

## ABSTRACT

Title of Thesis: THE INFLUENCE OF PULLMAN:  
RAILROAD PASSENGER COACH COLORS,  
1900-1940

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Degree and Year: Master of Arts in Historic  
Preservation, 2000

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This thesis shows the influence that the Pullman Company had on the colors of passenger coaches in the first forty years of the twentieth century. The Pullman Company was the foremost manufacturer of passenger coaches in North America. The Pullman name meant quality. The dark olive green color of Pullman-made coaches became known as "Pullman Green." Passenger coaches consist of any car that was used as a commuter or day coach, business car, dining car, post office car, baggage car, sleeper, or parlor car. Railroad companies not buying coaches from Pullman requested their coach manufacturers to paint their new coaches "Pullman Green." When railroads painted coaches

during normal maintenance, they were painted dark green or olive green like Pullman cars.

This thesis examines both archival records and physical evidence. Documents show that the railroads wanted the color of their coaches to resemble Pullman coaches. Coaches were investigated to date their age and document their histories. Paint samples were obtained and a paint color analysis performed on coaches representing different coach manufacturers and railroad companies.

Documentary and physical evidence shows that Pullman set the standard for passenger coach colors from 1900 to 1940. Evidence shows that the coach manufacturers tried to match the "Pullman Green" color but were not completely successful. Railroad companies had more difficulty matching "Pullman Green" but in turn, they each came up with their own unique green. Many of these colors were recorded in the course of this research. These colors are notated and an actual paint sample is included in this thesis.



THE INFLUENCE OF PULLMAN:  
RAILROAD PASSENGER COACH COLORS, 1900-1940

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Thesis submitted to the Faculty of Goucher College in  
partial fulfillment of the requirements for the  
degree of Master of Arts in  
Historic Preservation

2000

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## ACKNOWLEDGMENTS

I wish to thank all the people who assisted me with this thesis. My thesis committee, Pat McKnight, Hugh Miller and Frank Welsh for pushing me to get done, and Frank for letting me use his lab. Ray Libby and Ed Roche, my painting mentors. To Ruth McKnight for editing. Bill Withuhn, of the Smithsonian for his ideas. George Rust of DuPont, for all that information. To Al Kresse for leading me to Tod Hanger, and Tod who loaned me C&O paint chips to analyze. Carol Perrault for testing my theory. Katie Newell of the Hagley Museum and Library, Jo Ellen Dickie of the Newberry Library and Bruce Laverty, of the Athaeneum of Philadelphia. Robert Emerson, Kurt Bell and Allen Martin of the Railroad Museum of Pennsylvania. Courtney Wilson, Shawn Herne, and Harold Dorsey of the B&O Museum. Bruce Gibson, Wayne Dobson, and Mark Birtel, my bosses who gave me the time. To my parents, Tom and Millie Nolan for putting up with me the last two years. Last but not least, to Anna von Lunz for all her moral support.

## TABLE OF CONTENTS

Acknowledgments	i
List of Tables	v
List of Figures	iv
Chapter I: Introduction	1
Overview	1
American Railroads	1
The Influence of Pullman	2
The Effect of the Pennsylvania Railroad	4
Interior Colors	5
Formulas	5
Method of Research	7
Chapter II: Railroad Companies and Equipment	
Manufacturers	9
Coach Manufacturers	9
The Pullman Company	9
Jackson and Sharp/American Car and Foundry	11
Pressed Steel	12
Pennsylvania Railroad	12
Railroad Companies	14
Baltimore and Ohio	15
Central Railroad of New Jersey	15
Chesapeake and Ohio	16
Delaware, Lackawanna and Western	17
Santa Fe	18
Seaboard	18
Boston and Maine	18
Rutland	19
Chapter III: The Restoration of Passenger Railroad	
Coaches	20
Pennsylvania Railroad Standards	20
Museums and Railway Historical Societies	23





Documentary Evidence	26
Physical Evidence	28
Color Systems for Recording Colors	29
Professional Paint Analysis	33
Chapter IV: Exterior Body Color and Finishes:	
1900-1940	40
The Term Pullman Green	40
Passenger Coaches in the Nineteenth Century	40
Private Cars	42
Pullman's First Standard Color	43
The Change to Brewster Green	43
Color Research	46
Problems Researching Formulas for Old Colors	48
The Influence of Pullman	49
Jackson and Sharp/American Car and Foundry	50
Pressed Steel	52
Railroad Companies	52
Baltimore and Ohio	52
Central Railroad of New Jersey	53
Chesapeake and Ohio	53
Delaware, Lackawanna and Western	53
Santa Fe	56
Seaboard	58
Boston and Maine	58
Rutland	59
Railroads With Different Colors	59
Pennsylvania Railroad	60
Lettering	64
Chapter V: Interior Colors and Finishes: 1900-1940	66
Graining	66
Headliners	69
Walls of Steel	72
Chapter VI: Conclusion	77
Appendix I: Exterior Color Charts	83
Appendix II: Pennsylvania Railroad Paint Colors	88
Appendix III: Interior Color Charts	89

Appendix IV: 1999 Paint Formulas	94
Appendix V: Color Cards	98
Appendix VI: Exterior Applications of Paint	99
Horse Carriage Painting	99
Passenger Coach Colors	102
Paint as Protection	105
Nineteenth Century Paint Applications	106
Paint Materials	110
Spray Painting	112
Pennsylvania Railroad Testing Procedures for Baked Enamels	113
Twentieth Century Paint Applications	115
Glossary	118
Endnotes	123
Bibliography	138





## LIST OF TABLES

1. Manufacturer Exterior Color Chart	84
2. Railroad Exterior Color Chart	85
3. Pennsylvania Railroad Paint Colors	88
4. Interior Walls Color Chart	90
5. Headliner Color Chart	92
6. Paint Formulas	95

## LIST OF FIGURES

1. Pennsylvania Railroad Specification Sheet for Tuscan Red 1898	21
2. Pennsylvania Railroad Specification Sheet for Tuscan Red 1904-1939	22
3. Second page of the Pennsylvania Railroad Specification Sheet for Tuscan Red 1904-1939 Showing Return Policy	24
4. Munsell Book of Color	30
5. Close Up of Munsell Book of Color Showing the Notation Format	32
6. DuPont SpectraMaster™ Solid Color Library Chips	35
7. Sample of a "Preliminary Laboratory Data Sheets"	36
8. Paint Chip Cross Sections Mounted in a Dental Resin	37
9. Coatings, Color and Materials Analysis Flowchart	39
10. Comparison of "Pullman Green" Between Central Railroad of New Jersey and the Delaware, Lackawanna and Western Railroad	41
11. Pullman Lotos Club Car	45
12. Exterior Paint Scheme of the Central Railroad of New Jersey	54
13. Exterior Paint Scheme of the Delaware, Lackawanna and Western Railroad	57

14. The Pennsylvania Railroad and the Lighter and Brighter Form of the Pullman Earlier Tuscan Red	63
15. The Pennsylvania Railroad and the Darker and Browner Form of the Company's Later "Tuscan Red"	63
16. Graining of Steel Walls	68
17. Pumpkin Colored Headliner	71
18. Two Toned Green Headliner	73
19. Pennsylvania Railroad Wall Cross Section	74
20. Pennsylvania Railroad Wall and Window Sash Cross Section	74
21. Early Form of Carriage Looking Rail Coach	101
22. Carriage Looking Rail Coaches Mounted on a Flat Car	101
23. Four Private Cars Each in its Own Livey	104

## CHAPTER I INTRODUCTION

### Overview

This thesis is a study of the colors used to paint the passenger cars of some of the major railroad lines and coach manufacturers. It will compare and contrast the standard exterior and interior colors used by the Pullman Company with those used by other major American car manufacturing companies and railroads between 1900-1940. These companies consist of coach builders, railroads who sometimes built their own coaches and railroads who purchased cars from the coach builders.

### American Railroads

Railroads built our nation and fueled the industrial revolution by moving people and freight across the country. Railroads delivered coal, the major fuel source to the cities of the east and Midwest. The first steam locomotive

that ran in the United States was in Honesdale, Pennsylvania, in 1829. Since then railroads have connected this country, delivering freight and passengers throughout the United States. Trains with passenger coaches expanded the western United States more than any other transportation method.<sup>1</sup>

By 1900, the Pullman Palace Car Company of Chicago, Illinois, became the premier builder of passenger railroad cars. The name Pullman evoked a standard of quality in railroad transportation in the minds of people throughout the world. Pullman and other companies manufactured passenger coaches that were used as commuter or day coaches, business cars, dining cars, sleepers, and parlor cars. Commuters and day coaches were the type of coach the average American used to travel modest distances like those traveled today by automobiles and commuter airlines.<sup>2</sup>

### The Influence of Pullman

The railroad industry painted their passenger coaches so that the public would instantly recognize them. The Pennsylvania Railroad used "Tuscan Red," a brownish red color since at least 1879. The Louisville and Nashville

Railroad painted its coaches blue. Coach manufacturers such as the Wagner Palace-Car Company and American Car and Foundry painted their coaches green. Pullman at this time used a dark brown color known as Pullman Standard Car or Pullman Car Body. Jackson and Sharp painted its cars the same as Pullman upon request.<sup>3</sup>

On each railroad all types of passenger coaches were painted the same color as the day coaches so that the entire passenger train would match the individual railroad company's colors. The only exception to the rule was Pullman owned or leased coaches that carried the Pullman colors and lettering.<sup>4</sup>

The Pullman Company set the standards for paint colors in 1900, when it switched the paint color of its passenger coaches from dark brown to a dark olive green. The green was a popular color called "Brewster Green" and only Pullman-made coaches used "Brewster Green." Today the color is usually referred to as "Pullman Green" or "Pullman Standard Green." When a railroad ordered a Pullman-built passenger coach, between 1900-1930's, the coach was painted in "Brewster Green" as a rule.

In the early twentieth century the outside colors of passenger cars evolved into different shades of green,

predominately olive green and dark green, because of the influence of Pullman. When coach builders other than Pullman painted coaches or when the cars were repainted by the railroad companies themselves during normal paint scheduling, they painted them a green that did not match that of the original "Pullman green." Each individual railroad company developed their own unique shade of green <sup>5</sup>

The memory of the quality that the Pullman name evokes is still strong many years after the company's demise. So too, the memory of the company's color "Pullman Green" that even today any olive or dark green color on a passenger car in the United States is automatically referred to as "Pullman Green."<sup>6</sup>

#### The Effect of the Pennsylvania Railroad

The Pennsylvania Railroad was the major exception. In 1908, the Pennsylvania Railroad offered large contracts to Pullman and its competitors to build all-steel passenger coaches, on condition that all Pennsylvania equipment would be painted "Tuscan Red." Since the Pennsylvania Railroad was one of the largest railroads in America and usually



built their own coaches, Pullman readily accepted the conditions.<sup>7</sup>

### Interior Colors

Interior colors were also standardized throughout the industry. Passenger coaches in the early 1900's consisted mostly of wooden interiors that were stained and varnished. In 1907, the Pullman Car Company tried to introduce solid pastel colors to the metal interior parts of coach walls, but people rejected the look. As a result Pullman painters became very good at graining, the art of painting any surface to resemble wood.<sup>8</sup>

### Formulas

The formulas for these early twentieth century colors are generally no longer available through documentation by the major paint companies nor from records left by the railroads themselves. Since railroad colors are not readily accessible, careful research and paint analysis is required. The preservationist needs documentation and paint analysis to reproduce the actual colors with the modern paint products on the market.

While there are color studies for buildings, there are few available for the railroad industry between 1900-1940. Arthur Dubin has written a study of the exterior colors that Pullman used for the different railroads when it started painting cars any color that a company requested in 1942. There are some color chips, called drift cards, from the Pullman Company in the Illinois State Historic Library. While these color cards were produced by the company's paint shop in 1960, and are reproduced by Dubin in his book, they are too recent for this thesis. However, he does discuss early Pullman twentieth century colors.<sup>9</sup> Charles Blardone and Peter Tilp produced the same type of study with Pennsylvania Railroad coaches from 1910-1968.<sup>10</sup>

Color card pamphlets of paint manufacturers for horse carriages from the 1880's and 1890's give a clearer picture of the different colors that were used by the railroads who applied carriage painting to their locomotives and passenger coaches.<sup>11</sup> However, even when paint formulas are found, reproducing them today with the old types of materials may not necessarily create the exact color needed. Historically, when the paint shops of the railroad mixed together the pigments to get the desired color, the master painter matched it every day against a drift control

color card that was used as the standard color. These master painters spent years in the paint shops learning the craft of mixing paint in the proper way to get the same color consistently.<sup>12</sup>

### Method of Research

This thesis demonstrates methods that can be used by researchers in the railroad preservation field to better document the historic colors of their railroad artifacts. The research for this thesis traces the actual color evidence in the field of railroad painting and lettering schemes for select railroads.

Working with the various United States railroad museums, rail historical societies, and private collections, I obtained paint chips for paint analysis, paint card samples and formulas to reproduce the colors for the paint cards. Using the 1997 DuPont SpectraMaster™ Solid Color Library card system on loan from Steamtown National Historic Site, I visually matched original transportation color cards from the collection of the Athenaeum of Philadelphia and the Hagley Museum in Wilmington, Delaware. Paint chips were matched using the

Munsell Color System or the DuPont Color system. Paint analysis was performed under the tutelage of Frank S. Welsh, an Architectural Coatings Consultant, who demonstrated the very basics of paint analysis. Finally I worked with George Rust, a service technician at DuPont's High Performance Coatings Division, to identify the paints and colors of old DuPont products used by the railroads with modern automotive paints for use by present day restorationists.

The appendixes provide charts for a quick summary of exterior and interior color information that can be used to reproduce the colors that are be discussed. Color cards and samples are also included in the appendixes so that the reader may compare the different colors. For the understanding of problems relating to matching paints from old coaches, Appendix VI deals with paints and their application in the nineteenth and twentieth century, as paints evolved from early oil-based paints into the automotive paints used on railroad cars today in museums and by operating railroad companies. A glossary is included to explain some of the unique terms used by the railroads and the paint industry.

## CHAPTER II RAILROAD COMPANIES AND EQUIPMENT MANUFACTURERS

### Coach Manufacturers

Coach manufacturers like the Pullman Company and its competitors were in the business of building coaches to specification for a railroad company. The railroad companies wrote detailed coach specifications to the coach manufacturers.

### The Pullman Company

George Mortimer Pullman founded the Pullman Palace Car Company in 1867. George Pullman had begun designing and building sleeping cars in 1857. At that time he would buy a coach and customize the interior to accommodate sleeping berths. Once he started to manufacture the entire coach, he had more control over the process, including improvements to the mechanical portions of the car to produce a smoother ride.<sup>13</sup>

Pullman's greatest competitors in the mid to late 1800's were the Wagner Palace Car Company of New York, which was controlled by Cornelius Vanderbilt, and the Woodruff Sleeping and Parlor Coach Company, which was associated with Andrew Carnegie. The three companies competed continuously for development of patents for sleeping car design and overall car design for comfort and safety.<sup>14</sup>

In the 1890's, the Pullman Palace Car Company began to overpower its rivals through inventiveness and aggressive marketing. Over the years, Pullman had begun buying up smaller coach manufacturers. Pullman gained control of the Woodruff Sleeping Car Company in 1889. In 1899, the Pullman Palace Car Company bought out the Wagner Palace Car Company. Shortly thereafter, the Pullman Palace Car Company changed its name to The Pullman Company, since it had been building other types of passenger coaches besides sleeping and private cars. The Pullman Company continued to acquire small railcar companies into the twentieth century. It again had a name change in 1924 and became the Pullman Car and Manufacturing Corporation. In 1934, it became Pullman-Standard Car Manufacturing Company. The company was judged a monopoly in 1944 and was required to

divest itself of its sleeping car operations or its manufacturing division of coach building. Pullman kept the manufacturing division. Fifty-seven railroad companies formed a consortium that purchased Pullman in 1947. The competition from airlines caused the company to cease operation of sleeping car manufacture in 1969. Freight car building was discontinued in 1971 and, after a decade of poor production and labor troubles, the company left the railroad industry in 1978.<sup>15</sup>

#### Jackson and Sharp/American Car and Foundry

The Jackson and Sharp Car Company had been one of the major car builders in the late nineteenth century. The company was a large supplier of coaches for the Woodruff Sleeping and Palace Car Company and the Mann Boudoir Car Company, major competitors of Pullman and the Wagner Palace Car Company. Jackson and Sharp began building railcars, passenger coaches, ships and trolleys in 1863. Woodruff and Mann merged in 1888 to become the Union Palace Car Company, with the help of Job H. Jackson of Jackson and Sharp who owned stock in the companies. But, in 1889, when Pullman bought up the stock and controlled the new company,

Jackson and Sharp were no longer allowed to make the Union Company's coaches.<sup>16</sup>

American Car and Foundry of Wilmington, Delaware, was founded in 1899 by merging thirteen car builders making all types of railcars. One of the companies that they took over was Jackson and Sharp, which they acquired in 1901, after the death of Jackson. The company continued to build passenger coaches until 1961.<sup>17</sup>

### Pressed Steel

The Schoen Pressed Steel Company of Pittsburgh, began in 1892 as a manufacturer of railroad parts. In 1898, it became the Pressed Steel Car Company and sold its first coaches in 1903. By 1910 it had become one of the biggest carbuilders in the railroad industry. Like all railcar manufacturers Pressed Steel could not survive the advent of air and automobile travel, nor the trucking of freight.<sup>18</sup>

### Pennsylvania Railroad

The Pennsylvania Railroad was also a car manufacturer. The railroad was created by an act of the Pennsylvania state legislature in April of 1846. As the nineteenth



century wore on, the Pennsylvania Railroad grew into a very successful railroad. Its slogan was the "standard railroad of the world." The Pennsylvania Railroad eventually ranged from the New Jersey coast, to upstate New York, across Pennsylvania, Ohio, and Michigan, to St. Louis.<sup>19</sup>

The Pennsylvania Railroad also wanted control of New York City rail traffic. Since 1890, the Pennsylvania Railroad had been looking for a way to establish itself in New York City. By owning Long Island's railroad, which was located in Brooklyn and ran to the Hamptons at the eastern end of the island, Pennsylvania Railroad could connect to New York City rail traffic at a terminal in Manhattan. In 1900, controlling interest was purchased by the Pennsylvania Railroad. The Long Island had a very powerful charter with almost unlimited powers to do as it pleased in perpetuity. Since the Pennsylvania did not want to invalidate the charter of the Long Island Rail Road by absorption of the company, the smaller railroad was simply controlled by Pennsylvania through majority stock interests.<sup>20</sup>

As rail passenger travel declined in the late 1940's in the United States, most railroads eliminated their passenger service. However, the Long Island Rail Road

continued to be the largest commuter railroad in the country. Regardless of the number of riders, passenger service was not a moneymaker. Though, the Pennsylvania Railroad poured more money into the railroad service declined and trains broke down. Commuters were incensed and New Yorkers demanded that the Long Island be "freed". In 1954, the railroad started to "de-Pennsify" the Long Island Rail Road by giving the coach a new paint scheme hoping that commuters would forget the railroad was owned by the Pennsylvania Railroad. In 1966, ownership passed to the state of New York and today the railroad is administered by the state's Metropolitan Transportation Authority.<sup>21</sup>

#### Railroad Companies

Once the railroads received their coaches from the manufacturers, they performed all the maintenance on the cars, including painting. Coaches from the following railroads were used in this thesis.

## Baltimore and Ohio

Chartered in 1827, the Baltimore and Ohio Railroad became the United State's first major railroad. Horses pulled trains at first. The company's first locomotive, the famous "Tom Thumb," was built in 1831. The railroad extended from Baltimore to Washington, D.C., Philadelphia, New York, Chicago, Pittsburgh, Cincinnati, Cleveland, and St. Louis. It competed constantly with the Pennsylvania Railroad and the New York Central for freight and passengers. In 1962, the Chesapeake and Ohio took control of the Baltimore and Ohio, and in 1987 the two railroads merged.<sup>22</sup>

## Central Railroad of New Jersey

Founded in 1849, the Central Railroad of New Jersey carried coal and suburban passengers into New York City. It operated throughout New Jersey and the southeast coalfields of Pennsylvania. Conrail took over the railroad in 1976. In 1983, Conrail handed over the railway's lines to the New Jersey Transit Rail under the New Jersey Department of Transportation.<sup>23</sup>

## Chesapeake and Ohio

Founded in Virginia in 1836 the Chesapeake and Ohio Railway was known as the Louisa Railroad. In 1850, it became the Virginia Central and was running to the Allegheny Mountains by 1856. The railroad was created to connect Tidewater Virginia with the Ohio River where products could be shipped to the Mississippi River by boat. The railroad was a significant logistical connection for the South during the Civil War. After the Civil War the railroad reached West Virginia and the Ohio River. By 1900, the Chesapeake and Ohio was a major handler of coal to the Midwest. Eventually, the railroad reached Chicago. The railroad took control of the Baltimore and Ohio Railroad in 1962. During this time passenger service declined and the railroad just ran freight trains. In 1973, a new company was formed, the Chessie System, to own the Chesapeake and Ohio, the Baltimore and Ohio Railroad and Western Maryland Railroad.<sup>24</sup>

## Delaware, Lackawanna and Western

The Delaware, Lackawanna and Western was founded in 1848 by the Scranton family of Scranton, Pennsylvania. The family owned Scranton's first industry, an iron furnace. They made the first massed produced iron T-rail tracks in the United States. Their first customer was the Erie Railroad, which had to complete a stretch of track to Binghamton, New York by the end of 1848 or lose a three million dollar grant from New York State to build a railroad. The easiest way to ship the track was by a railroad which the Scranton's built. Coal was first mined in the area to provide fuel for the iron industry. However, coal soon became big business to Northeastern Pennsylvania and the Delaware, Lackawanna and Western supplied it to the northeastern United States. The Delaware, Lackawanna and Western eventually operated from Hoboken, New Jersey, to Scranton and Buffalo. The company merged with the Erie in 1960 and later was absorbed by Conrail in 1976.<sup>25</sup>

## Santa Fe

Founded in 1863, the Atchison, Topeka and Santa Fe, ran from Kansas and throughout the southwest. At times it followed the old Santa Fe Trail. Its early business was passenger service and moving cows to Chicago.<sup>26</sup>

## Seaboard

The Seaboard Air Line System was a southern railroad running from Virginia to Florida. The original railroad that would become Seaboard was founded in 1832. In 1967, the Atlantic Coast Line and the Seaboard Air Line Railroad merged. The new company was called Seaboard Coast Line, later changing its name to the Seaboard System. The company now belongs to CSX Transportation.<sup>27</sup>

## Boston and Maine

Founded in 1842, the Boston and Maine operated passenger and freight service in Maine, New Hampshire, Vermont, Massachusetts and New York.<sup>28</sup>

## Rutland

Founded in 1843 the Rutland Railroad ran in Vermont and New York, along Lake Champlain, and in the Connecticut River Valley. The company built the first covered railroad bridges in the country. Its primary business was freight, especially marble and granite. In 1902 William H. Vanderbilt's son-in-law William Seward Webb became president of the Rutland. Within two years, the New York Central owned by the Vanderbilts, purchased over fifty percent of Rutland's stock. Until the mid-1920's, the New York Central influenced the look of the Rutland. The Rutland was closed down by a strike in 1961 and never ran again.<sup>29</sup>

### CHAPTER III

#### THE RESTORATION OF PASSENGER RAILROAD CARS

##### Pennsylvania Railroad Standards

Documents are available on a sporadic basis that indicates that Pullman and other coach builders had strict standards pertaining to painting and colors. However, when companies were in financial trouble these standards might have been relaxed because there was little available money to buy paint materials.

There is enough remaining available documentation in archives to trace the Pennsylvania Railroad's commitment to standards set for its workers and the manufacturers who provided materials to the railroad. The Pennsylvania Railroad archives at the Hagley Museum and Library have numerous documents that show a pattern of methodical testing of paint materials, applications and adherence to paint specifications (figure 1 and 2).

The Pennsylvania Railroad was especially uncompromising with companies that supplied its materials.



Stamper  
Williams Coll.

# PENNSYLVANIA RAILROAD COMPANY.

PHILADELPHIA, WILMINGTON & BALTIMORE RAILROAD.  
NORTHERN CENTRAL RAILWAY.  
WEST JERSEY RAILROAD, CAMDEN & ATLANTIC RAILROAD.

MOTIVE POWER DEPARTMENT.

DEC 16 1896

No. 37.

## Specifications for Tuscan Red.

Superseding Specifications dated July 22nd, 1890.

Tuscan Red will be bought in the paste form, and the paste should contain nothing but pigment, oil and turpentine.

The proportions of the ingredients of the paste should be, as nearly as possible, as follows:

Pigment, 75 per cent. by weight.  
Oil, 9 per cent. by weight.  
Turpentine, 16 per cent. by weight.

The oil must be pure raw linseed oil, well clarified by settling and age. The turpentine must be good quality, and as free as possible from resinous matter.

The pigment desired contains no hygroscopic moisture, and has the following composition:

Sesquioxide of Iron, 80 per cent. by weight.  
Carbonate of Lime, 5 per cent. by weight.  
Organic Coloring Matter, 15 per cent. by weight.

Samples of dry pigment showing standard shade will be furnished, and shipments will be required to conform strictly to standard. The shade of paint being affected by the grinding, the P. R. R. standard shade is that given by the dry sample sent, mixed with the proper amount of oil and turpentine and ground, or better rubbed up in a small mortar with pestle, until the paste will pass the test for fine grinding. It is best to use fresh samples of the dry pigment for each day's testing. The comparison should always be made with the fresh material, and never with the paint after it has become dry. The comparison is easiest made by putting a small hillock of the standard paste, and of that to be compared near each other on glass, and then laying another piece of glass on the two hillocks, and pressing them together until the two samples unite. The line where the two samples unite is clearly marked, if they are not the same shade. The shade is affected by the color in the glass used to cover the hillocks of paste. It is recommended to employ for this purpose the thin cover glasses used in microscopic work. The round form,  $\frac{3}{16}$  inch in diameter, works nicely.

The paste must be so finely ground, that when a sample of it is thoroughly mixed five [5] parts paste to three [3] parts of pure raw linseed oil by weight, and a small amount of the mixture placed on a piece of dry glass, and the glass placed vertical, there will be no separation of the oil from the pigment for at least half an hour. The temperature affects this test, and it should always be made at 70° Fahrenheit. The sample under test runs down the glass in a narrow stream, when it is placed vertical, and it is sufficient if the oil and pigment do not separate for an inch down from the top of the test.

Shipments will not be accepted which

- I. Contain in the paste, less than 74 per cent. of pigment air dried at from 60° to 90° Fahrenheit.
- II. Contain in the paste, less than 8 per cent. of oil, dried at 250° Fahrenheit, or more oil than one-seventh of the weight of the pigment.
- III. Contain in the paste impure or boiled linseed oil or more than 5 per cent. of moisture.
- IV. Contain in the pigment less than 75 per cent. of sesquioxide of iron, less than 2 per cent., or more than 5 per cent. of carbonate of lime, or have present any barytes or any caustic substances, or any organic coloring matter that has not been approved.\*
- V. Vary from shade.
- VI. Are not ground finely enough.

\*In view of the vast number of coal tar products now available, whose properties are not yet definitely known, it has been deemed advisable, for the present at least, to ask those desiring to use any organic coloring matter as a constituent of Tuscan Red, to submit a sample of the same, and receive approval for its use. This does not mean that each new lot of organic coloring matter obtained by the manufacturers must be approved, but that the kind of organic coloring matter used must be approved, and no change must be made in the organic coloring matter that has been once approved, unless authority to do so is given by this Company.

F. D. CASANAVE,

Figure 1: 1896 Pennsylvania Railroad specification sheet for "Tuscan Red." Binders contained the specifications of all materials used by the PRR for building and maintaining their equipment. (Altoona, Pennsylvania: Pennsylvania Railroad Company, [1896]), photocopied, Restoration Shop, The Railroad Museum of Pennsylvania.

# PENNSYLVANIA RAILROAD

LINES EAST AND WEST OF PITTSBURGH

No. 37-B.

ISSUED ALTOONA, PA.

## SPECIFICATIONS FOR TUSCAN RED.

(SUPERSEDING SPECIFICATIONS No. 37-A, DATED AUGUST 6, 1904)

I. Tuscan Red will be bought in the paste form, and in amounts as the demands of the service indicate. The paste should contain nothing but pigment, oil and turpentine. Method of Purchasing

II. The proportions of the ingredients of the paste should be, as nearly as possible, as follows: Material Desired

Pigment .....	75 per cent. by weight
Oil .....	9 " " " "
Turpentine .....	16 " " " "

The oil must be pure raw linseed oil, well clarified by settling and age. The turpentine must be good quality and as free as possible from resinous matter. The pigment desired contains no hygroscopic moisture, and has the following composition:

Sesquioxide of iron .....	As much as possible.
Carbonate of lime .....	Not less than 2 per cent. nor more than 5 per cent. by weight
Organic Coloring Matter .....	Not exceeding 15 per cent. by weight

III. When a shipment is received at any point, a sample of about a pint must be sent to the Chemist, P. R. R., Altoona, Pa., by railroad service, in a "Sample-for-Test" box and can, accompanied by "Sample-for-Test" tag properly filled out, and paint must not be used until report of test is received. Sampling

IV. The sample being received at the Laboratory, it will be analyzed and tested by P. R. R. standard methods. These methods will be shown to anyone interested, who will pay a visit to the Laboratory. They have not yet been put in print. Analysis

V. Samples of dry pigment showing standard shade will be furnished, and shipments will be required to conform strictly to standard. The shade of paint being affected by the grinding, the P. R. R. standard shade is that given by the dry sample sent, mixed with the proper amount of oil and turpentine and ground, or better, rubbed up in a small mortar with pestle, until the paste will pass the test for fine grinding. It is best to use fresh samples of the dry pigment for each day's testing. The comparison should always be made with the fresh material, and never with the paint after it has become dry. The comparison is easiest made by putting a small hillock of the standard paste and of that to be compared near each other on glass, and then laying another piece of glass on the two hillocks, and pressing them together until the two samples unite. The line where the two samples unite is clearly marked, if they are not the same shade. The shade is affected by the color in the glass used to cover the hillocks of paste. It is recommended to employ for this purpose the thin cover glasses used in microscopic work. The round form  $\frac{7}{8}$  inch in diameter works nicely. Shade

Figure 2: First page of the 1911 Pennsylvania Railroad specification sheet for "Tuscan Red." Note the new measurements of ingredients for the sesquioxide of iron and the carbonate of lime and how samples were to be tested. (Altoona, Pennsylvania: Pennsylvania Railroad Company, 1939).

Everything from paint pigments to turpentine had to meet the exacting standards of the railroad. Materials were tested from each shipment that arrived at the Pennsylvania Railroad shops. Any materials that did not meet the specifications were rejected and returned to the manufacturer, who had to pay the shipping charges (figure 3).<sup>30</sup> A potential supplier under consideration by the Pennsylvania Railroad had to send samples to the railroad for inspection. For example, in a letter dated 2 December 1937, the Dolphin Paint and Varnish Company wrote to the railroad inquiring what type of Alizerine Lake pigment was required in the "Tuscan Red" paste they were to make. The company had sent several different samples to the Pennsylvania Railroad, all rejected because they did not contain the right Alizerine Lake pigment according to chemical analysis. The paint company also wanted to know the railroad's testing procedures. It is unknown whether the Pennsylvania Railroad complied with the request.<sup>31</sup>

#### Museums and Railway Historical Societies

In the preservation of rail equipment, as for buildings, the exterior and interior appearance of a coach

VI. The pigment of the paste must be so fine that after having been separated from the oil and freed from hygroscopic moisture, and then thoroughly mixed again with pure raw linseed oil, which has also been freed from moisture, in the proportion of one and one-half parts oil to one part pigment by weight, it will stand the following test, viz.: Place a small amount of the above mixture on one end of a strip of dry glass, set the strip vertically where the temperature is maintained at 70 degrees Fahrenheit, and allow it to remain undisturbed for half an hour. The mixture runs down the glass in a narrow stream, and, if the pigment is fine enough, the oil and pigment do not separate for at least an inch down from the top of the test. It is believed that dry grinding of the whole pigment before it is mixed with the oil exerts a valuable influence both on the shade and the test for fine grinding.

Fine  
Grinding

VII. Shipments will not be accepted which—

Rejection  
Limits

1. Contain in the paste less than 74 per cent. of pigment, air dried at from 60 degrees to 90 degrees Fahrenheit.
2. Contain in the paste less than 8 per cent. of oil, dried at 250 degrees Fahrenheit, or more oil than one-seventh of the weight of the pigment.
3. Contain in the paste impure or boiled linseed oil or more than 5 per cent. of moisture.
4. Contain in the pigment less than 75 per cent. of sesquioxide of iron, less than 2 per cent. or more than 5 per cent. of carbonate of lime, or have present any barytes or any caustic substances, or any organic coloring matter that has not been approved.\* If, however, the pigment contains no coloring matter except that furnished by the iron oxide, the amount of sesquioxide of iron need not exceed 50 per cent.
5. Vary from shade.
6. Are not ground finely enough.

The manufacturer must pay freight charges both ways on rejected shipments.

VIII. Samples of rejected material are usually preserved at the Laboratory one month from date of test report. Accordingly, in case of dissatisfaction with the results of tests, manufacturers must make claims for a rehearing, should they decide to do so, within that time. Failure to raise a question for one month will be construed as evidence of satisfaction with the tests, the samples will be scrapped, and no claim for a rehearing will be considered.

Claim for  
Rehearing

\*In view of the vast number of coal tar products now available, whose properties are not yet definitely known, it has been deemed advisable to ask those desiring to use any organic coloring matter as a constituent of Tuscan Red, to submit a sample of the same, and receive approval for its use. This does not mean that each new lot of organic coloring matter obtained by the manufacturers must be approved, but that the kind of organic coloring matter used must be approved, and no change must be made in the organic coloring matter that has been once approved, unless authority to do so is given by this Company.

R. N. DURBOROW,  
General Superintendent Motive Power,  
Penna. Railroad Lines East of Pittsburgh

D. F. CRAWFORD,  
General Superintendent Motive Power,  
Penna. Lines West of Pittsburgh

Altoona, Pa., July 1, 1911.

Figure 3: Second page of the 1911 Pennsylvania Railroad specification sheet. Note the part that the manufacture pays all shipping charges if product is rejected. Also, the fact that "samples of rejected materials" was kept on hand for a limited period of time in case manufacture wants to challenge the test results. (Altoona, Pennsylvania: Pennsylvania Railroad Company, 1939).

is the main aspect that people will remember. For a railroad museum, it is extremely important that railroad equipment have the proper paint schemes and colors. It is equally important that proper documentation be kept by museums and railway historical societies on any other colors and paint schemes found, so that future preservationist will have the information they may need, if the physical evidence is no longer available.

The reason that paint colors are researched is to discover what colors were used on a structure throughout its lifetime. Once the colors have been found, it must be determined which of those colors are the proper ones to use for the period to which the structure will be restored. Seeing the layers of paint that a structure has in different areas can indicate where a structure has been modified or added to over the years. Considerable research has been completed in the study of architectural paint and color analysis. The colors for industrial structures and industrial equipment have not been researched as thoroughly.

## Documentary Evidence

Documentation can help at times in determining when certain colors were in use on a structure. It is important to know that "Brewster Green" was the color used by the Pullman Car Company.<sup>32</sup> But what exactly is "Brewster Green?" What shade of green; light, medium or dark? Is it a bright or subdued color? What kind of finish did it have on it? What kind of paint was it, and how has it reacted to weathering, to exposure to sunlight, or to the application of other layers of paint? Can the color still be called "Brewster Green?"<sup>33</sup>

Documentary evidence, if found, is important because knowing the colors and paint schemes of a certain class of coach before the paint analysis is performed can help determine the timeframe and accuracy of the colors found on the actual equipment.<sup>34</sup> Dated photos of various types of passenger coaches of a particular railroad are a very important source of documentation. The availability of dates mean that the various paint schemes can be narrowed to more exact time frames and judgements can be made about the length of time that it took to convert equipment to new paint designs and colors. With dated photographs,

determination of a railroad's actual paint scheme can be made within a year or two. Without dated photographs, or other documentation, a dating of paint schemes may only be narrowed to within a few decades.

Further complicating the identification of coach paint schemes many coaches found today have had several owners, both commercial and tourist railroads. Often smaller companies would buy older equipment from the larger railroads. Numerous railroads merged over time. Often the car would get a new name, number and colors. Tourist railroads applied their own name or gave equipment the name of a railroad that once operated in the area, even though the actual piece of equipment never belonged to that company.

### Physical Evidence of Paint Colors

Paint is a fluid that, when exposed to air, dries into a hard film. Paint is made of two components, the pigment, which is the color that forms a solid coating on the surface, and the "vehicle," which is the fluid of paint, such as linseed oil or lacquers found in the older paints. The analysis of paint seeks to find the different colors

used on a structure, date when each color was applied, the order and the number of colors through the examination of layers as well as where the different colors were located, for example on trim, lettering and doors. Paint analysis can also indicate special painting such as lettering, pinstripes and graining on railcars. By looking at layers from different areas, a researcher may determine if the coach has had paint removed at some point in its service, something that is quite common.<sup>35</sup>

### Paint Analysis

Paint analysis of the actual paint from a structure is the best way to determine actual colors. However, finding remaining samples of paint can at times be extremely difficult. If a steel coach has been rebuilt, it may have been sandblasted to remove older paint. If the coach is wood, then sandblasting is not done, however chemical paint removers may have been applied, or the wood may have been replaced. Sometimes the paint deteriorates over time through exposure to the elements.<sup>36</sup> Looking for the physical evidence can sometimes be a game of "hide and seek." Look for evidence of paint on surfaces like walls,



roof, doors, letterboards, and windows. Knowing where different colors may be located determines where to take samples. On wood, the best samples can be obtained in corners at the miter point of trim, where the best layering can be found. For metal coaches, paint is rarely removed inside door jams, and old paint can often be found by removing a window frame. Samples should be taken using an exacto knife with a curved blade. On wood, a piece is actually gouged out of the material. On metal, the curvature of the blade allows a circular motion to be used and for a sample to be scraped off into many small chips.

### Color Systems for Recording Colors

The Munsell system of color notation was designed in 1905 by a professor of art, Albert H. Munsell in his book "A Color Notation." In 1915, he published "The Munsell Atlas of Color," which displayed ten hues of values and chromas of color samples. He began production of color standards in 1918 when he formed the Munsell Color Company (figure 4).<sup>37</sup>

The Munsell system is now used as a museum standard for recording colors. Munsell's system classifies color by

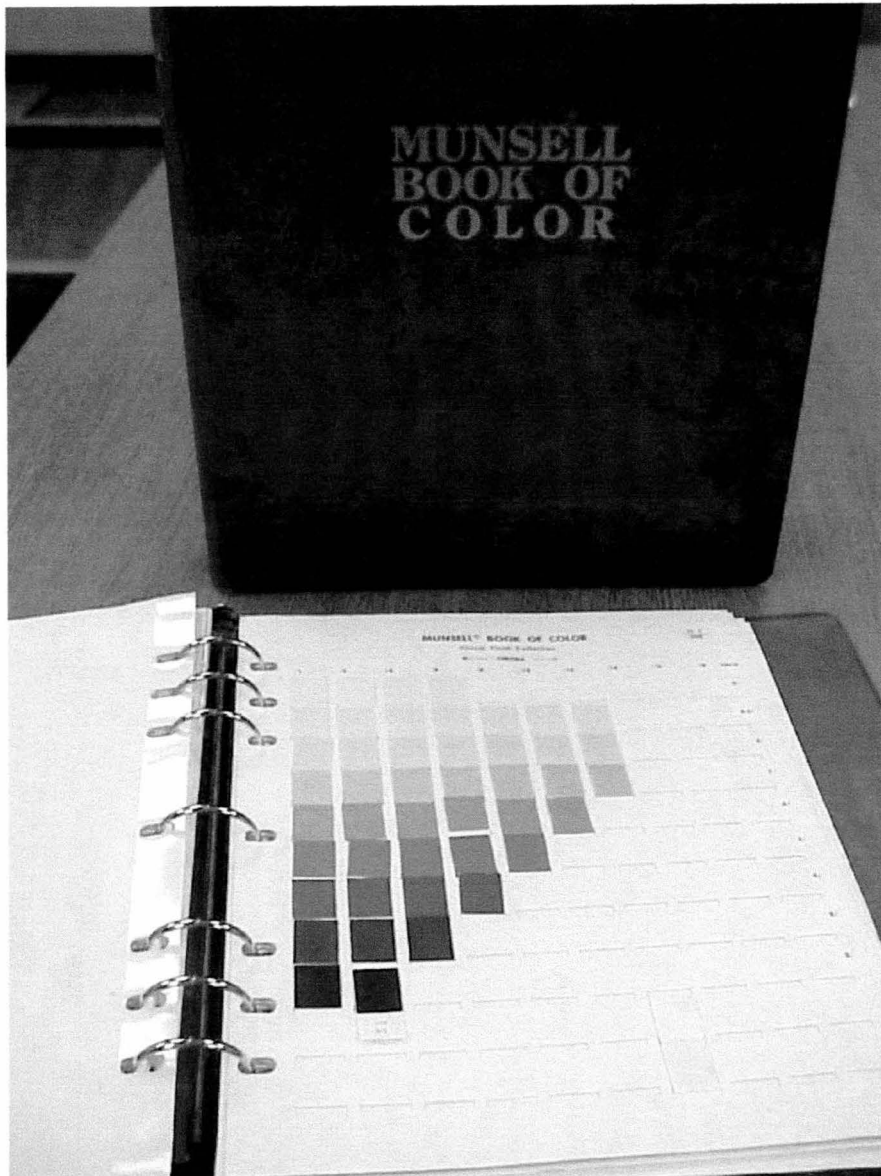


Figure 4: Munsell Book of Color consists of two volumes of different hues and one volume of neutral colors. Additional chips can be purchased from the company. Each numbered chip is housed into a slot that corresponds to numbers at the top and the side of the cardboard page. Photo by author.

hue, value and chroma (H V/C) (figure 5), for example 5GY 2/1 was the color of Central Railroad of New Jersey passenger coaches in the 1920's and 1930's. The hue notation shows how a color is referenced to the principle colors of red (R), yellow (Y), green (G), blue (B), and purple (P). The intermediate colors are yellow-red (YR), green-yellow (GY), blue-green (BG), purple-blue (PB), and red-purple (RP). The Munsell books now contain forty hues and an additional forty can be ordered from the company. Lightness or darkness of a color is called the value, from total white to total black. The chroma is how the color differs in hue from neutral gray within the same value.<sup>38</sup>

The problem with the Munsell system is that automotive divisions of paint companies such as DuPont and Sherwin-Williams do not use the Munsell system and have no way to cross-reference the numbered notation to their paints. However, the Munsell Company has developed a computer software program that will convert a Munsell notation into several other popular color systems.

One system that the automotive paint company labs use is the CIE LAB  $L^*a^*b^*$  system.<sup>39</sup> CIE, Commission Internationale de l'Eclairage, is a color system that uses mathematical values to identify colors, in contrast to

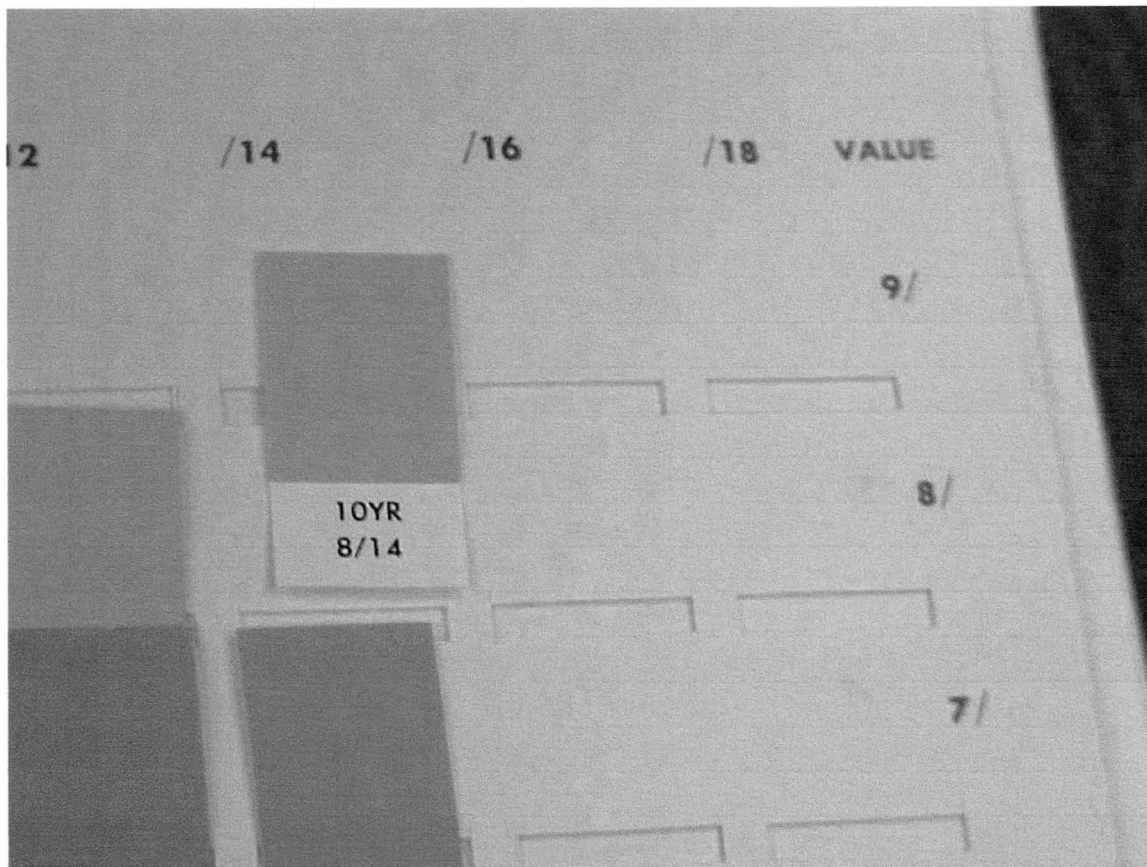


Figure 5: Close up of Munsell Book of Color showing the notation format. The "10YR" represents the hue, the "8/" is the value and the "/14" is the chroma. Photo by author.

other systems that use colors arranged in orders of hue and values as the Munsell system does. With this system a spectrophotometer can look at a sample and return a value that indicates which side of the white/black, blue/yellow, and red/green the color is in. This method can also be used to test if a newly mixed paint matches the historic color. A color matches if all three values of the L\*a\*b\* are within one unit. Spectrometers are also used to ensure that the color of the paint supplied by companies matches the color tests performed on the original paint sample.<sup>40</sup>

### Professional Paint Analysis

Color is seen differently by each person. Using the Munsell Color Notation System or any color system to visually match a sample may actually result in different color matches by different people.<sup>41</sup> Therefore, a paint analysis performed in the laboratory, by a professional whose color determination is tested accurately by standardized color testing is the best solution. Paint chips are placed under a stereomicroscope. Paint chips that are large enough can be beveled down layer by layer in increments of millimeters, with an exacto knife to reveal

all the layers of paint. This will allow a visual match under the microscope with Munsell chips, or with the chips of another color system, as has been done with the DuPont color system (figure 6) for this thesis. Paint layering can also be seen under the microscope when a paint chip is placed on edge to view the cross section. Recording the sequence of different colors seen on a cross section onto a "Preliminary Laboratory Data Sheet" is an easier way to count the number of layers (figure 7). The colors listed on this sheet are basic color names, such as red primer, olive green, varnish, white, light green and brown. By knowing the sequence of colors, the paint chips can be beveled down to attain a cross-match with a color system. Cross sections are not good enough for color matching because they do not provide a large enough sample of each layer. Cross sections can be placed in an acrylic resin that will allow a photograph of the sample to be taken (figure 8).

Paint analysis laboratories use several other pieces of equipment to study paint samples. Using a Polarized Light Microscope particles of chemicals, metals, fibers, binders and pigments within the paint layers will be found. This can identify the era of the paint because paints

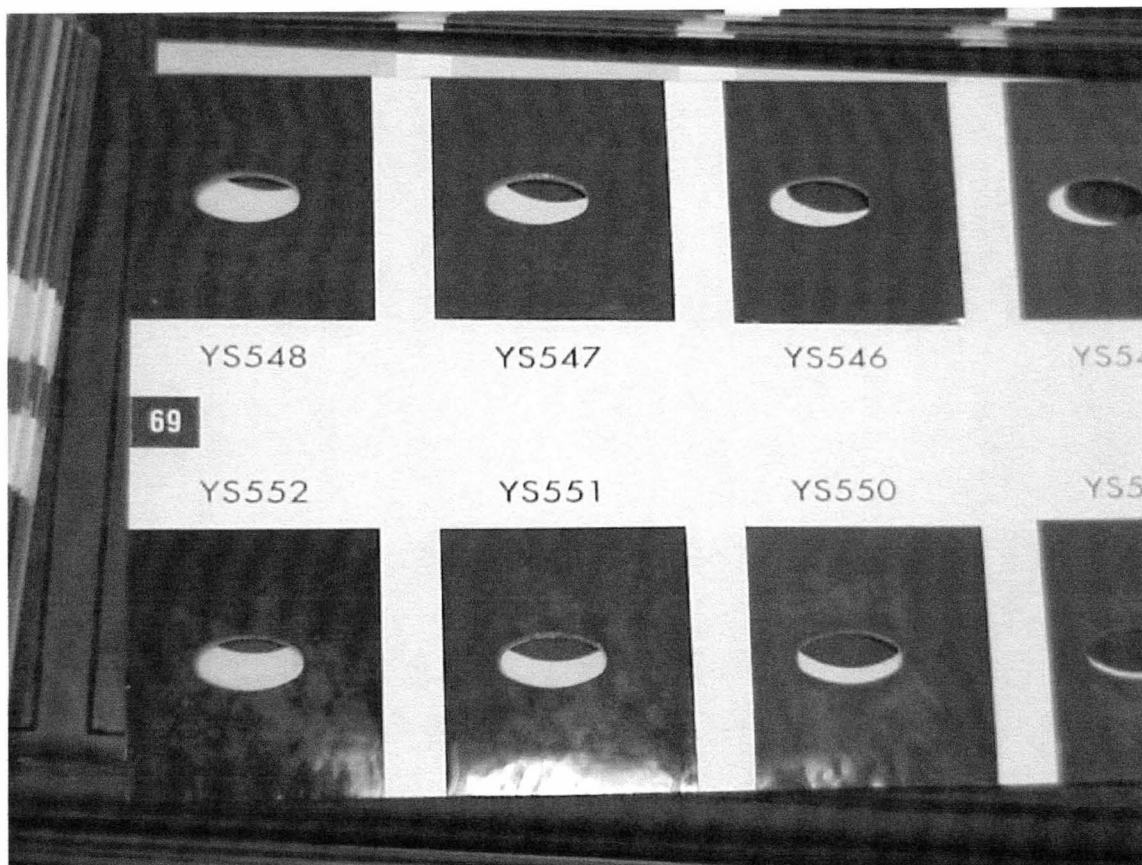


Figure 6: DuPont SpectraMaster™ Solid Colors chips. This system has six booklets comprised of reds, greens, blues, yellows, light neutrals and dark neutrals. For longer lasting finishes railroads now use automotive paint. Since DuPont and Sherwin-Williams paint companies, the two largest manufacturers of automotive paints, can not convert the Munsell color system to their own paint colors, than the colors needed must be visually matched with the paint chips. Photo by author.

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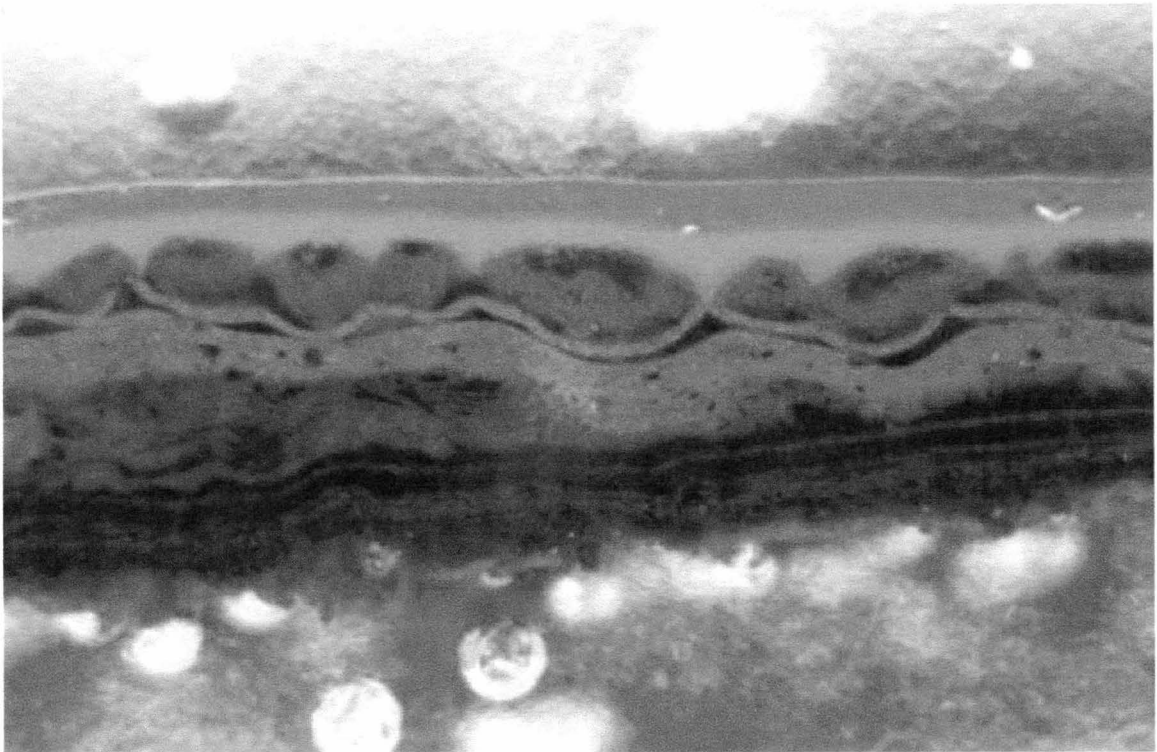


Figure 8: Cross section from Rutland coach 29 built by American Car and Foundry in 1914. Molding edges, doors, around windows, corners and motifs are good places to take paint samples. If paint has been removed over the years, there may not be any evidence of older paint. However, intricately carved designs make it difficult to remove all paint and most paint shops would not have gone through all the trouble. Here the earliest layers were dark green. Later the Rutland painted it a different green. Both colors are very similar to Pullman Green which the builder and the railroad tried to emulate. Photo by Frank Welsh.

during different eras were made up of different compounds (figure 9).

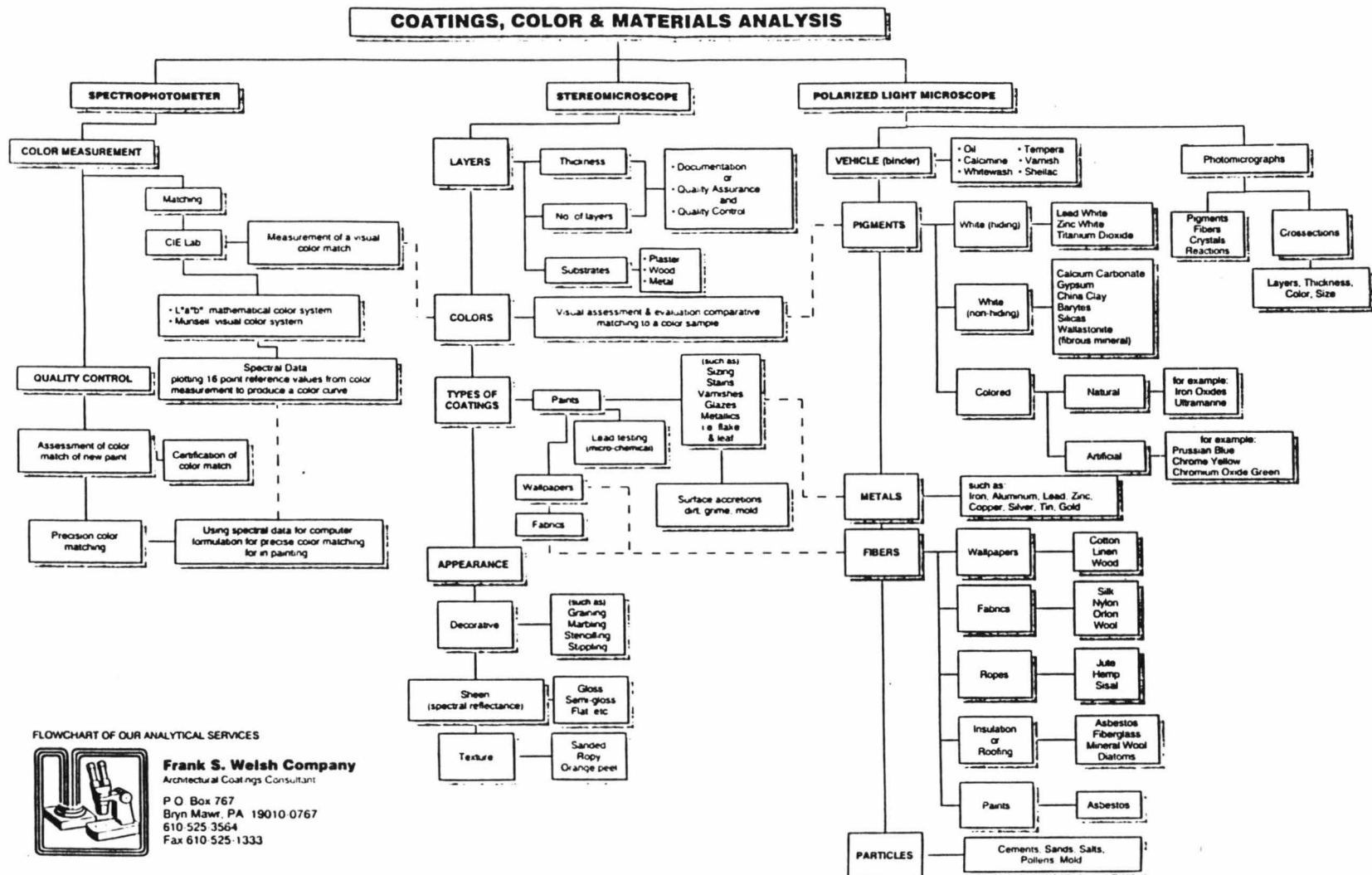


Figure 9: Coatings, color and materials analysis flowchart showing the different services a professional paint analysis can perform. Used with permission.

## CHAPTER IV EXTERIOR BODY COLORS AND FINISHES: 1900-1940

### The Term Pullman Green

The influence of Pullman was so great that present day restoration groups involved in railroad preservation and railroad fans commonly refer to any shade of dark green or olive green as "Pullman Green." However, Central Railroad of New Jersey "Pullman Green" is unlike the "Pullman Greens" of the Lackawanna Railroad, the Erie Railroad, the Louisville and Nashville Railroad, or many of the other railroads that used the "Pullman Green" color (figure 10).<sup>42</sup>

### Passenger Coaches in the Nineteenth Century

In the nineteenth century many coach manufacturers as well as railroads themselves produced coaches. The top manufacturers were the Pullman Palace Car Company of Chicago, the Wagner Palace-Car Company run by Cornelius Vanderbilt, the Jackson and Sharp Company/American Car and



Figure 10: Looking at theses two cars separately each would be called Pullman Green. However, when placed next to each other it is obvious that each coach is a different color. The coach on the left is Central Railroad of New Jersey Pullman Green and the coach on the right is Delaware, Lackawanna and Western Standard Car Body color. Photo by author.

Foundry Wilmington, Delaware, and the Mann Boudoir-Car Company, New York City.<sup>43</sup>

During this period, passenger coaches were painted in several colors. While greens and browns were the predominate colors, other colors such as red, blue and even white were used, as each major railroad built or purchased coaches and later repainted the cars during scheduled maintenance.

#### Private Cars

Private cars were different during the ninetieth century. They were special ordered by customers and designed by car manufacturers to suit the buyer. For example, Cornelius Vanderbilt of the New York Central, had a private car called "Vanderbilt." On its sides were painted landmark sites such as Niagara Falls and other scenes from New York City to Buffalo, found along the New York Central's route. The Erie Railroad had an all-white private car in 1868 for its director Jay Gould. The car built by the United States Military Shops for President Abraham Lincoln was a light reddish brown. It was delivered in time for his funeral in 1865. However, by the

twentieth century even private cars became uniform in color since the Pullman Company refused to paint private cars any color other than green.<sup>44</sup>

### Pullman's First Standard Color

An 1885 paint color card sales booklet from the Wadsworth, Howland and Company paint manufacturer sold "Pullman Car Body," a color that today we would consider a dark chocolate brown. Research by Arthur Dubin shows that Pullman used brown at this time. The Pullman color in this booklet was visually color matched in sunlight by the author using the DuPont SpectraMaster™ Solid Color Library card system at the Athenaeum of Philadelphia. When Pullman was using brown, railroads that purchased coaches from other manufacturers requested the cars be painted "Pullman Brown."<sup>45</sup>

### The Change to Brewster Green

In 1900, the general manager and vice president of the Pullman Company, Thomas H. Wicks (1896-1905) determined that Pullman cars needed a new color. The paint department foreman, William Breithaupt was told to create a green

color. He selected "Brewster Green," a very dark olive green color, almost black (figure 11).<sup>46</sup>

The green that Pullman had picked as its new color in 1900 was practical. The dark olive green did not show dirt or cinders the way that other colors did. Later research by the Canadian National Railroad in 1960 showed why the dark olive greens did not show dirt when they discovered that rural dirt is usually yellow and urban is black. Since "Pullman Green" is made up of green, yellow and black pigments, the dirt just made it look as if more pigments were added to the paint on the coaches. Red clay dust however, makes "Pullman Green" look dirty.<sup>47</sup>

Many paint manufacturers, including Harrison Brothers and Company, Wadsworth, Howland and Company, and the Devoe and Reynolds Company, sold "Brewster Green" between the 1880's through the 1910's. By the 1920's the color was being sold as "Pullman Standard Green." It is not known what paint manufacturer sold pigments to the Pullman Company nor whether Pullman received the paint paste in "Brewster Green" or mixed different pigments together to produce the desired color.<sup>48</sup>

Next to the Pullman factory town of "Pullman" outside Chicago was the Calumet Paint Company whose building



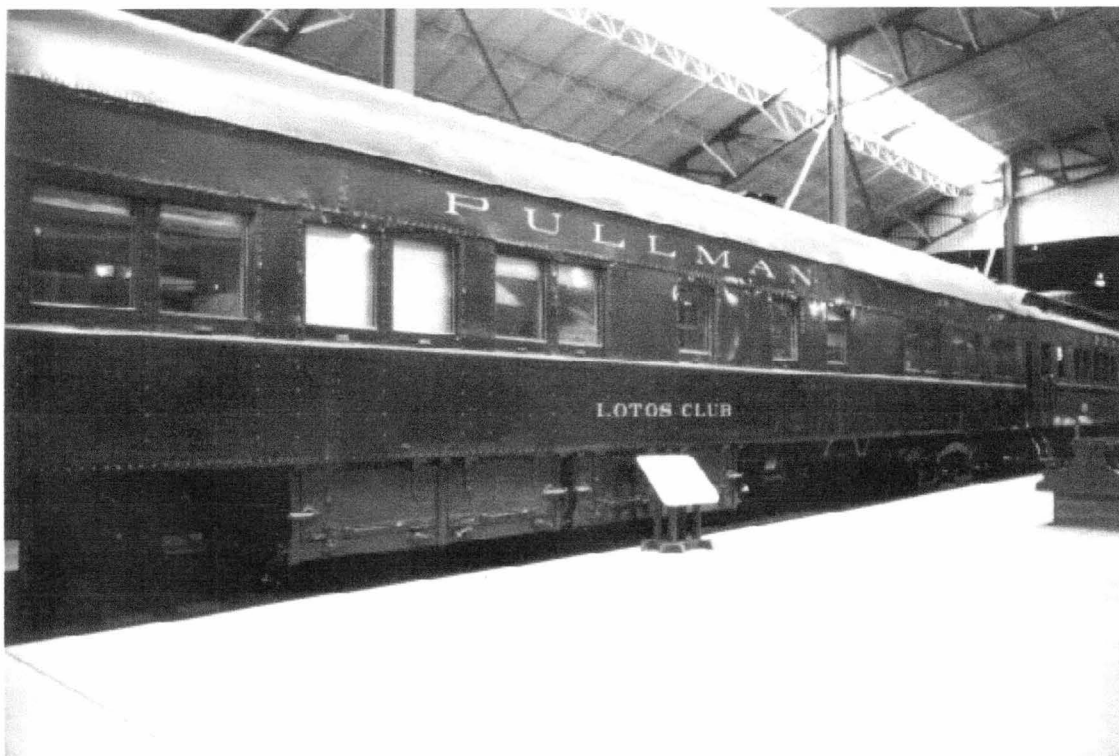


Figure 11: Pullman Lotos Club car at the Railroad Museum of Pennsylvania. The car was built in 1913 and rebuilt in 1936. Note the dark green color of the car. Though housed inside the museum the sunlight shining through the ceiling has allowed the paint to fade a little and the varnish to become a lighter green with a yellowish tint, just as if the car had been in service. However, in places where the sun has not affected the paint as in the doorways, the paint is "Pullman Green" as the color appeared when first painted. Photo by author.

eventually housed Sherwin-Williams. It is possible that the company got its start in the manufacturing of railroad paints because of its proximity to the main Pullman Company factory.<sup>49</sup>

It is also possible that Pullman used paint manufactured by the Flood & Conklin Paint Company on the body of its coaches. Pullman did use Flood and Conklin primer and finish coat paint on steel car roofs until 1915, when Pullman decided to make its own paints. Company correspondence indicates that roof paints were to be "one of the kinds that we expect to manufacture ourselves." How long Pullman made its own paints is unknown.<sup>50</sup>

### Color Research

To identify the "Pullman Green" color, I used the DuPont SpectraMaster™ Solid Color Library card system, visually matched color samples from the sales brochures of the Wadsworth, Howland & Company from 1885, F. W. Devoe & C. T. Reynolds Company from 1910, and the Harrison Brothers and Company from 1895. I also performed a paint analysis on a Pullman business coach, once owned by the Pullman Company, that had always been painted "Pullman Green." The

paint sample was placed under a stereomicroscope and matched using the DuPont color chips. The color in all cases was the same.<sup>51</sup>

By 1937, in addition to Pullman Standard Green, the Pullman Company had four separate paint schemes: one for the Pennsylvania Railroad, one for the Wabash Railway, one for the Milwaukee Road, and one for the Tennessee Central Railroad. These companies had contracts that required that Pullman cars would match their own railway paint scheme. There were twenty-one different paint schemes by 1942, as more railroads dropped the dark green and olive colors on passenger coaches. In 1948 when the major railroad companies bought Pullman, the colors increased even more. The use of brighter colors would increase greatly during the 1950's. Today, surviving in the Illinois State Historic Library are one hundred thirty "drift control color cards" for the colors of the exteriors, lettering, pinstriping and interiors of coaches built by Pullman for various railroads.<sup>52</sup>

## Problems Researching Formulas for Old Colors

One of the problems in researching railway paint colors is that many railroads would name the colors themselves, using their own railroad company's name without indicating the basic color such as green or brown. The Delaware, Lackawanna and Western Company called their body color "DL&W Standard Car Body." Standard would refer to the railroad's color of the time, which is not readily apparent without documentation that actually states what that color is or a paint analysis. For example, the "DL&W Standard Body Color" was brown from at least 1916 until 1928, when the "DL&W Standard Body Color" became green.<sup>53</sup>

Another problem in researching colors is that railroads sometimes omitted the color or pigment name of the most important ingredient in a paint formula. For example, the Erie Railroad sent its 1901 painting specifications sheet to American Car and Foundry in June 1902, which included the paint formula:

- 10 lbs. Paste Color
- 2 lbs. 10 ozs. First Quality Ivory  
Black
- 2 lbs. 2 ozs. First Tuscan Red Deep  
(First Quality)
- 1 lb. 4 ozs. Chrome Yellow, Medium  
(First Quality)

9 ozs. White Lead, dry

The paste color is the major pigment color for the "Erie Standard Color." The company would buy it in quantity from the paint manufacturer. However, it is not known what color paste was used.<sup>54</sup>

### The Influence of Pullman

While the Pullman Car Company decided to change from chocolate brown to "Brewster Green" in 1900, many railroad companies and other coach manufacturers were still using the different dark colors of the late nineteenth century. However, during the first decades of the twentieth century, most railroads turned to dark green or dark olive green.<sup>55</sup>

The influence of the Pullman Company was the major reason. Even when "Pullman Standard Body" color was brown, railroads around the turn of the twentieth century ordered coaches specifying that they would be "Pullman Standard Body" in color. Coach builders had painting instructions and specification documents that stated that the color used would be "Pullman Standard Body" color.<sup>56</sup>

### Jackson and Sharp/American Car and Foundry

Company records indicate that, while other colors were painted on the exterior, "Pullman Standard" was the most contracted color. Contracts from 1899 show that Jackson and Sharp would use "Pullman Standard". At this time Pullman was using brown not green. Contracts throughout the first decade of 1900, also show Jackson and Sharp using "Pullman Standard." Pullman switched to "Brewster Green" in 1900, but there is no indication when Jackson and Sharp changed to green. Records continue through 1905 with contracts to paint cars "Pullman Standard" with no indication that there may have been a color change.<sup>57</sup>

American Car and Foundry built Railway Postal Office car 1100 in 1913 for the Louisville and Nashville Railroad. Postal cars were pulled in passenger consists and were painted the same color as the passenger coaches. Through the years the car had been modified and sandblasted by the railroad, except for the doors on either end of the car. The earliest paint layer I found was dark olive green lighter in color than "Pullman Green." Ella Rayburn, curator of Steamtown National Historic Site, the owner the coach, matched the color against Munsell color chips.

Paint analysis on another Steamtown coach the Rutland 129 a steel baggage car built in 1914 by American Car and Foundry show that the oldest level of paint is also a dark olive green and a close match to the green on the Louisville and Nashville Postal car. This color is "Pullman Green" after the pigment has faded and the varnish has yellowed.<sup>58</sup>

Paint analysis I preformed on two 1923 American Car and Foundry built coaches for the Central Railroad of New Jersey coaches, the 1021 and the 1022, shows a very dark olive green. To the naked eye, the Pullman Green used by Pullman, is very similar to the color used by American Car and Foundry and other manufacturers, however the colors are different. It may be possible that American Car and Foundry and Pullman did not get their pigments from the same company and therefore could not match the color properly. American Car and Foundry may not have known the "Pullman Green" recipe and so where unable to get match the color perfectly. Perhaps American Car and Foundry tried to match the paint from a Pullman painted coach that was in service and not newly painted. We do not know.<sup>59</sup>

### Pressed Steel

Paint analysis on Pressed Steel Company built coaches shows that the company also tried to imitate "Pullman Green." Seaboard 259 a segregated Jim Crow car built in 1913 shows that company used a dark olive green as does the 1923 Chesapeake and Ohio coach 859 both built by Pressed Steel.<sup>60</sup>

### Railroad Companies

With respect to the railroads themselves, "Pullman Green" disappeared and the companies had their own green that they painted their coaches during repair or during routine painting.

#### Baltimore and Ohio

Paint analysis on the Baltimore and Ohio business coach 903 shows that, in 1923, the company used an olive green paint.<sup>61</sup> From 1926 until 1935 when the Baltimore and Ohio Railroad started to change to their new blue and gray paint scheme, the B&O used a darker olive green as found on business coach 908.<sup>62</sup>



## Central Railroad of New Jersey

Paint color of Central Railroad of New Jersey coaches 303 and 1006 was analyzed by the National Park Service was described as "Pullman Green." However, the blue-green color is not the dark olive green of "Pullman Green" (figure 12). It is documented that the Central Railroad of New Jersey was notorious for not mixing paint colors accurately. When economic times were hard, the railroad would mix black paint into the body color to make the paint go further.<sup>63</sup>

## Chesapeake and Ohio

Like the Central Railroad of New Jersey, the Chesapeake and Ohio used its own shade of green for passenger coaches. By the late 1920's, the C&O coach 859 had a dark green paint.<sup>64</sup>

## Delaware, Lackawanna and Western

Two paint analysis have been performed on DL&W coaches 315 and 335. The first was in 1993 by the National Park Service on coach 315. The latest paint analysis in 1999



Figure 12: Central Railroad of New Jersey coach 303. The Pullman Green that the CNJ used was a deep blue-green. The yellow lettering is Imitation Gold. Photo by Kenny Ganz, Steamtown National Historic Site.

was performed on a piece of metal from coach 335, that had been cut out by the railroad and had fallen inside the wall during the coaches' conversion to an electric trailer car. It showed that the earliest levels were brown not green as expected. The previous paint analysis had indicated that only green had been used. The green paint of coach 335 matched exactly the green paint on coach 315. The coaches were built in 1925 and, around 1929, the cars were converted. Therefore, the lack of brown paint on the cars, except for the metal that had fallen into the wall, indicated that the coaches were sandblasted after conversion and before painting.<sup>65</sup>

In 1916, the passenger coaches of the DL&W were painted dark brown, paint being supplied by Sherwin Williams. The name of the color in 1924 was "DL&W Standard Car Body," again from Sherwin-Williams. Exterior windows were painted mahogany. Lettering was gold leaf and handrails were black. Three coats of varnish were applied over the paint.

Specifications from 1928 and 1929 indicate that the Delaware, Lackawanna and Western went through a color change during the late 1920's. The new color was an olive green supplied by either Sherwin-Williams as paint color

#501 or Murphy's Green Simplex, produced by the Murphy Varnish Company of Newark, New Jersey (figure 13). The trucks, or wheel assemblies, of the coach and the platforms and steps were painted the same color as the body but with a thicker paint that was used as an undercoating paint but which had the top coat finish color and gloss. These undercarriage body paints would hold up better on moving mechanical parts, that were subject to oils and greases, while a normal top finish coat would not. However, if used as a top coat on flat surfaces the thicker paint would not look very good. By 1929, the exterior window sashes were the same color as the body. Paint analysis has shown that the Delaware, Lackawanna and Western used an olive green.<sup>66</sup>

### Santa Fe

The Santa Fe coaches were yellow in the 1880's. During the 1890's and into the first years of the twentieth century, coaches and business cars were "Tuscan Red." In the first decade of the twentieth century the company started to paint its cars green. In 1903, documentation states that business cars became "Pullman Green," but evidence indicates it was a brownish olive green.<sup>67</sup> The





Figure 13: The Delaware, Lackawanna and Western used an olive green known as D.L.&W. Standard Green Car Body. The railroad used this color from approximately 1928 through the 1940's. The paint was purchased from Sherwin-Williams (#501 Green) or the Flood and Conklin Paint Company (Green Simplex). Photo by author, Steamtown National Historic Site.

Kansas State Historical Society had a paint analysis performed in 1984 on two wooden coaches, the Santa Fe 2 and 3. According to the paint analysis, the coaches were painted "Pullman Green." This color is an olive drab, a brown-green color.<sup>68</sup>

#### Seaboard

According to DuPont records and confirmed by paint analysis on Seaboard 259 by Perrault of the National Park Service, it is known that by 1937 Seaboard was using a very dark olive green.<sup>69</sup>

#### Boston and Maine

By 1893, the Boston and Maine had already used a dark olive green on their coach Boston and Maine 959. The color was very close to what Pullman would use later. It was exactly the same color that the Pressed Steel Company would use.<sup>70</sup>

## Rutland

The Rutland Railroad also used a dark olive green in the 1920's, as shown on Rutland baggage car 129. It was slightly lighter than the Pressed Steel "Pullman Green."<sup>71</sup>

### Railroads With Different Colors

While some shades of olive green were becoming the most popular color for railroad passenger coaches, a few railroads tried to make their own color statements. The Reading Railroad had painted their coaches red in the mid-nineteenth century, however it changed the color to green when that color became popular after the Civil War. To make their cars less foreboding, the Reading began painting them lemon yellow with a light orange letterboard in 1888. By 1892, the company returned to the color green, probably because of problems with keeping light colors clean when pulled by coal burning steam engines.<sup>72</sup>

The Louisville and Nashville paint scheme was bright dark blue and gold. While the blue was an easy color to keep clean, the company nevertheless started to paint its passenger coaches green in the early years of the twentieth century. The reason for the color change is uncertain

though probably it was because of the popularity of dark greens.<sup>73</sup>

There were some other exceptions. The Wabash Railway had dark blue Pullman-built parlor cars to match with its special "Blue Banner Limited" train in 1925. The Milwaukee Road's paint scheme was maroon and orange, and the Tennessee Central Railroad used that same maroon on two Pullman sleeping cars to go with one of its special trains.<sup>74</sup>

### Pennsylvania Railroad

The Pennsylvania Railroad decided to be different. In 1879 "Tuscan Red" became the color of the company and it retained that color until its merger with the New York Central in 1968.<sup>75</sup> Tuscan red is an iron oxide; the pigment is achieved by burning particular types of ochres. It is considered a very stable and durable color.<sup>76</sup>

In 1910, the Pennsylvania Railroad completed tunnels under the Hudson and East Rivers so that it could provide direct passenger service into the newly finished New York City's Pennsylvania Station in downtown Manhattan. While the tunnels under the rivers were being constructed, New



York passed a law that would not allow wooden passenger coaches into the tunnels because of the hazard of fire. Thus, the railroad was required to build and use the first all steel passenger coaches in the nation. While the Pennsylvania Railroad had a long history of building its own equipment, the urgent need for steel coaches brought the company to contract in 1908 with Pullman, American Car and Foundry, and Pressed Steel to build its passenger coaches. Since 1900, Pullman had always painted coaches "Brewster Green," however the Pennsylvania Railroad insisted that its coaches and the coaches of the Long Island Rail Road would arrive painted in the "Tuscan Red" livery or there would be no contract. Pullman decided to comply, as the contract was an extremely large one.<sup>77</sup>

In 1954, the PRR started to "de-Pennsify" the Long Island Rail Road by giving it a new paint scheme and colors. Gone was the "Tuscan Red" of Pennsylvania, the new colors were a bluish gray with white lettering.<sup>78</sup>

Even though paints had to be mixed exactly the same each day and compared to drift control color cards, "Tuscan Red" did not stay the same, it changed over time. In the early days, "Tuscan Red" was redder and lighter in color than after World War II when the color was more brown

(figure 14 and 15). Over the years, Pullman-painted Pennsylvania Railroad cars remained light "Tuscan Red," while the Pennsylvania Railroad-painted cars became darker in color from the 1930's until the late 1950's. The result was that after 1930, the Pullman "Tuscan Red" was redder and the Pennsylvania was a browner form of "Tuscan Red."<sup>79</sup> In a series of letters, the Pennsylvania Railroad noted the problem. In 1938, the company noticed that its "Tuscan Red" was different than Pullman's "Tuscan Red," the Pullman being lighter and redder when matching coaches with drift control color cards. The Pennsylvania Railroad could not, however, "distinguish a color difference when standing 20 feet from the car." The Pennsylvania Railroad noticed that Pullman's varnished lacquer finish also appeared flat when compared with its own varnished enamel finish on cars, which were glossier and brighter. Pullman was asked to check their color. The problem in shade difference was that the Pennsylvania Railroad had changed the color. Pullman felt they had the proper shade and continued to paint Pullman coaches for the Pennsylvania Railroad in the lighter red until the 1960's.<sup>80</sup>



Figure 14: The older redder version of Tuscan Red. David R. Sweetland, and Robert J. Yanosey, PRR Color Guide to Freight and Passenger Equipment, (Edison, New Jersey: Morning Sun Books, Inc.,1992), 11.



Figure 15: The later browner version of Tuscan Red. David R. Sweetland, and Robert J. Yanosey, PRR Color Guide to Freight and Passenger Equipment, (Edison, New Jersey: Morning Sun Books, Inc.,1992), 11.

## Lettering

The most often used term for lettering style was "Railroad Roman." There were only a few different lettering styles available that railroads used and those styles were adopted from the horse carriage industry of the nineteenth century. Railroad lettering varied among each company. The lettering was in the style of the railroad purchasing the car. Other styles were named "Extended Railroad Roman" which was an elongated version of the standard "Railroad Roman."<sup>81</sup>

Lettering color varied also on passenger coaches between 1900-1920. During the first two decades, coach lettering was actual gold leaf applied by artisans to the both the exterior and interior of cars. In the 1930's, DuPont came out with "Dulux Gold," a yellow/orange color. The Pennsylvania Railroad, Long Island Rail Road and the Louisville and Nashville used "Dulux Gold" when they replaced the gold leaf. Other railroad companies came out with their own version of "Imitation Gold" as it was called. "Imitation Gold" and "Dulux Gold" have been used interchangeably as being the same color, but they are not. "Dulux Gold" is a specific DuPont paint, Dulux being an

enamel paint and gold being the color. Even the term "Imitation Gold" is used much as the term "Pullman Green." However, there is no standard color for "Imitation Gold." The Central Railroad of New Jersey and the Delaware, Lackawanna and Western Railroad, used "Imitation Gold," however, even though both used Sherwin-Williams paint, each of the colors were different indicating that the paint company did not use the same color term as the railroads. The CNJ color is a yellow/orange not as deep as "Dulux Gold," while the DL&W is more on the yellow side.

## CHAPTER V

### INTERIOR COLORS AND FINISHES: 1900-1940

Interiors of passenger coaches, like exteriors followed a basic pattern of color styles. In the nineteenth century, cars were made of wood on the inside as well as the outside. Cabinetmakers were hired by car builders to carve intricate moldings and designs. Interiors were clear varnished to let the natural color of the wood show. These types of wooden interiors lasted from 1865-1920'S. Mahogany was the most popular wood for interior walls. The Pennsylvania Railroad preferred oak. Sometimes a stain might have been applied to color the wood differently as in graining oak window sashes mahogany to match the mahogany wood surfaces of the rest of the interior. As with exterior applications, interiors required primers or linseed oil as a primer and were highly varnished.<sup>82</sup>

#### GRAINING

When interiors became partly steel in the first decades of the twentieth century, the steel portions were



grained. Graining is the process of painting a surface to resemble a particular species of wood. After priming, a "ground coat of paint" is used, usually a light cream color in railroad equipment. Next a dark tinted glaze is applied and graining tools are used to achieve what looks like the grain of whatever type of wood was needed. A clear finish of varnish was then applied to rail equipment. Graining was only used in interior application when coaches had all or some steel walls. Unlike in buildings, railroads rarely grained wood except for window sashes. Instead, wood was stained as the natural color of the wood or occasionally stained to another wood color.<sup>83</sup>

Pullman was the best at graining metal surfaces, and other railroads followed the Pullman practice (figure 16). The Pullman Company tried in 1907 to use pastel colors in an experimental coach at the Jamestown Exposition in Virginia. However, the public did not like the look; they wanted the surfaces to look like wood. Until 1931, graining was a standard at Pullman.<sup>84</sup>

Popular graining was in red or brown mahogany, walnut or natural wood. Car builder Pressed Steel used Light Salmon, as the base color or bottom coat that the darker

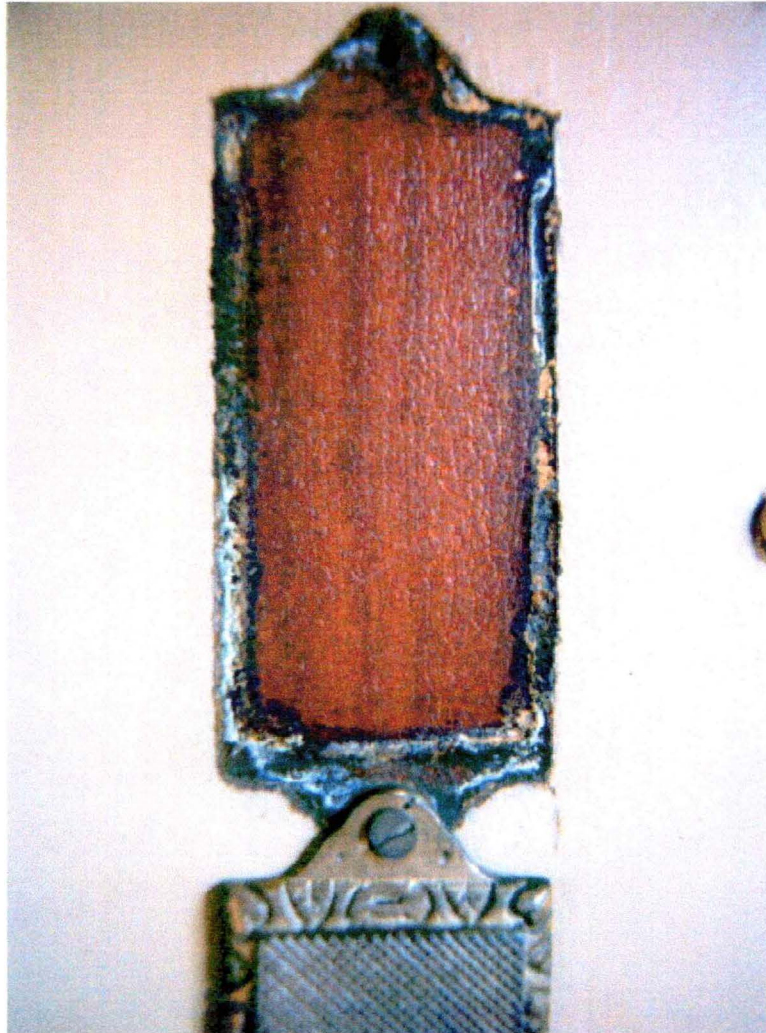


Figure 16: Graining on a metal wall. This is from Central Railroad of New Jersey combine coach 303. Graining is a painting method to make metal look like wood. It was discovered intact behind a brass match striker.



graining glaze would cover. A red-brown was used as the graining glaze or topcoat for graining.<sup>85</sup>

When Pullman built all-steel cars for the Pennsylvania Railroad, the railroad would grain the inside ends and interior vestibules and paint the rest of the interior of the passenger compartment in solid colors. Eventually, by the 1930's graining the metal was stopped because it was labor intensive and because of changing attitudes of the public.<sup>86</sup>

When painting the interiors of steel coaches became popular, coaches were usually painted in two or three colors. The ceiling or headliner would be one color. The upper wall around the windows would have its own usually light color. The base areas under the windows were usually a dark color, though by the mid 1930's and 1940's the base sometimes was the same colors as the upper wall.

### Headliners

Headliners are the ceiling panels and the curved panels between the clearstory and upper wall. Because headliners are curved they are made of agasote, an early form of Masonite™ that when steamed is easily pliable. Early twentieth century popular colors for the headliner

were medium green and pumpkin. These were bright, striking colors. The medium green's popularity was a holdover from the nineteenth century. Pumpkin was popular during the 1910's-1920's. The Jackson and Sharp/American Car and Foundry contracts indicate that they used medium green on all of the coaches they built between the 1890's and 1910, unless the customer specifically requested another color and sent a sample of that color. Jackson and Sharp/American Car and Foundry headliner green was a very bright olive green. The Erie Railroad, the Delaware, Lackawanna and Western Railroad, the Central Railroad of New Jersey, the Delaware and Hudson, Seaboard Railway, and the Missouri Pacific Railway were among the companies that had green headliners. The Pennsylvania Railroad cars had green headliners no matter who the manufacturer was until the 1920's, when they switched to ivory. The green looked good with the natural finish of mahogany, oak and poplar that decorated the coaches.<sup>87</sup>

Headliners frequently had a gold stripe painted around the panel approximately one to two inches from the edges. In the 1910's through 1920's, pumpkin was a popular color for the headliners (figure 17). The Seaboard Railway and the Central Railroad of New Jersey had used green in the

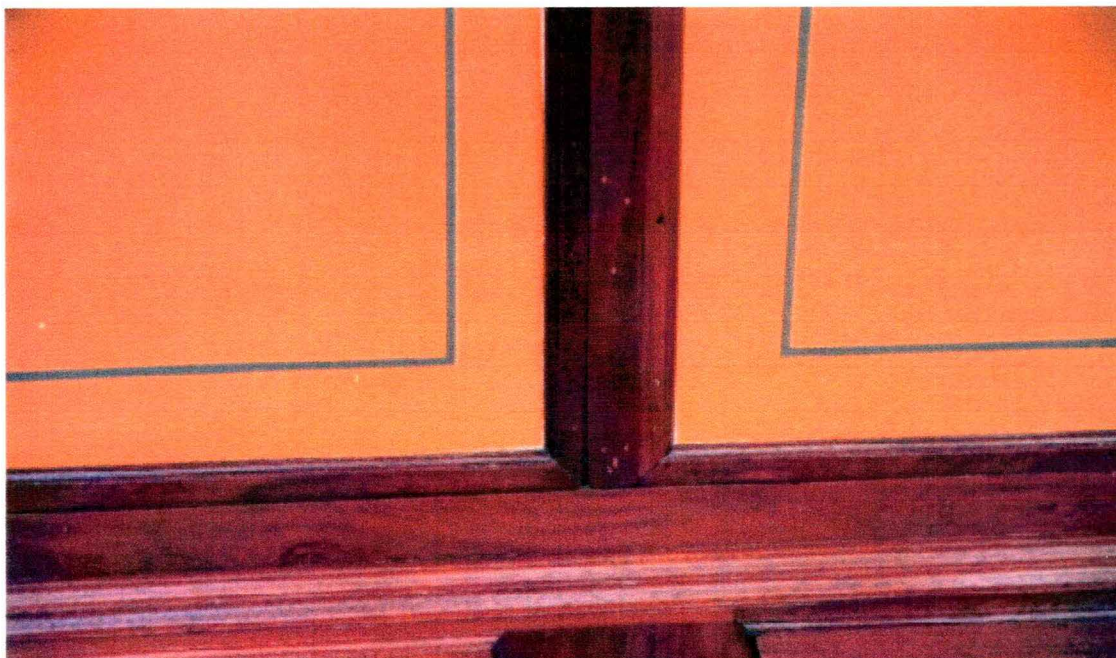


Figure 17: Ceiling headliner of Central Railroad of New Jersey. Note pumpkin color and gold stripe. This is the second interior paint scheme (1930's) on this coach. The earlier headliners were two tone green with an intricate double gold stripe and flower design (figure 18). Photo by author.

first two decades of the twentieth century. The Central Railroad of New Jersey used a light olive green and a dark green together (figure 18). By the 1930's, both companies were using pumpkin, though in different shades. By then, the railroads and public preferred ivories, whites and off-whites for ceilings.<sup>88</sup>

### Walls of Steel

Once the interiors of coaches became all steel, colors changed as well. Popular colors were shades of pale green, olive green, fawn, buff, cream, gray and red. As with the exterior green colors, interior colors of the same name would vary in actual shade from railroad to railroad. In the 1920's, the Pennsylvania Railroad was using green for the lower walls and fawn for the upper walls (figure 19 and 20). The company used buff, a light tan, required by the Postal Service, for mail cars that are classified as coaches. The Louisville and Nashville used buff as well.<sup>89</sup>

In 1912, inspectors of the Pennsylvania Railroad discovered that the old paints, which were made for wood, did not hold up in the interiors of the coaches. The company realized that using wood paint and varnish products on metal caused the varnish to crack. The oil in the paint



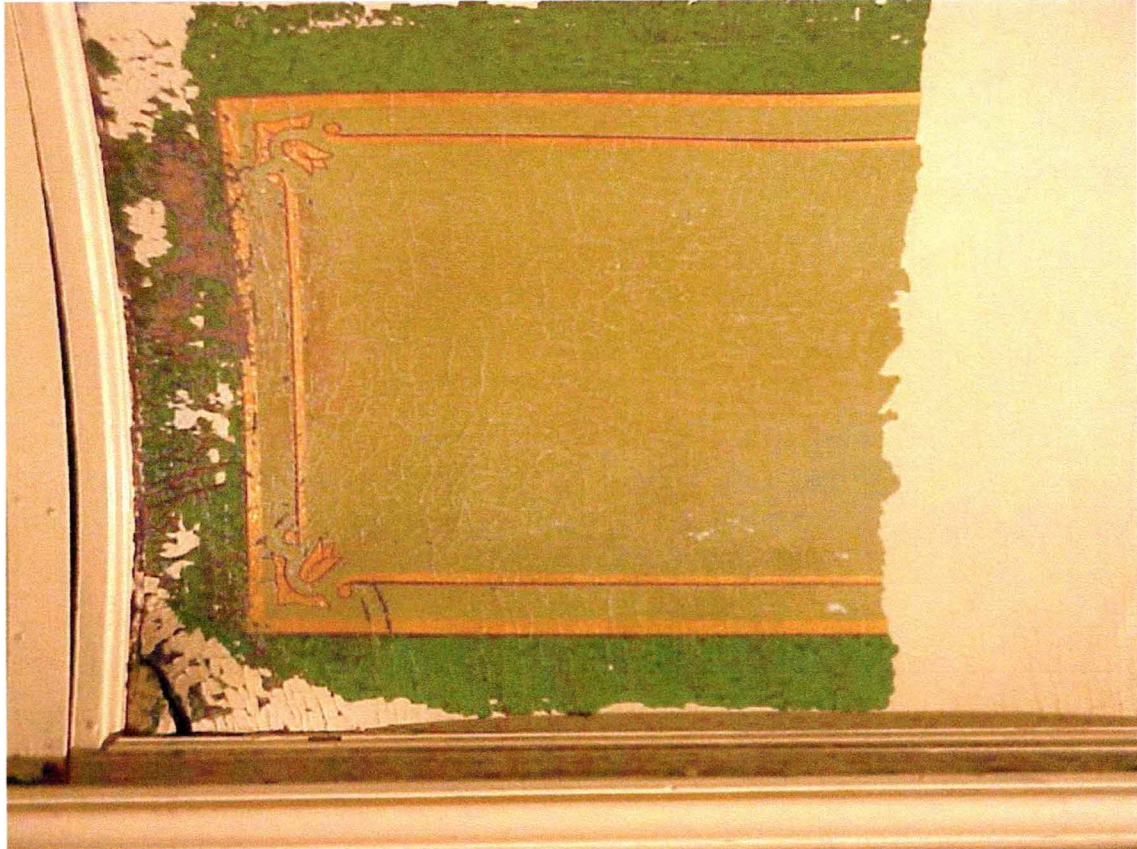


Figure 18: Lower deck headliner of an American Car and Foundry coach built in 1923 for the Central Railroad of New Jersey. This is the original headliner paint. The surrounding wood molding is mahogany that originally was unstained with a clear varnish applied. Note the flower motif and stripes in gold leaf. Most coaches of this period used only one color, however, both the darker green and the olive green were popular colors for headliners. Photo by author.

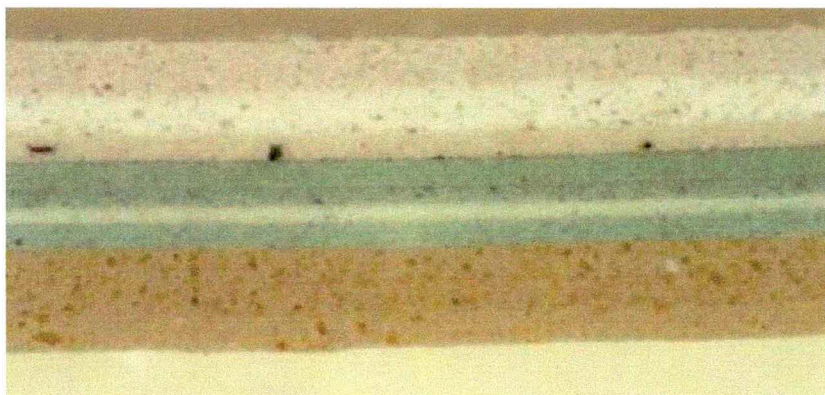


Figure 19: Paint cross section from the wall between windows of the Pennsylvania Railroad coach 1006. Oldest paint layers are at the bottom of photo. Thin dark lines that appear between paint layers represent dirt on the paint between painting. The bottom has four finish coats or layers of tan paint. Next, is 2 finish layers of light green, an intermediate coat of white lead primer. Then two to three finish layers of light green, two layers of tan, three layers of white and three layers of tan. This represents eighteen layers of paint in a 1/32" cross section from top to bottom. Photo by Frank Welsh.

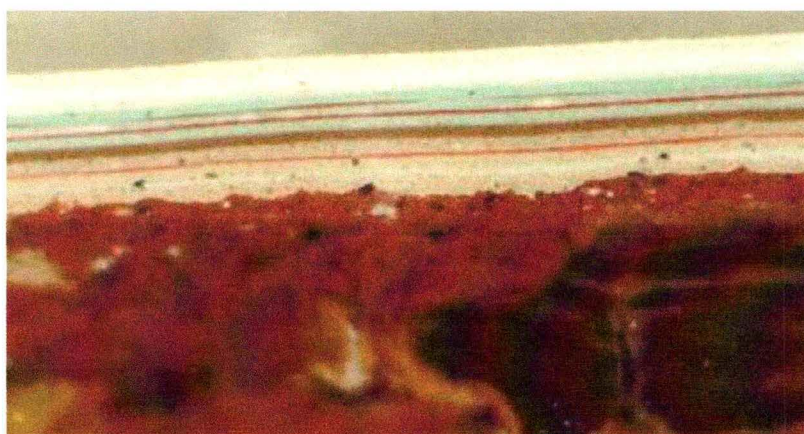


Figure 20: Cross section from the edge of the wooden windows coach PRR 1006. The lower layers are varnish and the same colors from the previous photo are on the window with red paint layers spaced within several of the layers. The windows were painted "Tuscan Red" and that when the upper wall was painted some of the wall paint ended up on the windows. Photo by Frank Welsh.

could not soak into the metal as in wood. Oil paint dries on the outside first, than eventually dries inside next to the surface. If the oil paint was not completely dry and varnish was applied over it, then the paint would crack the varnish in six to eight months. New paints and primers made specifically for metals were obtained and thoroughly tested by the railroads, just as they had the exterior paints.<sup>90</sup>

Another problem that the Pennsylvania Railroad discovered was the lack of knowledge of the painters who did not understand the basics of painting steel and the preparation work that needed to be accomplished before painting. They quickly realized that paint would not last long when painted over rust. Also, any acid left from the soldering joints had to be cleaned thoroughly for the paint to stay on the surface and not peel off later.<sup>91</sup>

As in exterior paint schemes, railroads named their interior colors after the company. The Delaware, Lackawanna and Western Railroad building specifications for 1916 required metal interior vestibules that were grained mahogany. The color of the headliner is unknown from company document as it was painted with "DL&W Standard Headlining Color." Floors were painted "Tuscan Red."<sup>92</sup>



In 1924, the Delaware, Lackawanna and Western building specifications for metal interior walls were "Light Mahogany Inside Enamel" from Murphy Varnish Company or "Interior Enamel Mahogany" from Sherwin-Williams. Wood interiors were to be Murphy's "Inside Car Varnish." Window sashes would match the walls. The headliner was to be painted "DL&W Standard Headlining Color," however, in February 2000 while undergoing scrapping to remove loose paint, a pumpkin color was discovered directly over the first layer of white lead primer on the agasote surface of DL&W coach 335. Over the pumpkin were two pinstripes, one green and one a reddish brown. Further sampling must be preformed to match the colors correctly.<sup>93</sup>

Delaware, Lackawanna and Western building specifications for 1929 stated that headliners were to be a light cream color. Interior walls were "DL&W Standard Interior Mahogany Enamel." Sashes would still be painted to match the rest of the interior walls.<sup>94</sup>



## CHAPTER VI

### CONCLUSION

While many colors were used in the nineteenth century and in the mid to late twentieth century, the first forty years of the twentieth century saw the emergence of dark green and olive green as the predominant colors for passenger coaches. Green was a good color to use to hide dirt and the railroad painters knew this, though it was not until 1960 that it was proven scientifically. It was a color the public liked and felt comfortable with in the early twentieth century. It was a color that conveyed power and wealth. Pullman's use of this color set the standard for other coach manufacturers and railroads to follow.

Since Pullman was the major manufacturer of railroad cars, it became the driving force behind the predominant use of dark green and olive green by railroads during the early twentieth century. Even before Pullman's color change from brown to green in 1900, railroads were ordering passenger coaches from Pullman's competitors in "Pullman

Standard Body Color." Therefore, Pullman was already a strong force in the selection of paint colors by railroads for their passenger cars. When the standard Pullman color changed to green, it is probable that the railroads used up their own supplies of "Pullman Brown" and within the first two decades, switched to green. To get business other car manufacturers accommodated the railroads and tried to match "Pullman Green." These colors were a very close match to Pullman's color, but paint analysis shows that the colors were not a true match. The other coach manufacturers had high standard, but they did not have as skilled a labor force as Pullman. They could maintain a consistent color, however, their master painters were not able to match the color correctly.

The individual railroads, however, could not manage to produce the signature shade of "Pullman Green" once they had to paint the coaches themselves. Over the decades, each railroad developed its own unique shade of dark green or olive green. Part of the reason may be that they did not have the same paint supplier as Pullman. It is possible that they bought the same paint pigments as Pullman but their master painters did not have the Pullman formula or have the skill of the Pullman master painters to

match and mix colors and thus could not match "Pullman Green." However, they continued to refer to their color as "Pullman Green." Some railroads, such as the Central Railroad of New Jersey, simply used whatever paint was available and was unable to make a consistent shade of green.

With the exception of "Tuscan Red" for the Pennsylvania Railroad, Pullman would not paint any coach a color other than "Pullman Green." Other manufacturers did not have the corporate power of Pullman to turn down customer requests of color selection. They would paint a coach any color the railroads wanted, however, "Pullman Green" was the most popular color requested. It has been shown that manufacturers and railroads set certain standards that they expected to be met by both their own paint employees and the companies that provided paints and pigments.

It is important for restored passenger cars to be the right color. It gives the public an idea of what an earlier generation saw as appealing. With today's powerful microscopes, paint chips can be matched with color cards so that paint colors can be reproduced with modern paints.

Cross sections of paint chips show the different layers of paint to help determine a time frame. Spectrometers ensure that the new paint color matches the old color.

Through both documentary and physical research, the color notation charts in the following Appendixes and the color cards in the rear sleeve were developed. They show the different colors of exterior greens, gold lettering, and inside colors of passenger coaches and can be used for accurate restoration and further paint color research.

The importance of documentary sources can not be over emphasized. To properly perform a paint color analysis, documentary information needs to be obtained on the coach as to its age, manufacturer, and the owners of the car throughout its life. Dated photographs of similar equipment from the owning railroads can establish the paint schemes of a car. Consequently, when a paint color analysis is performed the cross section of a paint chip can be helpful in determining which color belonged to a particular time frame. Thus, documentary research is the essential beginning step to physical paint analysis.

Modern and historic paint manufacturer paint sample booklets are very useful. They can be used to physically

compare a paint sample to the chips in the booklets or for documentary research. The Athenaeum in Philadelphia and the Hagley Museum and Library in Wilmington, Delaware have collections of paint sample booklets. The booklets in the Philadelphia collection begin in the 1870's and go to the 1920's. The Hagley Museum's booklets date back to the 1850's and go to the 1940's. They deal mostly with DuPont paint color. The Athenaeum also has books and pamphlets on the relationship between horse carriage painting and the painting of rail equipment. The Hagley Museum and Library archives has the passenger coach ordering contracts of Jackson and Sharp/American Car and Foundry for many different railroads.

Documentation shows that in the late 1930's and 1940's, some railroads started to change from green to different colors. These colors were somewhat reminiscent of the colors in the late nineteenth century, dark colors but in blues and maroons. Around 1936, the Baltimore and Ohio Railroad decided to paint its coaches dark blue and gray. The Louisville and Nashville began painting their coaches a dark blue in the late 1940's. After World War II, and into the diesel era of the 1950's, the colors of

passenger coaches became bright colors, which had not been seen since the Civil War.

Today the Pullman name still represents a standard for luxury, quality and durability, long after the company ceased building passenger coaches. The color name "Pullman Green" also remains, so much so that any dark green color found today on a passenger car in the United States is instantly referred to as "Pullman Green."<sup>95</sup>

## APPENDIX I EXTERIOR COLOR CHART

The following charts show the exterior colors of coach manufactures and railroad companies. Table 1 shows the green colors that the manufactures used when building coaches. Table 2 shows the colors that the railroads themselves painted its coaches during normal scheduled painting.

Each chart includes name of the railroad or manufacture; the name of the color used by the manufacture, railroad or its name today; the approximate year or timeframe that the color was known to be used; the Munsell color notation number used by museums; the CIE LAB value used by paint company research labs; the paint manufacture and paint number so that colors can be reproduced today; the method that was used to determine or identify a color; and an actual paint sample.

TABLE 1  
MANUFACTURER EXTERIOR COLOR CHART


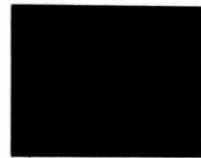



COACH MANUFACTURER	COLOR NAME	YEAR	MUNSELL VALUE	CIE LAB (ILLUM C <sup>2</sup> )	MODERN PAINT MFG.	PAINT NUMBER	METHOD OF COLOR IDENTITY	COLOR SAMPLE
Pullman Car Company	Pullman Car Body/ Chocolate Brown	Late 1800's	1.99Y 1.44/ 2.47	L* 15.02 a* 3.06 b* 16.56	DuPont	YS 260 Centari Acrylic Enamel	Visual match from late 1800's paint mfg. Color samples using DuPont Solid Color chips	
Pullman Car Company	Pullman Green/ Pullman Standard	1900	1.82GY 1.11/ 1.41	L* 11.73 a* -3.07 b* 7.17	DuPont	YS 560 Centari Acrylic Enamel	Same as above. Paint analysis by Author	
American Car & Foundary	Pullman Standard	1914	6.43Y 1.04/ 1.28	L* 11.03 a* -.40 b* 8.94	DuPont	YS 448 Centari Acrylic Enamel	Paint analysis by author	
American Car & Foundary	Pullman Standard	1923	.95GY 1.18/ 1.33	L* 12.47 a* -2.71 b* 7.28	DuPont	YS 552 Centari Acrylic Enamel	Paint analysis by author	
Pressed Steel	Pullman Green	1923	9.99Y 1.42/ 2.28	L* 14.81 a* -3.72 b* 13.74	DuPont	YS 452 Centari Acrylic Enamel	Paint analysis by author	



TABLE 2  
RAILROAD EXTERIOR COLOR CHART





RAILROAD COMPANY	COLOR NAME	YEAR	MUNSELL VALUE	CIE LAB (ILLUM C <sup>2</sup> )	MODERN PAINT MFG.	PAINT NUMBER	METHOD OF COLOR IDENTIY	COLOR SAMPLE
Central Railroad of New Jersey	CNJ Pullman Green	1926	5GY 2/1	L* 20.54 a* -2.87 b* 4.07	Sherwin-Williams	USS 52105 Acrylic Urethane	Paint Analysis by National Park Service	
Delaware, Lackawanna & Western	DL&W Standard Body/Olive Green	1935	10Y 2/2	L* 20.54 a* -3.07 b* 10.73	Sherwin-Williams	USS 52103E Acrylic Urethane	Paint Analysis by National Park Service	
Baltimore & Ohio	Olive Green	1923	10Y 3/4	L* 30.77 a* -6.44 b* 26.57	DuPont	YS 545 Centari Acrylic Enamel	Paint Analysis by National Park Service	
Baltimore & Ohio	Olive Green	1926-1935	6.94Y 2.09/2.46	L* 21.48 a* -1.65 b* 15.13	DuPont	YS 444 Centari Acrylic Enamel	Visual match using DuPont Solid Color chips	

TABLE 2 (CONTINUED)  
RAILROAD EXTERIOR COLOR CHART








RAILROAD COMPANY	COLOR NAME	YEAR	MUNSELL VALUE	CIE LAB (ILLUM C <sup>2</sup> )	MODERN PAINT MFG.	PAINT NUMBER	METHOD OF COLOR IDENTIY	COLOR SAMPLE
Seaboard	GM Pullman Green	1937	5.26Y 1.70/ 2.75	L* 17.56 a* -.02 b* 18.56	DuPont	4558DH Dulux Enamel	DuPont records/ George Rust	
Chesapeake and Ohio	Dark Green	1923	7.68Y 2.02/ 1.58	L* 20.78 a* -1.46 b* 9.07	DuPont	DS 111 Centari Acrylic Enamel	Paint analysis by author	
Santa Fe	Olive	1903	5.60Y 3.77/ 5.01	L* 38.83 a* -1.28 b* 34.95	DuPont	YS 368 Centari Acrylic Enamel	Paint analysis Kansas State Hist. Society	
Rutland	Dark Olive Green	1914	9.57Y 2.05/ 3.13	L* 21.05 a* -4.35 b* 19.60	DuPont	YS 451 Centari Acrylic Enamel	Paint analysis by author	
Boston & Maine	Dark Olive Green	1893	9.99Y 1.42/ 2.28	L* 14.81 a* -3.72 b* 13.74	DuPont	YS 452 Centari Acrylic Enamel	Paint analysis by author	See YS452 American Car and Foundry Page 84

TABLE 2 (CONTINUED)  
RAILROAD EXTERIOR COLOR CHART

RAILROAD COMPANY	COLOR NAME	YEAR	MUNSELL VALUE	CIE LAB (ILLUM C <sup>2</sup> )	MODERN PAINT MFG.	PAINT NUMBER	METHOD OF COLOR IDENTIY	COLOR SAMPLE
Pennsylvania Railroad	Tuscan Red	1913	7.92R 2.55/ 4.10	L* 26.13 a* 19.04 b* 10.67	DuPont	5505DH Dulux Enamel	Railroad Museum Of Pennsylvania	
Pennsylvania Railroad  Louisville & Nashville  Pullman	Dulux Gold for Lettering	1930's to 1990's	.89Y 6.17 8.60	L* 63.36 a* 8.84 b* 56.22	DuPont	014D Dulux Enamel	Railroad Museum Of Pennsylvania. Blueprints of Louisville & Nashville. Blardone, 35-36	
Central Railroad of New Jersey	Imitation Gold for Lettering	1920's to 1940's	2.5Y 8/10	L* 81.35 a* 4.19 b* 67.78	Sherwin-Williams	USS 52104E Acrylic Urethane	Paint Analysis by National Park Service	
Delaware, Lackawanna and Western	Imitation Gold	1920's to 1940's	1.25Y 8/16	L* 81.35 a* 11.85 b* 106.21	MAB Paints	1.25Y 8/16	Paint Analysis by National Park Service	No sample

# APPENDIX II PENNSYLVANIA RAILROAD COLORS

PRR NAME AND NUMBER	PULLMAN NAME AND NUMBER	DUPONT PAINT AND NUMBER	LOCATION ON PASSENGER COACH AND YEAR
Tuscan Red 47-2424	Light Tuscan Red 70-18	Red Dulux Enamel 5505DH	Coach Body 1879-1968
Olive Green	Brewster Green (not Pullman Standard Green)	Green Dulux Enamel 24166D	Trucks and Undercarriage Pre-1900-1943
Dark Sash Orange		Orange Centari Acrylic 6282AW	Window Sashes 1930-1937
Gold Leaf	Gold Leaf		Lettering and Numbers Pre-1900-1939 1940-1953
Lettering Buff 47-3294		Yellow Dulux Enamel 42831D	Lettering and Numbers 1939
Dulux Gold	Imitation Gold 600-9	Yellow Dulux Enamel 014D	Lettering and Numbers 1953-1968
Metallic Brown	Red Brown		Roof Pre-1900-1939

Table 3  
Pennsylvania Railroad paint colors

Here is a list of the Pennsylvania Railroad color names and numbers along with its Pullman counterpart and the DuPont paints that would reproduce the colors today.<sup>96</sup>

### APPENDIX III INTERIOR COLOR CHART

The following charts show a few interior colors of coach manufactures and railroad companies. Unlike the tables for the exterior colors, Tables 4 and 5 show only some colors that have a generic name. Each railroad would have a different shade of one of these basic colors. In these tables, few actual sample colors were inserted, however the information contained in the table will allow researchers to reproduce these colors.

As in Tables 2 and 3, each chart includes name of the railroad or manufacture; the name of the color used by the manufacture, railroad or its name today; the approximate year or timeframe that the color was known to be used; the Munsell color notation number used by museums; the CIE LAB value used by paint company research labs; the paint manufacture and paint number so that colors can be reproduced today; the method that was used to determine or identify a color; and an actual paint sample.



TABLE 4  
INTERIOR WALLS COLOR CHART



RAILROAD/ MANUFACTURER	COLOR NAME AND LOCATION	YEAR	MUNSELL VALUE	CIE LAB (ILLUM C <sup>2</sup> )	MODERN PAINT MFG.	PAINT NUMBER	METHOD OF COLOR IDENTITY	COLOR SAMPLE
Pullman Car Company	Natural wood and varnish (Walls)	Late 1800's to 1920's	No value	No value		Unknown	Paint Analysis by National Park Service	No sample
Pullman Car Company	Grained Red or Brown Mahogany, Oak, Walnut (Walls)	1908- 1931	Unknown	Unknown		Unknown	Dubin, 26.	No sample
American Car & Foundry	Natural wood and varnish (Walls)	Late 1800's to 1920's	No value	No value		Unknown	Paint Analysis by National Park Service	No sample
Pressed Steel	Natural wood and varnish (Walls)	Late 1800's to 1920's	No value	No value		Unknown	Paint Analysis by National Park Service	No sample
Pressed Steel	Grained red-brown Mahogany	1910's to 1930's	2.5YR 3/6 base  7.5YR 7/6 grain	L 30.77 a* 22.21 b* 26.05  L 71.60 a* 11.74 b* 34.53	DuPont	YS055 Centari Acrylic Enamel YS187 Centari Acrylic Enamel	Paint Analysis by National Park Service	 

TABLE 4 (CONTINUED)  
INTERIOR WALLS COLOR CHART



RAILROAD/ MANUFACTURER	COLOR NAME AND LOCATION	YEAR	MUNSELL VALUE	CIE LAB (ILLUM C <sup>2</sup> )	MODERN PAINT MFG.	PAINT NUMBER	METHOD OF COLOR IDENTITY	COLOR SAMPLE
Pennsylvania Railroad	Fawn (Upper Walls) Green (Lower Walls)	Late 1920's to 1930's	9.22YR 6.42/ 3.76	L 65.90 a* 5.53 b* 23.15	DuPont	Centari YS223	Pennsylvania Railroad Company Documents	
			Unknown	Unknown		Unknown		No sample
Pennsylvania Railroad Postal Car	Buff	Late 1920's to 1940's	Unknown	Unknown		Unknown	Pennsylvania Railroad Company Documents	No sample
Louisville and Nashville Postal Car	Buff	1913 to 1947	Unknown	Unknown	DuPont	Centari YS325	Paint analysis by Joseph Walsh and DuPont	
Delaware, Lackawanna and Western	Dark Red	1930's to 1940's	7.5R 2/6	L 20.54 a* 26.39 b* 11.63		Unknown	Paint Analysis by National Park Service	No sample

TABLE 5  
HEADLINER COLOR CHART




RAILROAD/ MANUFACTURER	COLOR NAME AND LOCATION	YEAR	MUNSELL VALUE	CIE LAB (ILLUM C <sup>2</sup> )	MODERN PAINT MFG.	PAINT NUMBER	METHOD OF COLOR IDENTITY	COLOR SAMPLE
Jackson and Sharp/ American Car and Foundry	Headliner Green	Late 1800's to 1910's	2.49GY 4.34/ 6.14	L 44.71 a* -14.93 b* 41.61	DuPont	YS504 Centari Acrylic Enamel	Visual match using DuPont Solid Color chips	
Pennsylvania Railroad	Headliner Green	Late 1800's to 1910's	Same as above	Same as above	Same as above	Same as above	Same as above	Same as above
Seaboard	Pumpkin	1910's to 1920's	4.94YR 6.44/ 9.55	L 66.09 a* 24.43 b* 49.60	DuPont	YS110 Centari Acrylic Enamel	Paint analysis by author	
Central Railroad of New Jersey	Pumpkin	1920's	Unknown	Unknown	Unknown	Unknown	Paint Analysis National Park Service	See figure 17



TABLE 5 (Continued)  
HEADLINER COLOR CHART

RAILROAD/ MANUFACTURER	COLOR NAME AND LOCATION	YEAR	MUNSELL VALUE	CIE LAB (ILLUM C <sup>2</sup> )	MODERN PAINT MFG.	PAINT NUMBER	METHOD OF COLOR IDENTITY	COLOR SAMPLE
Central Railroad of New Jersey	Lt. Green	1920's	5GY 7/6	L 71.60 a* -19.78 b* 37.98	DuPont	GS076 Centari Acrylic Enamel	Paint Analysis by National Park Service	See figure 18
Central Railroad of New Jersey	Green	1920's	5GY 4/6	L 41.22 a* -19.47 b* 36.56	DuPont	GS058 Centari Acrylic Enamel	Paint Analysis by National Park Service	See figure 18
Central Railroad of New Jersey	Lt. Cream	1930's	2.5Y 9/4	L 91.08 a* -.46 b* 29.79	DuPont	YS377 Centari Acrylic Enamel	Paint Analysis by National Park Service	
Pullman  Built for Delaware, Lackawanna and Western	Lt. Pumkin with red- brown stripe	1920's	Unknown	Unknown		Unknown	Paint Analysis Yet to be Performed. Color discovered by author	No sample
Delaware, Lackawanna and Western	Lt. Cream	1920's to 1940's	2.5Y 9/2	L 91.08 a* -.68 b* 51.81	Dupont	YS295 Centari Acrylic Enamel	Paint Analysis by National Park Service	No sample

## APPENDIX IV 1999 PAINT FORMULAS

The following are the 1999 paint formulas used to reproduce the colors found in Appendixes I, II and III. The paints involved are DuPont's Dulux Lead Based Enamel, DuPont Centari Acrylic Enamel and Sherwin-Williams Turbo Ultra One Stage Acrylic Urethane. As of this writing, DuPont Dulux is scheduled to be phased out within the next few years. As time progresses, DuPont Centari and Sherwin-Williams Turbo Ultra will be replaced with new paints that have yet to be invented. Hopefully, DuPont and Sherwin-Williams will keep records so that these colors can be cross-referenced into future paint formulas. Paint analysis can be performed on the color samples in Appendixes I, II and IV when the following formulas are no longer valid.

COLOR NUMBER	TINTING GUIDE	MIX SIZE: SPECIAL (2.50 OF GALLON)	MANUFACTURER
YS260 DuPont Centari	758S Centari Drier 763A Orange 764A Yellow 705A Black	4.4 13.8 35.2 89.9	Pullman Standard Body Brown
YS560 DuPont Centari	758S Centari Drier 763A Orange 764A Yellow 705A Black	4.4 6.4 25.8 89.4	Pullman Standard Body Brewster Green "Pullman Green"
YS448 DuPont Centari	758S Centari Drier 763A Orange 764A Yellow 705A Black	4.4 8.0 25.6 89.5	American Car and Foundry "Pullman Green"
YS552 DuPont Centari	758S Centari Drier 763A Orange 764A Yellow 705A Black	4.4 7.0 26.0 89.4	American Car and Foundry "Pullman Green"
YS452 DuPont Centari	758S Centari Drier 763A Orange 764A Yellow 705A Black	4.4 7.8 37.0 89.9	Pressed Steel "Pullman Green"
YS545 DuPont Centari	758S Centari Drier 763A Orange 705A Black 764A Yellow	4.5 5.4 31.5 90.9	Baltimore and Ohio Railroad Olive Green
YS444 DuPont Centari	758S Centari Drier 700A White 763A Orange 764A Yellow 705A Black	5.6 10.2 15.2 50.1 113.1	Baltimore and Ohio Railroad "Pullman Green"
USS 52105-E Sherwin- Williams	U7380 (formula U7118 for 1 U7303 gallon) U7140 U7110 U7107 U7106	1566.1 2759.1 3162.4 3481.8 3607.7 3682.8 3688.5	Central Railroad of New Jersey "Pullman Green"
DS111 DuPont Centari	758S Centari Drier 717A Red Oxide 700A White 732A Fer Yellow 705A Black	4.5 6.5 8.7 25.2 90.5	Chesapeake and Ohio "Pullman Green"

Table 6  
Paint Formulas

COLOR NUMBER	TINTING GUIDE	MIX SIZE: SPECIAL (2.50 OF GALLON)	MANUFACTURER/ RAILROAD
USS 52103-E  Sherwin- Williams	U7379 (formula U7118 for 1 U7140 gallon) U7107 U7302 U7110	1092.5 2146.0 2930.8 3431.2 3631.7 3771.3	Delaware, Lackawanna and Western  DL&W Standard Body
4558D  DuPont Dulux	5450S Drier 16D Orange 40D Yellow 2D Black	3.8 13.9 38.4 94.4	Seaboard  "Pullman Green"
YS451  DuPont Centari	758S Centari Drier 742A Blue Green 763A Orange 764A Yellow 705A Black	4.5 4.9 7.9 48.2 90.3	Rutland  "Pullman Green"
YS368  DuPont Centari	758S Drier 763A Orange 700A White 705A Black (HS) 764A Yellow	4.5 9.2 15.9 43.0 91.5	Santa Fe  Olive Green
5505D  DuPont Dulux	5450S Drier 34D Dark Red 42D Violet 1D White 2D Black 35D Maroon 38D Red Oxide	3.7 4.6 7.2 10.5 21.8 52.7 91.0	Pennsylvania Railroad  Tuscan Red
014D  DuPont Dulux	5450S Drier 16D Orange 13D Black 41D Light Yellow 23D White 5D Fer Yellow	4.0 4.5 6.0 22.3 49.1 99.1	Standard Lettering color of many railroads  Dulux Gold
USS52104-E  Sherwin- Williams	U7131 (formula U7379 for 1 U7110 gallon) U7106 U7302 U7118	1630.2 2722.7 3539.0 3634.5 3835.0 3967.6	Central Railroad of New Jersey  Imitation Gold

Table 6 (cont.)  
Paint Formulas

COLOR NUMBER	TINTING GUIDE	MIX SIZE: SPECIAL (2.50 OF GALLON)	MANUFACTURER/ RAILROAD
YS187 DuPont Centari	758S Centari Drier 763A Orange 764A Yellow 700A White	4.9 7.7 18.8 98.9	Pressed Steel Cream for graining
YS055 DuPont Centari	758S Centari Drier 746A Bright Red 700A White 705A Black 763A Orange	4.5 8.6 17.3 46.4 91.8	Pressed Steel Brown for graining
YS223 DuPont Centari	758S Centari Drier 717A Red Oxide 705A Black 732A Fer Yellow 700A White	4.8 9.9 16.9 30.5 98.3	Pennsylvania Railroad Interior Buff
YS325 DuPont Centari	758S Centari Drier 763A Orange 705A Black 700A White 764A Yellow	8.8 17.5 36.2 93.9 176.8	Louisville and Nashville Interior Buff
YS504 DuPont Centari	758S Centari Drier 742A Blue Green 700A White 705A Black 737A Yellow	4.8 12.2 22.8 50.7 96.6	Jackson and Sharp/ American Car and Foundry Headliner Green
YS110 DuPont Centari	758S Centari Drier 705A Black 763A Orange 764A Yellow 700A White	4.8 6.2 15.0 51.6 95.8	Seaboard Pumpkin Headliner
YS377 DuPont Centari	758S Centari Drier 763A Orange 764A Yellow 700A White	4.9 5.3 10.4 99.5	Central Railroad of New Jersey Cream Headliner

Table 6 (cont.)  
Paint Formulas

## APPENDIX V COLOR CARDS

In the sleeve of this thesis is the actual 5" x 8" color cards that can be used by researchers and restorationist to get the correct colors needed. These color cards are the same as the samples found in Appendix I, II and III. They were spray painted by the author and Ed Roche, a very experienced painter at Steamtown National Historic Site. The cards used were DuPont Test Panel Cards that require many coats of paints to cover the black and white squares to allow a uniform color to each sample.

The DuPont Test Panels that the color samples are on are meant for long term storage. In the event, that the paper these color samples are on should deteriorate even into dust, paint analysis can still be performed. Therefore, the samples should be kept and never thrown away.

## APPENDIX VI EXTERIOR APPLICATION OF PAINTS

The major railroad car manufacturers around 1900 include the Pullman Company, American Car and Foundry (ACF), and the Jackson and Sharp Company. Some railroads such as the Union Pacific Railroad (UP), Seaboard Railroad (SAL), Baltimore and Ohio (B&O), Illinois Central (ICRR), and the Pennsylvania Railroad (PRR), built some of their own coaches and developed their own colors. Other railroads such as the Delaware, Lackawanna and Western (DL&W), the Central Railroad of New Jersey (CNJ), the Milwaukee Road, Louisville and Nashville (L&N), the Erie, the Santa Fe, and the New York Central (NYC), purchased passenger coaches from car manufacturers and later repainted them in their own colors.<sup>97</sup>

### Horse Carriage Painting

When the railroads began carrying passengers in the 1830's, coaches that resembled carriages comforted a wary

American public (figure 21). The first passenger coaches pulled by a locomotive were built as a series of covered carriages mounted on flatcars (figure 22). The application of paint and colors used by the railroads were developed from the horse carriage industry because building methods and materials were the same. Also the painters for the early railroads had learned their trade in the carriage industry.<sup>98</sup>

Early passenger coaches were painted much like covered horse carriages of the time. Many paint manufacturers produced paint specially made for first wooden and later steel carriage bodies. Railroads and manufacturers of railroad cars continued to use carriage paints, colors and application techniques. Murals of landscape and historical themes were typical on the sides of the cars. Surrounding the murals, known as picture panels, were borders of fancy motifs that resembled picture frames in gold, pink and rose. The murals had the benefit of disguising coaches that in reality were wooden boxes. The coaches were painted light colors of pale yellow, fawn or buff so that the murals could be easily seen.<sup>99</sup>





Figure 21: Replica of a 1827-1828 Baltimore and Ohio horse pulled railroad car, built for the 1893 Columbian Exposition in Chicago. Photo by author at the Baltimore and Ohio Railroad Museum.

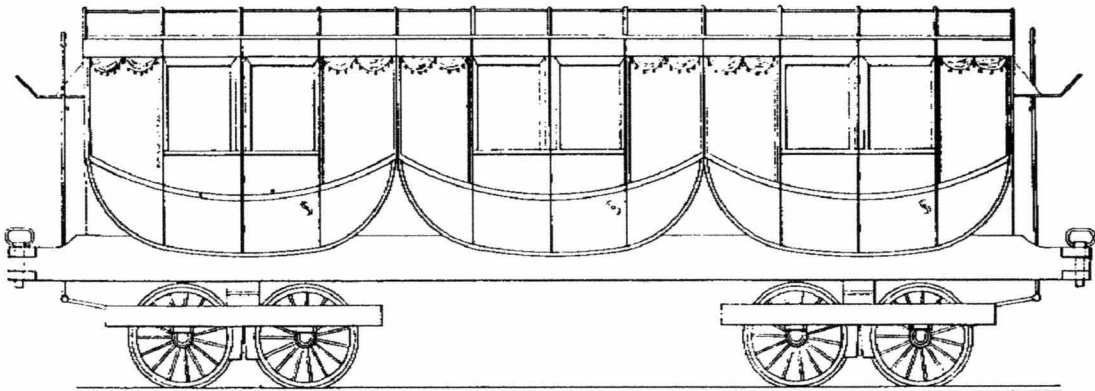


Figure 22: Early nineteenth century passenger coach. Individual horse carriages were placed on flat cars, pulled by a locomotive. Photo from John H. White, Jr., The American Railroad Passenger Car, part 2, (Baltimore: John Hopkins University Press, 1978), 233.

### Passenger Coach Colors

By 1860, passenger coaches were painted in a simpler fashion. Murals disappeared and were replaced with scrollwork and pinstriping. Lettering continued to be fancy, with shading for a three-dimensional look. Pale yellow was a popular exterior color until 1870. It was a color that hid the yellow clay dust that settled on the cars. Indian red, bright yellow, pea green, army or olive drab, gray green and light blue were also used.

After the Civil War ended in 1865, dark funeral colors were employed. This partly resulted from the American state of mind after the Civil War, as a nation mourning the death of President Lincoln and sons lost in the war. In addition, car building mirrored society's taste of the day in home furnishings and dress, as influenced by British fashions during the period. For decades after Prince Albert's death in 1861, Queen Victoria was in mourning for her husband and English fashion presented dark colors. Lewis Mumford, an American sociologist and author on architecture and urbanization, termed this period, the last three decades of the nineteenth century, the "brown decades."<sup>100</sup>

"Brewster green" was a very popular color in the horse carriage industry throughout the nineteenth century. The other colors of these decades were a very dark maroon called "Munich Lake," "Tuscan Red," olive green, dark blue, plum and chocolate brown (figure 23). Chocolate brown, also known as claret red in the late 1800's, was a reddish brown, not the dark brown color which we think of today. In the 1860's, chocolate was only made into a drink. Treated with lye, the chocolate made from cocoa beans turned reddish brown.<sup>101</sup>

The darker colors lasted longer. They also did not show the black cinders and soot from the coal used by the newer engines for fuel. Since only three coats of paint needed to be applied instead of the five coats for lighter colors, painters felt that the darker colors were much more economical. It was during this part of the nineteenth century, that Pullman cars were painted a dark brown that in the twentieth century is known as chocolate brown, as opposed to the reddish chocolate brown of the nineteenth century.<sup>102</sup>

Although Pullman had set the standard as an innovator of the way that passenger coaches would be built, the company followed the established techniques of applying

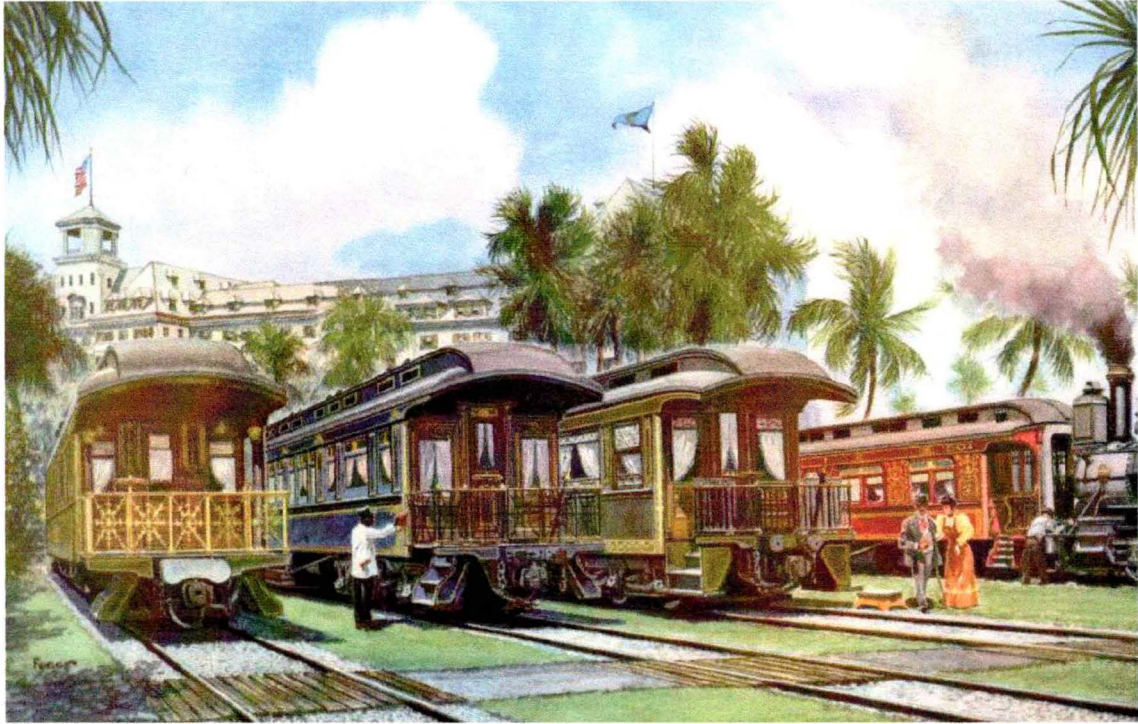


Figure 23: 1902 scene at a Florida Resort of private cars. From left to right, Pullman car in the new Brewster Green livery; the blue of the Louisville and Nashville; American Car and Foundry built car in its version of Pullman Green; and the Pennsylvania Railroad Tuscan Red car. Photo from Lucius Beebe, Mansions on Rails: The Folklore of the Private Railway Car, (Berkeley, California: Howell-North Press, 1959), 172.

paint and the public's sentiment in the use of colors.<sup>103</sup>

The lettering was in the style of the railroad purchasing the car. There were only a few different lettering styles available that railroads used and those styles were also adopted from the carriage industry.<sup>104</sup>

### Paint as Protection

Railroads used paint color to present a statement to the public about the company. The paint scheme that each individual railroad used facilitated quick identification by the public. However, the main reason that rail equipment was painted was to protect the wood and metal materials of the cars.<sup>105</sup> Left unpainted, steel would rust. Different metals that made contact with one another would cause a chemical reaction, deteriorating the metals. Paint, applied to the surfaces before the metals were placed together, reduced the risk of chemical reaction and corrosion. Wood, if not coated with paint, would rot from fungi, be attacked by insects and deteriorate from exposure to the elements.

## Nineteenth Century Paint Applications

Application of exterior paints on railroad equipment has changed greatly over the years. In the early period, it paralleled the horse carriage industry. Like horse carriages, rail equipment other than locomotives were made of wood in the late nineteenth century.<sup>106</sup> Passenger cars were painted by skilled craftsmen and artists who spent anywhere from weeks to months to achieve a finished railroad car. Coaches would spend more time in the paint shop than in the erecting shop. These wooden coaches had intricate designs and were painstakingly pinstriped and lettered in gold leaf. Some, such as the private car of the New York Central's Cornelius Vanderbilt, had murals painted on the sides. Then several coats of varnish were applied to obtain a high glossy shine. From these many coats of varnish, passenger coaches became known by the nickname "varnish" or "varnishes".<sup>107</sup>

There were standards for the application of the paints and the number of coats of primer, surfacer, paint and varnish required.<sup>108</sup> During the nineteenth century and into the first decades of the twentieth, paint was applied to passenger coaches by brush. Varnish was also applied by



brush and then rubbed to a high state of gloss. Since artisans were hired as painters in the nineteenth century, coach painting was expensive. In the 1830's, artists were receiving \$1560 a year. That amount rose by the 1850's to \$8000 per year for top artists to paint murals on the exterior and interior sections of coaches. After the Civil War coach painting became simpler. Murals painted on the exterior sides of cars were discontinued as they fell out of fashion in American society. Later railroad painters tried to touch up old murals, however their skills could not match the quality of the original artists. Railroads were also looking for cheaper labor costs since it cost \$500 to paint each coach and competition between coach builders had become fierce. By the 1880's, pinstripes, gold leaf lettering and scrollwork were the only painted ornamental features on the exterior of passenger coaches. Scrollwork design would be outlined from a stencil and then gold leaf applied by hand at a cost of \$120. In 1878, decals and transfers were used for the first time to bring down the cost of painting even further by reducing the labor time devoted to fancy scrollwork performed by hand.<sup>109</sup>

A coach could spend up to ninety days in the paint booth in the 1860's. The time was reduced to sixty days by

the 1880's due to stenciling techniques. Some painters could paint a car in fifteen days, however the results were poor in the eyes of car manufacturers who felt that a proper job could not be accomplished in that timeframe.<sup>110</sup>

A typical sixty-day painting schedule is shown below:

Wood primed with raw linseed oil and left for one week to dry.

Fill holes with wood putty.

Apply a light coat of paint color, drying time twelve to twenty-four hours.

Sand with pumice.

Apply two coats of surface filler known as "rough stuff."

One light coat of paint color, drying time twelve to twenty-four hours.

Sand with pumice.

Three coats of thin color, drying time twelve to twenty-four hours between each coat. Sand with pumice between each coat.

Apply striping, scrollwork and lettering.

One coat of rubbing varnish.

Sand with pumice.

Two coats of finishing varnish, drying time ninety-six hours.<sup>111</sup>

This amounted to 288 to 384 hours of drying time, approximately half the total time of the entire paint job. Oil based paints with or without lead are very slow drying even today. Drying time depends on the temperature and



humidity inside the paint shop. Each separate coat of paint, linseed oil, surface filler or varnish would take one day to apply. Sanding, which allows the next layer of paint and varnish to adhere to the surface, removes dirt in the paint, and smooths the surface after each coat of paint or varnish, also takes one day, including wiping down the surface to remove dirt. Filling holes with wood putty would take one day. Applying gold leaf, lettering, pinstriping, and scrollwork took six painters, each spending fifty to sixty hours, five to six days to complete. After varnishing, this finish created a durable, waterproof surface that could be easily cleaned of cinders from the steam engine and road dirt. Every year new varnish was applied after scratched surfaces were repaired with new paint and the entire coach sanded so that new varnish would adhere to the surface. The coach would return to the shops every seven to ten years for a completely new paint job. Old paint and varnish was removed by burning it off the surface and resanding the bare wood.<sup>112</sup>

## Paint Materials

Railroads produced their own paints. They purchased the raw materials necessary to produce primers, paints, surfacers, and other coatings. Varnish was purchased from manufacturers. Each railroad had its own very strict standards for mixing pigments and oils to get the proper color every day in the paint shop. The master painter would have to mix the paints in exactly the same way every day and compare the shade against the official drift control color cards. The testing department had already established the necessary amounts by weight of color paste, linseed oil and other ingredients required to produce the proper color.<sup>113</sup> It was the job of the master painter to grind pigments, boil the linseed oil and japan drier, and mix the ingredients correctly to produce the same colors every day to match a set of drift control color cards.<sup>114</sup>

Red-lead primer paint, made by mixing red-lead pigment and boiled linseed oil, was the most popular primer used by the railroads.<sup>115</sup> Different commercial surface filler primers were used beginning in the 1870's, because of the time saved in sanding the filler coat smooth. The filler coat, called "rough stuff" was a thick primer used to fill

uneven and rough surfaces. It was made using "3 parts of slate powder and 1 part of white lead ground in oil (keg lead)",<sup>116</sup> mixed with japan dryer and varnish in equal amounts and thinned with turpentine. This resulted in a dark gray color.

In the 1890's, colored varnishes called enamels were tested by the railroads for durability. By 1896, the Burlington Railroad was using four coats of enamel paint and no varnish. However, the rail industry believed that enamels did not have a durable finish nor were they glossy enough, though it was probably that the lack of a clear varnish over the color caused the paint to lack depth.<sup>117</sup>

Lead was a major ingredient in paints, primers and surface fillers. Since most paint colors are a mixture of different pigments, most paint contained lead to help bind the paint together. Some paint pigments were lead based such as white lead, red lead, chrome yellow. Chrome green is produced by large amounts of chrome yellow in combination with Prussian blue or other blues. Lead based paints flowed out better, meaning that when applied by brush they leveled out so as not to show brush marks. When applied by spraying in enamels, it produced a hard glossy finish.<sup>118</sup>

Painters themselves had preferences for the paints and finishes that they used. It was believed by some that the heat from the sun on dark colors was pulled into the varnish and caused it to crack. This, they said, made the color come off during the yearly varnish maintenance since it had been absorbed into the varnish. The pigments of the lighter colors were lead-based and lasted longer. Other painters who preferred the dark colors noted that lighter colors needed more coats, so paint was applied much thicker, causing them to crack. They also contended that lead-based paints required more varnish to be applied since it was absorbed into the paint.<sup>119</sup>

### Spray Painting

In the late 1800's, compressed air was used by mechanics for riveting and to run manufacturing machines, including spray painting equipment. The Southern Pacific Railroad was the first on record to use spray painting as a method of applying paint on railroad equipment, in this case steam engines in the 1880's. Shortly thereafter, the Southern Pacific started to spray paint freight equipment. Many other railroads also spray painted their freight

equipment. Since this equipment was a source of revenue that did not involve the public as passenger service did, appearance was less important. By the 1920's, railroad painting manuals touted the use of paint spraying since it was the way automobiles were painted. Spraying reduced labor time by twenty percent but consumed more paint by 10 percent. Yet, spray painting was adopted very slowly by the railroads for passenger coaches.<sup>120</sup>

However, the Pullman Company remained a staunch supporter of the brush and varnish method because they felt that the final finish was superior. The company had reduced labor time to fourteen days in the early decades of the twentieth century using seven coats of oleoresinous paints over a red-lead primer.<sup>121</sup>

#### Pennsylvania Railroad Testing Procedures for Baked Enamels

In February 1912, after performing paint inspections, the Pennsylvania Railroad found that the paint and varnish on coaches was deteriorating and the metal surfaces were rusting. The Pennsylvania Railroad decided that coaches should be repainted on a schedule of twelve to eighteen months. The railroad determined that new paint products

and methods of applying paint were needed so that equipment could be kept in service longer between repainting.<sup>122</sup> In 1913, the Pennsylvania Railroad tested a new system of paint and varnish application, the baked enamel finish. The test involved painting and tracking eighty-five coaches using the baked enamel method and seventeen coaches using the industry standard air-dried method. In 1916, the coaches were inspected and the baked enamel finish held up for forty months as opposed to the twelve to eighteen months for the air-dried application. The cost of each method was equal. Materials cost the same. Labor time for the baked enamel process was reduced to six to seven days over the air-dried method of fifteen to sixteen days. It took eight men to accomplish a baked enamel finish as opposed to four men for air-drying. It is unknown why the railroad did not adopt the baked enamel procedure. After the tests were completed, the railroad returned to the old methods they had been using.<sup>123</sup>

The Baltimore and Ohio Railroad tried baked enamel finishing in 1914. However, the company felt that a proper finish could not be completed in under twenty-three days. While the Pennsylvania Railroad used three coats of varnish over the enamel to give it a better shine and to protect

the paint, the Baltimore and Ohio Railroad applied two coats of varnish over baked enamel.<sup>124</sup>

### Twentieth Century Paint Applications

By the 1920's most railroads were still using oil-based paints instead of enamels and were still applying paint with brushes. A coach would remain in the paint booth for two or three weeks as this schedule shows:<sup>125</sup>

Prime surface and allow to dry 72 hours.

Second coat of primer and allow 24 hours to dry.

Knife coating of putty mixed with turpentine to fill holes. Dry 24 hours.

Apply two to three coats of "rough stuff" and dry 24 hours between each coat.

Apply guide coat thinned into a stain.

Rub off guide coat and smooth rough stuff using pumice stone and water (wet sanding). Dry for 5 hours.

Apply first topcoat of paint. Dry 24 hours. Sand.

Apply second topcoat of paint. Dry 24 hours.

Apply lettering and pinstripes. Dry 24 hours.

Three coats of varnish allowing to dry 48 hours between coats. Sand after first and second coat.<sup>126</sup>

By this time paints were drying faster because of improvements in drying additives and the simpler lettering schemes of the early twentieth century. In 1931 the Milwaukee Road started spray painting after it purchased an overhead exhaust fan to remove dust and eliminate overspray from the coach surface. Improvements in spray painting gave surfaces a smoother look and eliminated the amount of sanding. Also the increased amount of thinner necessary for spray painting allowed two or more coats of paint to be applied in the same day because of the greater evaporation rate of the thinner. The railroads did not completely adopt lacquer paints until the 1940's, even though automotive painting had used synthetic lacquers since the 1920's.<sup>127</sup>

Today some of the old materials are prohibited, such as lead oil-based pigments and paint, because of their possible use in buildings. Lead is sometimes still used in automotive paint applications and in sign painting. Other materials such as oil based paints fade easily in sunlight and are not durable enough for long term use. Currently, oil paints are very cheap, averaging \$15 to \$40 a gallon, while the cost of automotive paints ranges between \$20 for



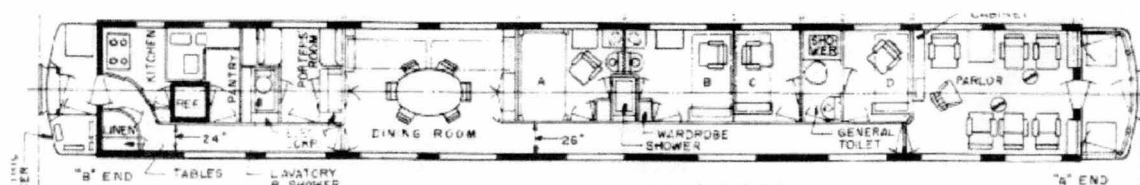
very cheap enamels, to an average of \$150 a gallon for acrylic enamels and urethanes, to over \$200 a gallon for base coat, clear coat. However, because equipment must be repainted more frequently, higher labor costs for the repeated application of oil paints are prohibitive. Current quality automotive paints can last ten to twenty years. While varnish, applied in several layers to make the coaches shine, is a durable product for the protection of museum artifacts, its yellowing effect over time changes the appearance of the color, giving the viewer a different perspective of the color. He no longer sees the true, original color, but the color that the coach would be after several years of operation. Just as visitors to automobile museums want to see cars that appear to have just come out of the paint booth, people who visit railroad museums want to see equipment that is not faded or yellowing.<sup>128</sup>

## GLOSSARY

Binder. The part of paint cements or binds the pigment together, such as varnishes, oils and proteins.<sup>129</sup>

Baggage car. Coach in a passenger train that only carries baggage.

Business car. Coach with a parlor, dining room, bedrooms with bathrooms, kitchen and servant quarters. Was once known as a private car.



Car. The term is used to indicate any piece of railroad equipment other than a locomotive. When referred to passenger equipment the term is synonymous with the term coach.

Chroma. In the Munsell system the chroma is the measure of distance from the hue of neutral gray.<sup>130</sup>

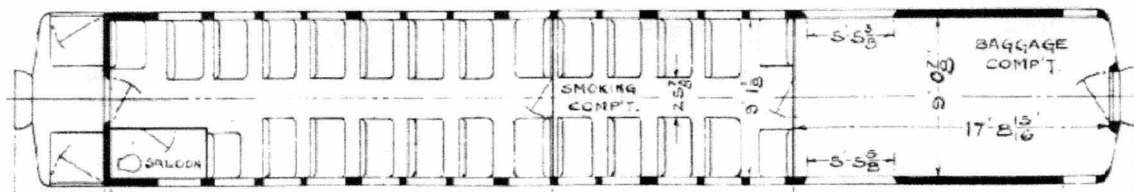
CIE Lab Value. Commission Internationale de l'Eclairage, developed in France, is a color system that uses mathematical values to identify colors in contrast to other systems that use colors arranged in orders of hue and values as the Munsell system does.

Clearstory or clerestory. The part of a structure with windows that is above the roof. In railroad terms this is part of what is called a monitor roof, made up of the lower deck, the clearstory and the upper deck.

Coach. The term is used only for passenger equipment. Its use started in the nineteenth century when early rail

passenger cars where a long flat car on which stage type coaches without wheels were mounted.

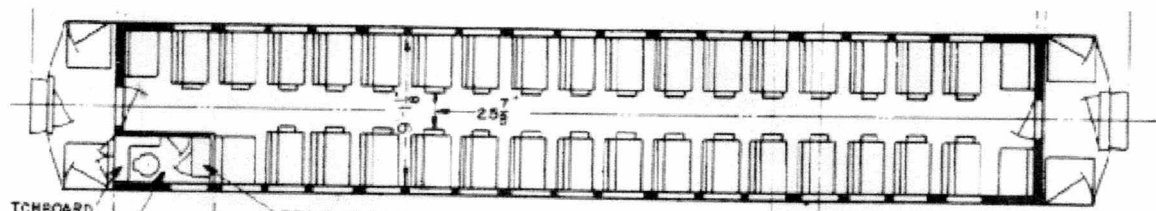
Combine coach. A coach that is part passenger and baggage car.



Consist. A consist in railroad terms is a type of train made up of a locomotive and a series of railcars that serve a particular purpose. A passenger consist is made up of any combination of passenger coaches regardless of the type, i.e. day coaches, sleepers, dining cars, baggage cars, mail cars, etc. A freight consist is made up of boxcars, flatcars, gondolas, tank cars, coal cars, caboose, etc. A work consist is for railroad maintenance crews, made up of cranes, work cars, tool cars, caboose, etc.

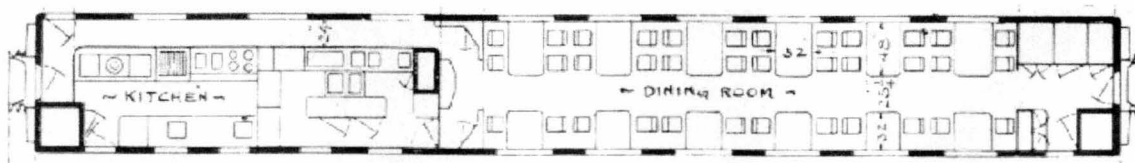
Crosssectional photomicrograph. A photo taken through a microscope that shows the layers of a paint chip. A paint chip is placed in dental resin and sanded smooth after resin hardens. A camera is attached to the lens of the microscope and a photograph is taken of the paint chip.

Day coach. Passenger coach that is used for traveling short distances, such as used by commuters to the city from the suburbs. Day coaches are likewise used between cities such as New York to Boston, Philadelphia, Baltimore, and Washington, D.C. The general design is for a long passageway through the center of the car, with a bench seat for two people.



Deck. The deck is the roof of a coach. In a Monitor type roof, where there is a clearstory, there is the upper deck which is the roof above the clearstory. The lower deck is the roof below the clearstory. The deck is also referenced in the interior whereas the ceiling headliners belongs to the upper deck and the arched headliners belong to the lower deck.

Dining car. Coach with a kitchen and an open area where dining tables are placed by the windows. Tables usually sat two to four people.



Drift control color cards. Color chips or cards that have been painted with the railroads standard approved colors and kept by the master painter for comparison every time a new batch of paint is mixed up.

Enamel (twentieth century). Oil based paint made with varnish or lacquer as the vehicle. Enamel is usually high in gloss and pigmented with high hiding pigments only. Unlike oil paints of the nineteenth century, modern oil based enamels from 1924 onward, can not have additional coats reapplied until the previous coat is dry, or else, it will streak.<sup>131</sup>

Hue. In the Munsell system the hue is the degree of color from the basic colors. The hues are red, yellow-red, yellow, green-yellow, green, blue-green, blue, purple-blue, purple, red-purple.<sup>132</sup>

Jim Crow Car. During segregation these cars were used to keep passengers separated from white passengers. These cars could have two separate sitting areas, bathrooms and water fountains. In cars that had one sitting area, whites and blacks would be in separate coaches.

Lacquer. A cellulose based material that dries by evaporation of the thinner. It has a low solids

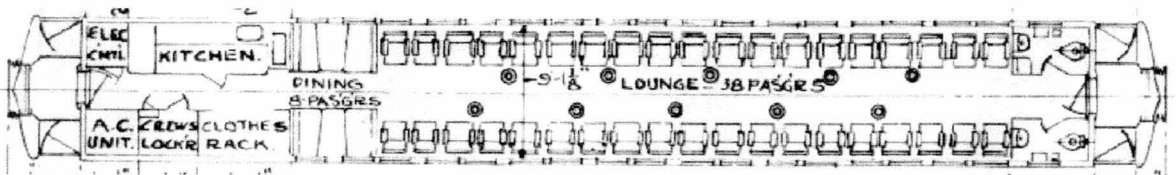
content and thus several coats must be applied for a good finish.<sup>133</sup>

Livery. A railroad's paint scheme.

Munsell System of Color Notation. Designed in 1905 by Albert H. Munsell. The Munsell system is used as a museum standard for recording colors. Munsell's system classifies color by hue, value and chroma (H V/C). The hue notation shows how a color is reference to the principle colors of red (R), yellow (Y), green (G), blue (B), and purple (P). The intermediate colors are yellow-red (YR), green-yellow (GY), blue-green (BG), purple-blue (PB), and red-purple (RP).

Paint scheme. The colors of a railcar body exterior and interior, roof, vestibules, wheels and undercarriage. The paint scheme also includes the style of lettering, pinstriping, and logos. Each railroad had its own distinct paint scheme.

Parlor coach. Car with an open interior, with chairs placed by windows facing toward the center walk area or around small tables. While usually having a small kitchen and bar, parlor cars should not be confused with dining cars. Parlor cars were meant for relaxing conversation. A parlor coach is also known as a lounge or observation car.



Passenger car or coach. Rail equipment used for carrying passengers. It may referred to any type of passenger car, including business cars, private cars, parlor cars, dining cars, sleeping cars, and day coaches.

Passenger consist. Any group of passenger type cars behind a locomotive. A passenger consist is made up of any combination of passenger coaches regardless of the type, i.e. day coaches, sleepers, dining cars, baggage

cars, mail cars, etc. A passenger consist in the twentieth century never has a caboose.

Private car. Later called business coaches, private cars where either owned by wealthy individuals, railroad owners and executives or for lease from the railroad companies. They where generally very ornate inside.

RPO. Railway Postal Office or Postal car. Railroads were the major mode of transportation for mail before the 1970's. An RPO would be pulled by a passenger train and be painted the same colors of the other cars.

Red Lead. A red colored oxide of lead that is used as a rust inhibiting pigment, a drier, and as a primer.<sup>134</sup>

Shading. Shading is the effect of applying a band of dark color along two sides of the border of letters or logos so as to look three-dimensional.

Stereomicroscope. A microscope that has two eyepieces each with its own light path thus producing a three dimensional image.

Value. In the Munsell system the value indicates the darkness of lightness of a color from neutral gray.<sup>135</sup>

Vehicle. The liquid portion of a paint.<sup>136</sup>

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<sup>121</sup> White, 447.

<sup>122</sup> Unknown Pennsylvania Railroad Inspector to C.D. Young, Engineer of Tests, Pennsylvania Railroad, TL, 19 February 1912, Accession 1810-712, Engineer of Tests, 412.042 Passenger Equipment Oven Baked Paint 1914-1922, Manuscripts & Archives Department, Hagley Museum and Library, Wilmington, Delaware.

<sup>123</sup> H.M. Ramsey [Pennsylvania Railroad] to C.D. Young, Engineer of Tests, Pennsylvania Railroad, TLs, 25 April 1916, Accession 1810-712, Engineer of Tests, 412.042 Passenger Equipment Oven Baked Paint 1914-1922, Manuscripts & Archives Department, Hagley Museum and Library, Wilmington, Delaware; Pennsylvania Railroad Test Department, sheet no. 8885-8894, blueprint, 23 April 1914, Accession 1810-712, Engineer of Tests, 412.042 Passenger Equipment Oven Baked Paint 1914-1922, Manuscripts & Archives Department, Hagley Museum and Library, Wilmington, Delaware.

<sup>124</sup> White, 447.

<sup>125</sup> Miller, Part 2, 4; White, 447.

<sup>126</sup> Miller, Part 2, 4.

<sup>127</sup> Hengeveld, 163-4; White, 447.

<sup>128</sup> The car and locomotive cyclopedia: 1997. 6<sup>th</sup> ed. (Omaha, NE: Simmons-Boardman Books, 1997), 958-959; The author works as a railcar restorationist and painter at Steamtown National Historic Site, and has learned about paints, the application of paints, and the costs in regards to material and labor from actual work experience, and from the mentoring of my work partners Raymond Libby and Edward Roche who continue to teach me on a daily basis.

<sup>129</sup> Painting and Decorating Craftsman's Manuel and Textbook, (Chicago: Painting and Decorating Contractors of America, Inc., 1965), 484.

<sup>130</sup> Macbeth Division of Lollmorgen Instruments Corporation, Munsell Book of Color, (Baltimore: Privately Published, 1993), 1.

<sup>131</sup> F.N. Vanderwalker, Interior Wall Decoration: Practical Working Methods for Plain and Decorative Finishes, New and Standard Treatments, (Chicago: Frederich J. Drake and Company, 1924), 114; Painting and Decorating Craftsman's Manuel and Textbook, 490.

<sup>132</sup> Macbeth Division of Lollmorgen Instruments Corporation, 1.

<sup>133</sup> Painting and Decorating Craftsman's Manuel and Textbook, 494.

<sup>134</sup> Painting and Decorating Craftsman's Manuel and Textbook, 498.

<sup>135</sup> Macbeth Division of Lollmorgen Instruments Corporation, 1.

<sup>136</sup> Painting and Decorating Craftsman's Manuel and Textbook, 504.

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