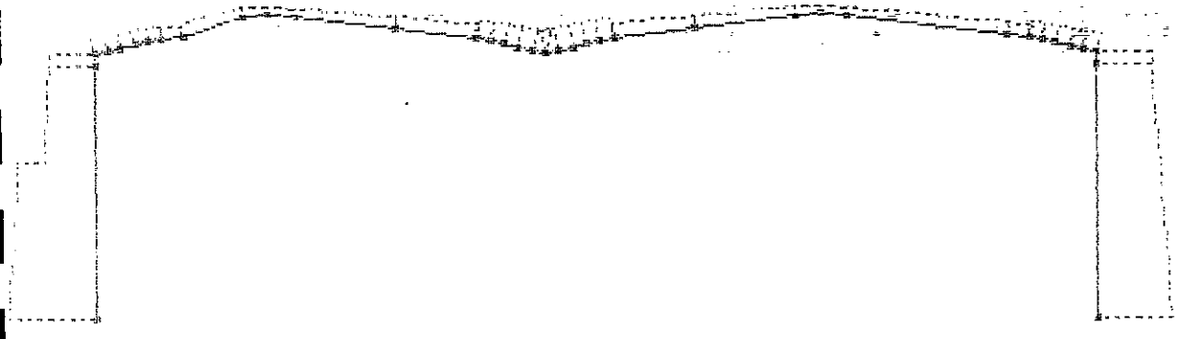
JOB NO. 0
RUN NO. 1
AUTHOR D.G.
DATE 14JAN90

INDUSTRIL UNIT AT DARNDALE
TWO SPAN PRECAST CONCRETE PORTAL

EN102: PLANE FRAME ANALYSIS V4.0 (c) ENCAD SYSTEMS LTD. 1991
Units: S.I. METRIC (Concrete) Data File : grain1



C3 : 1*B2+1*B3;SER DLMAX +LL

Nx XZL 300kN
StrXZL 80m

INDUSTRIL UNIT AT DARNDALE

Combination Case C3 : 1*B2+1*B3;SER DLMAX +LL
Member End Forces

MBR	JOINT	AXIAL Nx (kN)	SHEAR Sz (kN)	MOMENT My (kNm)
1	1	218.0234	-21.6765	.0000
1	2	113.4034	-21.6765	-226.5198
2	2	113.4034	-21.6765	-226.5198
2	3	113.4034	-21.6765	-237.3580
3	3	41.2486	84.3979	-237.3580
3	4	39.8610	78.2434	-191.5091

4	4	39.8609	78.2435	-191.5091
4	5	38.4733	72.0890	-149.1300
5	5	38.5980	72.0223	-149.1300
5	6	37.1993	65.8678	-110.2432
6	6	37.0852	65.9321	-110.2432
6	7	35.6977	59.7776	-74.8053
7	7	35.6978	59.7775	-74.8053
7	8	34.3102	53.6230	-42.8374
8	8	28.9083	56.7180	-42.8374
8	9	27.7445	47.3743	.9569
9	9	36.4689	41.0379	.9569
9	10	27.4945	14.0140	71.0018
10	10	23.0556	20.5129	71.0018
10	11	22.3283	9.3229	85.9511
11	11	20.9335	12.1349	85.9511
11	12	21.9534	-3.5551	90.2501
12	12	22.1257	-2.2452	90.2501
12	13	30.0178	-65.3979	-46.9414

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EN102: PLANE FRAME ANALYSIS V4.0 (c) ENCAD SYSTEMS LTD. 1991

Units: S.I. METRIC (Concrete) Data File : grain1

Combination Case C3 : 1*B2+1*B3;SER DLMAX +LL
Member End Forces

MBR	JOINT	AXIAL Nx (kN)	SHEAR Sz (kN)	MOMENT My (kNm)
13	13	30.0174	-65.3981	-46.9414
13	14	36.3405	-115.9979	-341.7150
14	14	47.4520	-111.9127	-341.7150
14	15	49.3975	-120.5422	-407.2447
15	15	49.3973	-120.5423	-407.2447
15	16	51.3429	-129.1718	-477.6397
16	16	51.5663	-129.0828	-477.6397
16	17	53.5276	-137.7122	-552.8792
17	17	53.2891	-137.8047	-552.8792
17	18	55.2347	-146.4342	-633.0070
18	18	55.2350	-146.4341	-633.0070
18	19	57.1806	-155.0636	-717.9999
19	19	61.6071	174.6972	-717.9999
19	20	59.6616	166.0677	-621.9375
20	20	59.6612	166.0679	-621.9375
20	21	57.7156	157.4383	-530.7401
21	21	57.9880	157.3382	-530.7401
21	22	56.0268	148.7087	-444.4311
22	22	55.7693	148.8055	-444.4311
22	23	53.8237	140.1759	-362.9664
23	23	53.8241	140.1758	-362.9664
23	24	51.8785	131.5463	-286.3673
24	24	38.8360	135.9690	-286.3673
24	25	32.5129	85.3688	-73.3158
25	25	32.5136	85.3685	-73.3158
25	26	24.6215	22.2163	291.5144
26	26	23.2588	23.6392	291.5144
26	27	22.2390	7.9492	307.3419
27	27	21.0228	10.7611	307.3419
27	28	21.7502	-.4289	312.5190
28	28	21.7372	.8645	312.5190
28	29	30.7116	-70.9193	86.0690
29	29	30.6789	-70.9335	86.0690
29	30	31.8426	-80.2771	22.4508
30	30	39.5318	-76.7829	22.4508
30	31	40.9193	-82.9374	-22.5746
31	31	40.9192	-82.9374	-22.5746
31	32	42.3068	-89.0919	-71.0701
32	32	42.4607	-89.0186	-71.0701
32	33	43.8595	-95.1732	-123.0148
33	33	43.6949	-95.2489	-123.0148
33	34	45.0824	-101.4034	-178.4515
34	34	45.0826	-101.4033	-178.4515
34	35	46.4701	-107.5578	-237.3580
35	35	137.1446	21.6765	-237.3580
35	36	137.1446	21.6765	-226.5198
36	36	137.1446	21.6765	-226.5198

36 37 185.1101 21.6765 .0000

Combination Case C3 : 1*B2+1*B3;SER DLMAX +LL
Member End Stresses

MBR	JOINT	Ax AXIAL (N/mm2)	By yAXIS BENDING (N/mm2)	Ax +ABS.By (N/mm2)	Ax -ABS.By (N/mm2)
1	1	1.4535	.0000	1.4535	1.4535
1	2	.7560	-18.1216	18.8776	-17.3656
2	2	.7560	-18.1216	18.8776	-17.3656
2	3	.7560	-18.9886	19.7447	-18.2326
3	3	.1740	-7.6225	7.7965	-7.4484
3	4	.1682	-6.1501	6.3183	-5.9819

EN102: PLANE FRAME ANALYSIS V4.0 (c) ENCAD SYSTEMS LTD. 1991
Units: S.I. METRIC (Concrete) Data File : grain1

Combination Case C3 : 1*B2+1*B3;SER DLMAX +LL
Member End Stresses

MBR	JOINT	Ax AXIAL (N/mm2)	By yAXIS BENDING (N/mm2)	Ax +ABS.By (N/mm2)	Ax -ABS.By (N/mm2)
4	4	.1682	-6.1501	6.3183	-5.9819
4	5	.1623	-4.7891	4.9515	-4.6268
5	5	.1629	-4.7891	4.9520	-4.6263
5	6	.1570	-3.5403	3.6973	-3.3834
6	6	.1565	-3.5403	3.6968	-3.3839
6	7	.1506	-2.4023	2.5529	-2.2517
7	7	.1506	-2.4023	2.5529	-2.2517
7	8	.1448	-1.3757	1.5204	-1.2309
8	8	.1927	-3.4270	3.6197	-3.2343
8	9	.1850	.0766	.2615	.1084
9	9	.2431	.0766	.3197	.1666
9	10	.1833	5.6801	5.8634	-5.4968
10	10	.1441	4.4563	4.6004	-4.3122
10	11	.1396	5.3946	5.5341	-5.2550
11	11	.1308	5.3946	5.5254	-5.2637
11	12	.1372	5.6644	5.8016	-5.5272
12	12	.1475	7.2200	7.3675	-7.0725
12	13	.2001	-3.7553	3.9554	-3.5552
13	13	.2001	-3.7553	3.9554	-3.5552
13	14	.2423	-27.3372	27.5795	-27.0949
14	14	.2002	-10.9738	11.1740	-10.7736
14	15	.2084	-13.0782	13.2866	-12.8698
15	15	.2084	-13.0782	13.2866	-12.8698
15	16	.2166	-15.3388	15.5555	-15.1222
16	16	.2176	-15.3388	15.5564	-15.1213
16	17	.2259	-17.7551	17.9809	-17.5292
17	17	.2248	-17.7551	17.9799	-17.5302
17	18	.2331	-20.3283	20.5613	-20.0952
18	18	.2331	-20.3283	20.5613	-20.0952
18	19	.2413	-23.0577	23.2990	-22.8165
19	19	.2599	-23.0577	23.3177	-22.7978
19	20	.2517	-19.9728	20.2245	-19.7211
20	20	.2517	-19.9728	20.2245	-19.7211
20	21	.2435	-17.0441	17.2876	-16.8006
21	21	.2447	-17.0441	17.2888	-16.7994
21	22	.2364	-14.2724	14.5088	-14.0360
22	22	.2353	-14.2724	14.5077	-14.0371
22	23	.2271	-11.6562	11.8833	-11.4291
23	23	.2271	-11.6562	11.8833	-11.4291
23	24	.2189	-9.1963	9.4152	-8.9775
24	24	.2589	-22.9094	23.1683	-22.6505
24	25	.2168	5.8653	6.0820	-5.6485
25	25	.2168	5.8653	6.0820	-5.6485
25	26	.1641	23.3212	23.4853	-23.1570
26	26	.1454	18.2964	18.4418	-18.1511
26	27	.1390	19.2898	19.4288	-19.1508

27	27	.1314	19.2898	19.4212	-19.1584
27	28	.1359	19.6147	19.7507	-19.4788
28	28	.1449	25.0015	25.1464	-24.8566
28	29	.2047	6.8855	7.0903	-6.6808
29	29	.2045	6.8855	7.0900	-6.6810
29	30	.2123	1.7961	2.0084	-1.5838
30	30	.1668	.7210	.8878	-.5542
30	31	.1727	-.7250	.8976	-.5523
31	31	.1727	-.7250	.8976	-.5523
31	32	.1785	-2.2823	2.4608	-2.1038
32	32	.1792	-2.2823	2.4615	-2.1032
32	33	.1851	-3.9505	4.1355	-3.7654
33	33	.1844	-3.9505	4.1348	-3.7661
33	34	.1902	-5.7308	5.9210	-5.5405
34	34	.1902	-5.7308	5.9210	-5.5405
34	35	.1961	-7.6225	7.8186	-7.4264
35	35	.9143	-18.9886	19.9029	-18.0743
35	36	.9143	-18.1216	19.0359	-17.2073

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Combination Case C3 : 1*B2+1*B3;SER DLMAX +LL
Member End Stresses

MBR	JOINT	Ax AXIAL (N/mm2)	By yAXIS BENDING (N/mm2)	Ax +ABS.By (N/mm2)	Ax -ABS.By (N/mm2)
36	36	.9143	-18.1216	19.0359	-17.2073
36	37	1.2341	.0000	1.2341	1.2341

Combination Case C3 : 1*B2+1*B3;SER DLMAX +LL
Support Reactions

JOINT	X FORCE (kN)	Z FORCE (kN)	Y MOMENT (kNm)
1	21.6765	218.0234	.0000
19	.0000	369.8120	.0000
37	-21.6765	185.1101	.0000

Combination Case C3 : 1*B2+1*B3;SER DLMAX +LL
Load Balance

ENTRY		X LINEAR (kN)	Z LINEAR (kN)
1	EXTERNAL LOADS SUM	.0000	-772.9455
2	REACTIONS SUM	.0000	772.9455

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INDUSTRIL UNIT AT DARNDALE
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IN102: PLANE FRAME ANALYSIS V4.0 (c) ENCAD SYSTEMS LTD. 1991
Units: S.I. METRIC (Concrete) Data File : grain1

Combination Case C4 : 1.4*B2+1.6*B3:ULT DLMAX +LL
Joint Displacements

JOINT	X LINEAR (mm)	Z LINEAR (mm)	Y ROTATION (rad)
1	.00000	.00000	-.02102
2	-154.06100	-.58364	-.00214
3	-154.68290	-.60220	-.00029
4	-154.68760	-.60307	.00019
5	-154.63820	-.84329	.00058
6	-154.54590	-1.26974	.00088
7	-154.42320	-1.83363	.00109
8	-154.27930	-2.49041	.00122
9	-154.13610	-3.70440	.00150
10	-153.43190	-5.91107	-.00020
11	-153.47930	-5.29088	-.00109
12	-153.38290	-3.70465	-.00210
13	-151.24960	13.64989	-.00499
14	-150.61290	19.03440	.00437
15	-151.20440	16.43716	.00523
16	-151.91160	13.32761	.00624
17	-152.76150	9.61628	.00742
18	-153.76210	5.20761	.00879
19	-154.94310	.00000	.01034
20	-153.55920	-6.17076	.01188
21	-151.99820	-13.12665	.01321
22	-150.27210	-20.75213	.01433
23	-148.43330	-28.93785	.01525
24	-146.49120	-37.58043	.01600
25	-138.44370	-102.29170	.02082
26	-130.72770	-164.34560	.00757
27	-130.34940	-170.27450	.00423
28	-130.52000	-172.79480	.00079
29	-119.83260	-86.85462	-.02362
30	-117.33400	-66.72300	-.02434
31	-114.31480	-53.31020	-.02434
32	-111.30230	-39.92563	-.02423
33	-108.28580	-26.62992	-.02400
34	-105.32830	-13.48820	-.02366
35	-102.42130	-.56967	-.02319
36	-91.30322	-.54721	-.02134
37	.00000	.00000	-.00246

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INDUSTRIL UNIT AT DARNDALE
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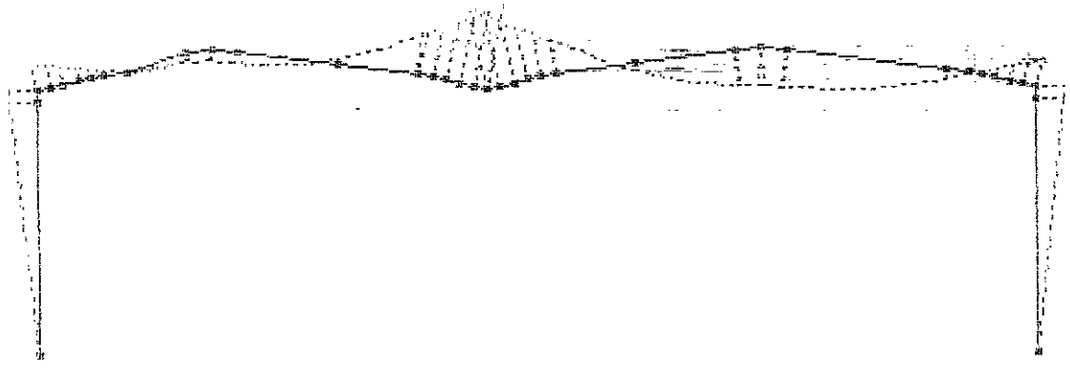
EN102: PLANE FRAME ANALYSIS V4.0 (c) ENCAD SYSTEMS LTD. 1991
Units: S.I. METRIC (Concrete) Data File : grain1



C4 : 1.4*B2+1.6*B3;ULT DLMAX +LL

My XZ 2000kNm

XStrXZ 20m

INDUSTRIL UNIT AT DARNDALE

'CONNOR SUTTON CRONIN

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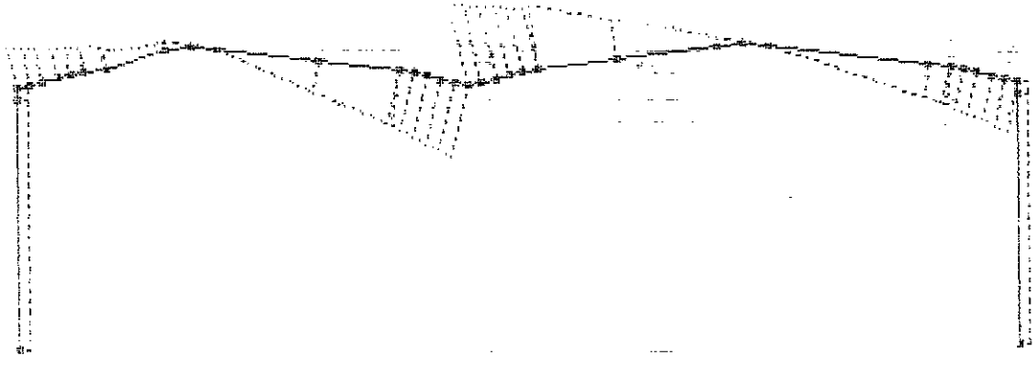
'NDUSTRIL UNIT AT DARNDALE
WO SPAN PRECAST CONCRETE PORTAL

EN102: PLANE FRAME ANALYSIS V4.0 (c) ENCAD SYSTEMS LTD. 1991
Units: S.I. METRIC (Concrete) Data File : grain1



C4 : 1.4*B2+1.6*B3;ULT DLMAX +LL

Sz XZL 300kN

XStrXZL 20m

INDUSTRIL UNIT AT DARNDALE

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INDUSTRIL UNIT AT DARNDALE
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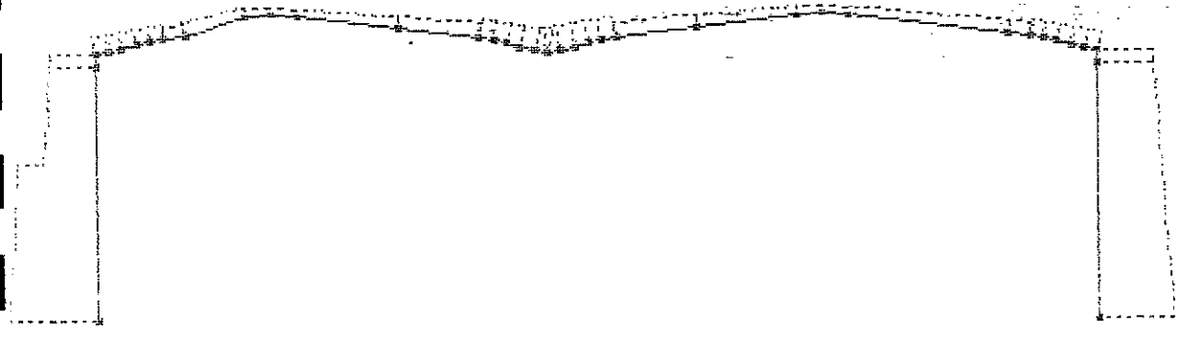
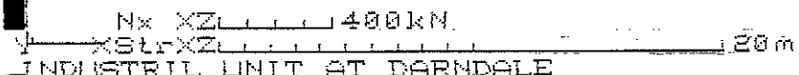
EN102: PLANE FRAME ANALYSIS V4.0 (c) ENCAD SYSTEMS LTD. 1991
Units: S.I. METRIC (Concrete) Data File : grain1



C4 : 1.4*B2+1.6*B3;ULT DLMAX +LL



INDUSTRIL UNIT AT DARNDALE

Combination Case C4 : 1.4*B2+1.6*B3;ULT DLMAX +LL
Member End Forces

MBR	JOINT	AXIAL Nx (kN)	SHEAR Sz (kN)	MOMENT My (kNm)
1	1	313.5656	-32.4038	.0000
1	2	167.0976	-32.4038	-338.6199
2	2	167.0976	-32.4038	-338.6199
2	3	167.0976	-32.4038	-354.8218
3	3	61.587m	125.8335	-354.8218

4	4	59.5326	116.7223	-286.4448
4	5	57.4785	107.6110	-223.2046
5	5	57.6646	107.5114	-223.2046
5	6	55.5938	98.4001	-165.1350
6	6	55.4235	98.4961	-165.1350
6	7	53.3693	89.3848	-112.1708
7	7	53.3695	89.3848	-112.1708
7	8	51.3153	80.2735	-64.3438
8	8	43.2288	84.9020	-64.3438
8	9	41.5060	71.0694	1.2774
9	9	54.5962	61.5862	1.2774
9	10	41.3102	21.5793	107.0926
10	10	34.5084	31.3268	107.0926
10	11	33.4316	14.7608	130.1851
11	11	31.2395	18.9644	130.1851
11	12	32.7843	-4.8016	137.2814
12	12	33.0116	-2.8463	137.2814
12	13	44.9659	-98.5051	-68.2762

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INDUSTRIL UNIT AT DARNDALE
WO SPAN PRECAST CONCRETE PORTAL

EN102: PLANE FRAME ANALYSIS V4.0 (c) ENCAD SYSTEMS LTD. 1991
Units: S.I. METRIC (Concrete) Data File : grain1

Combination Case C4 : 1.4*B2+1.6*B3;ULT DLMAX +LL
Member End Forces

MBR	JOINT	AXIAL Nx (kN)	SHEAR Sz (kN)	MOMENT My (kNm)
13	13	44.9653	-98.5054	-68.2762
13	14	54.5430	-175.1501	-512.9742
14	14	71.3222	-169.0138	-512.9742
14	15	74.2692	-182.0851	-611.9498
15	15	74.2689	-182.0852	-611.9498
15	16	77.2159	-195.1565	-718.2952
16	16	77.5535	-195.0226	-718.2952
16	17	80.5243	-208.0938	-831.9791
17	17	80.1640	-208.2329	-831.9791
17	18	83.1109	-221.3042	-953.0669
18	18	83.1115	-221.3040	-953.0669
18	19	86.0584	-234.3753	-1081.5240
19	19	92.6508	263.6155	-1081.5240
19	20	89.7038	250.5443	-936.5811
20	20	89.7032	250.5445	-936.5811
20	21	86.7563	237.4732	-799.0075
21	21	87.1672	237.3226	-799.0075
21	22	84.1964	224.2513	-668.8379
22	22	83.8081	224.3968	-668.8379
22	23	80.8612	211.3254	-546.0065
23	23	80.8617	211.3252	-546.0065
23	24	77.9147	198.2539	-430.5452
24	24	58.2595	204.8930	-430.5452
24	25	48.6818	128.2477	110.8221
25	25	48.6828	128.2473	110.8221
25	26	36.7285	32.5891	437.0232
26	26	34.7285	34.7126	437.0232
26	27	33.1837	10.9466	459.9010
27	27	31.4874	15.1502	459.9010
27	28	32.5642	-1.4158	466.7827
28	28	32.5908	.5220	466.7827
28	29	45.8767	-105.7489	126.6402
29	29	45.8280	-105.7700	126.6402
29	30	47.5508	-119.6026	-31.8202
30	30	59.0061	-114.3859	-31.8202
30	31	61.0603	-123.4972	-35.2395
31	31	61.0601	-123.4973	-35.2395
31	32	63.1143	-132.6086	-107.4363
32	32	63.3435	-132.4993	-107.4363
32	33	65.4142	-141.6106	-184.7393
33	33	65.1693	-141.7235	-184.7393
33	34	67.2235	-150.8348	-267.2121
34	34	67.2237	-150.8347	-267.2121
34	35	69.2779	-159.9460	-354.8218
35	35	202.0663	32.4038	-354.8218
35	36	202.0663	32.4038	-338.6199
36	36	202.0663	32.4038	-338.6199

36	37	269.2180	32.4038	.0000

Combination Case C4 : 1.4*B2+1.6*B3;ULT DLMAX +LL
Member End Stresses

MBR	JOINT	Ax AXIAL (N/mm2)	By yAXIS BENDING (N/mm2)	Ax +ABS.By (N/mm2)	Ax -ABS.By (N/mm2)
1	1	2.0904	.0000	2.0904	-2.0904
1	2	1.1140	-27.0896	28.2036	-25.9756
2	2	1.1140	-27.0896	28.2036	-25.9756
2	3	1.1140	-28.3857	29.4997	-27.2718
3	3	.2599	-11.3947	11.6545	-11.1348
3	4	.2512	-9.1988	9.4500	-8.9476

Combination Case C4 : 1.4*B2+1.6*B3;ULT DLMAX +LL
Member End Stresses

MBR	JOINT	Ax AXIAL (N/mm2)	By yAXIS BENDING (N/mm2)	Ax +ABS.By (N/mm2)	Ax -ABS.By (N/mm2)
4	4	.2512	-9.1988	9.4500	-8.9476
4	5	.2425	-7.1680	7.4105	-6.9254
5	5	.2433	-7.1680	7.4113	-6.9246
5	6	.2346	-5.3031	5.5377	-5.0685
6	6	.2339	-5.3031	5.5370	-5.0693
6	7	.2252	-3.6022	3.8274	-3.3770
7	7	.2252	-3.6022	3.8274	-3.3770
7	8	.2165	-2.0663	2.2828	-1.8498
8	8	.2882	-5.1475	5.4357	-4.8593
8	9	.2767	.1022	.3789	.1745
9	9	.3640	.1022	.4662	.2618
9	10	.2754	8.5674	8.8428	-8.2920
10	10	.2157	6.7215	6.9372	-6.5058
10	11	.2089	8.1709	8.3798	-7.9619
11	11	.1952	8.1709	8.3661	-7.9756
11	12	.2049	8.6162	8.8211	-8.4113
12	12	.2201	10.9825	11.2026	-10.7624
12	13	.2998	-5.4621	5.7619	-5.1623
13	13	.2998	-5.4621	5.7619	-5.1623
13	14	.3636	-41.0379	41.4016	-40.6743
14	14	.3009	-16.4736	16.7745	-16.1726
14	15	.3134	-19.6520	19.9654	-19.3387
15	15	.3134	-19.6520	19.9654	-19.3387
15	16	.3258	-23.0672	23.3930	-22.7414
16	16	.3272	-23.0672	23.3944	-22.7400
16	17	.3398	-26.7180	27.0578	-26.3783
17	17	.3382	-26.7180	27.0563	-26.3798
17	18	.3507	-30.6066	30.9573	-30.2559
18	18	.3507	-30.6066	30.9573	-30.2559
18	19	.3631	-34.7319	35.0950	-34.3687
19	19	.3909	-34.7319	35.1228	-34.3409
19	20	.3785	-30.0772	30.4557	-29.6987
20	20	.3785	-30.0772	30.4557	-29.6987
20	21	.3661	-25.6592	26.0252	-25.2931
21	21	.3678	-25.6592	26.0270	-25.2914
21	22	.3553	-21.4789	21.8342	-21.1237
22	22	.3536	-21.4789	21.8326	-21.1253
22	23	.3412	-17.5344	17.8755	-17.1932
23	23	.3412	-17.5344	17.8755	-17.1932
23	24	.3288	-13.8265	14.1552	-13.4977
24	24	.3884	-34.4436	34.8320	-34.0552
24	25	.3245	8.8658	9.1903	-8.5412
25	25	.3246	8.8658	9.1903	-8.5412
25	26	.2449	34.9619	35.2067	-34.7170
26	26	.2171	27.4290	27.6461	-27.2120

27	27	.1968	28.8649	29.0617	-28.6681
27	28	.2035	29.2968	29.5004	-29.0933
28	28	.2173	37.3426	37.5599	-37.1253
28	29	.3058	10.1312	10.4371	-9.8254
29	29	.3055	10.1312	10.4367	-9.8257
29	30	.3170	2.5456	2.8626	-2.2286
30	30	.2490	1.0219	1.2708	-.7729
30	31	.2576	-1.1317	1.3893	-.8740
31	31	.2576	-1.1317	1.3893	-.8740
31	32	.2663	-3.4502	3.7165	-3.1839
32	32	.2679	-3.4502	3.7175	-3.1829
32	33	.2760	-5.9327	6.2087	-5.6567
33	33	.2750	-5.9327	6.2077	-5.6577
33	34	.2836	-8.5812	8.8648	-8.2976
34	34	.2836	-8.5812	8.8648	-8.2976
34	35	.2923	-11.3947	11.6870	-11.1024
35	35	1.3471	-28.3857	29.7329	-27.0386
35	36	1.3471	-27.0896	28.4367	-25.7425

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INDUSTRIL UNIT AT DARNDALE
WO SPAN PRECAST CONCRETE PORTAL

EN102: PLANE FRAME ANALYSIS V4.0 (c) ENCAD SYSTEMS LTD. 1991

Units: S.I. METRIC (Concrete) Data File : grain1

Combination Case C4 : 1.4*B2+1.6*B3;ULT DLMAX +LL
Member End Stresses

MBR	JOINT	Ax AXIAL (N/mm2)	By yAXIS BENDING (N/mm2)	Ax +ABS.By (N/mm2)	Ax -ABS.By (N/mm2)
36	36	1.3471	-27.0896	28.4367	-25.7425
36	37	1.7948	.0000	1.7948	-1.7948

Combination Case C4 : 1.4*B2+1.6*B3;ULT DLMAX +LL
Support Reactions

JOINT	X FORCE (kN)	Z FORCE (kN)	Y MOMENT (kNm)
1	32.4038	313.5656	.0000
19	.0000	555.9018	.0000
37	-32.4038	269.2180	.0000

Combination Case C4 : 1.4*B2+1.6*B3;ULT DLMAX +LL
Load Balance

ENTRY		X LINEAR (kN)	Z LINEAR (kN)
1	EXTERNAL LOADS SUM	.0000	-1138.6850
2	REACTIONS SUM	.0000	1138.6850

O'CONNOR SUTTON CRONIN

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JOB NO. 0
RUN NO. 1
AUTHOR D.G.
DATE 14JAN90

INDUSTRIL UNIT AT DARNDALE
TWO SPAN PRECAST CONCRETE PORTAL

EN102: PLANE FRAME ANALYSIS V4.0 (c) ENCAD SYSTEMS LTD. 1991
Units: S.I. METRIC (Concrete) Data File : grain1

Combination Case C5 : 1.0*B5+1.0*B4;SER DLMIN +UPLIFT FROM ROOF
Joint Displacements

JOINT	X LINEAR (mm)	Z LINEAR (mm)	Y ROTATION (rad)
1	.00000	.00000	.00232
2	17.31662	-.15619	.00032
3	17.43129	-.15698	.00013
4	17.44391	-.21064	.00008
5	17.45086	-.23919	.00004
6	17.45344	-.24840	.00001
7	17.45280	-.24347	-.00002
8	17.45001	-.22912	-.00003
9	17.44547	-.18591	-.00006
10	17.44986	-.19044	.00011
11	17.45996	-.33450	.00018
12	17.44604	-.55977	.00027
13	17.24442	-2.20288	.00040
14	17.23730	-2.28894	-.00059
15	17.31514	-1.94621	-.00067
16	17.40413	-1.55410	-.00077
17	17.50688	-1.10471	-.00088
18	17.62363	-.58965	-.00101
19	17.75722	.00000	-.00115
20	17.60492	.67869	-.00130
21	17.43613	1.43042	-.00142
22	17.25173	2.24474	-.00152
23	17.05692	3.11171	-.00161
24	16.85234	4.02189	-.00168
25	16.01901	10.72214	-.00216
26	15.19437	17.35366	-.00088
27	15.14887	18.06547	-.00054
28	15.17287	18.42416	-.00018
29	14.05858	9.46372	.00258
30	13.78436	7.25449	.00268
31	13.45141	5.77539	.00269
32	13.11874	4.29737	.00268
33	12.78519	2.82723	.00266
34	12.45775	1.37229	.00262
35	12.13553	-.05962	.00257
36	10.90012	-.05939	.00238
37	.00000	.00000	.00038

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O'CONNOR SUTTON CRONIN

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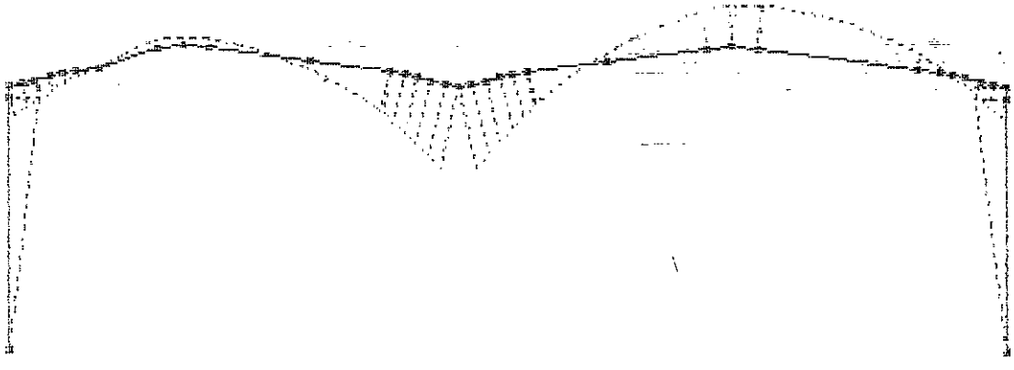
JOB NO. 0
RUN NO. 1
AUTHOR D.G.
DATE 14JAN90

INDUSTRIL UNIT AT DARNDALE
TWO SPAN PRECAST CONCRETE PORTAL

EN102: PLANE FRAME ANALYSIS V4.0 (c) ENCAD SYSTEMS LTD. 1991
Units: S.I. METRIC (Concrete) Data File : grain1



C5 : 1.0*B5+1.0*B4;SER DLMIN +UPLIFT FROM ROOF

My XZ 800kNm
Str XZ 20m

INDUSTRIL UNIT AT DARNDALE

O'CONNOR SUTTON CRONIN

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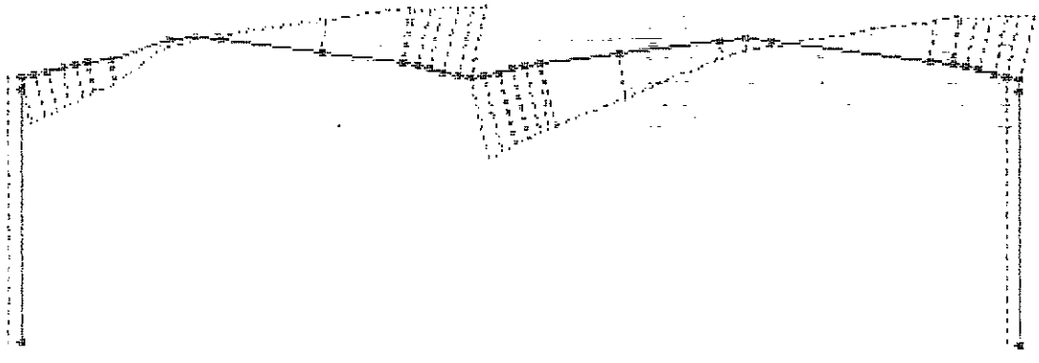
DATE	14JAN90

INDUSTRIL UNIT AT DARNDALE
TWO SPAN PRECAST CONCRETE PORTAL

EN102: PLANE FRAME ANALYSIS V4.0 (c) ENCAD SYSTEMS LTD. 1991
Units: S.I. METRIC (Concrete) Data File : grain1



C5 : 1.0*B5+1.0*B4;SER DLMIN +UPLIFT FROM ROOF

Sz XZ 30kN
XStrXZ 20m

INDUSTRIL UNIT AT DARNDALE

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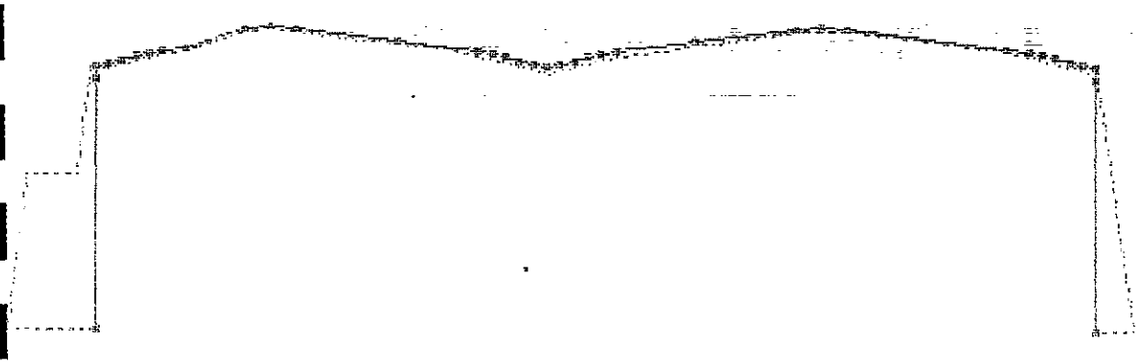
D'CONNOR SUTTON CRONIN

PAGE	71
JOB NO.	0
RUN NO.	1
AUTHOR	D.G.
DATE	14JAN90

INDUSTRIL UNIT AT DARNDALE
TWO SPAN PRECAST CONCRETE PORTAL

EN102: PLANE FRAME ANALYSIS V4.0
Units: S.I. METRIC (Concrete)

(c) ENCAD SYSTEMS LTD. 1991
Data File : grain1



C5 : 1.0*B5+1.0*B4;SER DLMIN +UPLIFT FROM ROOF

Nx XZ 200kN
XStrXZ 20m

INDUSTRIL UNIT AT DARNDALE

Combination Case C5 : 1.0*B5+1.0*B4;SER DLMIN +UPLIFT FROM ROOF
Member End Forces

MBR	JOINT	AXIAL Nx (kN)	SHEAR Sz (kN)	MOMENT My (kNm)
1	1	111.7164	3.4273	.0000
1	2	7.0964	3.4273	35.8148
2	2	7.0964	3.4273	35.8148
2	3	7.0964	3.4273	37.5285
3	3	-6.6212	-13.7849	-37.5285
3	4	-6.3732	-12.6849	30.0666

4	4	-6.3731	-12.6849	30.0666
4	5	-6.1251	-11.5849	23.2248
5	5	-6.1452	-11.5743	23.2248
5	6	-5.8952	-10.4743	17.0069
6	6	-5.8770	-10.4845	17.0069
6	7	-5.6290	-9.3845	11.4058
7	7	-5.6291	-9.3845	11.4058
7	8	-5.3811	-8.2845	6.4248
8	8	-4.5461	-8.7705	6.4248
8	9	-4.3381	-7.1005	-.2525
9	9	-5.6422	-6.1156	-.2525
9	10	-4.0382	-1.2856	-9.6694
10	10	-3.5817	-2.2653	-9.6694
10	11	-3.4517	-.2653	-10.9373
11	11	-3.3883	-.7099	-10.9373
11	12	-3.5183	1.2901	-10.6466
12	12	-3.5887	1.0789	-10.6466
12	13	-4.5947	9.1290	10.0568

Combination Case C5 :- 1.0*B5+1.0*B4;SER DLMIN +UPLIFT FROM ROOF

Member End Forces

MBR	JOINT	AXIAL Nx (kN)	SHEAR Sz (kN)	MOMENT My (kNm)
13	13	-4.5947	9.1290	10.0568
13	14	-5.4007	15.5790	-50.2079
14	14	-6.8905	14.9797	-50.2079
14	15	-7.1385	16.0797	58.9636
15	15	-7.1385	16.0797	58.9636
15	16	-7.3865	17.1797	-68.3396
16	16	-7.4162	17.1669	68.3396
16	17	-7.6662	18.2669	-78.3323
17	17	-7.6346	18.2802	78.3323
17	18	-7.8826	19.3802	-88.9489
18	18	-7.8826	19.3801	88.9489
18	19	-8.1306	20.4801	100.1856
19	19	-8.8645	-23.7351	100.1856
19	20	-8.6165	-22.6351	87.1137
20	20	-8.6164	-22.6351	-87.1137
20	21	-8.3684	-21.5351	74.6620
21	21	-8.4057	-21.5206	-74.6620
21	22	-8.1557	-20.4206	62.8341
22	22	-8.1204	-20.4347	-62.8341
22	23	-7.8724	-19.3347	51.6229
23	23	-7.8724	-19.3347	-51.6229
23	24	-7.6244	-18.2347	41.0321
24	24	-5.8144	-18.8899	-41.0321
24	25	-5.0084	-12.4399	-9.8801
25	25	-5.0085	-12.4398	-9.8801
25	26	-4.0025	-4.3898	-44.0133
26	26	-3.7348	-4.6198	-44.0133
26	27	-3.6048	-2.6198	-47.6407
27	27	-3.2353	-3.0644	-47.6407
27	28	-3.3653	-1.0644	-49.7094
28	28	-3.2961	-1.2625	-49.7094
28	29	-4.9001	11.5675	-16.3987
29	29	-4.8948	11.5698	-16.3987
29	30	-5.1028	13.2398	-5.9607
30	30	-6.3716	12.6780	-5.9607
30	31	-6.6196	13.7780	1.4973
31	31	-6.6196	13.7780	1.4973
31	32	-6.8676	14.8780	9.5755
32	32	-6.8933	14.8661	9.5755
32	33	-7.1433	15.9661	18.2707
33	33	-7.1157	15.9785	18.2707
33	34	-7.3637	17.0785	27.5895
34	34	-7.3637	17.0785	27.5895
34	35	-7.6117	18.1784	37.5285
35	35	2.5926	-3.4273	37.5285

36	37	49.5581	-3.4273	.0000	

Combination Case C5 : 1.0*B5+1.0*B4;SER DLMIN +UPLIFT FROM ROOF
Member End Stresses

MBR	JOINT	Ax AXIAL (N/mm2)	By yAXIS BENDING (N/mm2)	Ax +ABS.By (N/mm2)	Ax -ABS.By (N/mm2)
1	1	.7448	.0000	.7448	.7448
1	2	.0473	2.8652	2.9125	-2.8179
2	2	.0473	2.8652	2.9125	-2.8179
2	3	.0473	3.0023	3.0496	-2.9550
3	3	-.0279	1.2052	1.1772	-1.2331
3	4	-.0269	.9656	.9387	-.9924

Combination Case C5 : 1.0*B5+1.0*B4;SER DLMIN +UPLIFT FROM ROOF
Member End Stresses

MBR	JOINT	Ax AXIAL (N/mm2)	By yAXIS BENDING (N/mm2)	Ax +ABS.By (N/mm2)	Ax -ABS.By (N/mm2)
4	4	-.0269	.9656	.9387	-.9924
4	5	-.0258	.7458	.7200	-.7717
5	5	-.0259	.7458	.7199	-.7718
5	6	-.0249	.5462	.5213	-.5710
6	6	-.0248	.5462	.5214	-.5710
6	7	-.0238	.3663	.3425	-.3900
7	7	-.0238	.3663	.3425	-.3900
7	8	-.0227	.2063	.1836	-.2290
8	8	-.0303	.5140	.4837	-.5443
8	9	-.0289	-.0202	-.0087	-.0491
9	9	-.0376	-.0202	-.0174	-.0578
9	10	-.0269	-.7736	.7466	-.8005
10	10	-.0224	-.6069	.5845	-.6293
10	11	-.0216	-.6865	.6649	-.7080
11	11	-.0212	-.6865	.6653	-.7076
11	12	-.0220	-.6682	.6462	-.6902
12	12	-.0239	-.8517	.8278	-.8757
12	13	-.0306	.8045	.7739	-.8352
13	13	-.0306	.8045	.7739	-.8352
13	14	-.0360	4.0166	3.9806	-4.0526
14	14	-.0291	1.6124	1.5833	-1.6414
14	15	-.0301	1.8935	1.8634	-1.9237
15	15	-.0301	1.8935	1.8634	-1.9237
15	16	-.0312	2.1946	2.1635	-2.2258
16	16	-.0313	2.1946	2.1634	-2.2259
16	17	-.0323	2.5156	2.4832	-2.5479
17	17	-.0322	2.5156	2.4833	-2.5478
17	18	-.0333	2.8565	2.8232	-2.8897
18	18	-.0333	2.8565	2.8232	-2.8897
18	19	-.0343	3.2173	3.1830	-3.2516
19	19	-.0374	3.2173	3.1799	-3.2547
19	20	-.0364	2.7976	2.7612	-2.8339
20	20	-.0364	2.7976	2.7612	-2.8339
20	21	-.0353	2.3977	2.3624	-2.4330
21	21	-.0355	2.3977	2.3622	-2.4331
21	22	-.0344	2.0178	1.9834	-2.0523
22	22	-.0343	2.0178	1.9836	-2.0521
22	23	-.0332	1.6578	1.6246	-1.6910
23	23	-.0332	1.6578	1.6246	-1.6910
23	24	-.0322	1.3177	1.2855	-1.3499
24	24	-.0388	3.2826	3.2438	-3.3213
24	25	-.0334	-.7904	.7570	-.8238
25	25	-.0334	-.7904	.7570	-.8238
25	26	-.0267	-3.5211	3.4944	-3.5477
26	26	-.0233	-2.7624	2.7391	-2.7858

27	27	-.0202	-2.9901	2.9699	-3.0103
27	28	-.0210	-3.1199	3.0989	-3.1410
28	28	-.0220	-3.9768	3.9548	-3.9987
28	29	-.0327	-1.3119	1.2792	-1.3446
29	29	-.0326	-1.3119	1.2793	-1.3445
29	30	-.0340	-.4769	.4428	-.5109
30	30	-.0269	-.1914	.1645	-.2193
30	31	-.0279	.0481	.0202	-.0760
31	31	-.0279	.0481	.0202	-.0760
31	32	-.0290	.3075	.2785	-.3365
32	32	-.0291	.3075	.2784	-.3366
32	33	-.0301	.5867	.5566	-.6169
33	33	-.0300	.5867	.5567	-.6168
33	34	-.0311	.8860	.8549	-.9171
34	34	-.0311	.8860	.8549	-.9171
34	35	-.0321	1.2052	1.1731	-1.2373
35	35	.0173	3.0023	3.0196	-2.9850
35	36	.0106	2.8652	2.8758	-2.8546

Combination Case C5 : 1.0*B5+1.0*B4;SER DLMIN +UPLIFT FROM ROOF
Member End Stresses

MBR	JOINT	Ax AXIAL (N/mm2)	By yAXIS BENDING (N/mm2)	Ax +ABS.By (N/mm2)	Ax -ABS.By (N/mm2)
36	36	.0106	2.8652	2.8758	-2.8546
36	37	.3304	.0000	.3304	.3304

Combination Case C5 : 1.0*B5+1.0*B4;SER DLMIN +UPLIFT FROM ROOF
Support Reactions

JOINT	X FORCE (kN)	Z FORCE (kN)	Y MOMENT (kNm)
1	-3.4273	111.7164	.0000
19	.0000	-24.8704	.0000
37	3.4273	49.5581	.0000

Combination Case C5 : 1.0*B5+1.0*B4;SER DLMIN +UPLIFT FROM ROOF
Load Balance

ENTRY		X LINEAR (kN)	Z LINEAR (kN)
1	EXTERNAL LOADS SUM	.0000	-136.4040
2	REACTIONS SUM	.0000	136.4040

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INDUSTRIL UNIT AT DARNDALE
TWO SPAN PRECAST CONCRETE PORTAL

EN102: PLANE FRAME ANALYSIS V4.0 (c) ENCAD SYSTEMS LTD. 1991
Units: S.I. METRIC (Concrete) Data File : grain1

Combination Case C6 : 1.0*B5+1.4*B4;ULT DLMIN + UPLIFT FROM ROOF
Joint Displacements

JOINT	X LINEAR (mm)	Z LINEAR (mm)	Y ROTATION (rad)
1	.00000	.00000	.00325
2	24.25335	-.14237	.00046
3	24.41574	-.14250	.00018
4	24.43390	-.21979	.00011
5	24.44413	-.26200	.00006
6	24.44826	-.27716	.00001
7	24.44788	-.27259	-.00002
8	24.44451	-.25488	-.00004
9	24.43862	-.19819	-.00007
10	24.44892	-.21705	.00015
11	24.46342	-.42433	.00026
12	24.44356	-.74536	.00038
13	24.15863	-3.06705	.00056
14	24.14722	-3.19908	-.00082
15	24.25591	-2.72051	-.00094
16	24.38024	-2.17273	-.00107
17	24.52383	-1.54468	-.00123
18	24.68706	-.82459	-.00141
19	24.87388	.00000	-.00161
20	24.66084	.94935	-.00181
21	24.42470	2.00105	-.00199
22	24.16668	3.14047	-.00213
23	23.89407	4.35368	-.00226
24	23.60777	5.62747	-.00236
25	22.44086	15.00971	-.00303
26	21.28496	24.30499	-.00123
27	21.22103	25.30507	-.00076
28	21.25488	25.81089	-.00025
29	19.69744	13.28697	.00361
30	19.31373	10.19572	.00375
31	18.84783	8.12592	.00376
32	18.38228	6.05760	.00375
33	17.91550	4.00026	.00372
34	17.45728	1.96414	.00367
35	17.00633	-.03980	.00360
36	15.27730	-.04046	.00332
37	.00000	.00000	.00053

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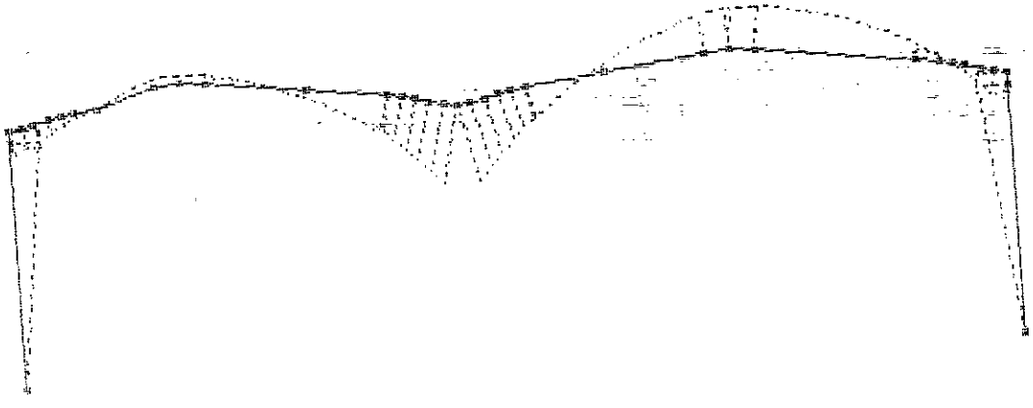
INDUSTRIL UNIT AT DARNDALE
TWO SPAN PRECAST CONCRETE PORTAL

EN102: PLANE FRAME ANALYSIS V4.0
Units: S.I. METRIC (Concrete)

(c) ENCAD SYSTEMS LTD. 1991
Data File : grain1



CB : 1.0*B5+1.4*B4;ULT DLMIN + UPLIFT FROM ROOF

My XZ 200kNm 20m
XStrXZ

INDUSTRIL UNIT AT DARNDALE

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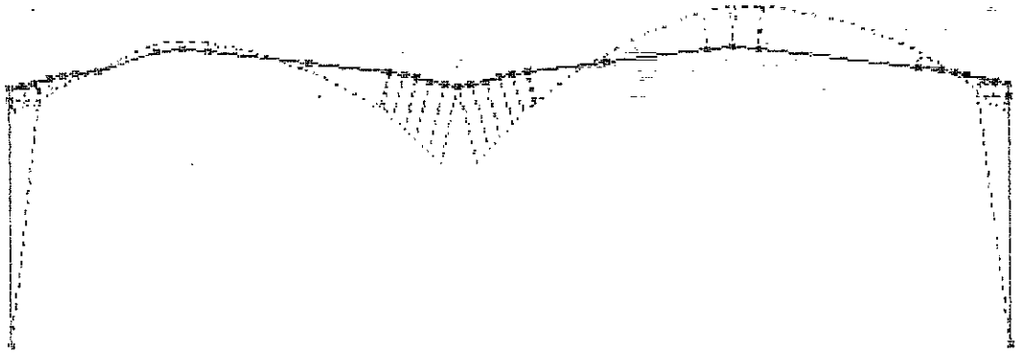
EN102: PLANE FRAME ANALYSIS V4.0 (c) ENCAD SYSTEMS LTD. 1991
Units: S.I. METRIC (Concrete) Data File : grain1



C6 : 1.0*B5+1.4*B4;ULT DLMIN + UPLIFT FROM ROOF

My XZ 200kNm

XStr XZ 20m

INDUSTRIL UNIT AT DARNDALE

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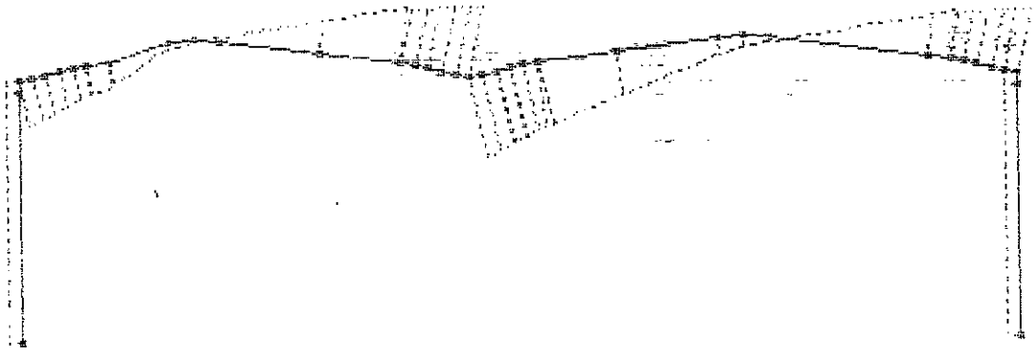
EN102: PLANE FRAME ANALYSIS V4.0 (c) ENCAD SYSTEMS LTD. 1991
Units: S.I. METRIC (Concrete) Data File : grain1



C6 : 1.0*B5+1.4*B4;ULT DLMIN + UPLIFT FROM ROOF

Sz XZ 40kN

XStrXZ 20m

INDUSTRIL UNIT AT DARNDALE

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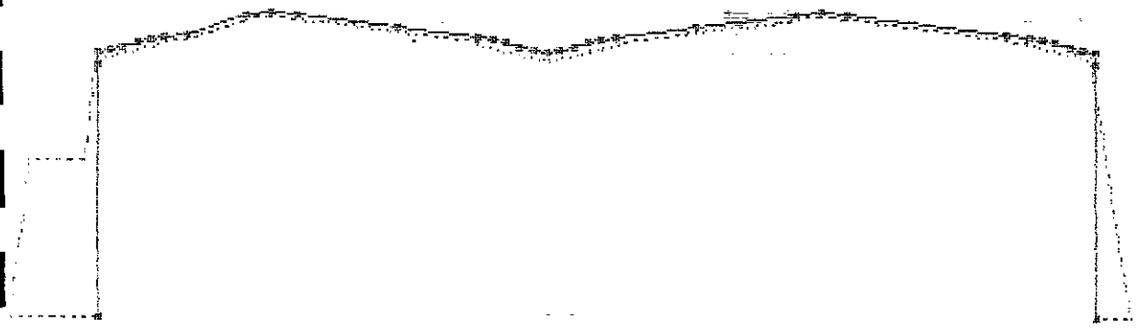
EN102: PLANE FRAME ANALYSIS V4.0 (c) ENCAD SYSTEMS LTD. 1991
Units: S.I. METRIC (Concrete) Data File : grain1



C6 : 1.0*B5+1.4*B4;ULT DLMIN + UPLIFT FROM ROOF

Nx XZ 200kN
XStrXZ 20m

INDUSTRIL UNIT AT DARNDALE

Combination Case C6 : 1.0*B5+1.4*B4;ULT DLMIN + UPLIFT FROM ROOF
Member End Forces

MBR	JOINT	AXIAL Nx (kN)	SHEAR Sz (kN)	MOMENT My (kNm)
1	1	105.7654	4.7916	.0000
1	2	1.1454	4.7916	50.0721
2	2	1.1454	4.7916	50.0721
2	3	1.1454	4.7916	52.4679
3	2	-9.2609	-19.2901	52.4679

4	4	-8.9137	-17.7501	42.0262
4	5	-8.5665	-16.2101	32.4527
5	5	-8.5945	-16.1952	32.4527
5	6	-8.2445	-14.6553	23.7525
6	6	-8.2192	-14.6695	23.7525
6	7	-7.8720	-13.1295	15.9159
7	7	-7.8720	-13.1295	15.9159
7	8	-7.5248	-11.5895	8.9475
8	8	-6.3567	-12.2691	8.9475
8	9	-6.0655	-9.9311	-.3926
9	9	-7.8896	-8.5540	-.3926
9	10	-5.6440	-1.7920	-13.5563
10	10	-5.0072	-3.1614	-13.5563
10	11	-4.8252	-.3614	-15.3214
11	11	-4.7378	-.9830	-15.3214
11	12	-4.9198	1.8170	-14.9034
12	12	-5.0190	1.5217	-14.9034
12	13	-6.4274	12.7918	14.1267

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INDUSTRIL UNIT AT DARNDALE
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EN102: PLANE FRAME ANALYSIS V4.0 (c) ENCAD SYSTEMS LTD. 1991
Units: S.I. METRIC (Concrete) Data File : grain1

Combination Case C6 : 1.0*B5+1.4*B4;ULT DLMIN + UPLIFT FROM ROOF

Member End Forces

MBR	JOINT	AXIAL Nx (kN)	SHEAR Sz (kN)	MOMENT My (kNm)
13	13	-6.4273	12.7918	14.1267
13	14	-7.5557	21.8217	70.3747
14	14	-9.6426	20.9833	70.3747
14	15	-9.9899	22.5233	82.6393
15	15	-9.9898	22.5233	82.6393
15	16	-10.3370	24.0633	95.7721
16	16	-10.3786	24.0453	95.7721
16	17	-10.7286	25.5853	109.7686
17	17	-10.6843	25.6039	109.7686
17	18	-11.0315	27.1439	124.6384
18	18	-11.0316	27.1439	124.6384
18	19	-11.3788	28.6839	140.3763
19	19	-12.4058	-33.2389	140.3763
19	20	-12.0586	-31.6989	122.0702
20	20	-12.0585	-31.6990	122.0702
20	21	-11.7113	-30.1590	104.6322
21	21	-11.7635	-30.1387	104.6322
21	22	-11.4135	-28.5987	88.0676
22	22	-11.3640	-28.6184	88.0676
22	23	-11.0168	-27.0784	72.3665
23	23	-11.0168	-27.0783	72.3665
23	24	-10.6696	-25.5383	57.5337
24	24	-8.1347	-26.4551	57.5337
24	25	-7.0063	-17.4251	-13.7735
25	25	-7.0065	-17.4251	-13.7735
25	26	-5.5981	-6.1551	-61.5977
26	26	-5.2227	-6.4766	-61.5977
26	27	-5.0407	-3.6766	-66.6851
27	27	-4.5223	-4.2982	-66.6851
27	28	-4.7043	-1.4982	-69.5895
28	28	-4.6070	-1.7752	-69.5895
28	29	-6.8526	16.1868	-23.0042
29	29	-6.8451	16.1900	-23.0042
29	30	-7.1363	18.5280	-8.3975
30	30	-8.9120	17.7423	-8.3975
30	31	-9.2592	19.2823	2.0399
31	31	-9.2591	19.2823	2.0399
31	32	-9.6063	20.8223	13.3454
32	32	-9.6423	20.8057	13.3454
32	33	-9.9923	22.3457	25.5148
33	33	-9.9537	22.3629	25.5148
33	34	-10.3009	23.9029	38.5572
34	34	-10.3009	23.9029	38.5572
34	35	-10.6481	25.4429	52.4679
35	35	-5.1618	-4.7916	52.4679
35	36	-6.5618	-4.7916	50.0721
36	36	-6.5618	-4.7916	50.0721

36	37	41.4037	-4.7916	.0000

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Combination Case C6 : 1.0*B5+1.4*B4;ULT DLMIN + UPLIFT FROM ROOF
Member End Stresses

MBR	JOINT	Ax AXIAL (N/mm2)	By yAXIS BENDING (N/mm2)	Ax +ABS.By (N/mm2)	Ax -ABS.By (N/mm2)
1	1	.7051	.0000	.7051	.7051
1	2	.0076	4.0058	4.0134	-3.9981
2	2	.0076	4.0058	4.0134	-3.9981
2	3	.0076	4.1974	4.2051	-4.1898
3	3	-.0391	1.6849	1.6459	-1.7240
3	4	-.0376	1.3496	1.3120	-1.3872

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INDUSTRIL UNIT AT DARNDALE
TWO SPAN PRECAST CONCRETE PORTAL

EN102: PLANE FRAME ANALYSIS V4.0 (c) ENCAD SYSTEMS LTD. 1991
Units: S.I. METRIC (Concrete) Data File : grain1

Combination Case C6 : 1.0*B5+1.4*B4;ULT DLMIN + UPLIFT FROM ROOF
Member End Stresses

MBR	JOINT	Ax AXIAL (N/mm2)	By yAXIS BENDING (N/mm2)	Ax +ABS.By (N/mm2)	Ax -ABS.By (N/mm2)
4	4	-.0376	1.3496	1.3120	-1.3872
4	5	-.0361	1.0422	1.0060	-1.0783
5	5	-.0363	1.0422	1.0059	-1.0784
5	6	-.0348	.7628	.7280	-.7976
6	6	-.0347	.7628	.7281	-.7975
6	7	-.0332	.5111	.4779	-.5443
7	7	-.0332	.5111	.4779	-.5443
7	8	-.0318	.2873	.2556	-.3191
8	8	-.0424	.7158	.6734	-.7582
8	9	-.0404	-.0314	-.0090	-.0718
9	9	-.0526	-.0314	-.0212	-.0840
9	10	-.0376	-1.0845	1.0469	-1.1221
10	10	-.0313	-.8508	.8195	-.8821
10	11	-.0302	-.9616	.9315	-.9918
11	11	-.0296	-.9616	.9320	-.9912
11	12	-.0307	-.9354	.9046	-.9661
12	12	-.0335	-1.1923	1.1588	-1.2257
12	13	-.0428	1.1301	1.0873	-1.1730
13	13	-.0428	1.1301	1.0873	-1.1730
13	14	-.0504	5.6300	5.5796	-5.6803
14	14	-.0407	2.2600	2.2193	-2.3007
14	15	-.0422	2.6539	2.6117	-2.6960
15	15	-.0422	2.6539	2.6117	-2.6960
15	16	-.0436	3.0756	3.0320	-3.1192
16	16	-.0438	3.0756	3.0318	-3.1194
16	17	-.0453	3.5251	3.4798	-3.5704
17	17	-.0451	3.5251	3.4800	-3.5702
17	18	-.0465	4.0026	3.9561	-4.0492
18	18	-.0465	4.0026	3.9561	-4.0492
18	19	-.0480	4.5080	4.4600	-4.5560
19	19	-.0523	4.5080	4.4557	-4.5604
19	20	-.0509	3.9201	3.8693	-3.9710
20	20	-.0509	3.9201	3.8693	-3.9710
20	21	-.0494	3.3601	3.3107	-3.4096
21	21	-.0496	3.3601	3.3105	-3.4098
21	22	-.0482	2.8282	2.7800	-2.8763
22	22	-.0479	2.8282	2.7802	-2.8761
22	23	-.0465	2.3240	2.2775	-2.3704
23	23	-.0465	2.3240	2.2775	-2.3704
23	24	-.0450	1.8476	1.8026	-1.8926
24	24	-.0542	4.6027	4.5485	-4.6569
24	25	-.0467	-1.1019	1.0552	-1.1486
25	25	-.0467	-1.1019	1.0552	-1.1486
25	26	-.0373	-4.9278	4.8905	-4.9651
26	26	-.0326	-3.8661	3.8334	-3.8987

27	27	-.0283	-4.1854	4.1571	-4.2136
27	28	-.0294	-4.3677	4.3383	-4.3971
28	28	-.0307	-5.5672	5.5364	-5.5979
28	29	-.0457	-1.8403	1.7947	-1.8860
29	29	-.0456	-1.8403	1.7947	-1.8860
29	30	-.0476	-.6718	.6242	-.7194
30	30	-.0376	-.2697	.2321	-.3073
30	31	-.0391	.0655	.0264	-.1046
31	31	-.0391	.0655	.0264	-.1046
31	32	-.0405	.4286	.3880	-.4691
32	32	-.0407	.4286	.3879	-.4693
32	33	-.0422	.8194	.7772	-.8615
33	33	-.0420	.8194	.7774	-.8614
33	34	-.0435	1.2382	1.1948	-1.2817
34	34	-.0435	1.2382	1.1948	-1.2817
34	35	-.0449	1.6849	1.6400	-1.7299
35	35	-.0344	4.1974	4.1630	-4.2318
35	36	-.0437	4.0058	3.9620	-4.0495

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N102: PLANE FRAME ANALYSIS V4.0 (c) ENCAD SYSTEMS LTD. 1991
Units: S.I. METRIC (Concrete) Data File : grain1

ombination Case C6 : 1.0*B5+1.4*B4;ULT DLMIN + UPLIFT FROM ROOF
ember End Stresses

MBR	JOINT	Ax AXIAL (N/mm2)	By yAXIS BENDING (N/mm2)	Ax +ABS.By (N/mm2)	Ax -ABS.By (N/mm2)
36	36	-.0437	4.0058	3.9620	-4.0495
36	37	.2760	.0000	.2760	.2760

ombination Case C6 : 1.0*B5+1.4*B4;ULT DLMIN + UPLIFT FROM ROOF
upport Reactions

JOINT	X FORCE (kN)	Z FORCE (kN)	Y MOMENT (kNm)
1	-4.7916	105.7654	.0000
19	.0000	-43.6377	.0000
37	4.7916	41.4037	.0000

ombination Case C6 : 1.0*B5+1.4*B4;ULT DLMIN + UPLIFT FROM ROOF
oad Balance

ENTRY		X LINEAR (kN)	Z LINEAR (kN)
1	EXTERNAL LOADS SUM	.0000	-103.5315
2	REACTIONS SUM	.0000	103.5315

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INDUSTRIL UNIT AT DARNDALE
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LN102: PLANE FRAME ANALYSIS V4.0 (c) ENCAD SYSTEMS LTD. 1991
Units: S.I. METRIC (Concrete) Data File : grain1

Envelope Case E1 : C1,C2
Joint Displacements

JOINT	X LINEAR (mm)	Z LINEAR (mm)	Y ROTATION (rad)
1	.00000 C1	.00000 C1	-.01858 C2
1	.00000 C1	.00000 C1	-.01237 C1
2	-135.85150 C2	-.54736 C2	-.00179 C2
2	-90.53577 C1	-.37715 C1	-.00123 C1
3	-136.34810 C2	-.56419 C2	-.00015 C2
3	-90.88541 C1	-.38851 C1	-.00014 C1
4	-136.33820 C2	-.62711 C2	.00015 C1
4	-90.88393 C1	-.40799 C1	.00029 C2
5	-136.28020 C2	-.90316 C2	.00038 C1
5	-90.85048 C1	-.56875 C1	.00063 C2
6	-136.18390 C2	-1.34526 C2	.00055 C1
6	-90.79166 C1	-.83952 C1	.00090 C2
7	-136.06040 C2	-1.91009 C2	.00068 C1
7	-90.71491 C1	-1.19152 C1	.00109 C2
8	-135.91810 C2	-2.55804 C2	.00076 C1
8	-90.62567 C1	-1.59847 C1	.00121 C2
9	-135.77850 C2	-3.73664 C2	.00092 C1
9	-90.53742 C1	-2.34484 C1	.00145 C2
10	-135.05870 C2	-5.98089 C2	-.00009 C1

10	-90.09367 C1	-3.73197 C1	-.00008 C2
11	-135.09460 C2	-5.52662 C2	-.00088 C2
11	-90.11977 C1	-3.39505 C1	-.00062 C1
12	-135.01380 C2	-4.19176 C2	-.00180 C2
12	-90.06432 C1	-2.48134 C1	-.00122 C1
13	-133.09910 C2	7.80893 C1	-.00456 C2
13	-88.79927 C1	11.38158 C2	-.00298 C1

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Envelope Case E1 : C1,C2

Joint Displacements

JOINT	X LINEAR (mm)	Z LINEAR (mm)	Y ROTATION (rad)
14	-132.47370 C2	11.13971 C1	.00254 C1
14	-88.40448 C1	16.64540 C2	.00376 C2
15	-132.98420 C2	9.62952 C1	.00304 C1
15	-88.74847 C1	14.40471 C2	.00453 C2
16	-133.59870 C2	7.81557 C1	.00365 C1
16	-89.16109 C1	11.70378 C2	.00544 C2
17	-134.34140 C2	5.64456 C1	.00435 C1
17	-89.65831 C1	8.46142 C2	.00651 C2
18	-135.22000 C2	3.05955 C1	.00516 C1
18	-90.24505 C1	4.59091 C2	.00773 C2
19	-136.26120 C2	.00000 C1	.00608 C1
19	-90.93893 C1	.00000 C1	.00913 C2
20	-135.03680 C2	-5.46030 C2	.00700 C1
20	-90.12448 C1	-3.63192 C1	.01053 C2
21	-133.65260 C2	-11.62879 C2	.00778 C1
21	-89.20476 C1	-7.73025 C1	.01172 C2
22	-132.11970 C2	-18.40093 C2	.00845 C1
22	-88.18707 C1	-12.22625 C1	.01273 C2

23	-87.10240 C1	-17.05490 C1	.01357 C2
24	-128.75760 C2	-33.36595 C2	.00944 C1
	-85.95644 C1	-22.15470 C1	.01424 C2
25	-121.58570 C2	-91.03725 C2	.01230 C1
	-81.20345 C1	-60.37468 C1	.01855 C2
26	-114.73920 C2	-146.09930 C2	.00444 C1
	-76.65531 C1	-96.95195 C1	.00664 C2

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DATE 14JAN90

INDUSTRIL UNIT AT DARNDALE
TWO SPAN PRECAST CONCRETE PORTAL

N102: PLANE FRAME ANALYSIS V4.0 (c) ENCAD SYSTEMS LTD. 1991
Units: S.I. METRIC (Concrete) Data File : grain1

Envelope Case E1 : C1,C2
Joint Displacements

JOINT	X LINEAR (mm)	Z LINEAR (mm)	Y ROTATION (rad)
27	-114.40930 C2	-151.27170 C2	.00247 C1
	-76.43411 C1	-100.41950 C1	.00366 C2
28	-114.55400 C2	-153.40590 C2	.00043 C1
	-76.53260 C1	-101.87380 C1	.00060 C2
29	-105.02990 C2	-76.82069 C2	-.02091 C2
	-70.22149 C1	-51.12450 C1	-.01391 C1
30	-102.81870 C2	-59.00449 C2	-.02153 C2
	-68.75076 C1	-39.27460 C1	-.01432 C1
31	-100.14870 C2	-47.14231 C2	-.02152 C2
	-66.97420 C1	-31.38200 C1	-.01432 C1
32	-97.48489 C2	-35.30735 C2	-.02142 C2
	-65.20165 C1	-23.50671 C1	-.01425 C1
33	-94.81812 C2	-23.55311 C2	-.02122 C2
	-63.42694 C1	-15.68437 C1	-.01412 C1
34	-92.20399 C2	-11.93704 C2	-.02091 C2
	-61.68710 C1	-7.95326 C1	-.01392 C1
35	-89.63490 C2	-.52013 C2	-.02049 C2
	-59.97708 C1	-.35403 C1	-.01364 C1
36	-79.81261 C2	-.49994 C2	-.01884 C2

36	-53.43801 C1	-.34041 C1	-.01255 C1
37	.00000 C1	.00000 C1	-.00206 C2
37	.00000 C1	.00000 C1	-.00141 C1

O'CONNOR SUTTON CRONIN

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AUTHOR D.G.
DATE 14JAN90

INDUSTRIL UNIT AT DARNDALE
TWO SPAN PRECAST CONCRETE PORTAL

EN102: PLANE FRAME ANALYSIS V4.0
Units: S.I. METRIC (Concrete)

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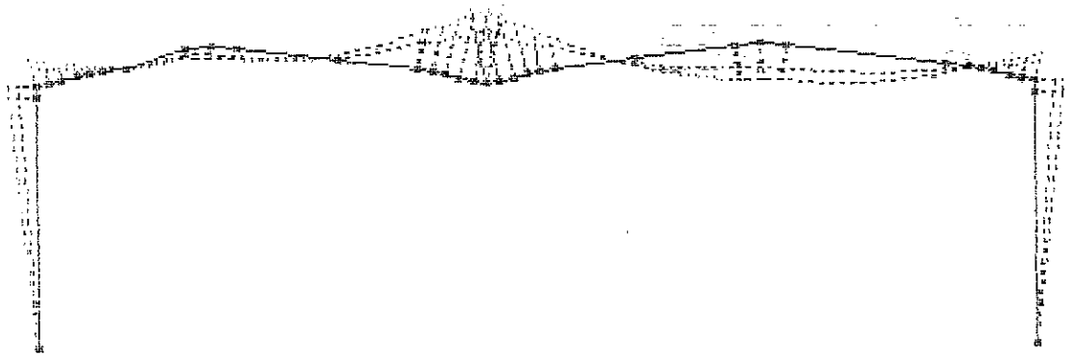
Data File : grain1



E1 : C1,C8

My XZ 1000kNm

StrXZ 20m

INDUSTRIL UNIT AT DARNDALE

O'CONNOR SUTTON CRONIN	PAGE	86
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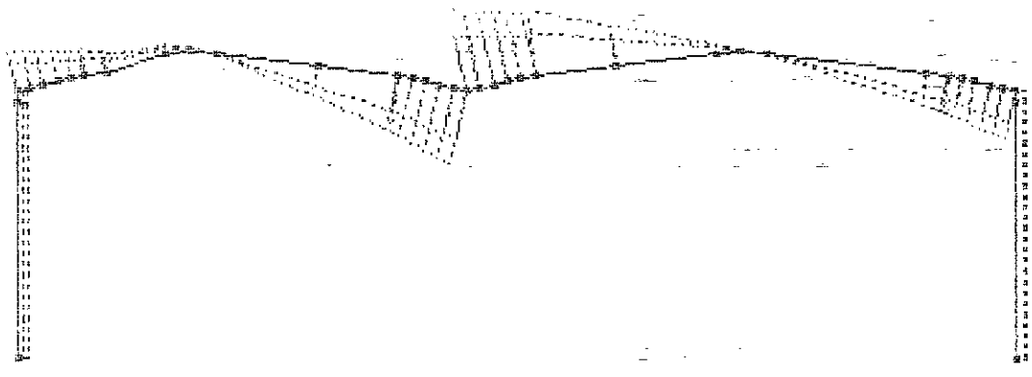
INDUSTRIL UNIT AT DARNDALE	AUTHOR	D.G.
TWO SPAN PRECAST CONCRETE PORTAL	DATE	14JAN90

EN102: PLANE FRAME ANALYSIS V4.0 (c) ENCAD SYSTEMS LTD. 1991
Units: S.I. METRIC (Concrete) Data File : grain1



E1 : C1,C8

Sz XZ 300kN

XStrXZ 20m

INDUSTRIL UNIT AT DARNDALE

O'CONNOR SUTTON CRONIN

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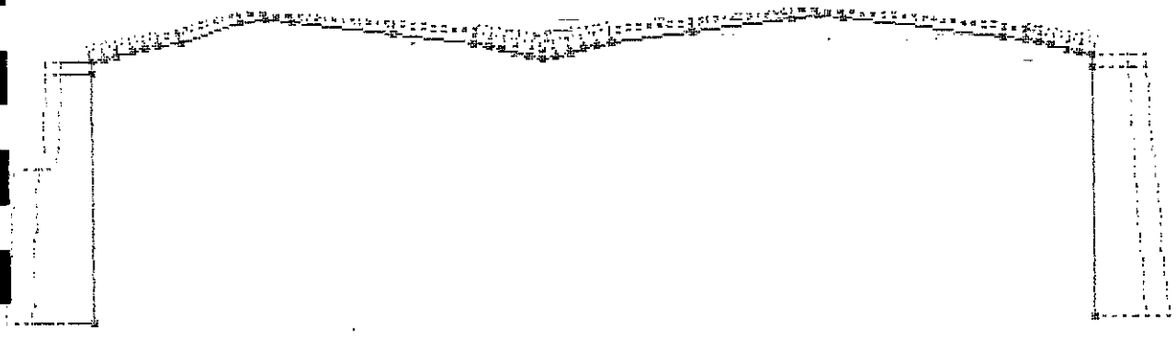
JOB NO. 0
RUN NO. 1
AUTHOR D.G.
DATE 14JAN90

INDUSTRIL UNIT AT DARNDALE
TWO SPAN PRECAST CONCRETE PORTAL

EN102: PLANE FRAME ANALYSIS V4.0 (c) ENCAD SYSTEMS LTD. 1991
Units: S.I. METRIC (Concrete) Data File : grain1



E1 : C1,C2

Nx XZ 300kN

XStrXZ 20m

INDUSTRIL UNIT AT DARNDALE

Envelope Case E1 : C1,C2
Member End Forces

MBR	JOINT	AXIAL Nx (kN)	SHEAR Sz (kN)	MOMENT My (kNm)
1	1	206.8652 C1	-28.8223 C2	.0000 C2
1	1	297.9441 C2	-19.1183 C1	.0000 C1
1	2	102.2467	-28.8223	-301.1333

1	2	151.4761 C2	-19.1183 C1	-199.7865 C1
2	2	102.2452 C1	-28.8223 C2	-301.1933 C2
2	2	151.4761 C2	-19.1183 C1	-199.7865 C1
2	3	102.2452 C1	-28.8223 C2	-315.6045 C2
2	3	151.4761 C2	-19.1183 C1	-209.3457 C1

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Envelope Case E1 : C1,C2
Member End Forces

MBR	JOINT	AXIAL Nx (kN)	SHEAR Sz (kN)	MOMENT My (kNm)
3	3	36.2989 C1	74.0756 C1	-315.6045 C2
3	3	54.6575 C2	111.3822 C2	-209.3457 C1
3	4	35.0974 C1	68.7461 C1	-255.0495 C2
3	4	52.8637 C2	103.4259 C2	-169.0839 C1
4	4	35.0973 C1	68.7461 C1	-255.0495 C2
4	4	52.8636 C2	103.4260 C2	-169.0839 C1
4	5	33.8957 C1	63.4166 C1	-198.9803 C2
4	5	51.0698 C2	95.4697 C2	-131.8269 C1
5	5	34.0054 C1	63.3579 C1	-198.9803 C2
5	5	51.2349 C2	95.3812 C2	-131.8269 C1
5	6	32.7941 C1	58.0284 C1	-147.4267 C2
5	6	49.4266 C2	87.4249 C2	-97.5944 C1
6	6	32.6937 C1	58.0850 C1	-147.4267 C2
6	6	49.2753 C2	87.5103 C2	-97.5944 C1
6	7	31.4921 C1	52.7555 C1	-100.3308 C2
6	7	47.4815 C2	79.5540 C2	-66.3482 C1
7	7	31.4922 C1	52.7555 C1	-100.3308 C2
7	7	47.4816 C2	79.5539 C2	-66.3482 C1
7	8	30.2907 C1	47.4260 C1	-57.7208 C2
7	8	45.6879 C2	71.5976 C2	-38.1068 C1
8	8	25.5133 C1	50.1580 C1	-57.7208 C2

8	8	38.4758 C2	75.7180 C2	-38.1068 C1
8	9	24.5055 C1	42.0668 C1	.6946 C1
8	9	36.9713 C2	63.6389 C2	.9102 C2
9	9	32.2550 C1	36.4658 C1	.6946 C1
9	9	48.6967 C2	55.1853 C2	.9102 C2
9	10	24.4836 C1	13.0644 C1	63.7140 C1
9	10	37.0949 C2	20.2499 C2	96.8898 C2

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Envelope Case Ei : C1,C2
Member End Forces

MBR	JOINT	AXIAL Nx (kN)	SHEAR Sz (kN)	MOMENT My (kNm)
10	10	20.3828 C1	18.8326 C1	63.7140 C1
10	10	30.7665 C2	28.9744 C2	96.8898 C2
10	11	19.7529 C1	9.1426 C1	77.7312 C1
10	11	29.8262 C2	14.5084 C2	118.6771 C2
11	11	18.4032 C1	11.6227 C1	77.7312 C1
11	11	27.6971 C2	18.2474 C2	118.6771 C2
11	12	19.3255 C1	-3.4186 C2	82.2685 C1
11	12	29.1054 C2	-2.5673 C1	126.1071 C2
12	12	19.4439 C1	-1.6843 C2	82.2685 C1
12	12	29.2570 C2	-1.4152 C1	126.1071 C2
12	13	26.5815 C1	-88.8905 C2	-57.5935 C2
12	13	40.1550 C2	-58.5303 C1	-39.3109 C1
13	13	26.5811 C1	-88.8907 C2	-57.5935 C2
13	13	40.1545 C2	-58.5304 C1	-39.3109 C1
13	14	32.2997 C1	-158.7630 C2	-460.0379 C2
13	14	48.8859 C2	-104.2928 C1	-303.9034 C1
14	14	42.2917 C1	-153.2547 C2	-460.0379 C2
14	14	64.0979 C2	-100.6562 C1	-303.9034 C1
14	15	44.0513 C1	-165.1710 C2	-549.8029 C2
14	15	66.7845 C2	-108.4607 C1	-362.8540 C1
15	15	44.0511	-165.1711	-549.8029

15	15	66.7842 C2	-108.4608 C1	-362.8540 C1
15	16	45.8106 C1	-177.0874 C2	-646.2864 C2
15	16	69.4708 C2	-116.2653 C1	-426.2048 C1
16	16	46.0118 C1	-176.9669 C2	-646.2864 C2
16	16	69.7771 C2	-116.1859 C1	-426.2048 C1
16	17	47.7855 C1	-188.8832 C2	-749.4607 C2
16	17	72.4854 C2	-123.9903 C1	-493.9375 C1

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Envelope Case E1 : C1,C2
Member End Forces

MBR	JOINT	AXIAL Nx (kN)	SHEAR Sz (kN)	MOMENT My (kNm)
17	17	47.5708 C1	-189.0084 C2	-749.4607 C2
17	17	72.1583 C2	-124.0729 C1	-493.9375 C1
17	18	49.3304 C1	-200.9247 C2	-859.3840 C2
17	18	74.8449 C2	-131.8774 C1	-566.0907 C1
18	18	49.3307 C1	-200.9245 C2	-859.3840 C2
18	18	74.8454 C2	-131.8773 C1	-566.0907 C1
18	19	51.0903 C1	-212.8408 C2	-976.0253 C2
18	19	77.5320 C2	-139.6818 C1	-642.6437 C1
19	19	54.9672 C1	156.8776 C1	-976.0253 C2
19	19	83.3549 C2	238.6681 C2	-642.6437 C1
19	20	53.2076 C1	149.0731 C1	-844.8224 C2
19	20	80.6683 C2	226.7518 C2	-556.3956 C1
20	20	53.2073 C1	149.0733 C1	-844.8224 C2
20	20	80.6678 C2	226.7520 C2	-556.3956 C1
20	21	51.4477 C1	141.2687 C1	-720.3375 C2
20	21	77.9812 C2	214.8357 C2	-474.5473 C1
21	21	51.6922 C1	141.1795 C1	-720.3375 C2
21	21	78.3530 C2	214.7004 C2	-474.5473 C1
21	22	49.9184 C1	133.3750 C1	-602.6017 C2
21	22	75.6447 C2	202.7841 C2	-397.1195 C1
22	22	49.6875	133.4612	-602.6017

22	22	75.2936 C2	202.9148 C2	-397.1195 C1
22	23	47.9279 C1	125.6567 C1	-491.5563 C2
22	23	72.6070 C2	190.9984 C2	-324.0734 C1
23	23	47.9282 C1	125.6566 C1	-491.5563 C2
23	23	72.6075 C2	190.9983 C2	-324.0734 C1
23	24	46.1686 C1	117.8521 C1	-387.2299 C2
23	24	69.9209 C2	179.0820 C2	-255.4278 C1

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Envelope Case E1 : C1,C2
Member End Forces

MBR	JOINT	AXIAL Nx (kN)	SHEAR Sz (kN)	MOMENT My (kNm)
24	24	34.4853 C1	121.7843 C1	-387.2299 C2
24	24	52.1686 C2	185.0344 C2	-255.4278 C1
24	25	28.7668 C1	-76.0215 C1	66.0148 C1
24	25	43.4372 C2	115.1615 C2	100.6007 C2
25	25	28.7673 C1	76.0213 C1	66.0148 C1
25	25	43.4381 C2	115.1612 C2	100.6007 C2
25	26	21.6298 C1	18.9066 C1	258.5432 C1
25	26	32.5401 C2	27.9555 C2	390.8635 C2
26	26	20.4689 C1	20.1576 C1	258.5432 C1
26	26	30.8226 C2	29.8385 C2	390.8635 C2
26	27	19.5466 C1	5.9676 C1	271.6334 C1
26	27	29.4144 C2	8.1725 C2	409.9091 C2
27	27	18.6096 C1	8.4478 C1	271.6334 C1
27	27	28.1089 C2	11.9115 C2	409.9091 C2
27	28	19.2394 C1	-2.5545 C2	275.2437 C1
27	28	29.0492 C2	-1.2422 C1	414.5974 C2
28	28	19.2792 C1	-.8236 C2	275.2437 C1
28	28	29.1497 C2	-.0966 C1	414.5974 C2
28	29	27.0506 C1	-93.6230 C2	73.6843 C1
28	29	40.7514 C2	-62.2580 C1	109.3017 C2
29	29	27.0319	-93.6418	73.6843

29	29	40.7082 C2	-62.2705 C1	109.3017 C2
29	30	28.0297 C1	-105.7209 C2	17.8826 C1
29	30	42.2127 C2	-70.3616 C1	25.4247 C2
30	30	34.7685 C1	-101.0920 C2	17.8826 C1
30	30	52.3376 C2	-67.2872 C1	25.4247 C2
30	31	35.9701 C1	-109.0483 C2	-33.8143 C2
30	31	54.1314 C2	-72.6167 C1	-21.5566 C1

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Envelope Case E1 : C1,C2
Member End Forces

MBR	JOINT	AXIAL Nx (kN)	SHEAR Sz (kN)	MOMENT My (kNm)
31	31	35.9699 C1	-109.0484 C2	-33.8143 C2
31	31	54.1312 C2	-72.6168 C1	-21.5566 C1
31	32	37.1715 C1	-117.0047 C2	-97.5391 C2
31	32	55.9250 C2	-77.9463 C1	-64.0007 C1
32	32	37.3062 C1	-116.9078 C2	-97.5391 C2
32	32	56.1271 C2	-77.8819 C1	-64.0007 C1
32	33	38.5174 C1	-124.8642 C2	-165.7223 C2
32	33	57.9354 C2	-83.2114 C1	-109.4313 C1
33	33	38.3735 C1	-124.9641 C2	-165.7223 C2
33	33	57.7194 C2	-83.2779 C1	-109.4313 C1
33	34	39.5751 C1	-132.9204 C2	-238.4205 C2
33	34	59.5132 C2	-88.6074 C1	-157.8861 C1
34	34	39.5752 C1	-132.9203 C2	-238.4205 C2
34	34	59.5134 C2	-88.6073 C1	-157.8861 C1
34	35	40.7768 C1	-140.8766 C2	-315.6045 C2
34	35	61.3072 C2	-93.9368 C1	-209.3457 C1
35	35	122.6050 C1	19.1183 C1	-315.6045 C2
35	35	181.7108 C2	28.8223 C2	-209.3457 C1
35	36	122.6050 C1	19.1183 C1	-301.1933 C2
35	36	181.7108 C2	28.8223 C2	-199.7865 C1
36	36	122.6050 C1	19.1183 C1	-301.1933 C2

35	36	181.7108 C2	28.8223 C2	-199.7865 C1
36	37	170.5705 C1	19.1183 C1	.0000 C1
36	37	248.8625 C2	28.8223 C2	.0000 C2

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Envelope Case E1 : C1,C2
Member End Stresses

MBR	JOINT	Ax AXIAL (N/mm2)	By yAXIS BENDING (N/mm2)	Ax +ABS.By (N/mm2)	Ax -ABS.By (N/mm2)
1	1	1.3791 C1	.0000 C2	1.3791 C1	1.3791 C1
1	1	1.9863 C2	.0000 C1	1.9863 C2	1.9863 C2
1	2	.6816 C1	-24.0955 C2	16.6646 C1	-23.0856 C2
1	2	1.0098 C2	-15.9829 C1	25.1053 C2	-15.3013 C1
2	2	.6816 C1	-24.0955 C2	16.6646 C1	-23.0856 C2
2	2	1.0098 C2	-15.9829 C1	25.1053 C2	-15.3013 C1
2	3	.6816 C1	-25.2484 C2	17.4293 C1	-24.2385 C2
2	3	1.0098 C2	-16.7477 C1	26.2582 C2	-16.0660 C1
3	3	.1532 C1	-10.1353 C2	6.8760 C1	-9.9046 C2
3	3	.2306 C2	-6.7229 C1	10.3659 C2	-6.5697 C1
3	4	.1481 C1	-8.1906 C2	5.5780 C1	-7.9676 C2
3	4	.2231 C2	-5.4299 C1	8.4137 C2	-5.2818 C1
4	4	.1481 C1	-8.1906 C2	5.5780 C1	-7.9676 C2
4	4	.2231 C2	-5.4299 C1	8.4137 C2	-5.2818 C1
4	5	.1430 C1	-6.3900 C2	4.3765 C1	-6.1745 C2
4	5	.2155 C2	-4.2335 C1	6.6055 C2	-4.0904 C1
5	5	.1435 C1	-6.3900 C2	4.3769 C1	-6.1738 C2
5	5	.2162 C2	-4.2335 C1	6.6062 C2	-4.0900 C1
5	6	.1384 C1	-4.7344 C2	3.2725 C1	-4.5259 C2
5	6	.2086 C2	-3.1341 C1	4.9430 C2	-2.9958 C1
6	6	.1379	-4.7344	3.2721	-4.5265

		C1	C2	C1	C2
6	6	.2079	-3.1341	4.9423	-2.9962
		C2	C1	C2	C1
6	7	.1329	-3.2220	2.2636	-3.0217
		C1	C2	C1	C2
6	7	.2003	-2.1307	3.4223	-1.9978
		C2	C1	C2	C1
7	7	.1329	-3.2220	2.2636	-3.0217
		C1	C2	C1	C2
7	7	.2003	-2.1307	3.4224	-1.9978
		C2	C1	C2	C1
7	8	.1278	-1.8536	1.3516	-1.6609
		C1	C2	C1	C2
7	8	.1928	-1.2238	2.0464	-1.0959
		C2	C1	C2	C1

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Envelope Case E1 : C1,C2
Member End Stresses

MBR	JOINT	Ax AXIAL (N/mm2)	By yAXIS BENDING (N/mm2)	Ax +ABS.By (N/mm2)	Ax -ABS.By (N/mm2)
8	8	.1701	-4.6177	3.2186	-4.3612
		C1	C2	C1	C2
8	8	.2565	-3.0485	4.8742	-2.8785
		C2	C1	C2	C1
8	9	.1634	.0556	.2189	.1078
		C1	C1	C1	C1
8	9	.2465	.0728	.3193	.1737
		C2	C2	C2	C2
9	9	.2150	.0556	.2706	.1595
		C1	C1	C1	C1
9	9	.3246	.0728	.3975	.2518
		C2	C2	C2	C2
9	10	.1632	5.0971	5.2603	-7.5039
		C1	C1	C1	C2
9	10	.2473	7.7512	7.9985	-4.9339
		C2	C2	C2	C1
10	10	.1274	3.9989	4.1263	-5.8888
		C1	C1	C1	C2
10	10	.1923	6.0811	6.2734	-3.8715
		C2	C2	C2	C1
10	11	.1235	4.8787	5.0021	-7.2622
		C1	C1	C1	C2
10	11	.1864	7.4486	7.6350	-4.7552
		C2	C2	C2	C1
11	11	.1150	4.8787	4.9937	-7.2755
		C1	C1	C1	C2
11	11	.1731	7.4486	7.6217	-4.7636
		C2	C2	C2	C1
11	12	.1208	5.1634	5.2842	-7.7330
		C1	C1	C1	C2
11	12	.1819	7.9149	8.0968	-5.0427
		C2	C2	C2	C1
12	12	.1296	6.5815	6.7111	-9.8935
		C1	C1	C1	C2
12	12	.1950	10.0886	10.2836	-6.4519
		C2	C2	C2	C1
12	13	.1772	-4.6075	3.3221	-4.3398
		C1	C2	C1	C2
12	13	.2677	-3.1449	4.8752	-2.9677
		C2	C1	C2	C1
13	13	.1772	-4.6075	3.3221	-4.3398

13	13	C1 .2677 C2	C2 -3.1449 C1	C1 4.8752 C2	C2 -2.9677 C1
13	14	C1 .2153 C2	C2 -36.8030 C1	C1 24.5276 C1	C2 -36.4771 C2
13	14	C1 .3259 C2	C2 -24.3123 C1	C1 37.1289 C2	C2 -24.0969 C1
14	14	C1 .1784 C1	C2 -14.7736 C2	C1 9.9379 C1	C2 -14.5031 C2
14	14	C2 .2705 C2	C1 -9.7595 C1	C2 15.0440 C2	C1 -9.5811 C1
14	15	C1 .1859 C1	C2 -17.6563 C2	C1 11.8385 C1	C2 -17.3745 C2
14	15	C2 .2818 C2	C1 -11.6526 C1	C2 17.9381 C2	C1 -11.4668 C1

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O'CONNOR SUTTON CRONIN

PAGE 95
JOB NO. 0
RUN NO. 1
AUTHOR D.G.
DATE 14JAN90

INDUSTRIL UNIT AT DARNDALE
TWO SPAN PRECAST CONCRETE PORTAL

EN102: PLANE FRAME ANALYSIS V4.0 (c) ENCAD SYSTEMS LTD. 1991
Units: S.I. METRIC (Concrete) Data File : grain1

Envelope Case E1 : C1,C2
Member End Stresses

MBR	JOINT	Ax AXIAL (N/mm2)	By yAXIS BENDING (N/mm2)	Ax +ABS.By (N/mm2)	Ax -ABS.By (N/mm2)
15	15	C1 .1859 C2	-17.6563 C2	11.8385 C1	-17.3745 C2
15	15	C2 .2818 C2	-11.6526 C1	17.9381 C2	-11.4668 C1
15	16	C1 .1933 C1	-20.7547 C2	13.8804 C1	-20.4616 C2
15	16	C2 .2931 C2	-13.6871 C1	21.0479 C2	-13.4938 C1
16	16	C1 .1941 C1	-20.7547 C2	13.8812 C1	-20.4603 C2
16	16	C2 .2944 C2	-13.6871 C1	21.0491 C2	-13.4929 C1
16	17	C1 .2016 C1	-24.0680 C2	16.0638 C1	-23.7622 C2
16	17	C2 .3058 C2	-15.8622 C1	24.3739 C2	-15.6606 C1
17	17	C1 .2007 C1	-24.0680 C2	16.0629 C1	-23.7636 C2
17	17	C2 .3045 C2	-15.8622 C1	24.3725 C2	-15.6615 C1
17	18	C1 .2081 C1	-27.5981 C2	18.3875 C1	-27.2823 C2
17	18	C2 .3158 C2	-18.1793 C1	27.9139 C2	-17.9712 C1
18	18	C1 .2081 C1	-27.5981 C2	18.3875 C1	-27.2823 C2
18	18	C2 .3158 C2	-18.1793 C1	27.9139 C2	-17.9712 C1
18	19	C1 .2156 C1	-31.3439 C2	20.8533 C1	-31.0168 C2
18	19	C2 .3271 C2	-20.6377 C1	31.6710 C2	-20.4222 C1
19	19	C1 .2319 C1	-31.3439 C2	20.8697 C1	-30.9922 C2
19	19	C2 .3517 C2	-20.6377 C1	31.6956 C2	-20.4058 C1
19	20	C1 .2245 C1	-27.1305 C2	18.0925 C1	-26.7901 C2
19	20	C2 .3404 C2	-17.8680 C1	27.4708 C2	-17.6435 C1
20	20	.2245	-27.1305	18.0925	-26.7901

		C1	C2	C1	C2
20	20	.3404	-17.8680	27.4708	-17.6435
		C2	C1	C2	C1
20	21	.2171	-23.1328	15.4566	-22.8038
		C1	C2	C1	C2
20	21	.3290	-15.2395	23.4618	-15.0224
		C2	C1	C2	C1
21	21	.2181	-23.1328	15.4576	-22.8022
		C1	C2	C1	C2
21	21	.3306	-15.2395	23.4634	-15.0214
		C2	C1	C2	C1
21	22	.2106	-19.3518	12.9637	-19.0327
		C1	C2	C1	C2
21	22	.3192	-12.7530	19.6710	-12.5424
		C2	C1	C2	C1

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O'CONNOR SUTTON CRONIN

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JOB NO. 0
RUN NO. 1
AUTHOR D.G.
DATE 14JAN90

INDUSTRIL UNIT AT DARNDALE
TWO SPAN PRECAST CONCRETE PORTAL

EN102: PLANE FRAME ANALYSIS V4.0 (c) ENCAD SYSTEMS LTD. 1991
Units: S.I. METRIC (Concrete) Data File : grain1

Envelope Case E1 : C1,C2
Member End Stresses

MBR	JOINT	Ax AXIAL	By vAXIS BENDING	Ax +ABS.By	Ax -ABS.By