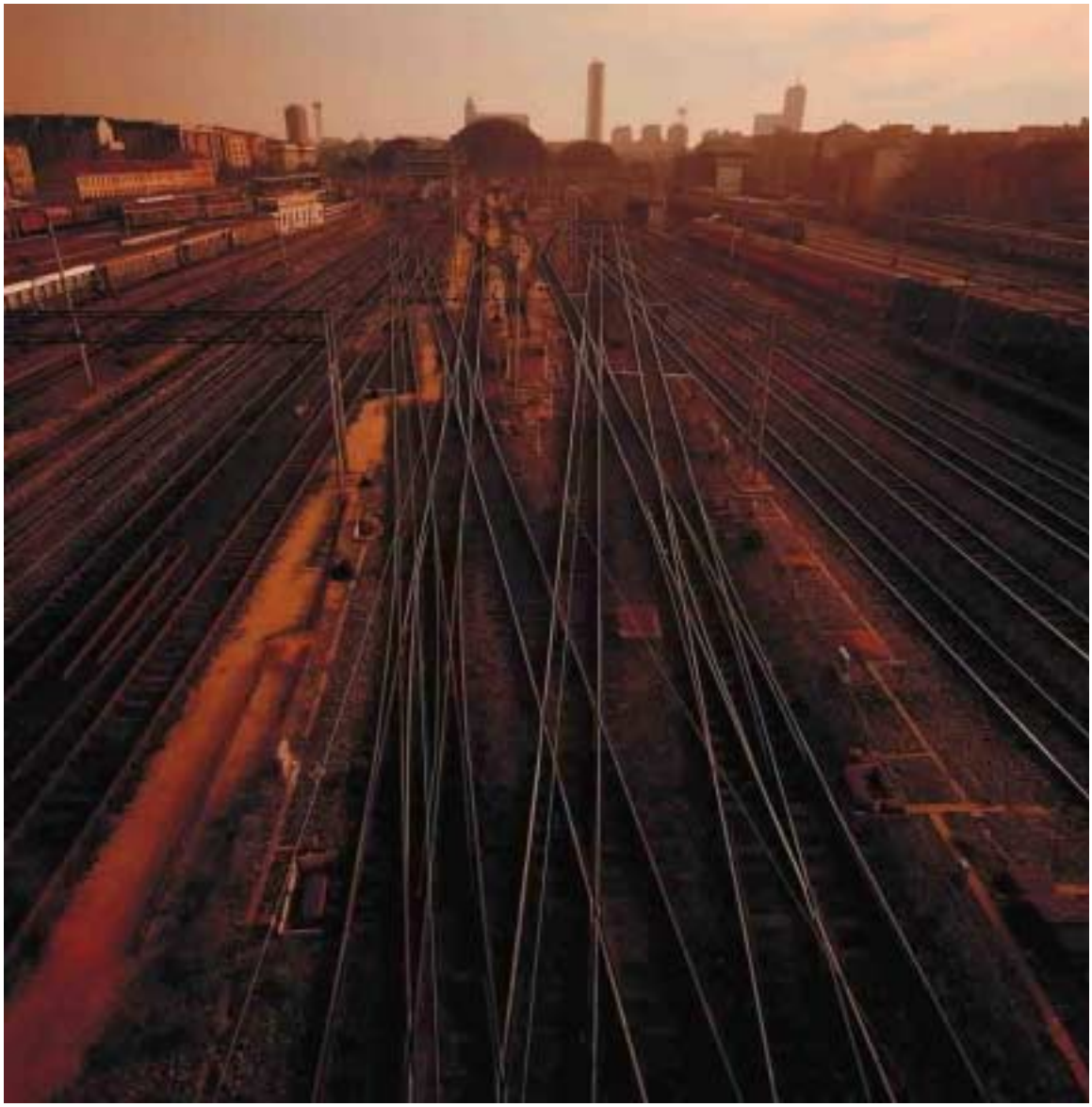
APPENDIX I

RAILROADS



Railroad tracks

Train with pipe sections

APPENDIX I

RAILROADS

MARK YUNOVICH[1]

SUMMARY

In 1997, there were nine Class I freight railroads (railroads with operating revenues of $256.4 million or more). These railroads accounted for 70 percent of the industry's 274,399 km (170,508 mi) operated. There were 35 regional railroads (those with operating revenues between $40 million and $256.4 million and/or operating at least 560 km (350 mi) of railroad). The regional railroads operated 34,546 km (21,466 mi). Finally, there were 515 local railroads (including switching and terminal railroads) operating more than 45,300 km (28,149 mi) of railroad.

The elements that are subject to corrosion include metal members, such as rail and steel spikes; however, corrosion damage to railroad components are either limited or go unreported. Therefore, a cost of corrosion could not be determined.

One area where corrosion has been identified is in electrified rail systems, such as those used for local transit authorities. Stray currents from the electrified systems can inflict significant and costly corrosion on non-railroad-related underground structures such as gas pipelines, waterlines, and underground storage tanks.

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[1] CC Technologies Laboratories, Inc., Dublin Ohio.

SECTOR DESCRIPTION

America's first common-carrier railroad, the Baltimore and Ohio (B&O), was chartered in Maryland on February 28, 1827. In another 2 years, the rail network grew to 48 km (30 mi). By 1848, 9,700 km (6,000 mi) of track were laid, mostly in the Northeastern United States. At the end of the century, this number grew to 306,000 km (190,000 mi) and, by 1916, there were 409,000 km (254,000 mi) of railroad track in this country.

Railroads were the first major industry in the United States to be the subject of economic regulation under the Interstate Commerce Act passed in 1887. The railroads remained under regulation for almost 100 years, until 1980, when the Staggers Rail Act was signed, which lifted some of the regulations.

In the most basic way, national railroads are divided into passenger and freight railroads. Passenger railroads are further separated into intercity railroads (with Amtrak, created by U.S. Congress in 1971, being the only U.S. company in this category) and those under the auspices of transit and suburban authorities.

The Surface Transportation Board (STB) defines Class I freight railroads as those with average operating revenues of $256.4 million or more. Those with revenues between $20.5 million and $256.4 million are classified as Class II railroads. Railroads with average operating revenues less than $20.5 million are considered Class III railroads. A brief summary of North American railroad statistics is presented in table 1.

Table 1. Basic facts of North American railroads (1999).

TYPE OF RAILROAD	NUMBER OF RAILROADS (INCLUDING CANADIAN)	KILOMETERS OPERATED	MILES OPERATED	NUMBER OF EMPLOYEES	FREIGHT REVENUE ($ x million)
Class I	9	191,891	119,239	178,222	$32,247
Regional	35	34,368	21,356	11,094	$1,586
Local	309	34,825	21,640	5,781	$856
Switching & Terminal	206	10,913	6,781	5,809	$606
Canadian	2	2,401	1,492	n/a	n/a
All Railroads	**561**	**274,399**	**170,508**	**200,906**	**$35,295**

n/a – data not available.

The following U.S. railroads (as of the end of 1999) were classified as Class I:[2]

- Burlington Northern and Santa Fe Railway Company.
- CSX Transportation.
- Kansas City Southern Railway Company.
- Norfolk Southern Corporation.
- Union Pacific R.R.

[2] The remaining four railroads are registered in Canada.

The Association of American Railroads (AAR) has estimated that while making up only 2 percent of the number of American railroads, Class I railroads employed approximately 89 percent of the industry workforce, operated 70 percent of the track, and generated 91 percent of the revenue in 1998.[1]

The sketch illustrating the density of coverage of railroads in the United States is shown in figure 1.

Figure 1. Railroad coverage in the United States.[1]

AREAS OF MAJOR CORROSION IMPACT

Published information with respect to corrosion-related issues in the industry is scarce. The elements of construction subject to corrosion include metal members, such as rail, steel spikes for wooden ties, etc. As far as the railroads are concerned, corrosion damage to the rail itself is limited and often goes unreported. One area where corrosion has been identified is in the electrified rail systems, such that as those used for local transit authorities. Barlo et al. (1995)[2] conducted a study on corrosion of electrified trains that covered a number of transit systems. It was estimated that the damage to the rail is primarily caused by stray current that occurs on the electrified rail systems.

The above-referenced 1995 review covered transit systems in Chicago, Jersey City (NJ), New York City, Washington, D.C., San Francisco, and Los Angeles. The systems were powered by 600V to 1000V direct current (DC), with the third positive rail, or overhead catenary wire, and the running rails providing a negative return. The transit authorities acknowledge that corrosion-related problems exist, as manifested by the accelerated corrosion of the insulators of the rail fasteners in Jersey City and New York City, or in the wood tie spikes in Chicago. For example, wood tie spikes need to be replaced after 6 months instead of the anticipated 25 years. In many instances, there was no formal tracking of corrosion-related costs. The estimates for the cost of corrosion made by the authors of this 1995 study suggest that the direct costs are small (less than 0.5 percent of the annual total non-vehicle costs). Additional expenditures included the *in situ* study of stray-current problems in Washington, D.C., and column footing reconstruction in Chicago.

While ostensibly there is corrosion damage to other railroad-owned property, such as bridges, railyard structures, etc., from exposure to the elements, the railroad systems apparently do not consider it to be a major expense and, therefore, do not track this data. No estimate of the cost of corrosion to railroads was possible from the data obtained.

REFERENCES

1. Association of American Railroads Data, 2000.

2. T.J. Barlo and A.D. Zdunek, *Stray Current Corrosion in Electrified Rail Systems*, Northwestern University, May 1995.