



Illinois Department of Transportation

Memorandum

To: ALL BRIDGE DESIGNERS 19.3
From: D. Carl Puzey *D. Carl Puzey*
Subject: Revised provisions for Precast Prestressed Concrete IL
Beams and applicable I and Bulb T Beams
Date: March 25, 2019

To help alleviate fabrication and procurement delays associated with precast prestressed concrete (PPC) beams, the following updates will be implemented.

1) WWR coating

The IL-Beams are fabricated with welded wire reinforcement (WWR) and this reinforcement is also required to be protected with an epoxy coating. To increase fabricator options, the Department will also permit the WWR to be galvanized, at no additional cost to the Department. This may be done without any adjustment to lap or development lengths. The note on the IL-Beam base sheets has been revised accordingly.

2) Shear Design Stresses for reinforcement bar substitution of WWR

The minimum yield strength of deformed WWR is 70 ksi. The Department developed an equivalent, alternate, reinforcement bar scheme that may be epoxy coated or galvanized which the fabricator may use in lieu of the specified WWR. This alternate is intended to provide the same design spacing with equal or greater yield strength. It also provides revised development details suitable for reinforcement bars. These details may be found in the appendix of the Manual for Fabrication of Precast Prestressed Concrete Products.

To permit a more cost effective and readily available rebar substitution of WWR in the future, IL-Beam projects with TSL'S approved on or after April 1, 2019 shall assume grade 60 ksi for the WWR stirrup design when determining the required design spacing. This will enable the fabricator to substitute grade 60 rebar, properly configured for development, for the WWR with the same contract plan design spacings. A note has been added to the beam base sheets, so the designer can fill in the grade 60 design stress. Plans without this note are assumed to be designed with the standard 70 ksi grade WWR.

3) Reduce 45-day beam retention rule to 30 days

The AASHTO LRFD Bridge Design Specifications and the PCI Design Handbook identify the creep and shrinkage characteristics of concrete and provide guidance on how to account for this behavior in PPC beam design. Since the January 2011 letting, IDOT has required PPC beams on multi-span projects to be 45 days old

before they may be shipped from the fabricator. Later, the Department added this requirement for simple span projects which exceeded 100 feet in length. This retention period, coupled with our current anchorage details, aided the Department in satisfying the spirit of the code requirements without the need for additional rigorous calculations.

The Department has not experienced transverse cracks at the pier diaphragms or other signs indicating a loss of continuity due to creep and shrinkage since using our current policy. In recent years fabricators have also made improvements in adjusting the cast beam lengths for creep and shrinkage so that the delivered beam length is within required tolerances and thereby preventing potential construction problems. Therefore, the Department will decrease the 45-day beam retention period to 30 days based on performance and as permitted in the commentary of the AASHTO code. This will require modifications to the number of extended strands from the beam ends of IL-Beams as follows in Table 1 to ensure proper anchorage of anticipated positive restraint moment from potential additional creep and shrinkage. The IL-Beam base sheets have been updated accordingly. The reduced 30-day retention period is also applicable to I-Beams and Bulb-T beams; however, the beam end pier anchorage details for these have not been revised at this time but will be monitored by the Department for potential future revisions. The 45-day retention note has been removed from the base sheets; however, the new policy is covered in the Manual for Fabrication of Precast Prestressed Concrete Beams.

| Beam | No. of required extended strands at piers |
|-------|---|
| IL 27 | 8 |
| IL 36 | 10 |
| IL 45 | 12 |
| IL 54 | 12 |
| IL 63 | 12 |
| IL 72 | 14 |

Table 1

4) Reduced concrete release strength for IL-Beams

Fabricators expressed concern that the 7.0 ksi release concrete compressive stress, f'_{ci} , required for IL-Beams can be difficult to achieve in adequate time to efficiently utilize their casting beds in a 24-hour period. Recent revisions to the AASHTO.LRFD Bridge Design Specifications have increased the allowable compressive stress from $0.6 f'_c$ to $0.65 f'_c$, which enables the f'_{ci} for IL-Beams to be reduced from 7 ksi to 6.5 ksi with virtually no net change in the allowable compressive stress. However, reducing the f'_{ci} to 6.5 ksi also reduces the allowable tension stress and increases the losses. This means there is less effective prestress for the bottom fiber tensile stress for the final condition.

The Department evaluated our standard strand patterns and beam configurations for an f'_c of 6.5 ksi and found that the allowable span length for each beam depth would be reduced by an amount less than two feet. Therefore, the IL-Beam base

sheets have been updated to allow a concrete release strength of 6.5 ksi instead of 7.0 ksi and the Planning Charts, Figures 4 through 16 of ABD memorandum 15.2, have been updated with slightly reduced permissible span lengths. These charts are included in this memorandum.

Implementation Summary

Item 1 may be implemented immediately on all projects, even those already let. The fabricator shall document the coating used on the shop drawings.

Item 2 shall be effective with TSL's approved on or after April 1, 2019.

Item 3 may be implemented immediately on all projects, even those already let provided the number of extended anchorage strands of IL-Beams at piers are revised as shown in Table 1 and recorded on the shop drawings.

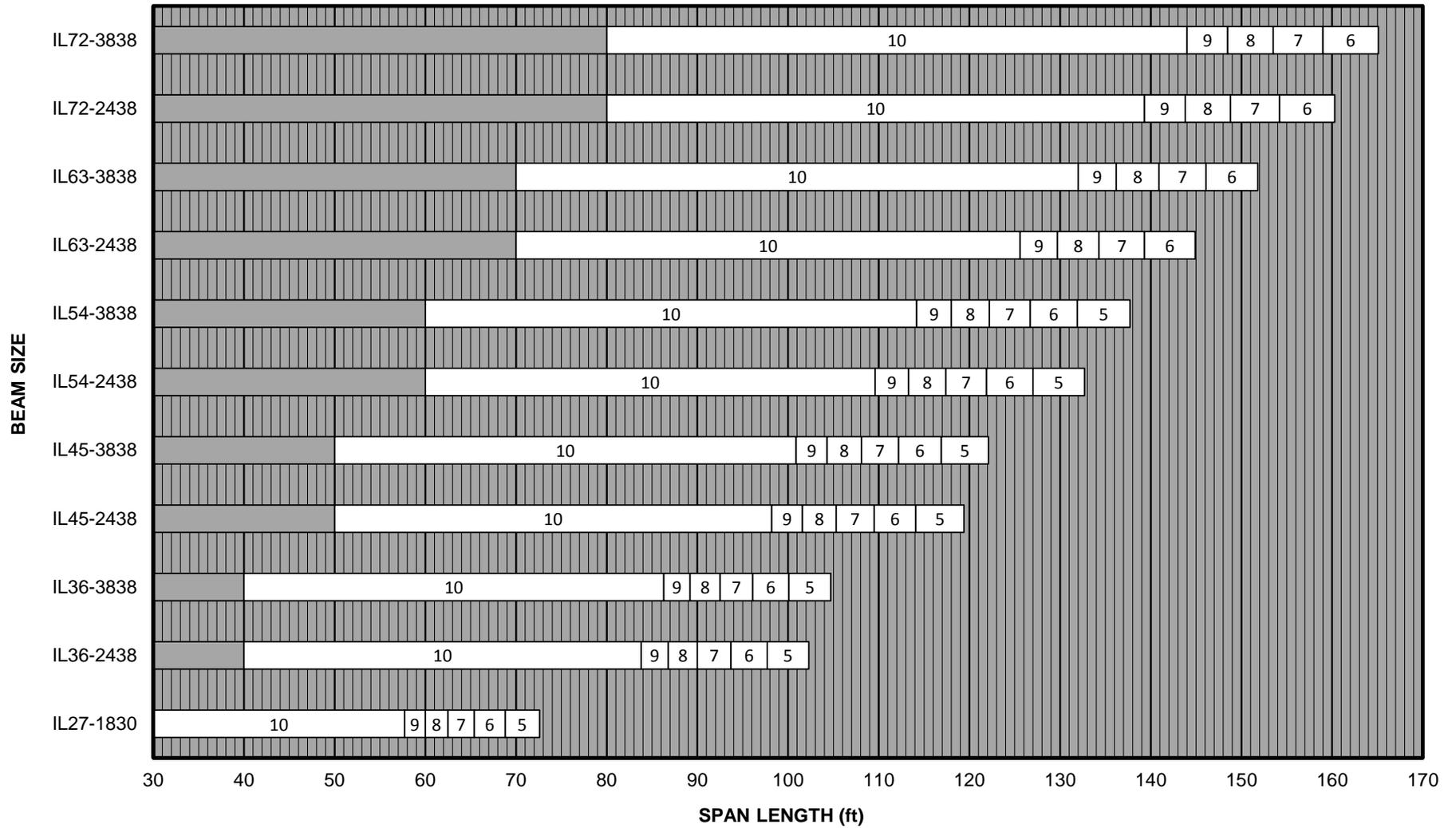
Item 4 shall be effective for structures with TSL's approved after April 1, 2019 and may be implemented by engineers for projects currently under design. Fabricators may utilize item 4 on current IL-Beam projects provided they submit SE sealed calculations with the shop drawings, evaluating the tensile stresses for initial and final conditions with the reduced release concrete compressive stress. The Department will not permit a concrete release strength less than 6.5 ksi for IL-Beams.

Please direct questions to Mark Shaffer in the Policies, Standards and Specifications Unit at (217) 785-2914.

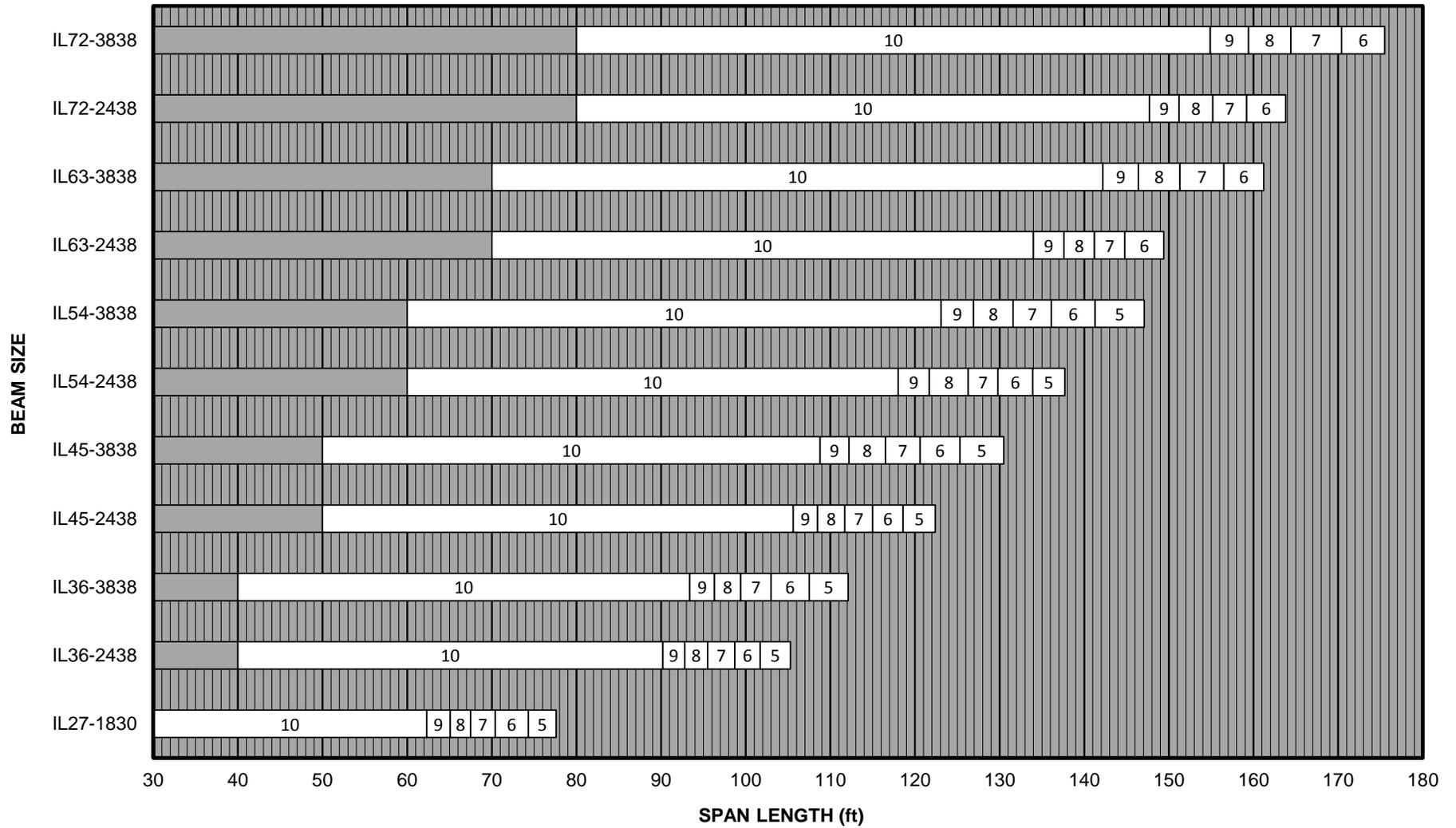
Attachments

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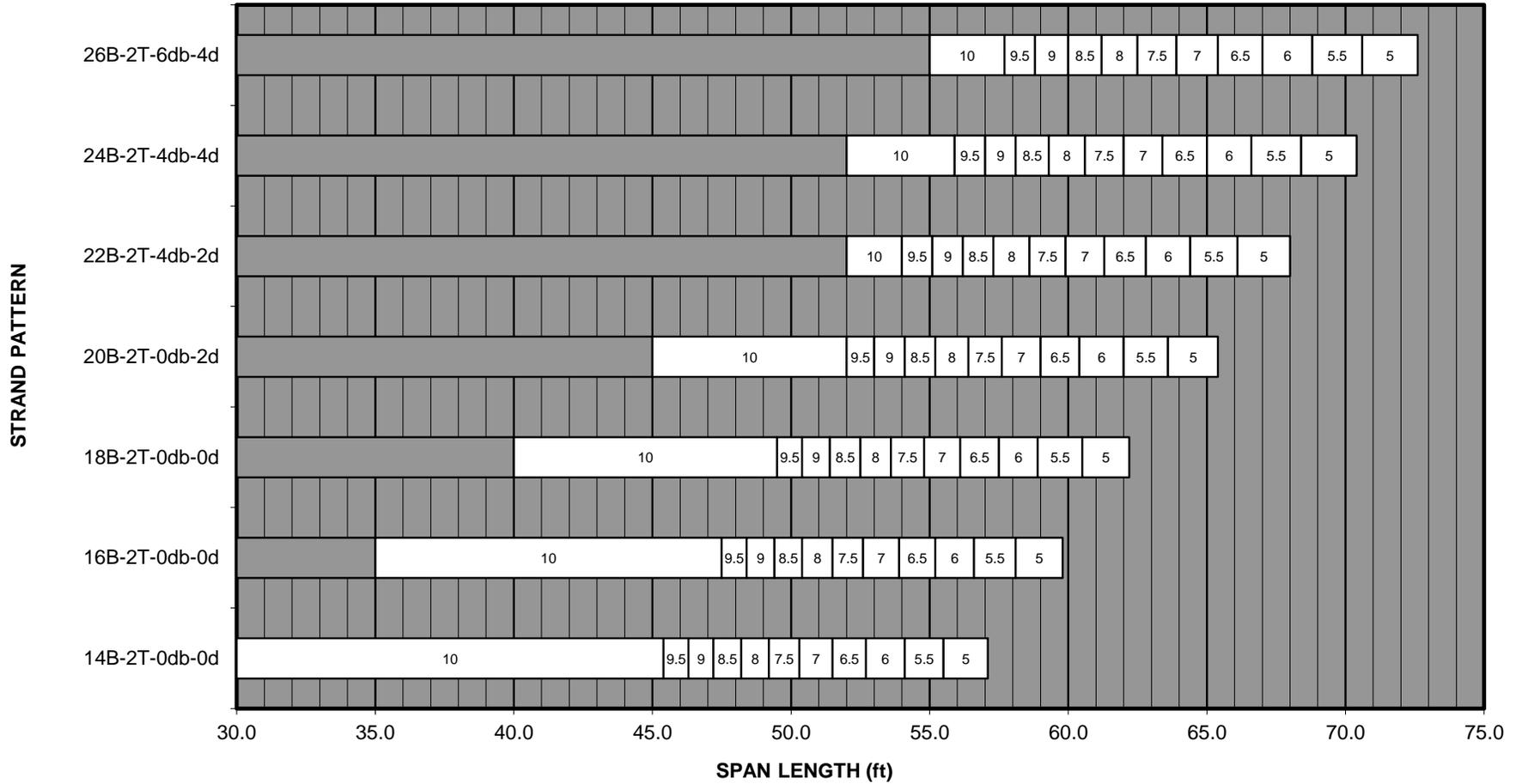
**PPC IL-BEAM SIMPLE SPAN LIMITS
(Beam Size/Span Length/Beam Spacing)**



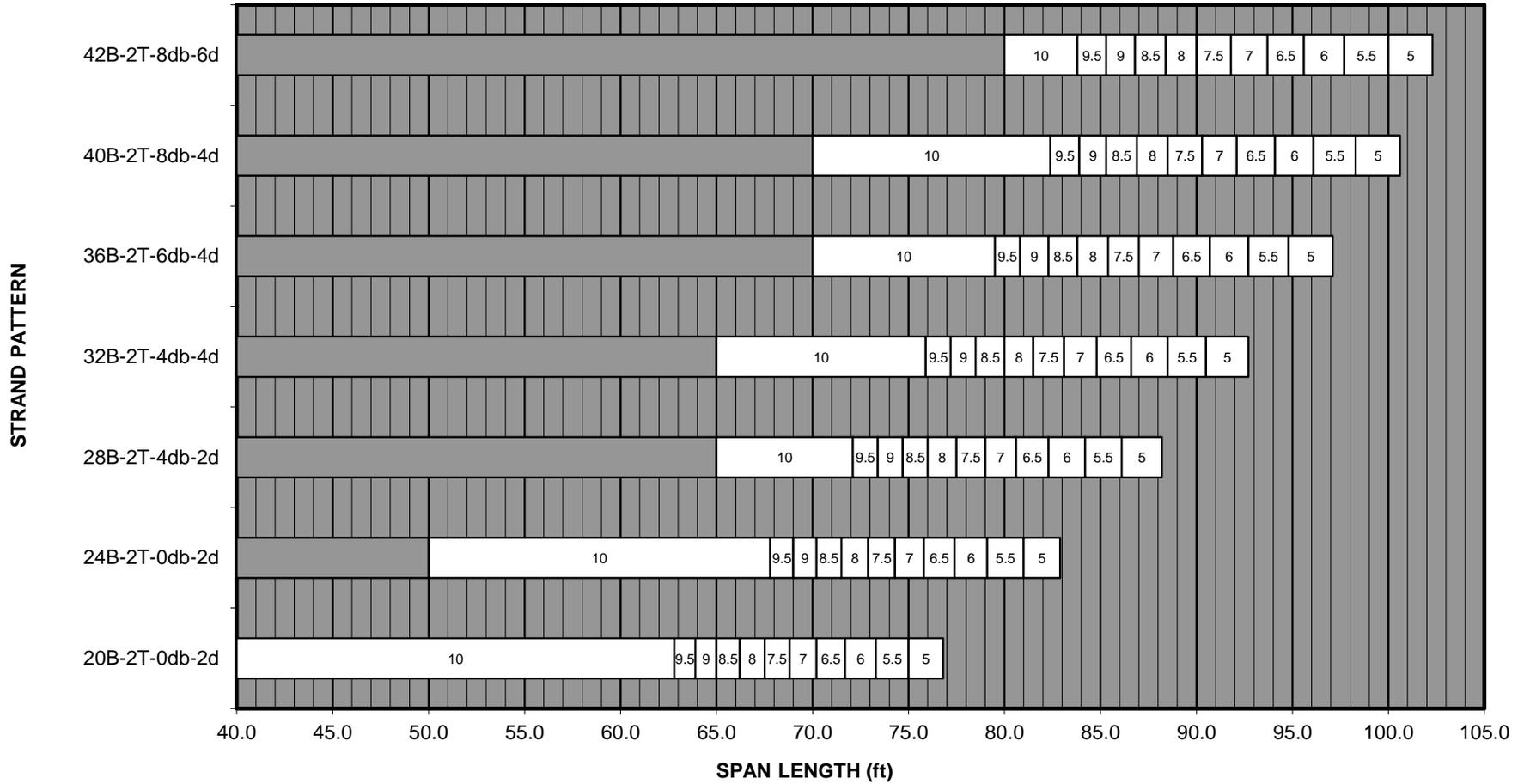
**PPC IL-BEAM MULTI SPAN LIMITS
(Beam Size/Span Length/Beam Spacing)**



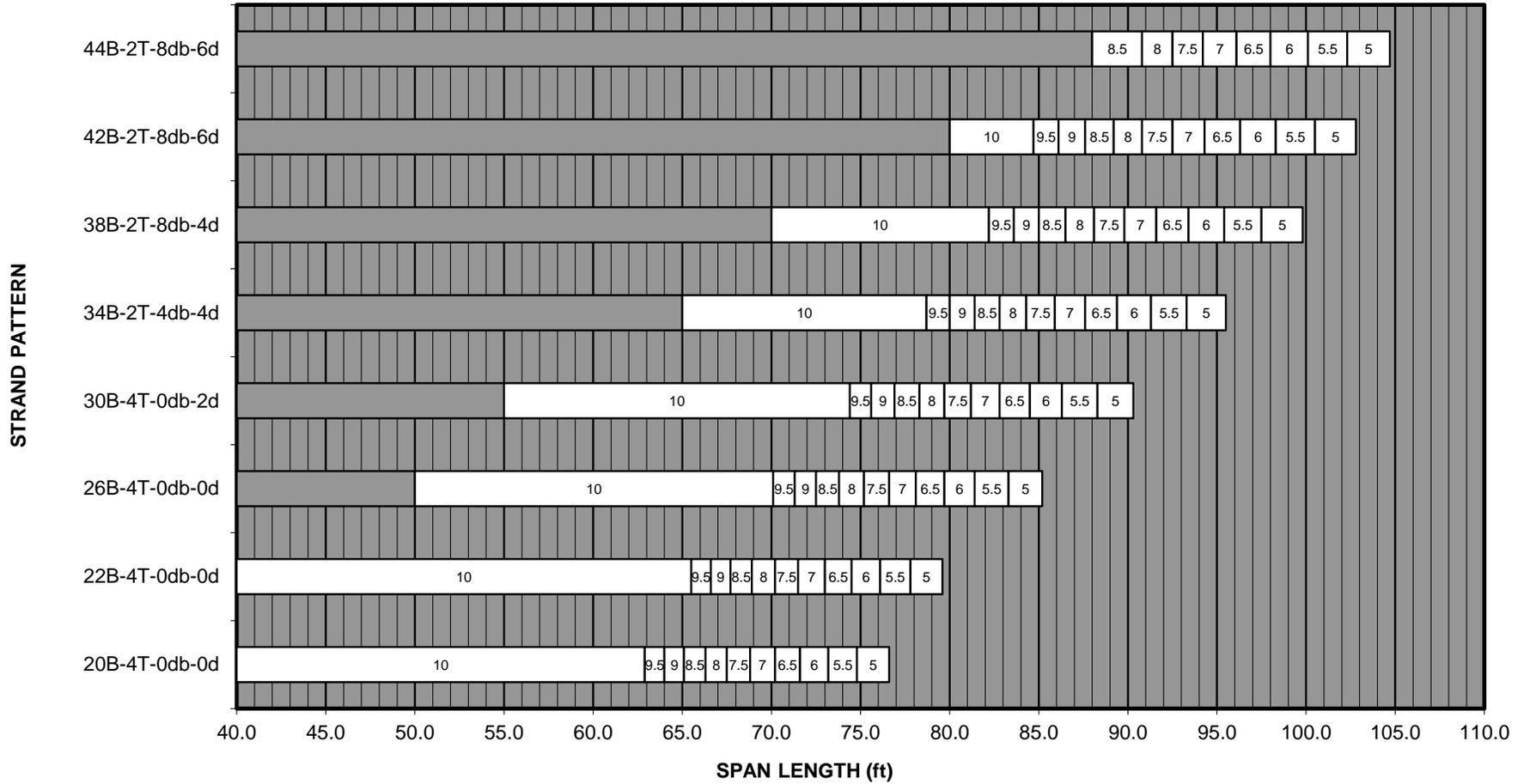
**IL27-1830 SIMPLE SPAN LIMITS
(Strand Pattern/Span Length/Beam Spacing)**



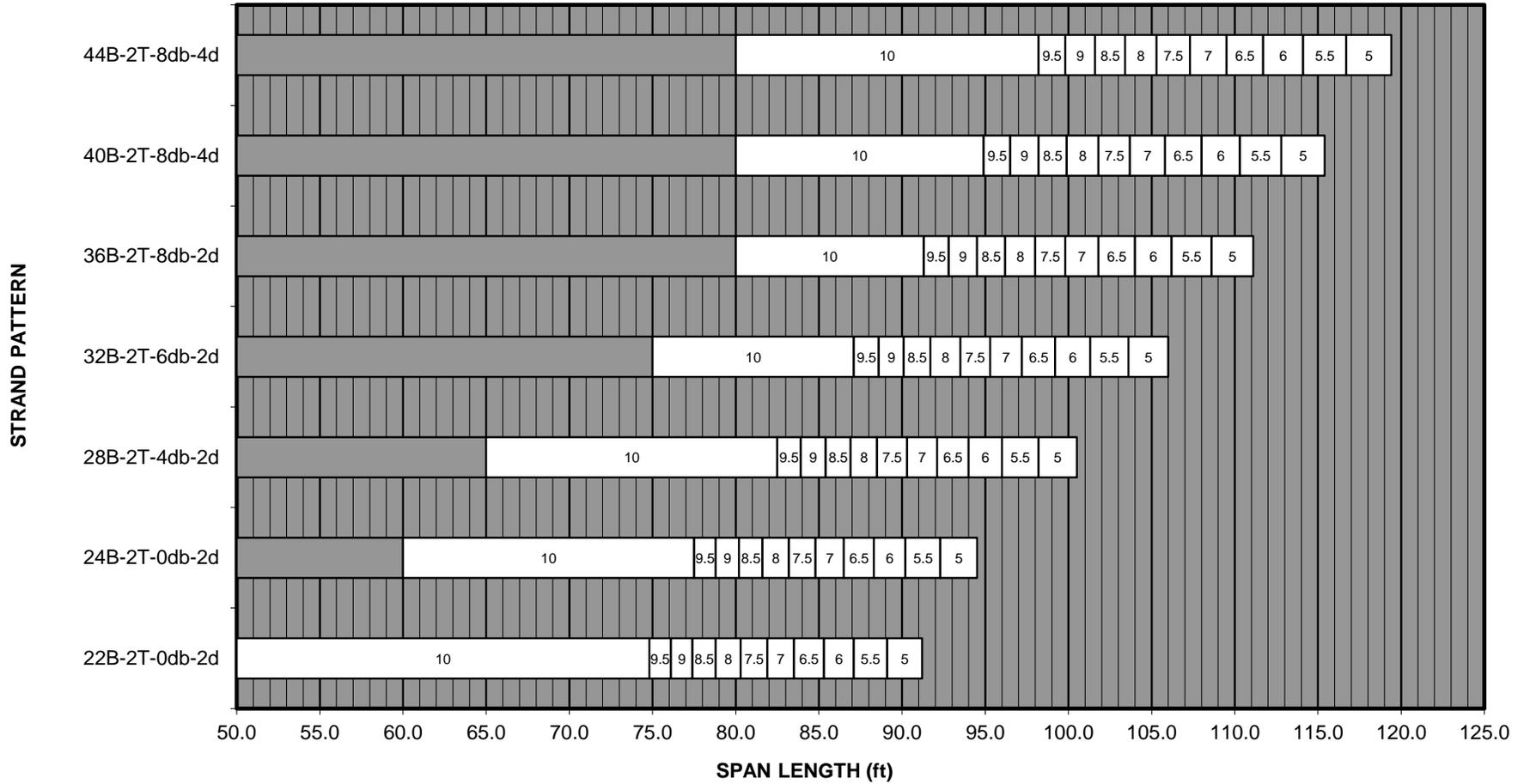
IL36-2438 SIMPLE SPAN LIMITS (Strand Pattern/Span Length/Beam Spacing)



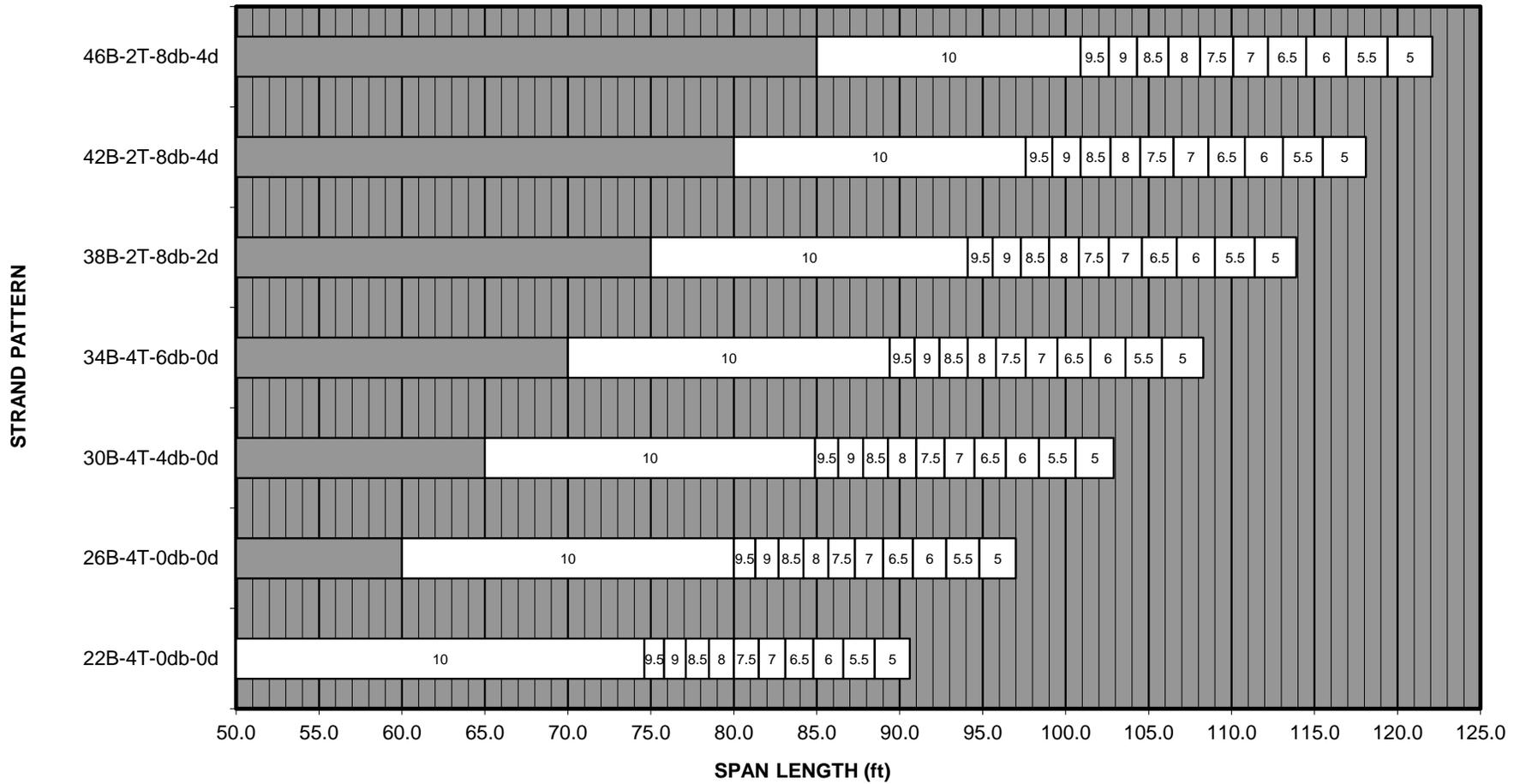
**IL36-3838 SIMPLE SPAN LIMITS
(Strand Pattern/Span Length/Beam Spacing)**



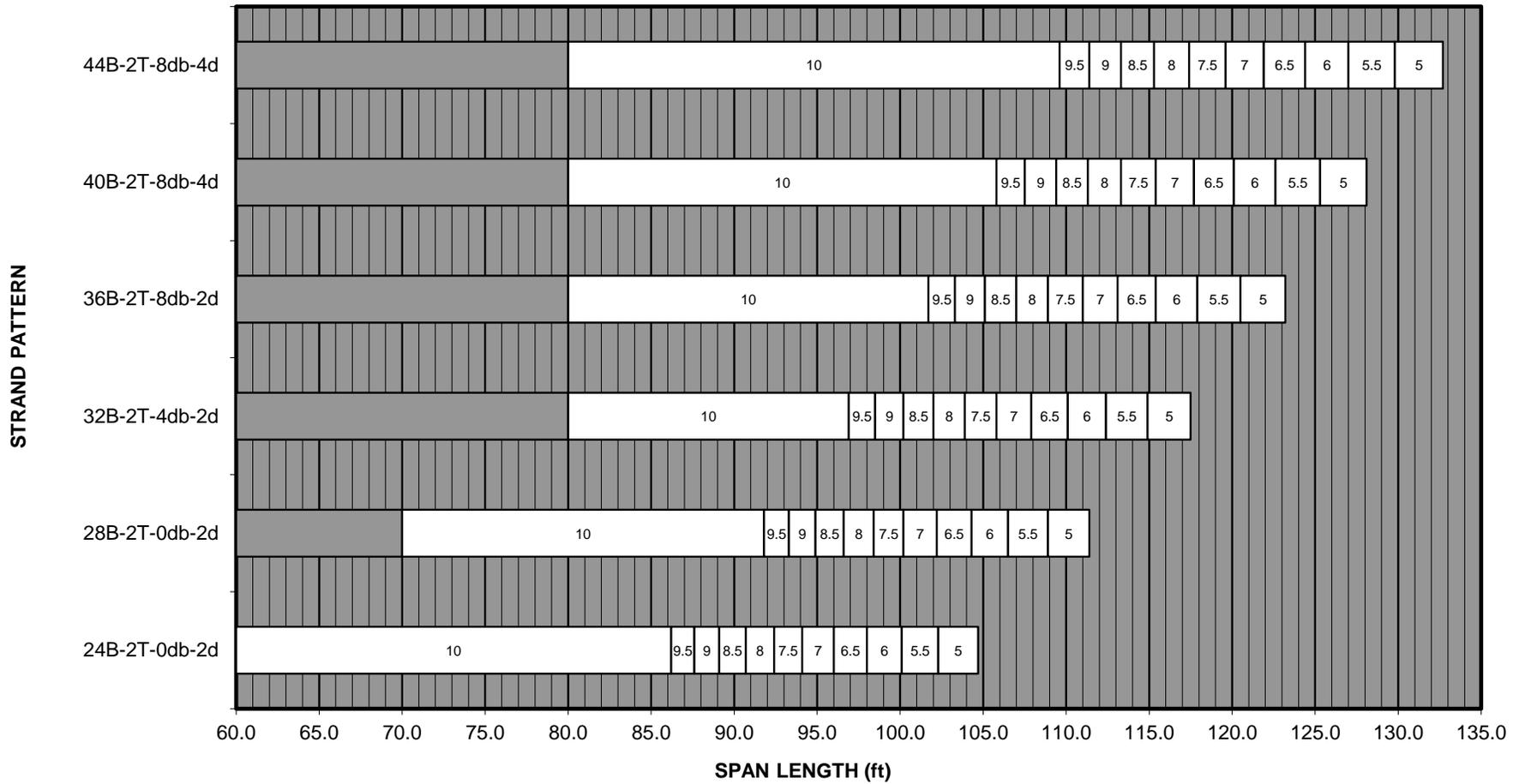
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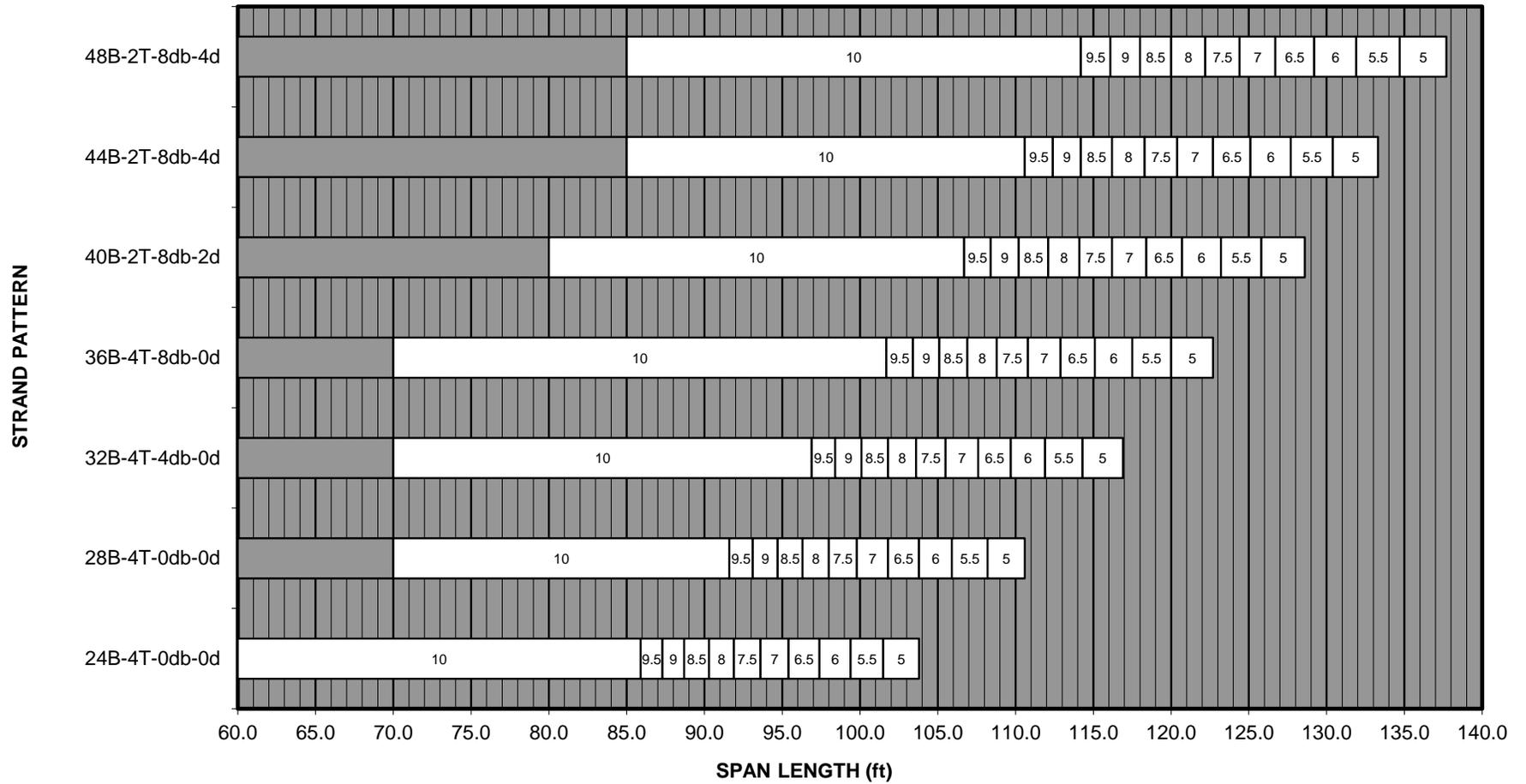
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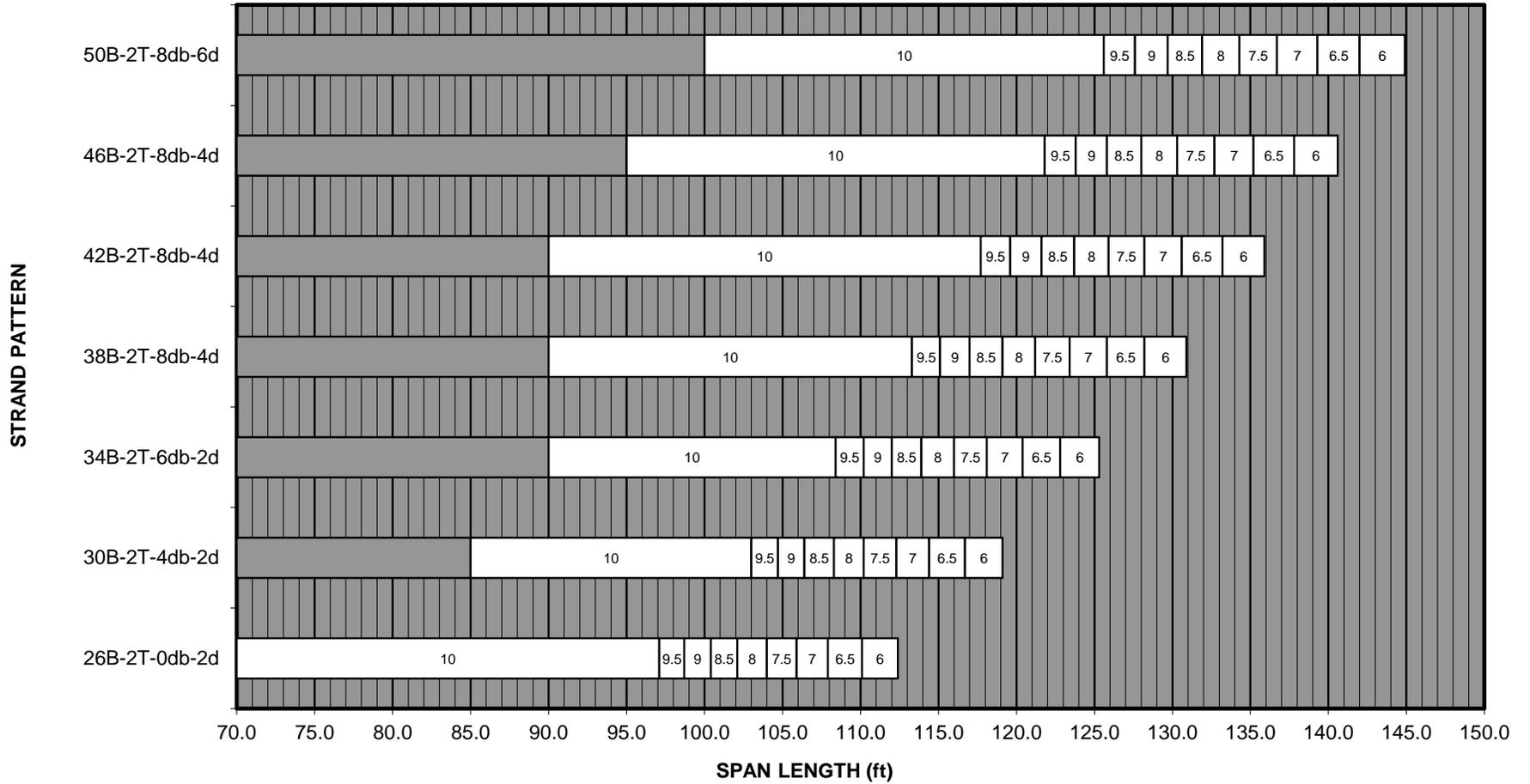
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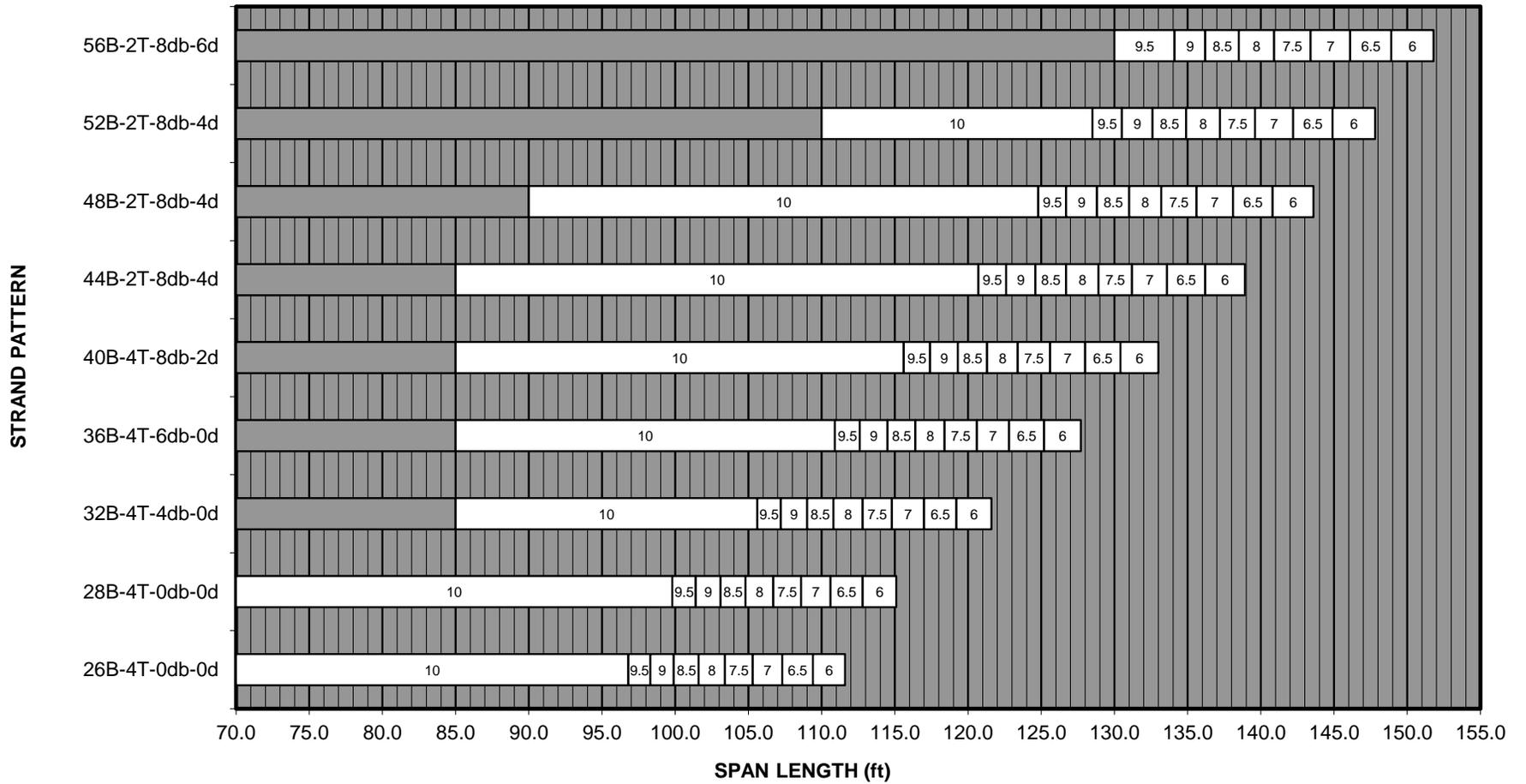
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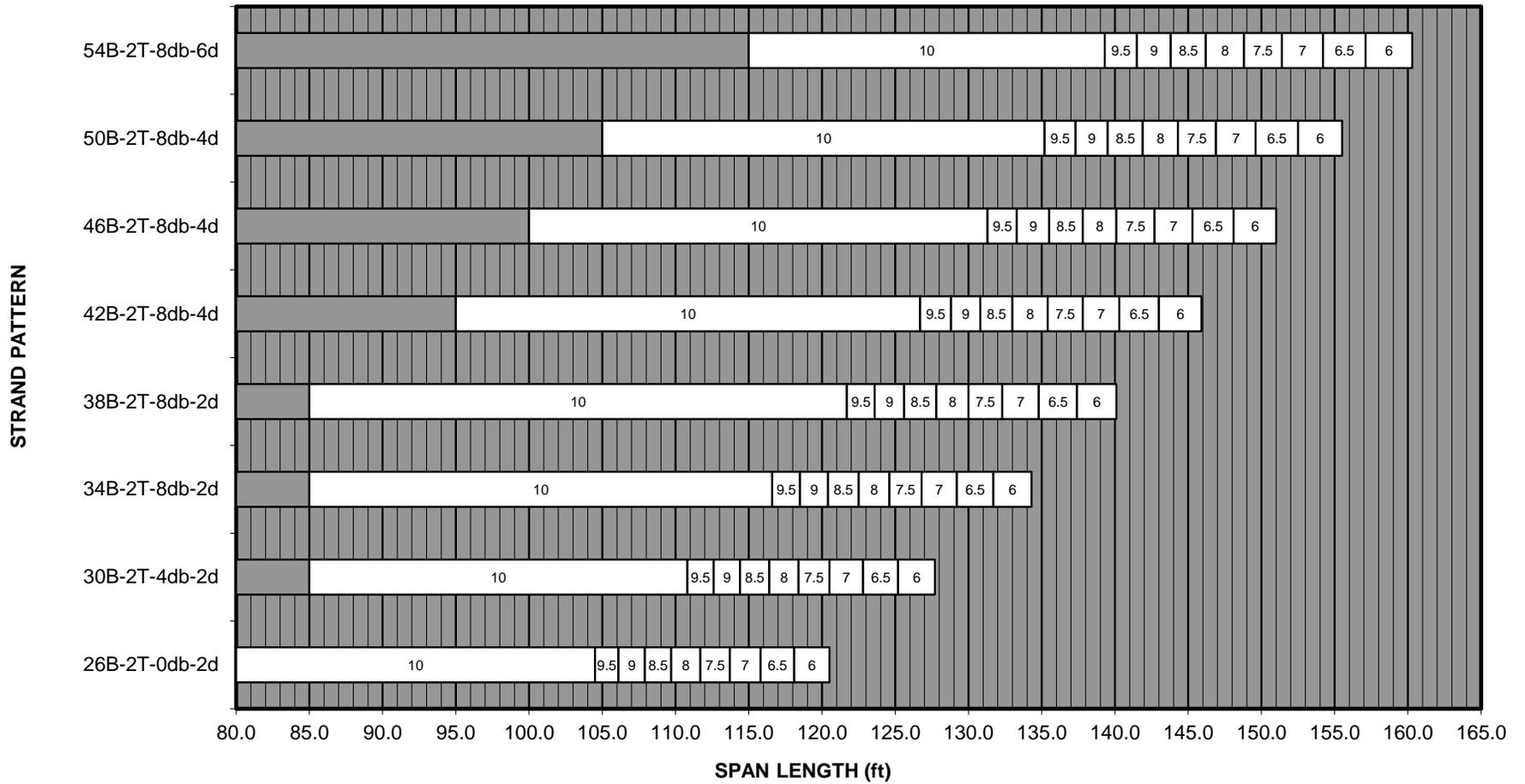
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(Strand Pattern/Span Length/Beam Spacing)**



IL63-3838 SIMPLE SPAN LIMITS (Strand Pattern/Span Length/Beam Spacing)



**IL72-2438 SIMPLE SPAN LIMITS
(Strand Pattern/Span Length/Beam Spacing)**



IL72-3838 SIMPLE SPAN LIMITS (Strand Pattern/Span Length/Beam Spacing)

