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DEPARTMENT OF AGRICULTURE, FOOD AND THE MARINE
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Procedure for companies wishing to produce concrete cattle or pig slats and be listed on the “Accepted Slat List” of the Department of Agriculture, Food and the Marine.

Introduction

For concrete slats, heavy duty (tractor) slats, manhole slats and manhole slabs to be acceptable in grant-aided buildings, the company manufacturing the slat/slab must be listed on the “Accepted Concrete Slat List” of the Department of Agriculture, Food and the Marine. The list will include both the accepted companies and the size of slat that is accepted for use in grant-aided buildings, amongst other details.

This document sets out the procedure and requirements for inclusion on the Department of Agriculture, Food and the Marine’s “Accepted Concrete Slat List”.

General:

Concrete slats for use in grant-aided animal houses shall be:

1. Designed, produced and tested as set out in Annex A.

Heavy duty (tractor) slats, all manhole slats and all manhole slabs for use in grant-aided animal houses shall:

1. Be designed in full accordance with Annex A.
2. Meet the additional requirements set out in Annex B.

Required Documentation:

To gain acceptance onto the Accepted Concrete Slat List, the slat producing company must forward the following documentation to the Department of Agriculture, Food and the Marine:

1. The certificate of conformity to EN 12737: 2004 + A1:2007 from the Notified body (e.g. NSAI) for slats.
2. The certificate of conformity to EN 13225:2013 from the Notified body (e.g. NSAI) for manhole slabs and manhole slats.
3. An original, completed copy of the slat test report for each size of slat being produced. The report of load tests for standard slats, heavy duty slats, manhole slats and manhole slabs shall be as per Annex C. No other form of strength test report shall be accepted. Tests shall have been carried no more than 12 months before submission of the test reports.
4. A full list of slat sizes intended to be included on the “Accepted Concrete Slat List” (both length and widths in metres). The list is to include normal strength slat, heavy duty slat, manhole slat and manhole slab sizes. Where slats are to

be included based on the testing of a longer slat, details of the reinforcing steel in each slat size that has not been tested.

5. A letter stating the cement content, water cement ratio and cube strength of the concrete used in the manufacture of each slat size and type.
6. A copy of the Declaration of Performance for each slat size.
7. A sample copy of the CE certificate to be issued with each slat size.
8. Details of slat markings for each slat size.
9. If the concrete used in the manufacture of the slats is produced by a third party, the name of the concrete supplier and a copy of the concrete supplier's current EN 206-1:2002 registration certificate (all delivery dockets must be retained as proof of use of correctly certified concrete.)

The information is to be supplied to:

Engineering Unit,
Nitrates, Biodiversity and Engineering Division,
Department of Agriculture, Food and the Marine,
Pavilion A,
Grattan Business Centre,
Dublin Road,
Portlaoise,
Co. Laois,
Ireland.

Duration of Approval on Accepted Concrete Slat List

This acceptance will last for 5 years. After a period of 5 years on the list, it will be required for companies to undergo a renewal process which will include the resubmission of the required data and evidence of having remained certified to the relevant standards for the previous 5 years and evidence of having produced the product to the agreed standard. If certification to the required standard is allowed to lapse or is withdrawn at any time, then the acceptance by the Department of Agriculture, Food and the Marine also automatically lapses.

Annex A: Requirement for the design, production and testing of normal strength concrete slats.

Design and production of concrete slats:

Concrete slats shall be designed and produced in accordance with IS EN 12737: 2004 + A1:2007, and shall be CE marked and produced in a plant certified by a Notified body (e.g. NSAI or equivalent) for the production of concrete slats. **The slats must be designed in full accordance with the Irish version of the slat standard, including the requirements of the National Forward and National Annex in IS EN 12737:2004 + A1:2007.**

The concrete slats shall be load tested as set out below, by an independent Chartered Engineer.

The results of the test shall be reported using the form in Annex C. All information listed must be supplied for each slat tested. No other form of strength test report shall be accepted.

Grouping of slats for testing:

- In the case of grouped slats, the test must be on the longest unit in the group.
- Where design is by test only, grouping of slats with identical profile and bar size but varying length is permitted.
- Where a design model is present, grouping of slats may be permitted to incorporate variations in profile or bar size.
- In cases where the grouping is on the basis of a design model, the slat groupings shall be agreed, in writing, with the Department of Agriculture, Food and the Marine prior to testing.

Load Testing requirement:

Strength testing of slats shall be undertaken on each slat group produced, at least, once every 10 years as part of the renewal process.

Any change to a slat design (length, depth, width, reinforcing steel size, spacing or concrete mix) will require the slat to be retested, unless it can be shown to fit into a previously tested group.

Calculation of test Load:

Each slat shall be load tested in the vertical plane with either a linear load and point load (to be applied with each linear load) as per design by calculation, or 2.0 times the point load, which ever gives the largest action affect. The loads shall be as per clause 4.3.3.3.2 (table 4) of I.S. EN 12737:2004+A1:2007.

In cases where it is not feasible to apply both point loads and linear loads simultaneously, the test load (P) shall be calculated as follows:

- For A2 and A3 cattle slats the test load (P) will be calculated as follows:
 - $P = O_m \times (1 \times q_k + 2 \times F_{kv})$

- Where P is the test load,
- O_m is the maximum number of occurrences of the load as required by clause 4.3.3.3.2 and table 4 of IS EN 12737,
- l is the test span and,
- q_k and F_{kv} are taken from table 4 (characteristic loading values) of IS EN 12737:2004+A1:2007.
 - This serviceability limit state test load for an A3 cattle slat, with a test span of 3.5 m and 1.2m wide, will be as follows:

$$P = 2 * (1 * q_k + 2 * F_{k,v}) = 2 * (3.5 * 5.0 + 2 * 4.2) = 51.8\text{kN}.$$
 - For A1 and B1, B2 and B3 slats this test load will be calculated as follows:
 - $P = (O_m \times l \times q_k) + (2 \times F_{kv})$.
 - Table 1 sets out the test loads (P) for given test spans for 1.2m wide A3 cattle slats and 1.2m wide B3 pig slats.

Table 1: Serviceability Limit State test loads (P) for various test spans for A3 cattle slats and B3 pig slats, both 1.2m wide.

Test Span (mm)	Serviceability Limit State Load (kN) for A3 cattle slats	Serviceability Limit State Load (kN) for B3 pig slats
2200	38.8	19.1
2500	41.8	21.4
2800	44.8	23.6
3100	47.8	25.8
3400	50.8	28.1
3700	53.8	30.4
4000	56.8	32.6
4300	59.8	34.9
4600	62.8	37.1
4900	65.8	39.4
5200	68.8	41.6
5500	71.8	43.9
5800	74.8	46.1
6100	77.8	48.4
6400	80.8	50.6

Loading Methodology

- The slat shall be placed on two (75 mm wide x width of the slat) hard and level bearings, separated by a distance centre to centre equal to the test span. The test span is equal to the top length of the slat less 100mm (as per Figure 1.).
- The various linear loads shall be applied as uniformly distributed loads using $\frac{1}{4}$ point loading on the slat (as per Figure 1.) and at such other points as the loading specification requires, such that the total load applied is equal to the required test load.
- A means by which the deflection under load (including failure load) can be measured shall be provided.
- All loadings shall be applied incrementally and without shock through bearings as described above.
- Where the “point load only” case is most severe the point will be applied at the most severe location in accordance with the harmonised standard.

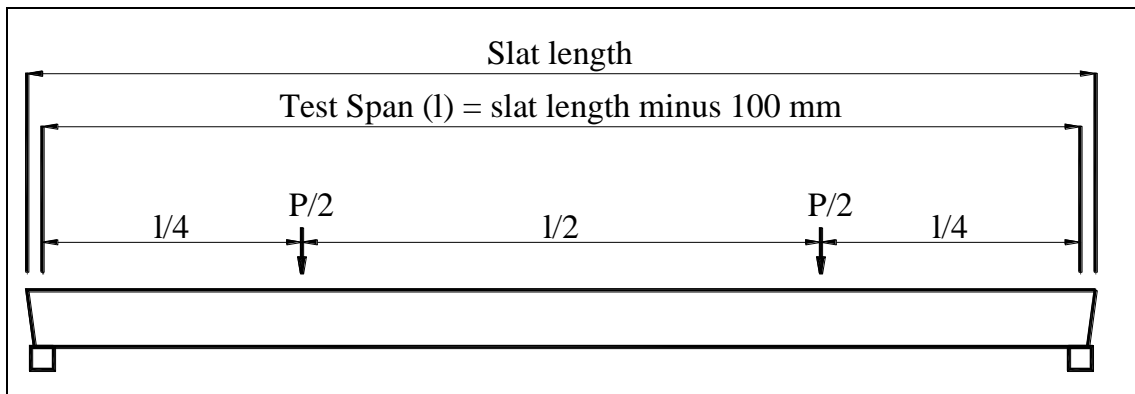


Figure 1: Test span and loading locations.

- The most severe arrangement of loadings shall be made bearing in mind that in some units not all beams are of equal depth. Justification of the loading case and arrangement shall be made in the report, in Annex C, by a suitably experienced Chartered Engineer.

Tests to be undertaken for Serviceability Limit State:

- Check for cracking:
 - The slat shall be loaded as specified above and that load sustained for a sufficient time for a visual inspection of the slat.
 - The width of crack may be determined by feeler gauge, optical or other means.
 - Once the check for cracking is complete, the load shall be removed from the slat.
- Check for deflection:
 - The same slat shall be reloaded as above and the load sustained for five minutes.
 - The maximum deflection of the slat shall then be recorded.
 - The load shall then be removed.
- Check for recovery:
 - Within five minutes of the removal of the 2nd application of the load, the recovery of the slat shall be recorded.
- The serviceability limit state test result requirements are set out in table 2 below.

Tests to be undertaken for Ultimate Limit State:

- Failure/Proof load test:
 - The slat shall be loaded until failure occurs. This is determined as either collapse of the slat or the deflection exceeding $l/40$. Where l = test span of the slat.
 - This load shall be recorded as the failure load and shall be used to establish the safety factor. The safety factor is the ratio of the failure load to the test load used for the serviceability limit state tests.
 - As an alternative to the failure load test, a proof load may be applied. This proof load must be sustained for five minutes. The proof load shall be such that the minimum safety factor set out in table 2 is achieved for the given number of slats tested.
- The ultimate limit state test result requirements are set out in table 2 below.

Report details:

- Mode of failure:
 - The test report shall remark upon the final condition of the slat. The actual safety factor achieved shall be recorded in the report.
- Accuracy of deflection measurements:
 - Deflection under test load and recovery after release of the test load shall be measured to within $\pm 0.5\text{mm}$ of the measured deflection.
 - Deflection under failure load shall be measured to within $\pm 5\text{ mm}$.

Table 2: Strength test result requirements for reinforced or prestressed slats.

Performance being tested	Test Load	Number of Samples tested	Pass criteria	Other requirements
Serviceability Limit State test result requirements				
Cracking	Vertical test load	Any number	$0.2 C/C_{\min}$, subject to a maximum crack width of 0.25mm.	To be measured within 25mm of tensile face.
Deflection	Vertical test load	Any number	$< l/250$	
Recovery	Vertical test load	Any number	Recovery to be 75% for reinforced slats and 85% for prestressed slats	
Ultimate Limit State test result requirements				
Deflection	Proof / failure load	1	$< l/40$	Safety factor to be a minimum of 2.5 for A1, A2 and A3 slats and minimum of 2.0 for B1, B2 and B3 slats.
Deflection	Proof / failure load	2	$< l/40$	Safety factor to be a minimum of 2.25 for A1, A2 and A3 slats and minimum of 1.75 for B1, B2 and B3 slats.
Deflection	Proof / failure load	5	$< l/40$	Safety factor to be a minimum of 2.0 for A1, A2 and A3 slats and minimum of 1.5 for B1, B2 and B3 slats.
l = test span. C = concrete cover to reinforcing steel. C _{min} = minimum concrete cover to reinforcing steel permitted for slat type.				

Annex B: Requirement for the design, production and testing of Heavy-duty (tractor) slats and manhole slabs and manhole slats.

Design and production of heavy duty slats, manhole slats and manhole slabs:

With the exception of the width and depth of the main ribs either side of the manhole, heavy-duty (tractor) slats and manhole slats shall be designed to be dimensionally the same as slats under IS EN 12737:2004 + A1:2007, with the same minimum concrete strength, cement content, cover to the reinforcing steel and the same maximum water cement ratio.

Heavy duty slats, manhole slats and manhole slabs shall be designed to withstand a 40kN wheel load or 80kN axle load with a wheel spacing of 1.8m, whichever gives the worst effect.

All manhole slats and manhole slabs shall be designed as heavy-duty.

All heavy duty slats, manhole slats and manhole slabs shall be subjected to a simulated wheel/axle load test. The tests will be performed as set out below, by an independent Chartered Engineer with experience of testing heavy-duty cattle slats.

The results of the test shall be reported using the form in Annex C. All information listed must be supplied for each heavy duty slat, manhole slat and manhole slab tested. No other form of strength test report shall be accepted.

Additionally, all manhole slabs and manhole slats shall be certified to be in accordance with EN 13225:2013 by a Notified body (e.g. NSAI).

Grouping of heavy duty slats, manhole slats and manhole slabs for testing:

- In the case of grouped heavy-duty slats, manhole slats or manhole slabs the test must be on the longest unit in the group.
- Where design is by test only, grouping of heavy-duty slats, manhole slats or manhole slabs with identical profile, bar size and manhole location but varying length is permitted.
- Where a design model is present, grouping of heavy-duty slats, manhole slats or manhole slabs may be permitted to incorporate variations in profile or bar size.
- In cases where the grouping is on the basis of a design model, the heavy-duty slats, manhole slats or manhole slabs groupings shall be agreed, in writing, with the Department of Agriculture, Food and the Marine prior to testing.

Load Testing requirement:

Strength testing of slats, manhole slats and manhole slabs shall be undertaken on each group produced, at least, once every 10 years as part of the renewal process.

Each unit is to be subjected to test as for normal cattle slats, unless it can be demonstrated that the heavy duty slat is of the same basic design as the normal strength cattle slat of the same dimensions (e.g.: the only change has been an increase in the reinforcing steel sizes).

Any change to a slat, manhole slat or manhole slab (length, depth, width, reinforcing steel size, spacing or concrete mix) will require the slat, manhole slat or manhole slab to be retested, unless it can be shown to fit into a previously tested group.

Calculation of test Load:

Each slat, manhole slat and manhole slab shall be tested for both shear and moment resistance in the vertical plane.

The test load shall be calculated as follows:

- For test spans up to 3.60m a point load (P) of 40kN shall be used for the serviceability limit state tests.
- For test spans above 3.60m the axle load may be simulated by a single point load using the following formula:
 - $P \text{ in kN} = 80 - 144/l$ with l in metres being the test span.
 - Table 3 sets out the point loads for given test spans.
- Alternatively, the test may be performed using an actual axle load, applied as two point loads spaced at 1.8m centres.

Table 3: Serviceability Limit State Point loads for various test spans

Test Span (mm)	Point Load (kN)
Up to 3600	40.0
3700	41.1
4000	44.0
4300	46.5
4600	48.7
4900	50.6
5200	52.3
5500	53.8
5800	55.2
6100	56.4
6400	57.5

Loading Methodology

- The slat, manhole slat or manhole slab shall be placed on two (75 mm wide x width of the slat) hard and level bearings, separated by a distance centre to centre equal to the test span. The test span is equal to the top length of the slat, manhole slat or manhole slab less 100mm.
- A means by which the deflection under load (including failure load) can be measured shall be provided.
- All loadings shall be applied incrementally and without shock through bearings as described above.
- The point load(s) shall be applied to each slat through a steel plate (measuring 300 mm by 300 mm x 20 mm) at those positions on the unit where it will produce the maximum stress (only one point to be loaded at a time). A sketch shall be attached to the test report indicating the location of the test points for each slat tested. The slat is to be tested for both moment and shear resistance.

Tests to be undertaken for Serviceability Limit State:

- Check for cracking:
 - The slat, manhole slat or manhole slab shall be loaded as specified above and that load sustained for a sufficient time for a visual inspection of the slat.
 - The width of crack may be determined by feeler gauge, optical or other means.
 - Once the check for cracking is complete, the load shall be removed from the slat.
- Check for deflection:
 - The same slat, manhole slat or manhole slab shall be reloaded as specified above and the load sustained for five minutes.
 - The maximum deflection of the slat shall then be recorded.
 - The deflection shall be measured at the outer edge of the slat.
 - The load shall then be removed.
- Check for recovery:
 - Within five minutes of the removal of the 2nd application of the load, the recovery of the slat shall be recorded.
- The serviceability limit state test result requirements are set out in table 4 below.

Tests to be undertaken for Ultimate Limit State:

- Failure/Proof load test:
 - The slat, manhole slat or manhole slab shall be loaded, in the same positions as tested for serviceability limit state, until failure occurs. This is determined as either collapse of the slat, manhole slat or manhole slab or the deflection exceeding $l/40$. Where l = test span of the slat, manhole slat or manhole slab.
 - This load shall be recorded as the failure load and shall be used to establish the safety factor. The safety factor is the ratio of the failure load to the test load used for the serviceability limit state tests.
 - As an alternative to the failure load test, a proof load may be applied. This proof load must be sustained for five minutes. The proof load shall be such that the minimum safety factor set out in table 3 is achieved for the given number of slats tested.
- The ultimate limit state test result requirements are set out in table 4 below.

Report details:

- Mode of failure:
 - The test report shall remark upon the final condition of the slat, manhole slat or manhole slab, referring to the method of failure and whether failure was in the Serviceability Limit State or Ultimate Limit State. The actual safety factor achieved shall be recorded in the report.
- Accuracy of deflection measurements:
 - Deflection under test load and recovery after release of the test load shall be measured to within ± 0.5 mm of the measured deflection.
 - Deflection under failure load shall be measured to within ± 5 mm.

Table 4: Strength test result requirements for heavy duty reinforced or prestressed slats, manhole slats and manhole slabs.

Performance being tested	Test Load	Number of Samples tested	Pass criteria	Other requirements
Serviceability Limit State test result requirements				
Cracking	Working load	Any number	$0.2 C/C_{\min}$, subject to a maximum crack width of 0.25mm.	To be measured within 25mm of tensile face.
Deflection	Working load	Any number	$\leq l/250$	
Recovery	Working load	Any number	Recovery to be 75% for reinforced slats and 85% for prestressed slats	
Ultimate Limit State test result requirements				
Deflection	Proof / failure load	1	$\leq l/40$	Safety factor to be a minimum of 2.0
Deflection	Proof / failure load	2	$\leq l/40$	Safety factor to be a minimum of 1.75
Deflection	Proof / failure load	5	$\leq l/40$	Safety factor to be a minimum of 1.5
l = test span. C = concrete cover to reinforcing steel. C _{min} = minimum concrete cover to reinforcing steel permitted for slat type.				

Annex C – Report format (all test results to be produced in this format, separate test report required for each slat manhole slat or manhole slab size tested).

General details	
Company Name:	
Company Address:	
Nominal slat length (m)	
Nominal width of cover of slat (m)	
Slat use and Load class (i.e: Cattle, calves, dry sows, sheep etc)	
Date of test	
Location of test	
Name of tester	
Address of tester	

Slat details (visual and dimensional assessment)	
Number of slats of this type tested:	
Overall slat length: Top (mm)	
Bottom (mm)	
Overall slat width: top (mm)	
Bottom (mm)	
Height at ends measured on centre line of slat (mm)	
Gap between beams on top surface (mm)	
No of Longitudinal beams	
Width of each beam: top (mm)	
Bottom (mm)	
Depth of each beam:	
No of transverse connections:	
Vertical camber:	
Horizontal bow:	
Twist:	
Profile of beam:	
Concrete strength:	
Aggregate size	
Top Surface finish	
Comments:	

Details of reinforcement	
<u>Main ribs, Depth of concrete cover:</u>	
All concrete cover measurements shall be undertaken at the quarter point of the slat using a cover meter.	
Top steel (top cover) (mm)	
Bottom steel (bottom cover) (mm)	
<u>Main Beams side cover</u>	
Top Steel (mm)	
Bottom steel (mm)	
<u>Reinforcement in Slat</u>	
Top steel – longitudinal Beams	
Bottom Steel – Longitudinal steel	
Top steel – transverse connections	
Bottom steel – transverse connections	
Comments:	

Strength Test (Vertical Load) – normal Strength concrete slats	
Age of Slat (days)	
Test span (mm)	
Serviceability Limit State test load (kN)	
Crack width (under first application of load) (mm)	
Deflection in mm (under second application of load)	
Percentage recovery - 5 minutes after removal of load:	
Ultimate Limit State test load (kN)	
Deflection under Ultimate Limit State load (mm)	
Load at maximum permitted deflection (kN) (if tested)	
Safety factor achieved	
Type of failure	
Justification for Test load selection and application:	
Comments:	

Strength Test (Vertical Load) – Heavy Duty concrete slats				
Age of Slat (days)				
Test span (mm)				
Serviceability Limit State test load (kN)				
Crack width (under first application of load) (mm)	Point 1	Point 2	Point 3	Point 4
Deflection in mm (under second application of load)	Point 1	Point 2	Point 3	Point 4
Percentage recovery - 5 minutes after removal of load:	Point 1	Point 2	Point 3	Point 4
Ultimate Limit State test load (kN)				
Deflection under Ultimate Limit State load (mm)	Point 1	Point 2	Point 3	Point 4
Load at maximum permitted deflection (kN) (if tested)	Point 1	Point 2	Point 3	Point 4
Safety factor achieved				
Type of failure				
Justification for Test load selection and application:				
Comments:				
Sketch of test positions (usually):				
Point 1 Mid span on outer two beams		Point 2 Mid span on centre two beams		
Point 3 Shear test at end on outer two beams		Point 4 Shear test at end on centre two beams		