Steel Underframe for Canadian Northern Railway Passenger Cars.

The type of steel underframe adopted by the C.N.R. is shown in the accompanying illustration, and is intended for use under all classes of passenger equipment. It is practically the same as the Barney and Smith standard design for equipment exceeding 70 ft. in length over end sills. The principal differences lie in the refinement in the method of insulation, etc., to care for the more severe climatic conditions to be encountered in the north country, and they are also arranged, as regards the height of body centre plate, to suit trucks now in use under the company's wooden passenger equipment, which has been found to be a difficult feature to embody in steel underframes of any design. The principal dimensions of the steel underframe are as follows:—

Length over buffer angles	80 ft. 9¼ ins.
Length over wooden end posts	72½ ft.
Length over steel end posts	72 ft. 5¾ ins.
Length between crossbearers	28½ ft.
Width over side sill stringers	9 ft. 10½ ins.
Width over side sill Z bars	9 ft. 8⅛ ins.
Width over steel buffer beam	9 ft. 4¾ ins.
Width between side girder plates	9 ft. 1 in.
Width over platform step stringers	4 ft. 4 ins.
Truck centres	56½ ft.
End of car (steel frame) to centre line of bolster	7 ft. 11⅞ ins.
Height, top of rail to underside of centre sill angles at bolster	3 ft. 1 in.
Height, top of rail to underside of body centre plate	2 ft. 11 ins.
Height to centre line of coupler	3 ft. 1 in.
Height, top of rail to top of platform buffer angle	4 ft. 2 11-16 ins.

The underframe is of structural steel throughout, in accordance with the American Society of Testing Materials latest specifications. The centre sill is of the fish belly girder type, with a 25½ by 5-16 in. web plate, reinforced at the top by 5 by 3 by ⅜ in. angles, inside and outside, and at the bottom by 3 by 3 by ⅜ in. angles, inside and outside, with a 30 by ⅜ in. cover plate, running the full length of the car. The side girder is composed of a main member, consisting of a 24 by 5-16 in. plate, with a 3 by 3 by ¼ in. centre angle, 3 by 3 by ⅝ in. top angle, 2 by 2 by ¼ in. angle stiffener at the side posts, and a 5 in. 11.6 lb. bottom Z bar. The top angle of the side girder has a ¾ in. camber, the side girder plate being run straight, with the top and bottom edges parallel to the rail. The rivet gauge in the top angle is 2 ins., beginning 1⅞ in. down on the web plate at each end, rising to 1⅛ in. at the centre of the car.

The crossbearers are built up on 25¼ by 5-16 in. web plates, with 10 by ⅜ in. top plates, 7 by ⅜ in. bottom cover plates connected to the side girders with 12 by 5-16 by 30 in. gussets and 3 by 3 by 5-16 in. angles, and to the centre sills with 3 by 3 by 5-16 in. angles, and having 3 by 3 by 5-16 in. top and bottom angles. The body bolsters are built up on 13½ by 5-16 in. web plates, with 66 by 5-16 in. top cover plate and 7 by ⅜ in. bottom cover plate, the centre filler and centre plate being of cast steel.

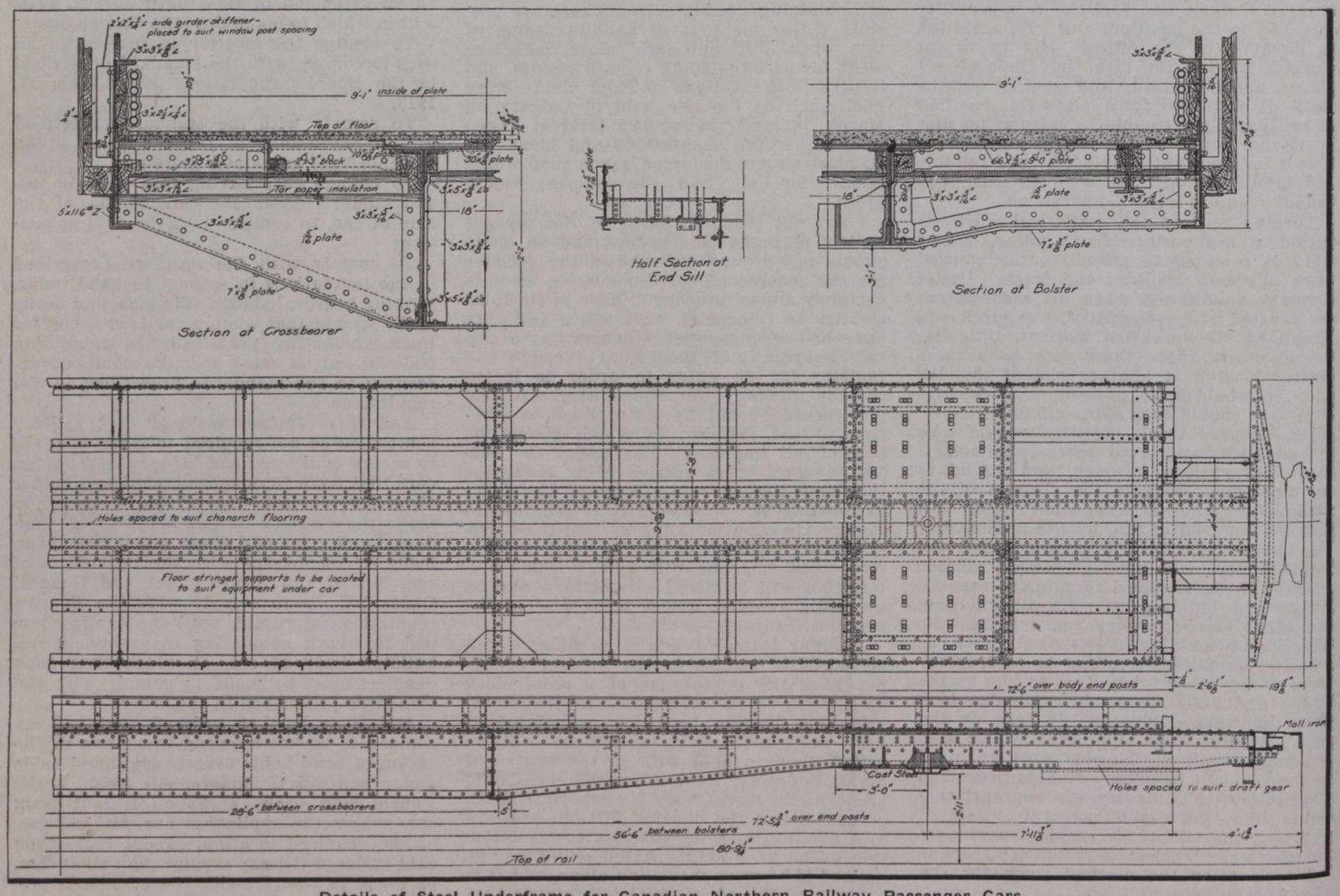
The body end sills are of 8 in. 16.25 lb. channels, with 12 by 5-16 in. top cover plate and 8 by ½ in. bottom cover plate, connected to the side girder by ⅜ in. gusset plates and having malleable iron centre filling stop to suit the buffing device. The buffer beams are composed of 6 in. 8 lb. channels inside, and 6 in. 14.75 lb. I beams outside, and fitted with 8⅝ by 5-16 in. top and bottom cover plates. The end construction is composed of 4 in. 13.8 lb. Z bar posts, with 8 by 3½ by ½ in. end plate angles connected to the Z bar posts with 5 by 5 by ⅜ in. angles.

The following weights and loads formed the basis of the design calculations:—

Assumed weight of car	140,000 lbs.
Assumed live load	5,000 lbs.
Total	145,000 lbs.
Deduction for two trucks	40,000 lbs.
Total weight of body	105,000 lbs.

This load of 105,000 lbs. was assumed to be evenly distributed over the entire length, and only the portion of the load which came between the truck centres was considered, the overhang being neglected. The latter, had it been taken into account, would have somewhat reduced the determined fibre stresses at the centre of the car, as the virtual centre to centre distance between supports in an overhanging beam is less than in an end supported beam.

With these assumptions, the maximum bending moment at the centre of the car was found to be 6,900,000 inch pounds. The side girder was calculated to have a section modulus on the compression side of 181 and on the tension side of 184. The centre sills at the centre gave a section modulus of 383 on the compression side and 420 on the tension side. The total section modulus on the tension side for the combined side sills and side girders is 604, with 564 as the section modulus for the combined members on the compression side. With the maximum bending moment of 6,900,000 inch pounds at the centre, these section moduli give a fibre stress on the tension side of 11,520 lbs. per sq. in., and on the compression side of 12,230 lbs. per sq. in. This is based on the assumption that there is no



Details of Steel Underframe for Canadian Northern Railway Passenger Cars.