



**Modern
Coal-Burning
Steam Locomotives
of the
Norfolk and Western
Railway Company**



**Roanoke, Virginia
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Foreword

During recent years the Norfolk and Western Railway has designed and constructed 155 modern steam locomotives.

By the term "modern steam locomotive" is meant a locomotive designed with a high capacity boiler, equipped with roller bearings on all engine and tender wheels, one-piece cast steel bed frame, improved counterbalancing, and complete mechanical and pressure lubrication. If the locomotive is intended for high-speed passenger service, rod and valve gear connections should be equipped with roller bearings.

The principal advantages of modern coal-burning steam locomotives in comparison with other types of motive power are: low initial cost, high availability, and low maintenance cost. They have another great advantage in that they burn coal for fuel—a fuel readily available, and of which this nation has, within its own boundaries, reserve supplies sufficient for hundreds of years.

These modern steam locomotives are essentially of three types:

1. A streamlined passenger locomotive, Class J, with a 4-8-4 wheel arrangement.
2. A single expansion articulated freight and heavy passenger locomotive, Class A, with a 2-6-6-4 wheel arrangement.
3. A compound Mallet heavy freight locomotive, Class Y6, with a 2-8-8-2 wheel arrangement.

Photographs of these locomotives, together with brief descriptions including data on the performance, maintenance cost, fuel economy, and utilization, are shown on the following pages.

Streamlined Passenger Locomotive Class J

The type 4-8-4 Class J locomotive has a calculated tractive effort of 80,000 pounds, is 109 feet $2\frac{1}{4}$ inches over all in length, and the engine and tender weigh 872,600 pounds in working order.

This locomotive is equipped with cast steel bed frame, roller bearings on the engine truck, drivers, trailing truck and tender truck journals, and on the wrist and crank pins and valve gear. It has light weight rods and reciprocating parts, and mechanical lubrication to a total of 192 points. The mechanical lubricators have a capacity sufficient to operate 1,300 miles without replenishment. The roller bearings on the crank and wrist pins have sufficient lubrication capacity to run 500 miles without replenishment. On extended runs these crank and wrist pins can be refilled in station stop time. The drawbar horsepower of this locomotive is in excess of 5,000.

The Class J locomotives were primarily designed to handle heavy passenger trains over mountain grades, but where grades and curvature permit, speeds in excess of 100 miles per hour have been recorded. These locomotives have an assignment of approximately 15,000 miles per month per locomotive, and accumulated an average of 238,000 miles per locomotive before first shopping for classified repairs was necessary. On a longer railroad where the locomotive can be assigned to long passenger runs, mileages greatly in excess of 15,000 a month could be made.



Streamlined Passenger Locomotive Class J

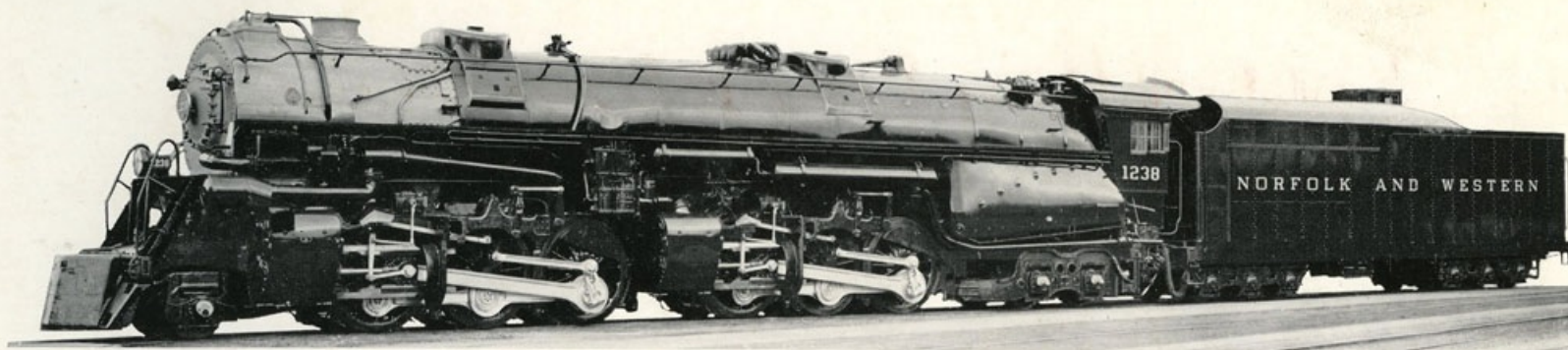
Wheel Arrangement.....	4-8-4	
Tractive Effort.....	80,000 lbs.	
Cylinders.....	Two 27" dia. x 32" stroke.	Weight on Driving Wheels.....
Driving Wheels.....	Four pair 70" diameter.	Total weight of engine and tender in working order.....
Boiler Pressure.....	300 lbs.	Coal capacity of tender.....
Over-All Length (engine and tender).....	109 ft. 2¼ in.	Water capacity of tender.....
		288,000 lbs.
		872,600 lbs.
		35 tons.
		20,000 gals.

Freight and Heavy Passenger Locomotive Class A

The type 2-6-6-4 Class A is a single expansion articulated locomotive, 121 feet 9 $\frac{1}{4}$ inches over all in length, has a calculated tractive effort of 114,000 pounds, and the weight of engine and tender in working order is 951,600 pounds.

These locomotives are equipped with cast steel bed frames, roller bearings on the engine trucks, drivers, trailing truck and tender truck journals, and mechanical lubrication to a total of 227 points. The maximum sustained drawbar horsepower, as determined by dynamometer records, is 6,300 at 45 miles per hour. The maximum rate of evaporation recorded is 116,055 pounds of water per hour, or approximately 14,000 gallons. The maximum sustained combustion rate is seven tons per hour.

This is a versatile type locomotive, being used for slow freight service in certain districts, for time freight service in other districts, and for heavy passenger train movement over practically all main line districts. In passenger service this engine has shown capacity for sustained speeds in excess of 70 miles per hour.



Single Expansion Articulated Freight and Passenger Locomotive Class A

Wheel Arrangement	2-6-6-4
Tractive Effort	114,000 lbs.
Cylinders	Four 24" dia. x 30" stroke.
Driving Wheels	Six pairs 70" diameter.
Boiler Pressure	300 lbs.
Over-All Length (engine and tender)	121 ft. 9¼ in.
	Weight on Driving Wheels
	432,350 lbs.
	Total weight of engine and tender in working order. 951,600 lbs.
	Coal capacity of tender
	30 tons.
	Water capacity of tender
	22,000 gals.

Heavy Freight Locomotive Class Y6

The type 2-8-8-2 compound Mallet locomotive, Class Y6, is 114 feet 10½ inches over all in length, has a calculated tractive effort of 126,838 pounds in compound and 152,206 pounds in simple position, and the engine and tender weigh 961,500 pounds in working order.

These locomotives are equipped with cast steel bed frames, roller bearings on the engine trucks, drivers, trailing truck journals, and have mechanical lubrication to a total of 191 points.

This type locomotive is assigned to both time and slow freight service in mountainous territory. Where operating conditions permit, they attain top speeds of 45 to 50 miles per hour with tonnage trains.



Compound Mallet Freight Locomotive Class Y6

Wheel Arrangement.....	2-8-8-2	
Tractive Effort.....	Simple 152,206 lbs. Compound 126,838 lbs.	
Cylinders.....	{ Two HP 25" dia. x 32" stroke. Two LP 39" dia. x 32" stroke.	Weight on Driving Wheels.....522,850 lbs.
Driving Wheels.....	Eight pairs 58" diameter.	Total weight of engine and tender in working order.961,500 lbs.
Boiler Pressure.....	300 lbs.	Coal capacity of tender.....30 tons.
Over-All Length (engine and tender).....	114 ft. 10½ in.	Water capacity of tender.....22,000 gals.

Fuel Economy, Maintenance Cost, and Freight Performance Statistics

The modern steam locomotive, as compared with the conventional type engine constructed 20 to 25 years ago, requires approximately 23% less coal per thousand gross ton miles of traffic handled, and costs 19% to 37% less to maintain per million tractive power pound miles. To express the figures in another way, the conventional type steam engine, built 20 years ago, costs over 50% more to maintain for the same amount of service delivered than does the fully modern steam engine. For detail of the freight performance statistics for the year 1950, see Page 10.

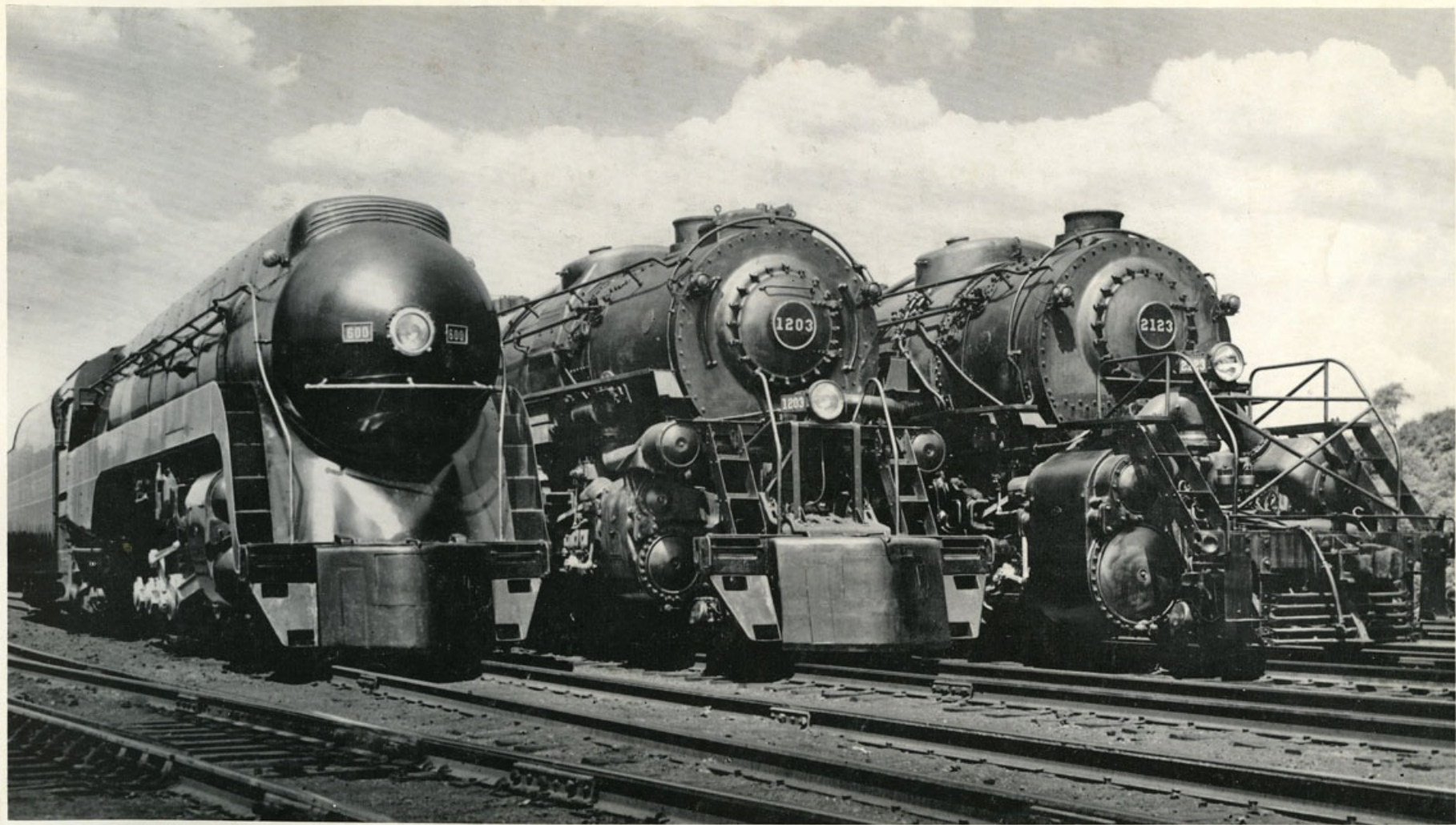
Utilization

Modern steam locomotives are more available and can be utilized a greater per cent of the time than conventional locomotives. Of the Norfolk and Western Railway's fleet of freight power, one-half are of modern design. These 50 per cent of the freight locomotives handle 90 per cent of the total freight gross ton miles.

The ownership of Norfolk and Western passenger locomotives totals 61, of which 14, or 23 per cent, are the modern streamlined Class J's. These locomotives are regularly handling 77 per cent of the total passenger car miles.

General

On the opposite page are shown the three types of modern, coal-burning steam locomotives designed and built by the Norfolk and Western Railway Company. These locomotives represent a low initial investment, are capable of high utilization, cheap to operate and maintain, and give an outstanding reliability of performance.



Freight Performance Statistics

SYSTEM AVERAGES BY CLASSES OF LOCOMOTIVES

YEAR 1950

	Class A	Class Y5 and Y6
Gross Ton Miles per Train Mile	5,788	3,761
Gross Ton Miles per Train Hour	147,145	74,820
Train Miles per Train Hour	25.4	19.9

