

EXHIBIT NO. 1

IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF COLUMBIA

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KENNETH CAMPBELL, et al.,)	
)	
Plaintiffs,)	
)	
v.)	CIVIL ACTION NO. 1:99CV02979 (EGS)
)	Judge Sullivan
NATIONAL RAILROAD PASSENGER)	
CORPORATION,)	
)	
Defendant.)	
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EXPERT REPORT

EDWIN L. BRADLEY, Ph.D.

LIESL M. FOX, Ph.D.

Edwin L. Bradley, Jr., Ph.D., is CEO and founder of Quantitative Research Associates. He has applied statistical methodology in the fields of litigation, medical research and business applications for over 44 years. He has been accepted as an expert witness in both State and Federal Courts on a variety of issues, including employment discrimination. He is an author of over 215 publications and research papers. His work has appeared in scientific journals such as *American Statistician*, *Journal of the American Statistical Association*, *IMA Journal of Mathematics Applied in Business and Industry*, and *Technometrics*. He received his Ph.D. in statistics from The University of Florida in 1969. He was a tenured Professor in the Department of Biostatistics at The University of Alabama at Birmingham ("UAB"), where he taught and conducted research for 28 years. He is currently Professor Emeritus of Biostatistics at UAB. A copy of his curriculum vitae, attached hereto in Appendix D, lists his qualifications and

publications in the field of statistics, and sets forth cases in which he has provided expert testimony in the last four years.¹

Dr. Liesl M. Fox is a Senior Consultant and has been employed at Quantitative Research Associates, a firm that provides statistical and computing consulting services, since 1997. She has been a statistical consultant for over seventeen years, including conducting analyses in the fields of litigation and medical research, and has testified as an expert witness. She specializes in data analysis and the application of statistical methodology to various fields of study, and has worked with data related to different areas of employment. Her responsibilities also include database preparation and management, and the acquisition and use of Census and other source data in statistical analyses. She is an author of several research articles. A copy of her curriculum vitae lists her qualifications and is attached hereto in Appendix D.²

Introduction

The National Railroad Passenger Corporation ("Amtrak", "Company" or "Defendant") operates a nation-wide rail system, serving more than 500 destinations in 46 States and three Canadian provinces on more than 21,200 miles of track. Amtrak employs more than 20,000 individuals and has an average of more than 78,000 passengers ride more than 300 Amtrak trains per day. In addition, every weekday an average of more than 862,000 people depend on commuter rail services that use Amtrak-owned infrastructure, dispatching, and/or shared operations, or ride commuter trains operated by Amtrak under contracts with local or regional agencies. Amtrak incurred expenses in FY 2010 of \$3.74 billion, including operating or capital costs.³

¹ Dr. Bradley's time is billed at the rate of \$500 per hour.

² Dr. Fox's time is billed at the rate of \$330 per hour.

³ Information obtained from Amtrak's National Fact Sheet: FY 2010 available at www.Amtrak.com.

We have been asked by counsel for the Plaintiffs to review the competitive selections and disciplines received by employees covered by collective bargaining agreements ("CBA") at Amtrak (hereinafter "Agreement" employees) to the extent that records and data have been produced by the Defendant for the period from April 4, 1996⁴ through December 31, 2008 ("Analysis Period"). In particular, we have been asked to examine the differences in selection rates for vacant competitive positions and the discipline rates between African-American and non-African-American Agreement employees at Amtrak to determine whether the policies and practices used by Amtrak have had adverse impact against its African-American Agreement employees during the Analysis Period.

Summary of Conclusions

Based on our analyses, we have reached the following conclusions for the Analysis Period:

- African-Americans are hired for Agreement positions at Amtrak at a rate less than their non-African-American counterparts. These results are statistically significant.⁵
- African-American Agreement employees at Amtrak are selected for competitive promotions at a rate less than their non-African-American counterparts. These results are statistically significant.
- African-American Agreement employees at Amtrak are charged with disciplinary violations at a rate higher than their non-African-American counterparts. These results are statistically significant.
- The class in this case is composed of the more than 13,000 African-Americans who have worked at Amtrak during the Analysis Period and who were potentially affected by the hiring, promotion, and discipline policies, practices and procedures adhered to by Amtrak.
- The named Plaintiffs and declarants in this case worked at locations where 96% of all class members worked, as well as in the same Unions as did 99% of all class members.

⁴ Start of Analysis Period is 300 days prior to plaintiff Linda Stroud's January 25, 1997 classwide charge regarding competitive promotions.

⁵ Statistical significance is discussed in Appendix B attached to this Report. Throughout this Report, differences that are preceded by a negative (-) sign indicate results that are adverse to African-American Agreement employees.

Information Relied Upon

For our analyses, we have relied upon the following:

- Stata databases “amtrak606.dta”, “amtrak201.dta”, “fullhist.dta”, “snapshots.dta”, “snapshots2.dta”, “employee_history.dta”, “transactions.dta”, “transactions2.dta”, “discipline.dta”, “appflow20110708.dta”, “educ_transactions.dta”, and “training.dta” provided by Amtrak; and
- *Uniform Guidelines on Employee Selection Procedures with Interpretive Questions and Answers* (“Uniform Guidelines”).

Data Files Used for Analyses

Counsel for both the Plaintiffs and Defendant⁶ agreed to use databases that were prepared by the Defendant and reviewed by the Plaintiffs (“Joint Databases”) as the basis for the statistical analyses in this case. The Joint Databases provided information regarding seniority, Craft Group, Union, Division (Boston, Chicago, Los Angeles, New York, Philadelphia, Washington), and assignment location of Amtrak’s Agreement employees. Additionally, information was provided regarding education, training, applications for vacancies, and disciplinary charges.

In order to conduct our analyses, a dataset was created that combined the information contained in the separate Joint Database files. The race of an employee was determined using the database entitled “amtrak606.dta”. For employees with more than one race code, the race code that appeared in more of the records was used as the race of the individual. Employees’ names were contained in the database entitled “snapshots.dta”. Information regarding employment records, including dates of hire and termination, rates of pay, changes in job assignment, location assignment, and division assignment was obtained from the databases entitled “amtrak.201.dta”, “fullhist.dta”, “snapshots2.dta”, “employee_history.dta”, and “transactions2.dta”. The data

⁶ “The existing data set, which contains data for 1991 through 2008, provides an ample data set for both parties’ use.” Letter from Joyce E. Taber to Timothy B. Fleming dated October 15, 2010, page 3.

contained in these seven databases were combined to create the dataset “AllHistory.sas7bdat” (“Employee History File”).

An employee’s Union and Craft Group were determined from the job assignments shown in the Employee History File. The Union was determined from the first two letters of an employee’s job code.⁷ Once the Union was determined, an Agreement employee was assigned to one of four Craft Groups:

Shop Crafts – Comprised of mechanical and electrical workers who engage, generally, in locomotive and train car maintenance. Unions included in the Shop Crafts are IAM, IBEW, JCC, NCFO / SEIU, SMWIA, IBBB, and TCU ARASA Mechanical Foremen.

Engineering Crafts – Comprised of employees who work on the rights-of-way, including track and out-buildings. Unions included in the Engineering Crafts are BMW (outside NE Corridor), BRS, and TC ARASA Maintenance of Way Supervisors.

Operating and Police Crafts – Comprised of employees who operate the trains. Includes police, as they are part of the security operations for the trains. Unions included in the Operating and Police Crafts are UTU, BLET, ATDA, FOP (previously AFRP),

Clerical and On-Board Services Crafts – Comprised of employees who do all the things needed to service customers, both in the stations and on-board the trains. Unions included in the Clerical and On-Board Services Crafts are ASWC, TCU (Clerks and Tower Division), UTU (Stewards), and ARASA OBS Supervisors.

The database “discipline.dta” contained information regarding employees who were charged with disciplinary violations. The file included, *inter alia*, the date of the charge, the rule violated, and the outcome of the charge. The dataset “DisciplinesData.sas7bdat” was created using this database.

The database entitled “appflow20110708.dta” contained applicant pools for some vacancies beginning in July 2003. Information regarding the race of the applicant and the Craft Group and Division of the vacancy was included. If race, Craft Group, or Division was unknown, then that information was obtained from the Employee History File, if possible. The dataset entitled “AppPools.sas7bdat” (“Applicant Flow Data”) was created using this database.

The Applicant Flow Data does not contain information regarding vacancies prior to July 2003, nor is it a complete record of all vacancies that were filled in, or after, July of 2003. The dataset entitled “Vacancies.sas7bdat” (“Vacancy Data”) contains vacancies that were identified from the Employee History File for the period from April 4, 1996 through December 31, 2008. A record was evaluated for inclusion in the Vacancy Data if an Agreement employee was hired or changed jobs in the Analysis Period.⁸ All individuals hired into one of the four Craft Groups during the Analysis Period were considered as filled vacancies. To identify non-hiring vacancies, the Employee History File was searched for changes in job titles and job codes. These potential vacancies were reviewed to determine whether the change in job title represented a non-competitive in-line progression, a change in pay scale, an artificial movement created by the merging of the different data sources, or a renaming of the same job. All potential non-hiring vacancies that met one of these four criteria were excluded from the analysis. Only vacancies with known Craft Group, Division, Union, and rate of pay were included in the Vacancy Data. Any records identified as a vacancy in the Employee History File that were also found in the Applicant Flow Data were not included in the Vacancy Data.

⁷ Letter from Joyce E. Taber to Bob Childs, *et al.*, dated August 11, 2011. See Appendix C.

⁸ “This is because the Salary Reason Code field is not a verified field and has not been relied upon by the business to determine whether a promotion actually occurred.” Letter from Joyce E. Taber to Bob Childs, *et al.*, dated April 22, 2011, page 7.

Workforce Statistics

The total number of Amtrak Agreement employees⁹ on July 1 of each year from 1996 through 2008 is shown, by race, in Figure 1. At the top of each column is the number of the Amtrak Agreement employees that the race represents. African-Americans averaged approximately 29.5% of Amtrak's Agreement employee workforce during this period.

The percent of African-American Agreement employees in each Craft Group are shown in Figures 2a-2d for the years 1996 through 2008. For the Shop Crafts, African-Americans averaged approximately 29.3% of Amtrak's Agreement employee workforce. For the Engineering Crafts, it averaged approximately 14.7%; for the Operating and Police Crafts, it averaged approximately 15.6%; and for the Clerical and On-Board Services Crafts, it averaged approximately 40.4%.

Analysis of Selections (Hires and Promotions) With Applicant Flow Data

For the period July 2003 through December 2008,¹⁰ there were 6,193 vacancies for Agreement positions with a job posting and a list of individuals who applied for these vacancies.¹¹ That is, there is Applicant Flow Data consisting of pools of individuals who actually applied for and expressed an interest in, a vacancy. For each posting, the proportion of African-Americans in the pool of applicants for that position was calculated to determine an African-American representation benchmark. From this benchmark, the expected number of African-American selections was computed and compared to the actual number of African-Americans selected. The results from each posting were then aggregated to determine the results

⁹ Excludes BMW Union employees working in the Northeast Corridor.

¹⁰ It is our understanding that no applicant flow records were maintained prior to July 2003. It is also our understanding that applicant flow records were not collected for all vacancies after July 2003.

¹¹ "With respect to the Applicant Flow Data (which covers the time period of September 2003 to September 2008), this data set pertains to promotional opportunities that were posted by Human Resources externally (as well as to

overall and for each Craft Group separately. This method insures that the statistical comparisons made are adjusted, or controlled, for date of selection (including year and month), Craft Group, Union, location of selection (including Division), and decision-maker(s).¹²

In Table 1 of Appendix A, we show the results of our analysis of the selection rates of African-Americans and non-African-Americans for vacant positions during the Period July 2003 through December 2008 using both conventional statistical testing and the four-fifths (80%) rule of the *Uniform Guidelines*.¹³ These are vacant positions for which Applicant Flow Data is provided.

In Table 1, we summarize the analysis of selections for each Craft Group separately and overall during the period for which Applicant Flow Data are provided.¹⁴ For the Shop Crafts, there were a total of 1,868 selections. Of these, 695 (37.2%) were African-American. If the selection process were race-neutral, one would have expected approximately 771 (41.29%)

internal candidates), after the position could not be filled internally. Thus, external and internal candidates are considered for those positions." Letter from Joyce E. Taber to Bob Childs, *et al.*, dated April 22, 2011, page 6.

¹² Each job posting contains a particular job vacancy to be filled. By controlling for posting, we have controlled for differences in the position, the date the position was posted, the department and the work area of the position, and the decision-maker. The effect of the bidders' qualifications have also been taken into account by controlling for each job posting independently so that only persons who decided to bid and met the posted qualifications were included in the analysis. Applicants were removed who were held not to be qualified due to the following reasons: failed drug screen; failed background investigation; failed physical; failed skills test; open discipline; nepotism; not eligible for rehire; not qualified; or less than one year in position. After computing the results for each posting, the results are aggregated by summing over all postings for each Craft Group using a Cochran-Mantel-Haenszel statistic that is appropriate for use in the analysis of selections involving multiple pools of applicants as occurs in the job posting data in this case.

¹³ The four-fifths rule of the *Uniform Guidelines* (1607.4D) states in part that "[a] selection rate for any race, sex, or ethnic group which is less than four-fifths (4/5) (or eighty percent) of the rate for the group with the highest rate will generally be regarded by the Federal enforcement agencies as evidence of adverse impact. Smaller differences in selection rate may nevertheless constitute adverse impact, where they are significant in both statistical and practical terms or where a user's actions have discouraged applicants disproportionately on grounds of race, sex, or ethnic group."

¹⁴ Amtrak operates pursuant to a nation-wide set of hiring, position creation, position selection, and position assignment practices, policies and procedures which are set by Amtrak corporate and are applicable throughout all Amtrak regions, facilities and departments. See *Plaintiffs' Memorandum in Support of Motion for Class Certification*. While there are a number of sign-offs prior to the final decision, the ultimate decision to create an Agreement position and to select an employee or new hire for such a position, has rested exclusively with one person during the Analysis Period - the President of the SBU, or his designee, from 1996 to 2002 and the CEO of

African-American selections. This disparity of 76 *fewer* African-American selections than expected is statistically significant with -5.72 standard deviations of difference. The adverse impact ratio¹⁵ is 75.8%, which is below the 80% threshold set forth by the *Uniform Guidelines*. Similarly, for the Engineering Crafts, there is a disparity of 30 *fewer* African-American selections than expected which is statistically significant with -4.40 standard deviations of difference and an adverse impact ratio of 63.5%. For the Operating and Police Crafts, there is a disparity of 65 *fewer* African-American selections than expected which is statistically significant with -5.26 standard deviations of difference and an adverse impact ratio of 72.7%. For the Clerical and On-Board Services Crafts, there is a disparity of 83 *fewer* African-American selections than expected which is statistically significant with -5.61 standard deviations of difference and an adverse impact ratio of 79.5%.

There were a total of 6,193 selections in the Applicant Flow Data for all Craft Groups. Of these, 2,335 (37.7%) were African-American. If the selection process were race-neutral, one would have expected approximately 2,589 (41.80%) African-American selections. This disparity of 254 *fewer* African-American selections than expected is statistically significant with -10.41 standard deviations of difference and an adverse impact ratio of 75.8%, which is below the 80% threshold set forth by the *Uniform Guidelines*.

Based on our analyses of the Agreement selections at Amtrak using the Applicant Flow Data, we find that African-Americans were selected for these positions less than would be expected in a race-neutral environment. These differences, which controlled for date of selection (including year and month), Craft Group, Union, location of selection (including Division), and

Amtrak from 2002 to the present. *Id.* As external hires compete directly with Agreement employees for these positions, there is only one system at issue here for both hires and promotions. *Id.*

¹⁵ The adverse impact ratio is computed using only those vacancies for which the applicant pool contained at least one African-American and one non-African-American.

decision-maker(s) demonstrate statistically significant adverse impact against African-Americans in the selection process for vacant Agreement positions at Amtrak.

Analysis of Selections (Hires and Promotions) With No Applicant Flow Data

For the majority of vacancies that occurred during the Analysis Period, there are no applicant pools.¹⁶ Thus, there is no data on who may have applied for, or expressed an interest in, these vacancies. That is, there is no Applicant Flow Data or pools of individuals who actually applied for, or expressed interest in, a particular vacancy.¹⁷

In the applicant flow section above, we analyzed those vacancies for which Applicant Flow Data has been provided. In this section, we analyze those vacant positions found in the Employee History File and listed in the Vacancy Data for which no Applicant Flow Data existed. For the Analysis Period, we identified more than 49,000¹⁸ such selections for vacant positions at Amtrak, and for which we were able to identify the Union, Craft Group, Division, pay rate and date of selection. We analyze the external hires and internal promotions separately and jointly. Since Applicant Flow Data was not maintained for these selections, we will analyze these selections using proxy benchmarks to represent the African-American availability.

Analysis of External Hires

We used the African-American benchmarks that we calculated for the vacancies for which Applicant Flow Data existed to analyze the external hires identified in the Vacancy Data.

¹⁶ "[T]he vast majority of the job moves in the Transaction Data are *not* present in the Applicant Flow data (e.g., where the job move did not involve posting to external candidates as well as internal candidates, but rather, the job was only posted internally for internal candidates)." Letter from Joyce E. Taber to Bob Childs, *et al.*, dated April 22, 2011, page 6.

¹⁷ See Paetzold and Wilborn, *The Statistics of Discrimination*, §4.03 regarding the use of proxy populations when applicant data are unavailable.

¹⁸ To avoid double counting of vacancies, these analyses exclude vacancies found in the Employee History File that were also identified in the Applicant Flow Data.

That is, we utilized the weighted African-American benchmarks of Table 1 as proxy benchmarks for the African-American representation for those hires where no applicant data was available.¹⁹

In Table 2 of Appendix A, we show the results of our analysis of the external hiring rates of African-Americans and non-African-Americans for vacant positions during the Analysis Period using both conventional statistical testing and the four-fifths (80%) rule of the *Uniform Guidelines*. These are hires for which no Applicant Flow Data was provided. Our analyses use the weighted African-American benchmarks calculated from the Applicant Flow Data and shown in Table 1.

In Table 2, we summarize the analysis of hires for each Craft Group separately and overall. For the Shop Crafts during the Analysis Period, there were a total of 2,744 hires at Amtrak. Of these, 1,009 (36.8%) were African-American. If the hiring process were race-neutral, one would have expected approximately 1,133 (41.29%) African-American selections. This disparity of 124 *fewer* African-American hires than expected is statistically significant with -4.81 standard deviations of difference. The adverse impact ratio is 82.7%. Similarly, for the Engineering Crafts, there is a disparity of 36 *fewer* African-American hires than expected which is statistically significant with -3.25 standard deviations of difference and an adverse impact ratio of 73.2%. For the Operating and Police Crafts, there is a disparity of 212 *fewer* African-American hires than expected which is statistically significant with -10.27 standard deviations of difference and an adverse impact ratio of 57.7%. For the Clerical and On-Board Services Crafts, there is a disparity of 363 *fewer* African-American hires than expected which is statistically significant with -10.41 standard deviations of difference and an adverse impact ratio of 73.9%.

¹⁹ The court in *Brown v. Nucor Corp.*, 576 F.3d 149 (4th Cir. 2009), has previously upheld our use of applicant flow African-American benchmarks from one period as a proxy for benchmarks that could not be calculated due to the lack of applicant flow data in another period.

There were a total of 10,074 hires in all Craft Groups at Amtrak.²⁰ Of these, 3,577 (35.5%) were African-American. If the hiring process were race-neutral, one would have expected approximately 4,312 (42.81%) African-American selections. This disparity of 735 *fewer* African-American hires than expected is statistically significant with -14.81 standard deviations of difference with an adverse impact ratio of 73.6%, which is below the 80% threshold set forth by the *Uniform Guidelines*.

Analysis of Internal Promotions

We used the Applicant Flow Data to compute proxy African-American benchmarks for those vacancies identified in the Vacancy Data to which an internal Agreement employee was promoted. We computed weighted African-American benchmarks, using only the applicants who were employees at the time they applied, as proxy benchmarks for the African-American representation for those promotions for which no applicant data was available.

In Table 3 of Appendix A, we show the results of our analysis of the promotion rates of African-Americans and non-African-Americans for vacant positions during the Analysis Period using both conventional statistical testing and the four-fifths (80%) rule of the *Uniform Guidelines*. These are promotions in the Employee History File for which no Applicant Flow Data is provided.

In Table 3, we summarize the analysis of promotions for each Craft Group separately and overall using the weighted Applicant Flow proxy benchmarks. For the Shop Crafts during the Analysis Period, there were a total of 9,369 promotions at Amtrak. Of these, 2,535 (27.1%) were African-American. If the promotion process were race-neutral, one would have expected approximately 3,163 (33.76%) African-American selections. This disparity of 628 *fewer*

²⁰ These are the selections in the Employee History File for which no Applicant Flow Data existed.

African-American promotions than expected is statistically significant with -13.72 standard deviations of difference. The adverse impact ratio is 72.8%, which is below the 80% threshold set forth by the *Uniform Guidelines*. Similarly, for the Engineering Crafts, there is a disparity of 196 *fewer* African-American promotions than expected which is statistically significant with -7.99 standard deviations of difference and an adverse impact ratio of 69.5%. For the Operating and Police Crafts, there is a disparity of 1,114 *fewer* African-American promotions than expected which is statistically significant with -24.95 standard deviations of difference and an adverse impact ratio of 52.6%. For the Clerical and On-Board Services Crafts, there is a disparity of 127 *fewer* African-American promotions than expected which is statistically significant with -1.94 standard deviations of difference and an adverse impact ratio of 97.1%.

There were a total of 39,548 promotions in all Craft Groups at Amtrak.²¹ Of these, 12,834 (32.5%) were African-American. If the promotion process were race-neutral, one would have expected approximately 14,899 (37.67%) African-American selections. This disparity of 2,065 *fewer* African-American promotions than expected is statistically significant with -21.43 standard deviations of difference an adverse impact ratio of 79.5%.

Combined Analysis of External Hires and Internal Promotions

Since there is only one system at issue here for selecting both hires and promotions, we have combined the results of Tables 2 and 3 and show the results in Table 4 of Appendix A. See *Plaintiffs' Memorandum in Support of Motion for Class Certification*.

In Table 4, we show the results of our analysis of the selection rates of African-Americans and non-African-Americans for all vacant positions during the Analysis Period using

²¹ These are the selections in the Employee History File for which no Applicant Flow Data existed.

both conventional statistical testing and the four-fifths (80%) rule of the *Uniform Guidelines*. These are selections in the Employee History File for which no Applicant Flow Data is provided.

In Table 4, we summarize the analysis of selections for each Craft Group separately and overall using the weighted Applicant Flow proxy benchmarks from Tables 2 and 3. For the Shop Crafts during the Analysis Period, there were a total of 12,113 selections at Amtrak. Of these, 3,544 (29.3%) were African-American. If the selection process were race-neutral, one would have expected approximately 4,296 (35.47%) African-American selections. This disparity of 752 fewer African-American selections than expected is statistically significant with -14.31 standard deviations of difference. The adverse impact ratio is 75.3%, which is below the 80% threshold set forth by the *Uniform Guidelines*. Similarly, for the Engineering Crafts, there is a disparity of 232 fewer African-American selections than expected which is statistically significant with -8.62 standard deviations of difference and an adverse impact ratio of 70.3%. For the Operating and Police Crafts, there is a disparity of 1,326 fewer African-American selections than expected which is statistically significant with -26.95 standard deviations of difference and an adverse impact ratio of 53.6%. For the Clerical and On-Board Services Crafts, there is a disparity of 490 fewer African-American selections than expected which is statistically significant with -6.59 standard deviations of difference and an adverse impact ratio of 91.5%.

There were a total of 49,622 selections in all Craft Groups at Amtrak.²² Of these, 16,411 (33.1%) were African-American. If the selection process were race-neutral, one would have expected approximately 19,211 (38.72%) African-American selections. This disparity of 2,800 fewer African-American selections than expected is statistically significant with -25.83 standard deviations of difference²³ and an adverse impact ratio of 78.2%.

²² These are the selections in the Employee History File for which no Applicant Flow Data existed.

²³ Combining the results from the Applicant Flow Data (Table 1) and the Vacancy Data (Tables 2-4) the overall

Based on our analyses of the Agreement selections (both promotions and hires) at Amtrak during the Analysis Period, we find that African-Americans were selected to these vacancies at a rate less than would be expected in a race-neutral environment. These differences demonstrate statistically significant adverse impact against African-Americans in the selection process for vacant positions at Amtrak.

Analysis of Disciplines

We have analyzed disciplinary charges and the resulting outcomes in Tables 5 and 6 for the Analysis Period.

Table 5 shows the result of our comparison of the rates of disciplinary charges between African-American and non-African-American Agreement employees at Amtrak after controlling for the Division and Craft Group in which the employee worked.²⁴ There were 10,796 Agreement employees issued a total of 24,136 disciplinary charges at Amtrak during the Analysis Period. Of these, 10,651 disciplinary charges (44.1%) were issued to 4,175 African-Americans. If the disciplinary process were race-neutral, one would have expected only 8,924 (37.0%) African-American disciplinary charges. This disparity of 1,727 *more* African-American disciplinary charges than expected is statistically significant with -24.11 standard deviations of difference. The adverse impact ratio is 71.4%, which indicates that African-Americans are issued disciplinary charges 40% more often than are non-African-Americans.

disparity is 3,053 *fewer* African-American selections than expected which is statistically significant with -27.49 standard deviations of difference. For the Shop Crafts, the combined disparity is 828 *fewer* African-American selections than expected which is statistically significant with -15.28 standard deviations of difference. For the Engineering Crafts, the combined disparity is 262 *fewer* African-American selections than expected which is statistically significant with -9.43 standard deviations of difference. For the Operating and Police Crafts, the combined disparity is 1,391 *fewer* African-American selections than expected which is statistically significant with -27.43 standard deviations of difference. For the Clerical and On-Board Services Crafts, the combined disparity is 573 *fewer* African-American selections than expected which is statistically significant with -7.57 standard deviations of difference.

²⁴ Amtrak operates pursuant to a nation-wide set of discipline policies, practices and procedures that are set by Amtrak corporate and are applicable throughout all Amtrak regions, facilities and departments. See *Plaintiffs'*

In Table 6, we have shown the resolution of the 24,136 disciplinary charges for the 10,796 Amtrak Agreement employees who were charged. We have grouped the outcomes into 10 different possible resolutions for purposes of statistical analysis. In Table 6, we have indicated the percent of each resolution by race and compared these percentages to the overall distribution of African-American (44.1%) and non-African-American (55.9%) disciplinary charges issued to the Agreement employees.

From Table 6, we show that African-Americans are terminated and receive formal reprimands at a statistically significant higher rate than non-African-Americans, while non-African-Americans resign at a statistically significant higher rate than African-Americans. Similarly, African-Americans receive deferred suspensions, after the appeal process, at a statistically significant higher rate than non-African-Americans, while non-African-Americans receive suspensions at a statistically significant higher rate than African-Americans.

Class Size

Class members consist of the 13,627 African-Americans whom we could identify as having worked at Amtrak during the Analysis Period and who were potentially affected by the disciplinary process and the selection process used by Amtrak to fill vacant positions.

The named Plaintiffs and declarants in this case worked in all Craft Groups and all Divisions at Amtrak. Additionally, these representatives worked at locations where 96% of the class members worked²⁵ and worked in the same Unions as did 99% of the class members.²⁶

The hiring class size cannot be exactly computed since Amtrak has not maintained hiring applicant records. However, based on the limited records that were available in the Applicant Flow Data, this number of African-American applicants would have been in excess of 7,300.

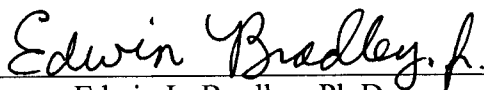
Memorandum in Support of Motion for Class Certification.

²⁵ Includes only those class members for whom the city where they worked could be identified.

Concluding Remarks

The opinions that we have expressed above are based on our education, training, teaching, research, professional consultations, publications, experience and expertise as detailed in our curriculum vitae, the "Information Relied Upon" materials, and our own analyses.

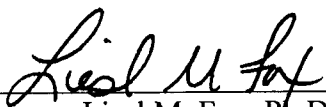
If any issues regarding the data we have been provided to date, or any additional data we may receive from the Defendant, reveals additional areas of statistical analyses that need to be done, we will file supplemental reports.



Edwin L. Bradley, Ph.D.

February 21, 2012

Date



Liesl M. Fox, Ph.D.

²⁶ Includes only those class members for whom a Union could be identified.

APPENDIX A

Statistical Figures and Tables

Figure 1
Racial Distribution of Amtrak Agreement Employees
By Year

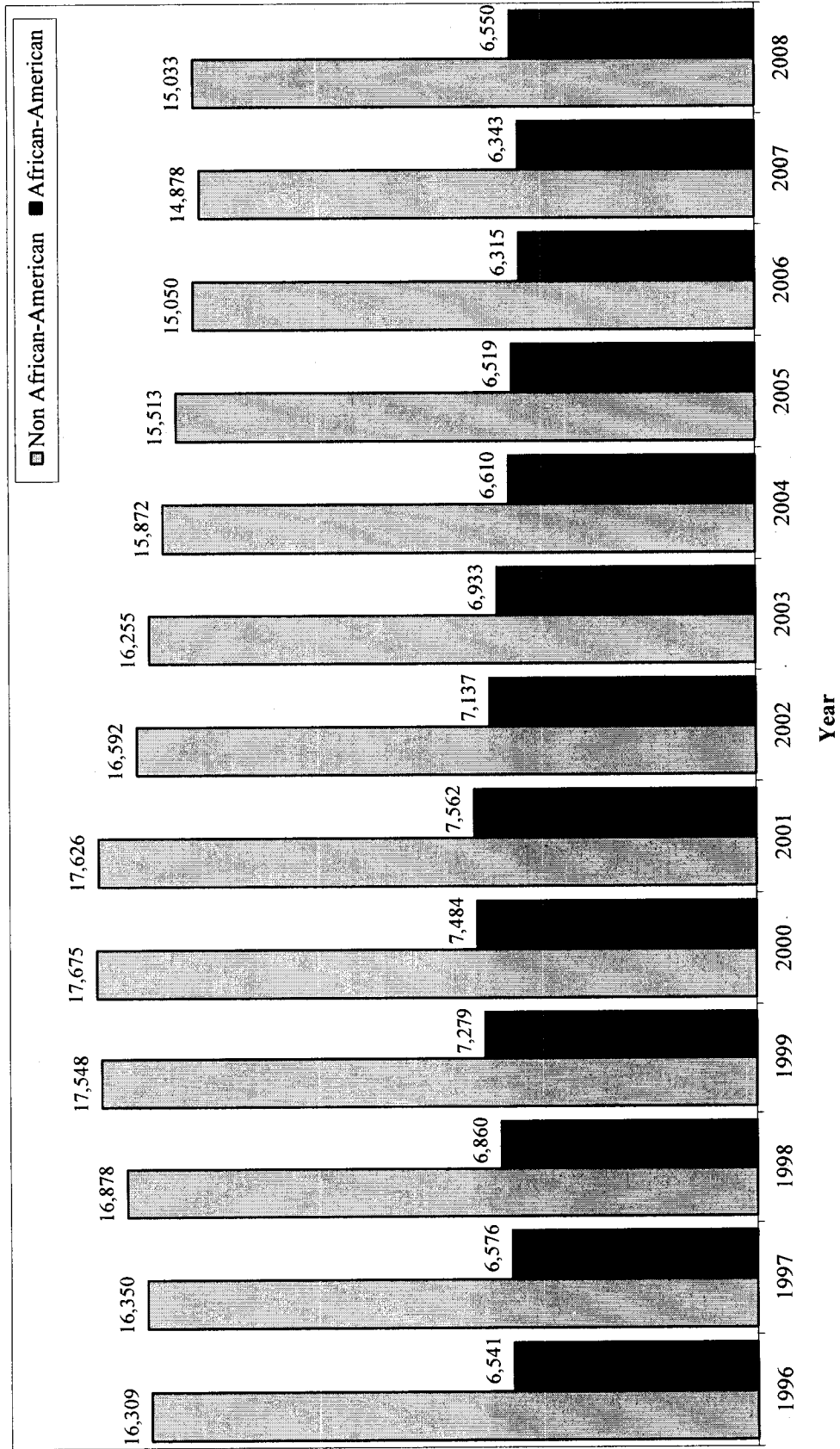


Figure 2a
Racial Distribution of Amtrak Agreement Employees - Shop Crafts
By Year

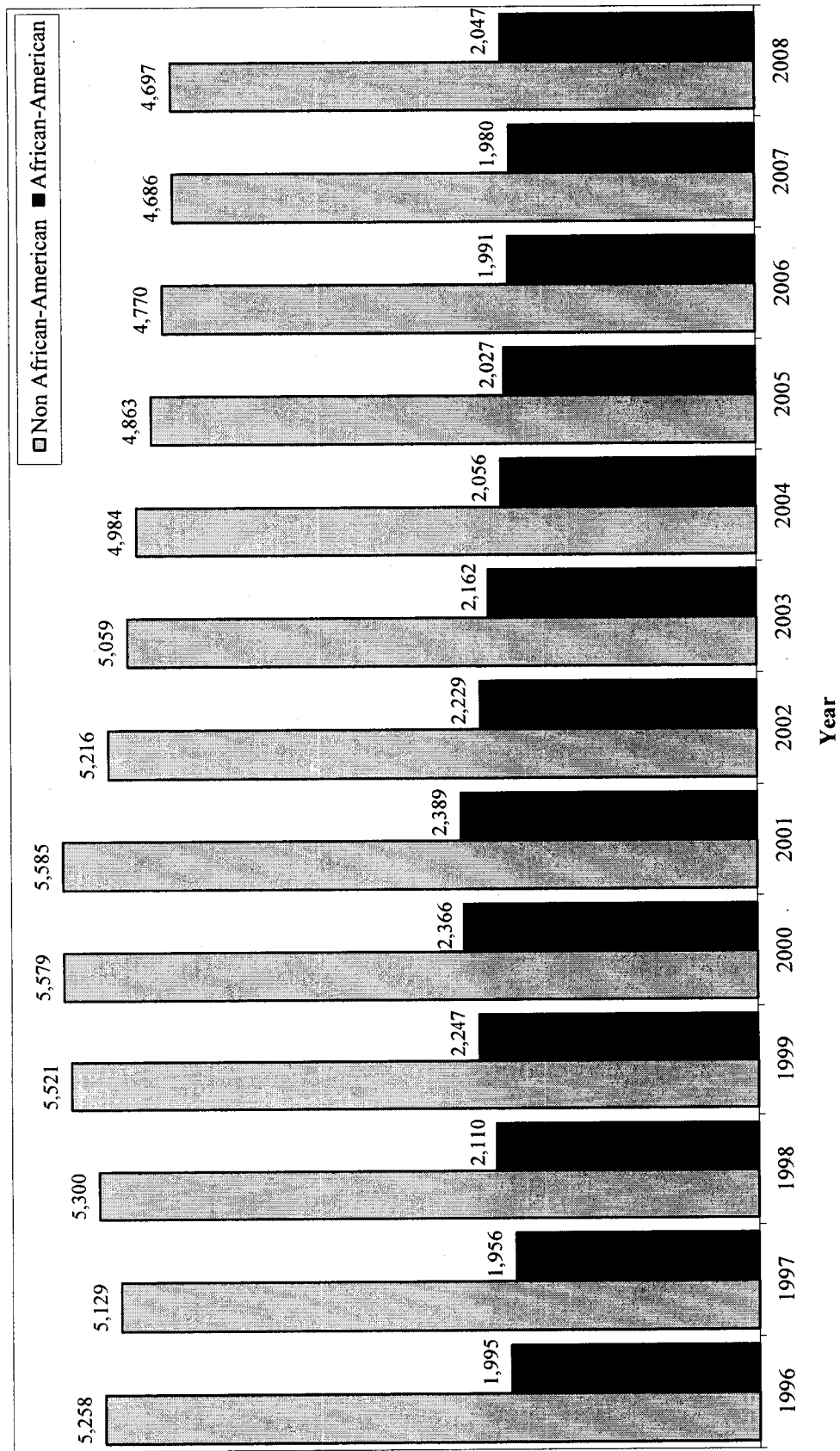


Figure 2b
Racial Distribution of Amtrak Agreement Employees - Engineering Crafts
By Year

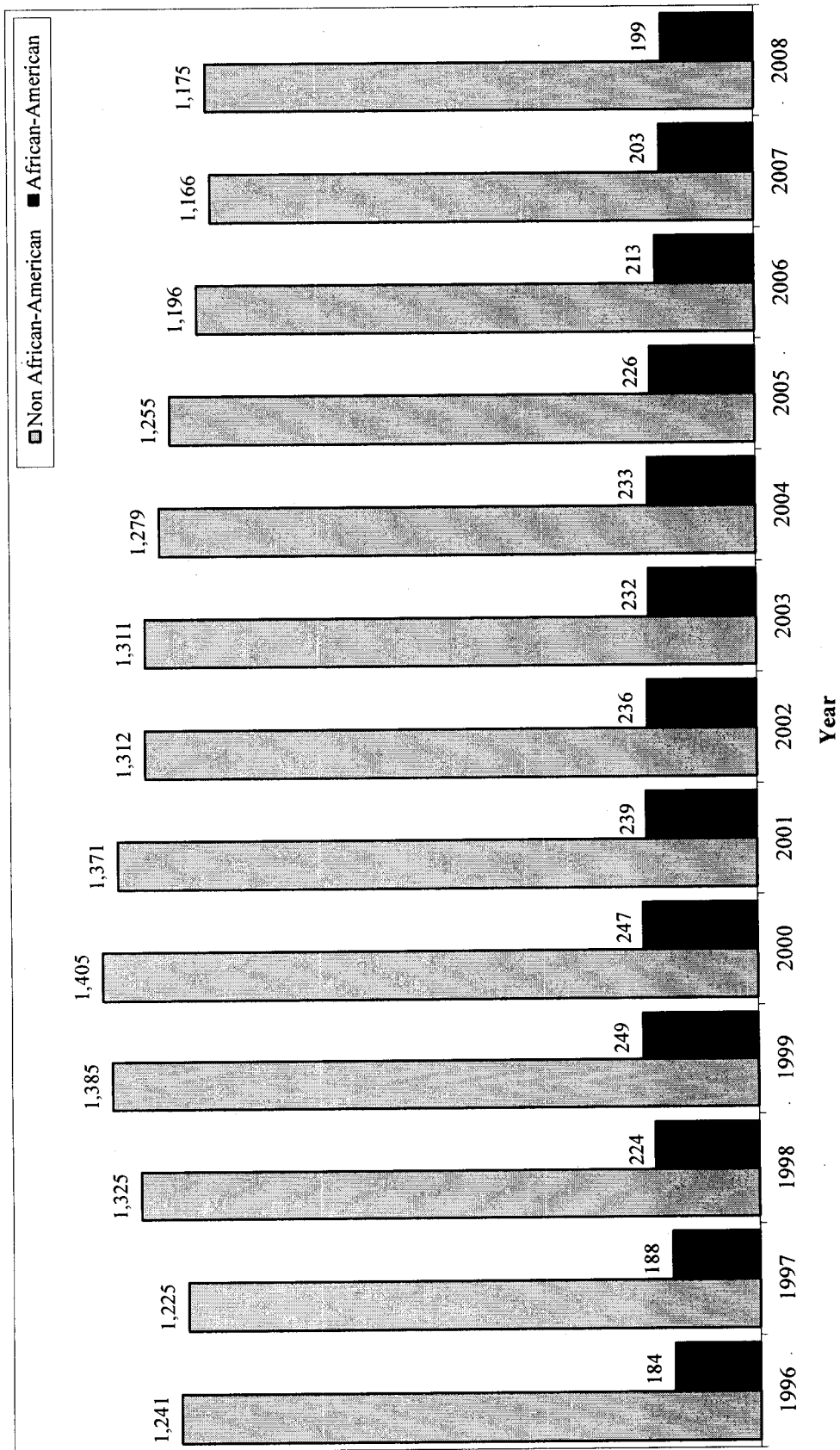


Figure 2c
Racial Distribution of Amtrak Agreement Employees - Operating and Police Crafts
By Year

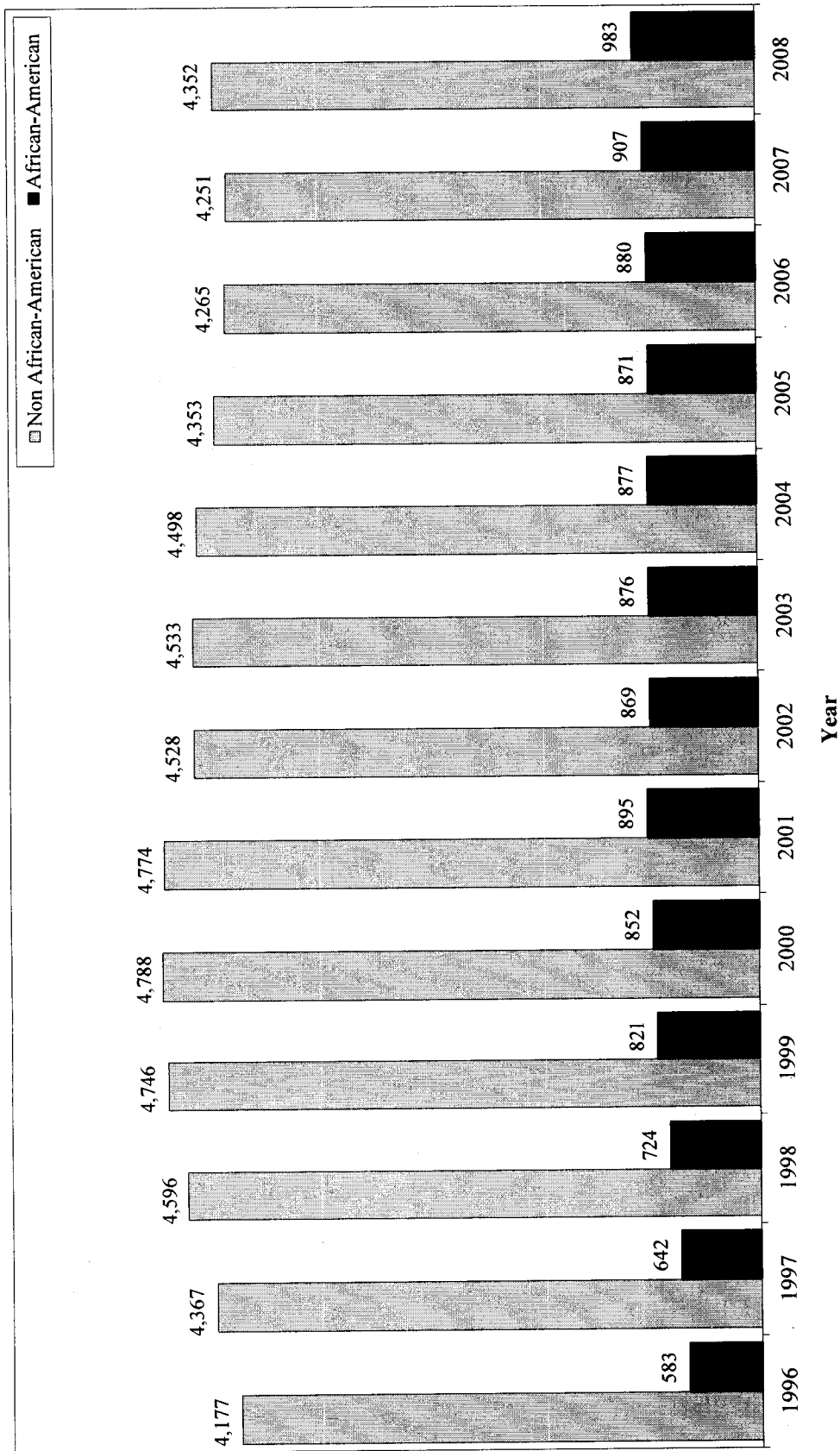


Figure 2d
Racial Distribution of Amtrak Agreement Employees - Clerical and On-Board Services Crafts
By Year

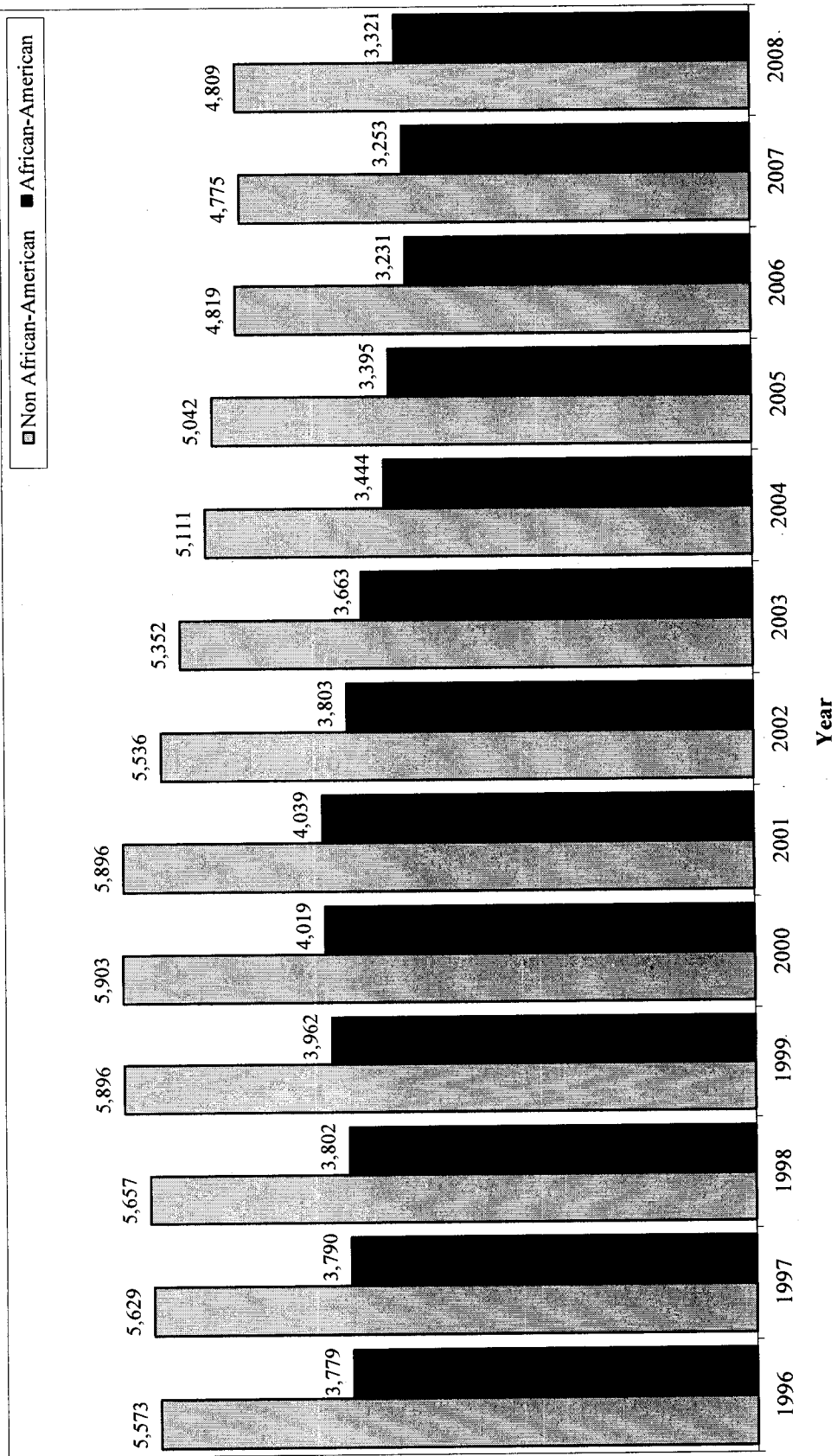


Table 1

Analysis of Selections for Vacancies Identified in the Applicant Flow Data
July 2003 Through December 2008

Applicant Flow Data Benchmarks

Controlling for Job Posting, Date of Selection, Craft Group, Union, Location, and Decision-Maker(s)

Craft Group	Total Selections	African- American Selections	African- American Benchmark	Expected African- American Selections	Actual minus Expected	Number of Standard Deviations	Adverse Impact Ratio
Shop	1,868	695	41.29%	771.35	-76.35	-5.72	75.8%
Engineering	407	93	30.16%	122.74	-29.74	-4.40	63.5%
Operating and Police	1,476	456	35.30%	521.01	-65.01	-5.26	72.7%
Clerical/On-Board Services	2,442	1,091	48.07%	1,173.78	-82.78	-5.61	79.5%
Total	6,193	2,335	41.80%	2,588.89	-253.89	-10.41	75.8%

Table 2

Analysis of Hires for Vacancies Identified in Employee History File¹
 April 1996 Through December 2008

Applicant Flow Data Proxy Benchmarks

Craft Group	Total Hires	African-American Hires	African-American Benchmark	Expected African-American Hires	Actual minus Expected	Number of Standard Deviations	Adverse Impact Ratio
Shop	2,744	1,009	41.29%	1,133.00	-124.00	-4.81	82.7%
Engineering	591	142	30.16%	178.25	-36.25	-3.25	73.2%
Operating and Police	1,867	447	35.30%	659.05	-212.05	-10.27	57.7%
Clerical/On-Board Services	4,872	1,979	48.07%	2,341.97	-362.97	-10.41	73.9%
Total	10,074	3,577	42.81%	4,312.26	-735.26	-14.81	73.6%

¹ Analysis excludes vacancies found in the Employee History File that were also identified in the Applicant Flow Data.

Table 3

Analysis of Promotions for Vacancies Identified in Employee History File¹
 April 1996 Through December 2008

Applicant Flow Data Proxy Benchmarks²

Craft Group	Total Promotions	African-American Promotions	African-American Benchmark	Expected African-American Promotions	Actual minus Expected	Number of Standard Deviations	Adverse Impact Ratio
Shop	9,369	2,535	33.76%	3,162.97	-627.97	-13.72	72.8%
Engineering	3,698	563	20.53%	759.20	-196.20	-7.99	69.5%
Operating and Police	9,135	1,825	32.17%	2,938.73	-1,113.73	-24.95	52.6%
Clerical/On-Board Services	17,346	7,911	46.34%	8,038.14	-127.14	-1.94	97.1%
Total	39,548	12,834	37.67%	14,899.04	-2,065.04	-21.43	79.5%

¹ Analysis excludes vacancies found in the Employee History File that were also identified in the Applicant Flow Data.

² Benchmark calculated only from employee applicants in the Applicant Flow Data.

Table 4

Analysis of Selections (Hires and Promotions) for Vacancies Identified in Employee History File¹
 April 1996 Through December 2008

Applicant Flow Data Proxy Benchmarks

Craft Group	Total Selections	African-American Selections	African-American Benchmark	Expected African-American Selections	Actual minus Expected	Number of Standard Deviations	Adverse Impact Ratio
Shop	12,113	3,544	35.47%	4,295.97	-751.97	-14.31	75.3%
Engineering	4,289	705	21.86%	937.45	-232.45	-8.62	70.3%
Operating and Police	11,002	2,272	32.70%	3,597.78	-1,325.78	-26.95	53.6%
Clerical/On-Board Services	22,218	9,890	46.72%	10,380.11	-490.11	-6.59	91.5%
Total	49,622	16,411	38.72%	19,211.30	-2,800.30	-25.83	78.2%

¹ Analysis excludes vacancies found in the Employee History File that were also identified in the Applicant Flow Data.

Table 5

Analysis of Charges for Disciplinary Violations

Number of Charges	Number of African-American Charges	African-American Benchmark	Expected African-American Charges	Actual minus Expected	Number of Standard Deviations	Adverse Impact Ratio
24,136	10,651	36.98	8,924.36	1,726.64	-24.11	71.4%

Table 6

Analysis of Resolution of Charges for Disciplinary Violations

Resolution	Non-African-Americans		African-Americans		Number of Standard Deviations
	Number of Charges	Percent	Number of Charges	Percent	
Termination	787	49.7%	798	50.3%	5.16
Resignation	475	59.7%	320	40.3%	2.24
Suspension	2,657	61.6%	1,653	38.4%	8.43
Restitution	92	60.9%	59	39.1%	1.26
Disqualification	94	49.5%	96	50.5%	1.78
Deferred Suspension	1,915	51.2%	1,824	48.8%	6.23
Formal Reprimand	1,664	54.1%	1,410	45.9%	2.08
Guilty	457	55.7%	363	44.3%	0.08
Not Guilty	2,162	56.0%	1,699	44.0%	0.17
Unknown/Unresolved	3,182	56.7%	2,429	43.3%	1.44
Total Charges	13,485	55.9%	10,651	44.1%	

APPENDIX B

Statistical Significance

Statistical Significance of Disparities of African-Americans' Selections

Statistical significance, in the field of employment discrimination and in other areas of science, is generally accepted as occurring at the 0.05 level of significance (sometimes stated inversely as a 95% confidence level). The larger the number of standard deviations, the smaller the probability, i.e., the less likely the result occurs solely due to chance. Statistical significance means that results are not likely due to chance, but rather, are related to race or some other protected class at a certain confidence level. When testing to determine whether a procedure has adverse impact against a protected group, statistical significance occurs at the 95% confidence level (5% probability of being due to chance). However, when testing to determine whether a procedure is related to race or has an adverse impact against a protected group, such as African-Americans, a one-tailed assumption is appropriate. Statistical significance at the 0.05 level of significance occurs for this type of question when the observed disparity is 1.65 standard deviations from what would be expected in the absence of a correlation between being black and selected. The inquiry only changes to an "unsigned" or "two-tailed" issue when the question being asked is whether African-Americans are selected at a different rate (either less or more) than non-African-Americans. The only question of interest, however, is whether African-Americans are selected at a significantly lower rate than non-African-Americans and, if the answer to that one-tailed inquiry is "no," then there is no need to go further by answering the second of a two-tailed inquiry regarding whether African-Americans are also selected at a rate significantly *more* than non-African-Americans. Adding that second question to the analysis doesn't improve the answer to the first question regarding whether the African-American selection rate is significantly less than the corresponding non-African-American rate, and such an adjustment of the question considered comes at a substantial cost to the statistical power to

detect a true negative disparity in African-Americans' selection *when it in fact exists*. Adding such a second "tail" to the question being analyzed raises the number of standard deviations necessary to meet the 0.05 level of significance from 1.65 to 1.96 and correspondingly decreases the statistical power of the test to detect a true negative disparity in the selection rate of African-Americans when it in fact exists.

We do not believe that the statistical power of the test to detect a significant disparity in the African-Americans' rate of selection when it really exists should be compromised by reframing the question of interest into a two-tailed inquiry that addresses more than whether the African-American selection rate is significantly less than the non-African-American rate. If that difference is not significant, the *relevant* inquiry is at an end without any need to conduct a two-tailed inquiry regarding whether African-Americans are selected more than would be expected by chance.

A 0.05 significance level means that the observed disparity could have occurred by chance only 5% of the time or, stated another way, once in twenty occurrences. Both the one-tailed and two-tailed assumptions declare a result not statistically significant at the 0.05 level of significance if it is less than 1.65 standard deviations, and both assumptions declare a result statistically significant at the 0.05 level of significance if it is 1.96 or more standard deviations. These two assumptions only differ in declaring statistical significance at the 0.05 level of significance if the resulting number of standard deviations lies between 1.65 and 1.96. The computation of the number of standard deviations is the same whether a one-tailed or two-tailed assumption is used. In this Report, We indicate the number of standard deviations statistic so that the Court can make the decision regarding the statistical significance of a result.

APPENDIX C

Joyce E. Taber Letter of August 11, 2011

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Joyce E. Taber
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jtaber@morganlewis.com

August 11, 2011

VIA ELECTRONIC MAIL

Bob Childs, Esq.
Timothy B. Fleming, Esq.
Abby Richardson, Esq.
WIGGINS, CHILDS, QUINN & PANTAZIS, P.L.L.C.
The Kress Building
301 - 19th Street North
Birmingham, Alabama 35203

Re: Campbell, et al. v. Amtrak; Civil Action No. 1:99cv02979 (EGS)

Dear Counsel:

In response to the two questions raised in your e-mail correspondence dated August 1, 2011, please see the information below:

(1) Union Status

The union agreement covering the work that an employee is performing can be derived from the first two characters of the job code in the snapshot and transaction data. The following table provides a crosswalk between union agreements and job codes:

Union/Agreement	First 2 Characters of Job Code
FOP - Fraternal Order of Police (previously AFRP - American Federation of Railroad Police, Inc.)	KK
BLET - Brotherhood of Locomotive Engineers and Trainmen (previously BLE - Brotherhood of Locomotive Engineers)	
Northeast Corridor	PC
Off-Corridor	PD, PE, PM, PP
ATDA - American Train Dispatchers Association (previously BLE - Brotherhood of Locomotive Engineers - Dispatchers)	GN

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BMW - Brotherhood of Maintenance of Way Employees	
Northeast Corridor	WD
Off-Corridor	W4, W5, WM
BRS - Brotherhood of Railway Signalmen	
Northern District	Job Codes: H1109, H1125, H1132-H1134, H1151, H1157, H1163- H1170
Southern/Western District	All other H1's, H3, HP, H2
ASWC - Amtrak Service Workers Council	SF
JCC - Joint Council of Carmen, Coach Cleaners and Helpers	C8
IBB - International Brotherhood of Boilermakers and Blacksmiths	IC
IAM - International Association of Machinists and Aerospace Workers	M2
IBEW - International Brotherhood of Electrical Workers	E3
NCFO - SEIU - National Conference of Firemen and Oilers Division of Service Employees International Union (previously IBF&O - International Brotherhood of Firemen & Oilers)	F9
SMWIA - Sheet Metal Workers International Association	DA
TCU - Transportation Communications International Union	
Northeast Corridor Clerks	BC, B2, B4, B6
Off-Corridor Clerks	BN, B1, B3, B5
TC Division (Tower)	BJ, BT
Am Railway & Airway Supervisors Assn (ARASA) Mechanical Foremen	AB
Am Railway & Airway Supervisors Assn (ARASA) MW Supervisors	AH
Am Railway & Airway Supervisors Assn (ARASA) OBS Supervisors	0G (note: this is a 0G not an OG but is a union job)
UTU - United Transportation Union	
Northeast Corridor Conductors	TC
Off-Corridor Conductors	TE, TM, TP
Stewards	T7
Yardmasters (previously RYA - Railroad Yardmasters of America)	YL, YN, YP

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C O U N S E L O R S A T L A W

Please note that job codes that start with a number are management positions.

There are also a small number of job codes that start with an X. The XS and XY job codes are not union positions. The XX job codes are temporary management jobs held by union employees, except for XX229 (ARASA Operations Supervisor), which is a union position. Please note that the job title for XX positions is generally updated to be the temporary management job, but it may be the employee's union job if the system was not updated.

There are also a small number of AT job codes, which used to be Am Railway & Airway Supervisors Assn (ARASA) Tech. That job code no longer exists because that job code was converted to management in 1992.

(2) Functional Plan Areas

There is no ascertainable method to map individuals in the snapshot or transaction data to a functional plan area.

Please feel free to contact me with any questions.

Sincerely,

/s/ Joyce E. Taber

Joyce E. Taber, Esq.

*Counsel for Defendant
National Railroad Passenger Corporation*

cc: Keren Rabin, Esq.
Grace E. Speights, Esq.

APPENDIX D

Curriculum Vitae

February 1, 2012

CURRICULUM VITAE

EDWIN LUTHER BRADLEY, JR.

CEO, Quantitative Research Associates
2015 Kentucky Avenue
Vestavia Hills, Alabama 35216
Phone: (205) 979-2991

RESIDENCE:

1836 Catala Road
Vestavia Hills, Alabama 35216
Phone: (205) 822-8428

PERSONAL DATA:

Born July 16, 1943 in Jacksonville, Florida.
Married, three grown children.

EDUCATION:

Bachelor of Science (with honors), August 1964
Mathematics Major
University of Florida

Master of Statistics, April 1967
Statistics Major
University of Florida

Doctor of Philosophy, December 1969
Statistics Major
University of Florida

PRIMARY ACADEMIC APPOINTMENTS:

1997-Present	Professor Emeritus Department of Biostatistics University of Alabama at Birmingham
1988-1997	Professor Department of Biostatistics University of Alabama at Birmingham
1976-1988	Associate Professor Department of Biostatistics (Formerly Biostatistics and Biomathematics) University of Alabama at Birmingham (Vice Chairman, 1978-1982)
1970-1976	Assistant Professor Department of Biostatistics University of Alabama at Birmingham

SECONDARY ACADEMIC APPOINTMENTS AND OTHER PROFESSIONAL EXPERIENCE:

1973-1997 Professor, Associate Professor, Assistant Professor
Department of Mathematics
University of Alabama at Birmingham

1978-1980 Associate
Diabetes Research and Training Center
University of Alabama at Birmingham

1970-1977 Investigator
Institute of Dental Research
University of Alabama at Birmingham

1968-1969 Statistical Consultant
Patuxent Wildlife Research Center
Department of Interior
Gainesville, Florida

1966-1969 Computer Programmer and Statistical Consultant
University of Florida
Gainesville, Florida

1965 Computer Programmer
Lockheed-Georgia Company
Marietta, Georgia

ADMINISTRATIVE APPOINTMENTS AND ACTIVITIES:

1993-1996 Member, Financial Aid Committee
School of Public Health
University of Alabama at Birmingham

1989-1997 Director, Graduate Program in Biostatistics
Department of Biostatistics
(Formerly Biostatistics and Biomathematics)
University of Alabama at Birmingham

1989-1995 Member, Advisory Committee
Postdoctoral Training Program in Caries Research
University of Alabama at Birmingham

1985-1997 Chairman, Graduate Committee
Department of Biostatistics
(Formerly Biostatistics and Biomathematics)
University of Alabama at Birmingham

ADMINISTRATIVE APPOINTMENTS AND ACTIVITIES: (Continued)

- 1978-1982 Vice Chairman
 Department of Biostatistics
 University of Alabama at Birmingham
- 1979 Participant, UAB Funding Institute
 Office of Research and Grants Administration
 University of Alabama at Birmingham
- 1972-1973 Member, Accreditation Self Study Council
 Division of Biophysical Sciences
 University of Alabama at Birmingham

ASSOCIATIONS AND MEMBERSHIPS:

- The Biometric Society, 1970 - Present
- American Statistical Association , 1970 - Present
 Member, National Council, 1982 - 1983
- Alabama Chapter of American Statistical Association, 1970 - Present
 Secretary-Treasurer, 1978-1979
 Vice-President, 1980-1981
 President, 1982-1983

HONORS AND AWARDS:

- Phi Eta Sigma - Freshman Honorary, Elected 1962
- Pi Mu Epsilon - Mathematics Honorary, Elected 1963
- Phi Kappa Phi - Scholastic Honorary, Elected 1964
- Sigma Xi - Scientific Honorary, Elected 1982
- Emmett B. Carmichael Award for the Outstanding Paper in the Journal of the Alabama Academy of Science, 1987.
- American Men and Women of Science

REVIEW REFEREE FOR THE FOLLOWING JOURNALS:

- American Journal of Medical Sciences
- Fertility and Sterility
- Anesthesiology
- Alabama Journal of Medical Science
- Hypertension Journal
- Technometrics
- Journal of the American Statistical Association
- American Statistician
- Annals of Neurology
- Clinical Trials

RESEARCH INTERESTS:

- Statistical Computing
- Statistical Modeling
- Statistical Methodology and Applications

TEACHING ACTIVITIES:

- Statistical Analysis
- Statistics in Biology
- Design of Experiments
- Probability
- Inference
- Least Squares
- Nonparametric Statistics
- Discrete Data Analysis
- Stochastic Processes
- Biometrical Consulting in Research
- Nonlinear Data Analysis
- Multivariate Analysis
- Advanced Analysis

MASTERS' THESES AND PROJECTS DIRECTED:

Martha Perry Roton (1974): Statistical Inference in the Multinomial Distribution with Applications to Human Blood Groups. University of Alabama at Birmingham.

Wayne R. Satterwhite (1977): An Evaluation of a Cancer Rehabilitation Project. University of Alabama at Birmingham.

Sharon Truelove (1978): Models for the Prediction of the Survival of Patients Undergoing Primary Surgery for the Tetralogy of Fallot. University of Alabama at Birmingham.

Ray Allen McKinnis (1979): A Statistical Analysis of Burn Patient Care at the University of Alabama Hospital Burn Service. University of Alabama at Birmingham.

Gretchen A. Cloud (1982): An Exponential Family of Models. University of Alabama at Birmingham.

Carl M. Russell (1988): Two Approaches to Modeling the Mineral Density Profile of Dental Hard Tissues Exposed to Demineralizing Conditions. University of Alabama at Birmingham.

Tonya O. McMillan (1990): The Estimation of Cross - Correlation Coefficients in the Presence of Missing Data. University of Alabama at Birmingham.

Ellen S. Caldwell (1992): Comparing the Effects of Intervention Drugs on Cardiovascular Response to Intubation -- A Meta Analysis. University of Alabama at Birmingham.

Liesl M. Fox (1995): The Pseudo-Binomial Distribution: Applications in Survival Analysis. University of Alabama at Birmingham.

Traci E. Clemons (1996): The Overlapping Coefficient for Two Normal Probability Functions with Unequal Variances. University of Alabama at Birmingham.

Claudia C. Powell (1997): Least Squares Parameter Estimation for the Three-Parameter Weibull Distribution. University of Alabama at Birmingham.

DOCTORAL DISSERTATIONS DIRECTED:

David Naftel (1978): A Generic Family of Survival Distributions. University of Alabama at Birmingham.

Henry F. Inman (1984): Behavior and Properties of the Overlapping Coefficient as a Measure of Agreement between Distributions. University of Alabama at Birmingham.

Larry G. Blackwood (1989): Contributions to the Theory and Application of the Rasch Model. University of Alabama at Birmingham.

Carl M. Russell (1992): A Simulation Study of Multivariate Randomization Testing Applied to Radiographic Cephalometry. University of Alabama at Birmingham.

Tonya M. Smoot (1993): The Use of Cubic Spline Interpolation in the Analysis of Incomplete Stationary Time Series. University of Alabama at Birmingham.

Traci E. Clemons (1997): A Nonparametric Approach to Estimating the Overlapping Coefficient Using the Kernel Estimation Technique. University of Alabama at Birmingham.

Liesl M. Fox (1997): An Exploration of the Pseudo-Binomial Distribution With Applications to Survival Curve Confidence Intervals. University of Alabama at Birmingham.

PRESENTATIONS AND INVITED SEMINARS:

The Queue GI/M/1 with Balking at Queues of a Fixed Length. Alabama Chapter, American Statistical Association. Tuscaloosa, Alabama, February 21, 1970.

The Effect of pH and Hexamine Concentration upon the Extinction of E. Coli. Alabama Chapter, American Statistical Association, Birmingham, Alabama, February 27, 1971.

A Sufficient Condition for the Equivalence of Maximum Likelihood and Weighted Least Squares Estimates. Alabama Chapter, American Statistical Association, Birmingham, Alabama, June 17, 1972.

The Overlapping Coefficient as a Measure of Agreement between Distributions, with S. Piantadosi. Alabama Chapter, American Statistical Association, Birmingham, Alabama, February 27, 1982.

Some Discrete Distributions Useful in Dentistry. Caries Epidemiology and Clinical Trials Seminar Series, School of Dentistry, Winter, 1983.

Overlapping Coefficient: A Measure of Agreement Between Distributions, with Steven Piantadosi and Henry F. Inman. Biometric Society (ENAR), Spring Meeting, Nashville, March 20-23, 1983.

The Overlapping Coefficient as a Measure of Association in 2 x k Contingency Tables. With H. Inman. Alabama Chapter, American Statistical Association, Birmingham, Alabama, February 4, 1984.

Statistical Approaches for the Analysis of Anesthetic Mortality. Anesthesiology Residents Research Conference, University of Alabama at Birmingham, Fall 1984.

Power Analysis in Statistics. Anesthesiology Residents Research Conference, University of Alabama at Birmingham, Winter 1985.

PRESENTATIONS AND INVITED SEMINARS: (Continued)

Probit Analysis and Isoboles. Biostatistics Seminar Series, University of Alabama at Birmingham, Winter, 1986.

A Generalized and Unified Model for Predicting Long Term ²²²Rn Concentrations from Short Term Screening Tests, with J.M. Hardin. Third Environmetrics Conference, Madison, Wisconsin, October, 1991.

The Flat Maximum Effect and Generic Linear Scoring Models: A Test, with George A. Overstreet and Robert S. Kemp. Conference on Credit Scoring and Credit Control II, University of Edinburgh, Scotland, September, 1991.

TECHNICAL REPORTS:

Saw JG, **Bradley EL** (1969): The proportion of baulking customers in the queue GI/M/1 with baulking at queues of length N. Project Themis. Technical Report No. 15. University of Florida.

Saw JG, **Bradley EL** (1969): A reordering policy with instantaneous emergency delivery. Project Themis. Technical Report No. 16, University of Florida.

Lyle ES, Jr Patterson RM, Hicks DR, **Bradley EL** (1975): Polymorphic site index curves for natural sweetgum in Alabama. Agriculture Experiment Station, Auburn University. Circular 220, October.

PUBLICATIONS:

Bradley EL (1969): Queues with baulking and their application to an inventory problem. Doctoral dissertation, University of Florida.

Hunt DE, **Bradley EL**, Bachman JW (1970): Microbiological assay for estimating salivary concentrations of the cariostatic antibiotic actinobolin. *Applied Microbiology*, 20(4):583-586.

Legler DW, Mayhall CW, **Bradley EL** (1972): Behavioral characteristics of disadvantaged adult patients. *Journal of Public Health Dentistry*, 32(1):15-21.

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Bradley EL (1973): The equivalence of maximum likelihood and weighted least squares estimates in the exponential family. *Journal of the American Statistical Association*, 68(341):199-200.

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Gonzalez M, Feagin F, **Bradley EL** (1975): Factors affecting mineral accretions in the enamel-solution interface. *Journal of Dental Research*, 54(Spec No B):B121-125

Turner ME, **Bradley EL**, Kirk KA, Pruitt KM (1976): A theory of growth. *Mathematical Biosciences*, 29:367-373.

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Feagin FF, Thiradilok S, Aponte-Merced L, **Bradley EL** (1977). Effects of bicarbonate on remineralization of enamel. *Journal of Oral Pathology*, 6:331-337.

Conrad ME, Knodell RG, **Bradley EL** (1977): Risk factors in transmission of non-A, non-B, posttransfusion hepatitis; the role of hepatitis B antibody in donor blood. *Transfusion*, 17(6):579-585.

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Legler DW, Hughes ML, **Bradley EL** (1979): Utilization of prepaid dental health care by students in health professional schools. *American Journal of Public Health*, 69(10):1017-1020.

Retief DH, **Bradley EL**, Barbakow FH, Friedman M, van der Merwe EHM, Bischoff JI (1979): Relationships among fluoride concentration in enamel, degree of fluorosis and caries incidence in a community residing in a high fluoride area. *Journal of Oral Pathology*, 8:224-236.

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- ❖ Delta Omega, Public Health Scholastic Honorary, 1995
- ❖ Phi Kappa Phi, Scholastic Honorary, 1994
- ❖ Outstanding Math Education Student, Academic Year 1990-1991
- ❖ Kappa Mu Epsilon, Mathematics Scholastic Honorary, 1991
- ❖ Who's Who in American Colleges & Universities, 1991

Professional Memberships

- ❖ American Statistical Association, 1996 to Present

Publications

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