TECHNICAL REPORT
OF THE JOINT LEGISLATIVE
AUDIT AND REVIEW COMMISSION ON

The State Salary Survey Methodology

TO THE GOVERNOR AND
THE GENERAL ASSEMBLY OF VIRGINIA

House Document No. 5

COMMONWEALTH OF VIRGINIA
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Preface

Item 13 of the 1988 Appropriations Act directed the staff of the Joint Legislative Audit and Review Commission (JLARC) to review (1) the methods used to compile and evaluate data reported in the State annual salary survey, and (2) the methods used to determine the annual salary structure adjustment for State employees. This technical report contains the staff findings and recommendations for improving these methods.

Overall, the current methods are generally consistent with statutory provisions, and are adequate for producing an approximation of the gap between State and private sector compensation. However, considering the survey's potential financial impact on the State, the accuracy of the estimated salary differential can and should be improved.

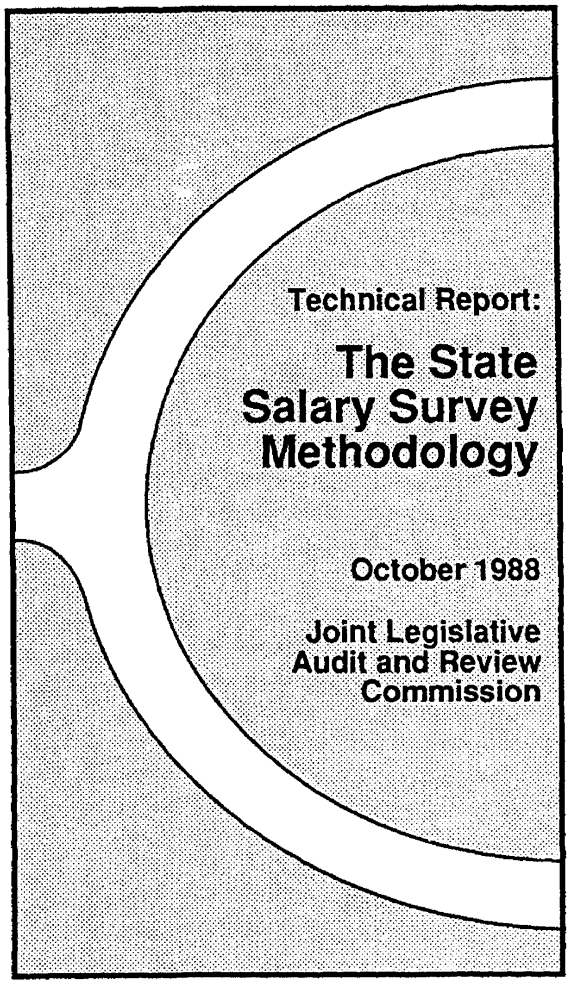
In its written response to the report, the Department of Personnel and Training recognizes the need to make modifications to its current approach to the salary survey The department will submit a plan for implementing the improvements recommended in this report to the Governor and the House Appropriations and Senate Finance Committees by December 1, 1988. The plan will include the amount and type of additional resources needed to implement the changes recommended in this study

On behalf of the JLARC staff, I wish to express our appreciation for the cooperation and assistance extended by the staff of the Department of Personnel and Training.

Philip A. Leone
Director

October 28, 1988

JLARC Report Summary



The Department of Personnel and Training (DPT) conducts an annual survey of salaries paid in the private sector The primary purpose of the survey is to provide information for adjusting the State classified salary structure. Millions of State dollars are budgeted and appropriated each year for salary increases, based on this estimation. In the 1986-1988 biennium, for example, over 110 million dollars were spent on salary increases.

Legislative interest in the salary survey led to a mandate (Item 13 of the 1988 Appropriations Act) for the Joint Legislative Audit and Review Commission (JLARC) to study:

(1) the methods used to compile and evaluate data reported in the survey, and

(2) the methods used to determine the minimum percentage salary scale adjustment for state employees.

The JLARC staff's analysis of the survey methodology concluded that, overall, the current methods are generally consistent with statutory provisions, and are adequate for producing an approximation of the gap between State and private sector compensation. However, considering the survey's potential financial impact on the State, the accuracy of the estimated salary differential can and should be improved.

The current survey process, the JLARC study issues, and the main findings of this report are summarized on the next page.

The most important recommended improvements include:

- Defining systematically the private firms to be sampled in the survey
- Increasing the number of private firms sampled in the survey
- Estimating the difference between State and private sector salaries with a more stable measure that better represents State employees.
- Estimating and taking into account the random error that is inevitable when using a sample.

In addition, JLARC staff found that a one-time, comprehensive study of estimating fringe benefits is needed.

Most of the recommended technical improvements can be phased in over a two-year period, starting with the 1988 annual salary survey Some of these improvements may require greater resources than DPT currently allocates to the salary survey Therefore, JLARC staff recommend that DPT submit a plan for implementing these improvements to the Governor and the House Appropriations and Senate Finance Committees by December 1, 1988. This plan should include the amount and type of additional resources needed to implement the changes recommended in this study

ASSESSING SALARY SURVEY AND SALARY STRUCTURE ADJUSTMENT METHODS: ISSUES AND FINDINGS

STEP	CURRENT PROCESS	JLARC STUDY ISSUE	MAIN FINDINGS
1	Select benchmark job classes to represent State employees	Are benchmark job classes representative of State employees?	DPT's selection of benchmarks is reasonable, but needs annual review.
2	Collect salary data from a sample of private sector firms	Is the sample representative of all competing private sector employers in Virginia?	Sample is not as representative as it could be. Can be improved by: • Defining target population • Deleting out-of-state and publicly-run medical centers • Using personal interviews to enhance data collection • Increasing sample size
3	Estimate difference between State and private sector salaries with a single number	Is there a significant difference between State and private sector salaries?	Current method for summarizing data has three technical problems. Proposed alternative method, using weighted means, can reduce these problems. DPT should estimate sampling error, and use it to derive minimum and maximum values of estimated salary difference.
4	Estimate difference between State and private sector total compensation (including fringe benefits)	Are fringe benefits represented adequately?	State needs to improve fringe benefit estimates, through (1) better data collection, and (2) better analysis of data. A more comprehensive study of estimating fringe benefits is needed.
5	Project future changes in compensation (from Aug. 1 to June 30)	Are projections of future differences in compensation adequate?	Three methods have already been used. One is clearly superior to the others, but still needs technical improvements.

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I. Introduction

The Department of Personnel and Training (DPT) conducts an annual survey of salaries paid in the private sector. The primary purpose of the survey is to provide information for adjusting the State classified salary structure. Millions of State dollars are budgeted and appropriated each year for salary increases, based on this estimation. In the 1986-1988 biennium, for example, over 110 million dollars were spent on salary increases.

Legislative interest in the salary survey led to a mandate (Item 13 of the 1988 Appropriations Act) for the Joint Legislative Audit and Review Commission (JLARC) to study the survey methodology.

> The study shall include, but not necessarily be limited to: 1) the methods used to compile and evaluate data reported in the survey, and 2) the methods used to determine the minimum percentage salary scale adjustment for state employees. The Commission shall report its findings to the Governor and the Chairmen of the House Appropriations and Senate Finance Committees by September 15, 1988.

The JLARC staff's analysis of the survey methodology concluded that, overall, the DPT's current methods are consistent with legislative intent and are adequate for producing an approximation of the gap between State and private sector compensation. However, considering the survey's potential financial impact on the State, the accuracy of the estimated salary differential can and should be improved.

This chapter of the study (1) provides background information on the State salary structure and its adjustment, (2) explains several assumptions necessary to define the scope of the study, and (3) summarizes DPT's current survey process and the major issues identified by JLARC staff within each step of that process.

THE STATE SALARY STRUCTURE AND ITS ADJUSTMENT

DPT's annual salary survey is used to adjust the Commonwealth's salary structure. An understanding of this structure and how it is adjusted is helpful in assessing the impact of any refinements to the adjustment methodology

The Current Salary Structure

The State first established a salary structure in 1943. Table 1 shows the current State salary structure, which is composed of grades and steps. Most State

Table 1

Commonwealth Salary Structure

Effective July 1, 1988

Grade	Steps 1	2	3	4	5	6	7	8
1	9,718	10,161	10,619	11,105	11,609	12,137	12,699	13,277
2	10,619	11,105	11,609	12,137	12,699	13,277	13,881	14,517
3	11,609	12,137	12,699	13,277	13,881	14,517	15,168	15,859
4	12,699	13,277	13,881	14,517	15,168	15,859	16,586	17,338
5	13,881	14,517	15,168	15,859	16,586	17,338	18,134	18,962
6	15,168	15,859	16,586	17,338	18,134	18,962	19,817	20,720
7	16,586	17,338	18,134	18,962	19,817	20,720	21,666	22,655
8	18,134	18,962	19,817	20,720	21,666	22,655	23,688	24,767
9	19,817	20,720	21,666	22,655	23,688	24,767	25,903	27,085
10	21,666	22,655	23,688	24,767	25,903	27,085	28,310	29,595
11	23,688	24,767	25,903	27,085	28,310	29,595	30,953	32,355
12	25,903	27,085	28,310	29,595	30,953	32,355	33,833	35,368
13	28,310	29,595	30,953	32,355	33,833	35,368	36,993	38,678
14	30,953	32,355	33,833	35,368	36,993	38,678	40,434	42,280
15	33,833	35,368	36,993	38,678	40,434	42,280	44,200	46,209
16	36,993	38,678	40,434	42,280	44,200	46,209	48,320	50,520
17	40,434	42,280	44,200	46,209	48,320	50,520	52,824	55,231
18	44,200	46,209	48,320	50,520	52,824	55,231	57,742	60,385
19	48,320	50,520	52,824	55,231	57,742	60,385	63,133	66,012
20	52,824	55,231	57,742	60,385	63,133	66,012	69,010	72,154
21	57,742	60,385	63,133	66,012	69,010	72,154	75,449	78,873
22	63,133	66,012	69,010	72,154	75,449	78,873	82,477	86,229
23	69,010	72,154	75,449	78,873	82,477	86,229	90,158	94,263

Source Department of Personnel and Training

employees are "classified personnel," meaning that their salaries are determined by this salary structure.

Specific types of jobs, called "job classes" by DPT, are assigned to specific grades, thereby defining their salary ranges. For example, the job class Custodial Worker is assigned to grade 1, meaning that it has a salary range of $9,718 to $13,277 The job class Senior Accountant is assigned to grade 11, meaning that it has a salary range of $23,688 to $32,355.

The salary range of each grade is divided into steps. Usually, when an employee is first hired for a specific job, the employee's salary is at step 1, the lower end of the range. After being in the job for a year and receiving a satisfactory performance evaluation, that employee is generally given a "proficiency increase," meaning that the salary moves from the step 1 to the step 2 level.

With every additional year of employment in that particular job, and assuming satisfactory performance evaluations each year, the employee will move up the salary range by an additional step each year, until the employee reaches step 8. At step 8, there are no more additional steps for that particular job class, so the employee receives no more proficiency increases.

The employee still receives raises, however, because each year the State increases all salaries in the salary structure by an across-the-board percentage increase. This increase is based on the survey of private firm salaries.

Adjustments to the Salary Structure

The salary structure had a comprehensive revision following the 1972 study by Executive Management Services, Incorporated (EMSI). EMSI conducted a salary survey of private businesses, local governments, other states, and Federal agencies. The study recommended a realignment of the overall salary structure, based on the survey In addition, EMSI recommended specific new pay alignments for selected occupations based on within-grade step increases.

DPT is required by statute (section 2.1-114.6 of the *Code of Virginia*) to survey private sector salaries and benefits as a primary means for adjusting the salary structure:

> It is a goal of the Commonwealth that its employees be compensated at a rate comparable to the rate of compensation for employees in the private sector of the Commonwealth in similar occupations. In determining comparability, consideration shall be given to the economic value of fringe benefits in addition to direct compensation. An annual review shall be conducted by the Director of Personnel and Training to de-

> termine where discrepancies in compensation exist as between the public and private sectors of the Commonwealth; the results of such review to be reported each year to the Governor and the General Assembly, by the fifteenth day of December.

The process DPT uses to implement this requirement is overviewed in later sections of this chapter.

How Salaries are Adjusted in Other States

Other states have followed similar practices in adjusting salaries. For instance, Figure 1 shows that 34 other continental states implement salary surveys. Of these, 23 appear to use them as a primary means for adjusting employee salaries. Of the states not primarily using salary surveys, most use collective bargaining with unions to adjust salaries (Figure 2). A few states determine salaries through the political process.

ASSUMPTIONS OF THIS STUDY

Carrying out the JLARC study mandate requires some assumptions for defining the study scope. The four key assumptions are defined in the sections which follow

Assumption 1: Closing the Gap Between State and Private Sector Salaries Is a Goal, Not a Policy, of the State.

This assumption is based on the specific language in Section 2.1-114.6 of the *Code of Virginia*, which states: "It is a goal of the Commonwealth that its employees be compensated at a rate comparable to the rate of compensation for employees in the private sector...." This passage has frequently been misquoted as: "It is a policy of the Commonwealth...."

The word "goal" implies that the State should strive to close the gap between State and private sector compensation, but is not absolutely obligated or required to do so. In contrast, the word "policy" implies that the State is indeed obligated or required to do so, regardless of the difficulty or cost. Interpreting this statute as a "goal" versus as a "policy" also has implications for the design of the salary survey Different degrees of precision would be required under these different interpretations.

Figure 1

States Using Salary Surveys

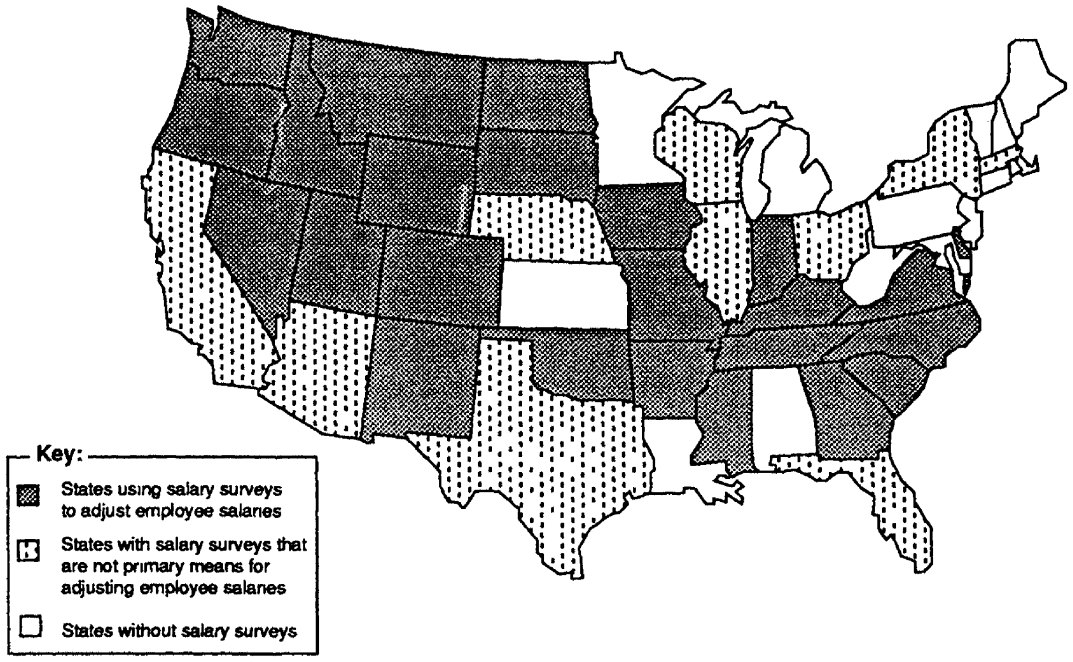
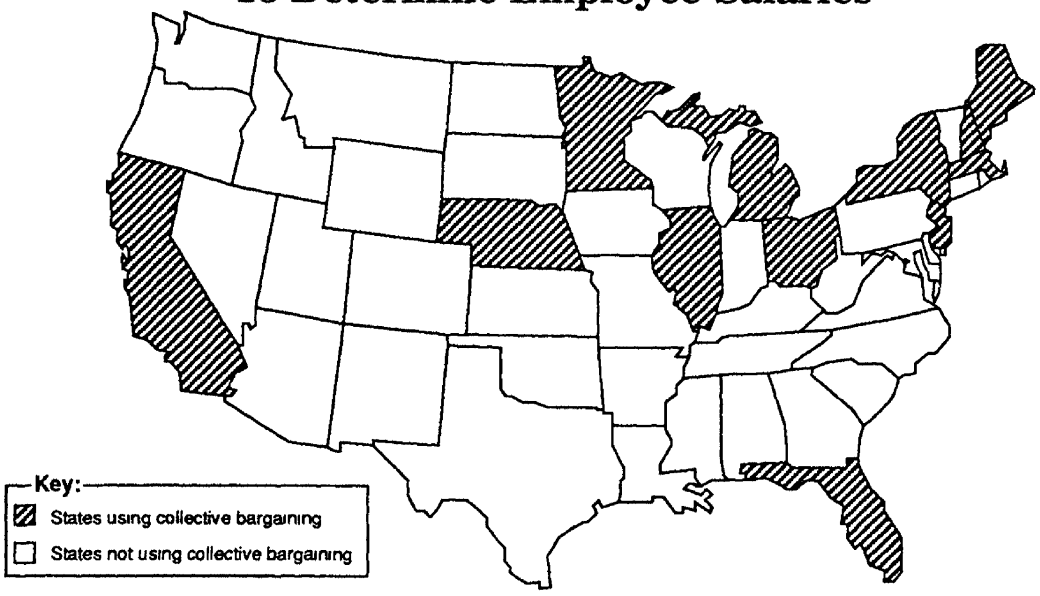


Figure 2

States Using Collective Bargaining To Determine Employee Salaries



Source: JLARC survey.

Assumption 2: The Study Should Examine Compensation Paid Only by Private Sector Firms.

A fundamental choice in designing the salary survey is either to examine the salaries and benefits paid only by private sector firms, or else by all possible sources of competition with the State, including public sector entities such as the federal government and local governments within the State. Given the statutory directive for the salary survey to examine private sector salaries, however, the JLARC staff analysis examined only private sources of competition.

Currently, DPT uses primarily private sector data to calculate the difference between private sector and State compensation, although it also collects data from the public sector. This public sector data, however, is used only for more qualitative comparisons, and generally does not affect the numbers used to adjust the State salary structure.

Assumption 3: The Survey Should Produce an Across-the-Board Number.

This assumption addresses the question: What primarily is the survey supposed to measure? For instance, the survey and analysis could take a broad, cross-sectional approach, to calculate a single number representing the average State benchmark salary, estimate a corresponding single average salary for private sector counterparts, and then examine the difference between these two aggregate numbers.

Alternatively, the survey and analysis could emphasize an accurate estimation of the differences between State and private sector salaries within each benchmark job class, and use these differences to adjust the salaries of the other job classes related to the benchmark class. Some other states use this approach in their salary surveys.

This study focuses on the first approach, which is currently used by DPT, because the primary purpose of the DPT salary survey is to provide information for increasing the entire State salary structure by an across-the-board percentage increase. The other approach would entail a radical departure from the current State policy of having a single salary schedule with grades and steps applying to all classified jobs. It would entail fundamental changes to every step of the data collection and analysis, and it would also be far more costly

It should be noted that, after adjusting the entire State salary structure, some particular State job classes may have salaries that are still much less competitive than salaries offered by the private sector. Therefore, DPT conducts separate salary surveys for targeted highly-competitive jobs. Because these surveys are independent of the annual State salary survey, they are not examined in this report.

Assumption 4: The Study Should Use Employers as the Unit of Analysis.

In defining the specific population to be represented by the salary survey, there appear to be two choices. First, the population of interest could be characterized as private sector employers, whose competing salaries are to be compared with those of the State for benchmark jobs. Therefore, the unit of analysis would be the private sector firm as an employer.

However, because survey research typically focuses on individuals, much of the research literature on surveys has been developed with the individual in mind as the unit of analysis. Alternatively, then, the salary survey population could be defined in terms of what an individual State employee could expect to be paid, if he or she were to look for the same job in the private sector. Under this second approach, the unit of analysis would be the individual employee.

This study relies on the first approach, because data are more feasible to collect and can be interpreted more coherently when the population is defined in terms of competing employers. The State is one competing employer offering many types of jobs. And the primary purpose of the salary survey is to determine what competing private sector employers, in the aggregate, are paying employees who perform similar sets of tasks.

The private sector employers vary in terms of how many benchmark job classes they have. Therefore, when collecting data with the employer as the unit of analysis, some employers will reappear in the sample from one benchmark to another. The employers appearing with greater frequency represent the ones who indeed compete with the State more frequently across different types of positions.

For example, a large bank may compete with the State for computer programmers, accountants, secretaries, and custodial workers, while a small real estate firm may compete only for secretaries. The large bank, then, is the employer that is competing with the State more frequently across different types of jobs. Therefore, the large bank should appear across more benchmarks in the sample.

If the individual employee were the unit of analysis, the same firms reappearing across benchmarks would be regarded as a "contamination" of the sample. Under this "ideal sample" perspective, individuals would have to be randomly selected within each benchmark, with little overlap. But if this approach were used, it would then be difficult to justify generalizing across the benchmark job classes, as it is necessary to do in order to adjust the entire salary structure by an across-the-board percentage. Further, such an approach would require a much more massive data collection effort, and be far more costly to the State than the employer-oriented approach assumed in this analysis.

CURRENT SURVEY METHODOLOGY AND RELATED STUDY ISSUES

In implementing the salary survey, DPT continues to use the general approach of the EMSI salary survey, with refinements. The current approach can be summarized in five steps: (1) select benchmark classes; (2) collect data from private sector firms; (3) estimate the difference between State and private sector salaries; (4) estimate the difference in total compensation; (5) project changes in salaries, and adjust salary structure.

In recent years, DPT has administered the first four steps, while the fifth step has been carried out by other agencies and staff more closely involved in the budgeting process. The salary structure adjustment itself is recommended by the Governor and finally approved by the General Assembly

In assessing each of these five steps, JLARC staff raised issues and found significant areas for improvement. The survey steps and their related JLARC study issues are summarized below Figure 3 provides a graphic overview of the major study issues and how they are integral to the survey process.

Step 1: Selection of Benchmark Classes

A close match between State and private sector jobs is essential for a valid comparison of State and private sector salary data. The benchmark classes should represent as large as possible a population of State jobs which have counterparts in the private sector.

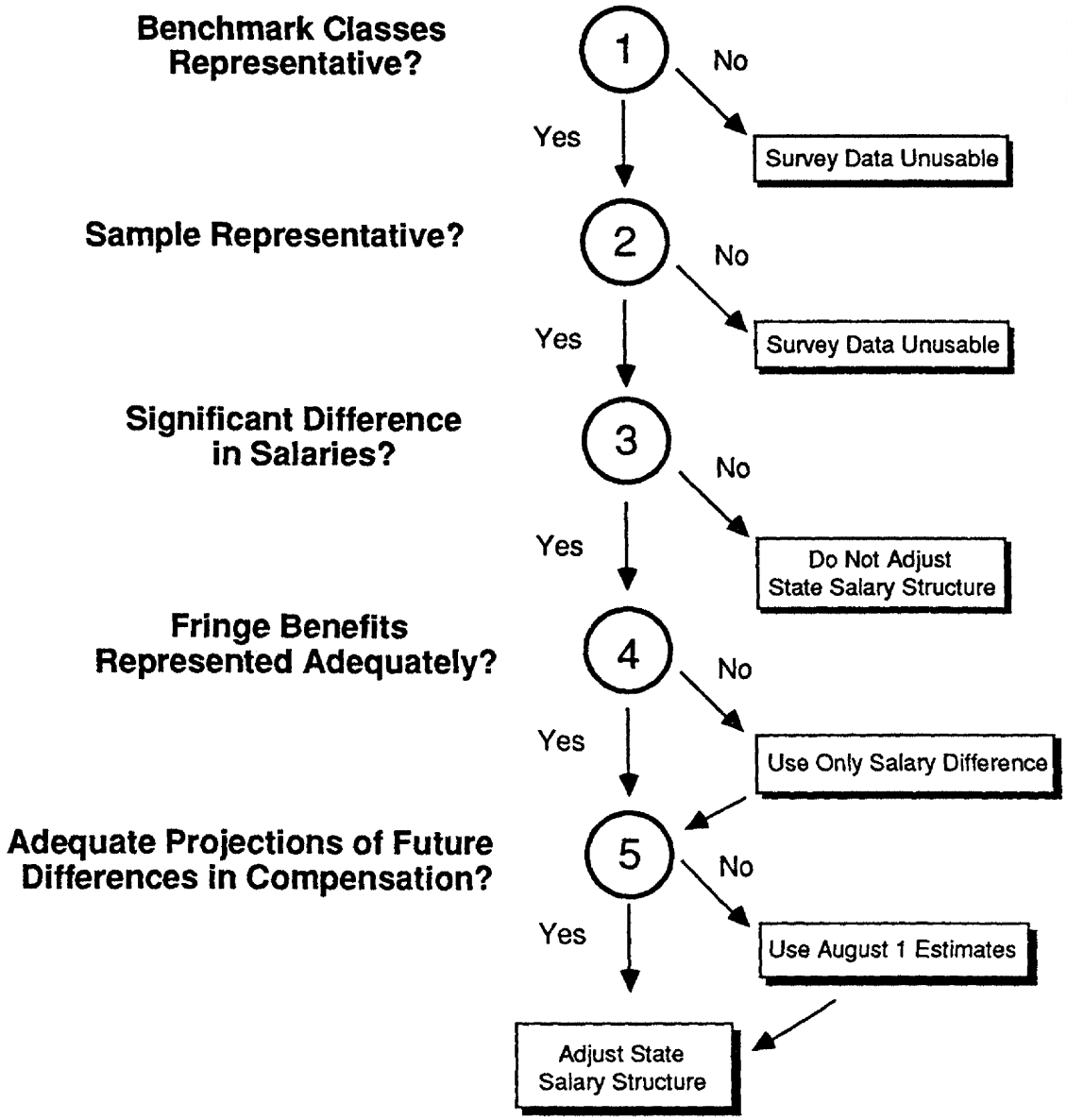
Current Practice: DPT selects a sample of State job classes normally found in the private sector. These benchmark job classes are intended to provide a good match to private sector jobs having the same responsibilities and requiring the same qualifications and skills. The benchmark classes are selected to represent the State's occupational groups, salary grades, and employee population as much as possible.

Benchmark job classes serve as indicators for closely related job classes as well. For example, the job classes of Programmer and Systems Analyst were selected as benchmarks, and also served as indicators for related jobs: Programmer Trainee and Programmer Analyst.

In the 1987 survey, 43 job classes were used as benchmarks, with an additional 64 classes being closely related to them. Currently, approximately half of all classified State employees fall into the job classes that are either benchmarks or closely related to benchmarks.

Figure 3

Issues For Assessing Salary Survey And Salary Structure Adjustment



Source: JLARC staff analysis.

JLARC Study Issue: Are the Benchmark Classes Representative? The entire survey process and subsequent salary structure adjustment depends on this fundamental assumption: either the benchmark classes are at least roughly representative of a broader population of State employees, or they are not. If they are not, then there is no point in conducting the survey, and any adjustment of the State salary structure based on these benchmarks would be inappropriate.

Step 2: Collection of Data from Private Sector Firms

The salary survey compares salaries in the State workforce and salaries for similar jobs in the private sector. Data for the State side of this comparison is relatively complete and easy to obtain. Obtaining reliable data for the private sector, however, requires considerable effort. A major challenge to DPT is to obtain comparable data on a voluntary basis.

Current Practice: DPT states that private sector firms were selected for its survey sample on the basis of "relevant labor market, size, geographic distribution, and willingness to participate." In the 1987 survey, the sample representing private sector employers consisted of 14 hospitals, 8 medical centers, and 27 firms in other sectors of private industry DPT supplemented its own sample data with data from the Bureau of Labor Statistics (BLS) survey of private sector employers in the Richmond and Tidewater areas.

From each employer in its sample, DPT collects data on salary ranges and actual average salaries of jobs that correspond to State benchmark job classes. DPT also collects data on fringe benefits provided by employers. DPT collects the data in August of each year, so that the results can be used in the next session of the General Assembly

JLARC Study Issue: Is the Sample Representative? This issue concerns the sample of private sector firms surveyed. In particular, the issue is whether or not this sample is representative of all private sector employers who compete with the State for employees in benchmark jobs. If it is not, an adjustment of the salary structure based on information from this sample is inappropriate.

Step 3: Estimation of the Difference Between State and Private Sector Salaries

The process of comparing State and private sector salaries must at some point come down to a comparison of two types of numbers derived from the salary survey How DPT arrives at these numbers and utilizes them is of critical importance.

Current Practice: DPT estimates the difference between State and private sector salaries by taking the following steps. First, for each benchmark job

class, DPT calculates the mean State employee salary Then DPT estimates the mean of private firm salaries that are comparable to the State salaries in this benchmark job class. The difference between the two means is computed. This difference is then represented as a percentage of the mean State salary for that benchmark. After computing percent differences for all benchmarks, DPT rank-orders the percentages, from highest to lowest. The centermost (that is, the median) percentage is then used to summarize the difference between State and private sector salaries across all benchmarks.

JLARC Study Issue: Is There a Significant Difference in Salaries? This issue addresses whether or not the difference between State and private sector salaries which results from the salary survey seems genuine. More precisely, the question is whether or not the observed difference between State and private sector salaries can be attributable to sampling error.

This question must always be asked when collecting data from a sample rather than from the entire population, because using a sample requires inferring from relatively few cases to the many which are not measured in the sample. If there is a high probability that this observed difference results from error due to sampling, then basing a salary structure adjustment on this difference is not appropriate.

Step 4: Estimation of the Difference in Total Compensation

In order to compare the full compensation of State employees with that of their counterparts in the private sector, fringe benefits should be considered along with salaries. Therefore, an adequate representation of the additional value of fringe benefits to the average benchmark State employee, and to the corresponding average private sector counterpart, is necessary In this way an adjustment of the State salary structure can be based on the full picture of differences in compensation between State employees and their private sector counterparts.

Current Practice: DPT first represents the value of State employee fringe benefits as a percentage of salary Then DPT summarizes the data on fringe benefit costs to private sector employers, also in the form of an average percentage of salary These percentages, along with the estimated difference in salary, are then used to estimate the difference between State and private sector total compensation.

JLARC Study Issue: Are Fringe Benefits Represented Adequately? If fringe benefits are not represented adequately, or if no significant difference in fringe benefits between the State and private sector firms is found, then the appropriate alternative is to use only the difference in salaries to make a salary structure adjustment.

Step 5: Projection of Future Changes in Compensation

The estimated difference in total compensation is used to adjust the salary structure in the next fiscal year. This estimated difference may change between August 1 (the date when the DPT survey asks for salary and benefit information) and June 30 of the following year (the day before the next fiscal year begins). Therefore, the changes in private sector and State salaries in that eleven-month period are projected, and the estimated difference in total compensation is adjusted accordingly The salary structure is then adjusted by a single specified percentage to reduce this projected difference.

Current Practice: Users of the salary survey have varying methods for projecting future changes in compensation. These methods are comparatively discussed in the body of this report.

JLARC Study Issue: Are Projections of Future Differences in Compensation Adequate? Any projection should take into account factors which may affect average private sector compensation in the future, as well as those affecting average State compensation levels (such as turnover and proficiency increases). But if adequate projections cannot be made, the alternative is to use the August 1 estimated difference for adjusting the salary structure each year.

REPORT ORGANIZATION

The five steps of the current salary survey methodology which are summarized above are the basis for the body chapters of this report. The chapters which follow each focus on one step of the process, providing greater detail on both the current process and those areas in need of improvement.

II. Are Benchmark Job Classes Representative of State Employees?

The benchmark classes used in the salary survey should be a set of jobs in which the State competes with the private sector for employees to perform similar duties. To determine these job classes, DPT must choose between conflicting goals, such as representing the maximum number of State employees, and obtaining a close match between State and private sector jobs.

The benchmarks which DPT currently uses, and job classes closely related to the benchmarks, include approximately half of all classified State employees. DPT's selection of benchmark job classes appears to be reasonable, yet there is room for improvement. Selection could be improved by adding new classes and by replacing those that have become obsolete.

Conflicting Goals in Selecting Benchmark Classes

In assessing DPT's current method of selecting the benchmark job classes, an important survey research question must be asked: Exactly what population should this sample be representing? Given that the salary survey is supposed to focus on the private sector, the benchmark classes should be representing the population of State jobs which have counterparts in the private sector with the same responsibilities and requiring the same qualifications and skills.

There is a tradeoff in selecting the benchmarks. On the one hand, for a reasonable comparison of salaries to be made, the match between each State benchmark job and its private sector counterpart should be as close as possible. Yet there are varying degrees of how closely responsibilities, qualifications, and skills really match.

On the other hand, because the survey data are used to adjust the salary structure for all classified State employees, it is desirable for the benchmarks to represent as much of the State employee population as possible. Further, DPT has stated that representing as many grades and occupational groups as possible are also goals. But these goals may be an inducement to include benchmarks which may have less than perfect matches with private sector jobs.

A close match between State and private sector jobs is essential for a valid and reliable comparison of State and private sector salary data. Therefore, when selecting benchmarks, this goal should be given higher priority than the others. As a consequence, however, proportionally fewer higher-level State jobs will be selected as benchmarks, because the higher-level responsibilities and qualifications do not as closely match jobs in the private sector.

Further, small firms often have the same individuals performing a wider range of tasks in a given job title than more "specialized" State jobs with comparable titles. So the State, being a larger-scale employer itself, often must look to relatively larger-size firms for more comparable jobs, when selecting benchmark classes.

Changing the Benchmarks to Represent More State Employees

In the last four annual salary surveys, DPT has used virtually the same set of benchmarks, with only minor changes from one year to another. Exhibit 1 lists the specific job classes that were used by DPT as benchmarks in the 1987 salary survey

Exhibit 1

Job Classes Used As Benchmarks in 1987 Salary Survey

Clerical, Sales, and Data Processing Group

Secretary
Secretary, Senior
Executive Secretary
Executive Secretary, Senior
Office Services Aide
Office Services Assistant
Office Services Supervisor, Senior
Photocopy Technician
Store Clerk B
Computer Operator
Computer Lead Operator
Programmer
Systems Analyst

Finance, General Administration

Fiscal Technician
Fiscal Technician, Senior
Accountant
Accountant, Senior
Buyer B
Comp. & Classification Analyst

Education, Information, and Planning

Information Director B

Institutional and Human Services

Anesthetist
Nutrition Specialist A
Hospital Attendant A
Medical Lab Technologist
Practical Nurse A
Pharmacist
Physical Therapist
Radiology Technologist
Registered Nurse
Registered Nurse Clinician A
Respiratory Therapist A

Engineering and Sciences

Mechanical Engineer B

Trades, Labor and Warehouse

A/C & Refrigeration Mechanic
Custodial Worker
Food Operations Asst. A
Groundsman
Highway Equipment Operator A
Carpenter
Electrician
Motor Vehicle Operator A
Storekeeper Supervisor B
Trades Assistant

Law Enforcement, Corrections

Watchman B

Source: DPT 1987 Salary Survey Report

JLARC staff examined all State job titles and descriptions to determine whether there are additional job classes that could also serve as benchmarks. Using the Commonwealth of Virginia Compensation Plan and DPT's job description corresponding to each job class title, JLARC staff compiled a list of additional job classes that seem to have counterparts in the private sector. Table 1 shows the job classes representing more than 100 State employees that may also serve as benchmarks. As with the current benchmarks, these job classes would represent more jobs than just those in the specific job classes listed. Appendix A shows the complete list compiled by JLARC staff, along with the DPT code numbers of the related job classes.

Although the current benchmarks and their related classes represent half of all classified State employees, it may be worthwhile to survey additional benchmarks to increase this percentage and to cover some job types that currently are not represented. Some examples of job classes to consider as potential benchmarks, which could cover new areas as well as add to the percentage of State employees represented, include: highway equipment maintenance classes, which make up .69 percent of the State workforce; facilities coordinator (.64 percent); and learning center supervisor (.55 percent).

These percentages may seem small, but the 43 currently-used benchmarks, with related classes, represent an average of approximately 1 percent each. Furthermore, some current benchmark job classes represent relatively small percentages of the State workforce, such as the mechanical engineer and the anesthetist benchmarks (each representing .03 percent).

In time, some benchmark job classes may become obsolete. Periodic review of existing and potential benchmark job classes should continue to be done to substitute currently relevant job classes for obsolete ones.

Conclusion

Overall, a substantial proportion of all State employees are already represented by the current set of benchmarks, even though not all State employees have private sector counterparts. Yet the representativeness of the benchmarks can be improved in two ways. First, DPT should attempt to add new benchmark classes, to increase the different types of State employees represented, as well as to increase the proportion of total State employees represented. Second, new benchmark classes should be substituted for old ones that have become obsolete.

Recommendation (1). Each year DPT should review existing and potential benchmark job classes, in order to substitute currently relevant job classes for obsolete ones, and to increase the number and variety of State employees directly represented by the benchmarks.

Table 2

Possible Additional Benchmark Jobs

State Job Class Title	No. of State Employees Represented	Percent* of Total State Employees	Private Sector Counterpart
Highway Equip. Mechanic A	499	0.69	Equipment Mechanic
Facilities Coordinator	467	0.64	Facilities Coordinator
Learning Center Supervisor B	401	0.55	Youth Home Supervisor
Special Activities Assistant	368	0.51	Special Activities Asst.
Psychologist B	224	0.31	Psychologist
Enrollment & Student Services Specialist	207	0.28	Admissions Counselor
Instructional Assistant	201	0.28	Instructional Assistant
Laundry Worker B	189	0.26	Laundry Worker
Power Plant Shift Supervisor B	187	0.26	Power Plant Shift Supv
Agricultural Technician B	180	0.25	Agricultural Technician
Rehabilitation Physician	169	0.23	Physician
Laboratory Instrument Maker	164	0.23	Lab Instrument Maker
Printing Press Operator	157	0.22	Printing Press Operator
Employee Relations Manager	155	0.21	Employee Relations Mgr.
Hospital Administrative Asst. A	140	0.19	Hospital Admin. Asst.
Resident Physician (licensed)	136	0.19	Physician
Hospital Accounts Collection Manager	123	0.17	Hosp. Accts. Coll. Mgr.
Human Resource Director	123	0.17	Human Resource Director
Highway Equipment Electrician	121	0.17	Equipment Electrician
Printing/Bindery Worker	120	0.17	Bindery worker
Highway Equip. Repair Foreman A	116	0.16	Equipment Repair Foreman
Switchboard Operator A	111	0.15	Switchboard Operator
Central Sterile Supply Aide B	106	0.15	Sterile Supply Aide
Stationary Boiler Fireman B	102	0.14	Stationary Boiler Fireman
Physical/Occupational Therapist Aide	101	0.14	Physical/Occupational Therapist Aide

*The percentages are based on the total number of State classified employees as of April 1, 1988: 72,696.

Source: JLARC staff analysis of Department of Personnel and Training data.

III. Does the Sample Represent the Population?

In analyzing the sample of private firms selected by the Department of Personnel and Training, JLARC staff examined the following factors:

- how the target population is defined;
- reasons for sampling the population, as opposed to using the entire population, and the limitations inherent in the sampling approach;
- specific sources of error in DPT's sampling approach and alternative procedures to improve the survey process;
- methods for improving the way the survey is administered.

The JLARC staff analysis indicated that there are limitations to how well the current survey sample represents the target population. An explicit definition of the target population, currently lacking, is needed in order to safeguard against subjectivity and error. Several actual or potential sources of error were identified which are not currently recognized or addressed through DPT's procedures. Current salary comparisons for many benchmark classes can be improved by taking greater advantage of existing data sources. The analysis also indicated that, considering the potential impact, more resources should be devoted to the salary survey

DEFINING THE TARGET PRIVATE SECTOR POPULATION

DPT is required to match comparable positions across the State classification system with a target population of private sector firms. Identifying the relevant private sector population for comparison to the State workforce is a critical step. This section discusses weaknesses in the comparison process that result from the lack of a definition for the target population.

Origin of DPT's Target Population

Current procedures for the salary survey do not explicitly define the population from which the particular sample is drawn. DPT relies on what might be called a judgment or expert sample initially selected in 1972 by a consulting firm, EMSI, for use in Virginia.

The initial sample has evolved over time based on two factors: (1) judgments as to which firms continue to fit DPT's perception of the State's comparators, and (2) attempts to tap a sufficient number of firms which are willing to respond.

Although DPT currently has procedures to achieve a mix of firms by geographic region, industry type, and firm size, the criteria the department used to determine the proportions of the mix are unclear.

Why a Definition is Necessary

Scientific sample survey practice requires explicit definition of the target population as a safeguard against subjectivity and error. Such a definition would help ensure that over time all those responsible for assembling the survey had an objective standard by which to identify individual firms and the mix of firms that comprised the total survey sample. Without a written definition, questions concerning the propriety of certain survey participants persist.

For example, though the statute currently calls for comparisons with the private sector in the Commonwealth, some of DPT's respondents clearly fall outside the target population so defined. Seven of the eight medical centers surveyed are neither private nor in the Commonwealth, but rather are university medical centers in neighboring states. These seven medical centers should not be included in the sample used to calculate the difference between State and private sector compensation.

Recommendation (2). Consistent with statutory directive, DPT should stop using out-of-state or publicly-run medical centers to represent private sector employers in Virginia.

DPT's Rationale for Current Procedures

DPT has defended its current procedure as reliable over time, yielding highly consistent estimates of private sector salary trends. Further, DPT believes that its sample, which relies heavily on large Richmond-based corporations, is likely to be more sensitive to trends in the total labor market than a sample emphasizing smaller firms would be. The current procedure is therefore felt to produce a sample which reflects a larger population.

Although much of DPT's rationale for its sampling procedure may be defensible, the fact that this rationale is undocumented increases the potential for inconsistencies in the future.

Improving the Process through Definition

DPT procedures do not sufficiently guarantee that the employer sample will remain representative of the original target population. Nor can they guarantee that bias will not be introduced during the selection of firms through severely limited or subjective information concerning the State's true comparitors.

DPT's tacit or working definition of the employer population appears to be reasonable. However, the failure to define explicitly the target population introduces a weakness in the survey process which could have serious consequences over time.

A systematic, written definition of the target population is essential if consistency and objectivity are to be maintained in the sample. The definition should address as many as possible of the factors discussed later in this chapter, including size of firms, geographic representation, and industrial representation.

Recommendation (3). DPT should have a clear systematic written definition of the target population to be sampled to prevent error and improve reliability over time. This written definition should specify characteristics of the target population such as distribution of firm size, geographic location, industrial sectors and any other factors relevant for drawing the sample.

USING A SAMPLE TO REPRESENT THE POPULATION

DPT's salary survey is meant to provide a comparison between salaries in the State workforce and salaries for similar jobs in the private sector. Data for the State side of this comparison is relatively complete and easy to obtain. Obtaining similar data for the private sector, however, requires considerable effort. Since responses are voluntary, the problem of incomplete data will always be present.

In assessing DPT's method for sampling private sector salaries, the JLARC staff considered the feasibility of using the total or census target population (i.e., <u>all</u> private employers in the State) instead of a sample. This approach appeared impractical, and a sampling process such as DPT's was judged a reasonable alternative, with some reservations. DPT needs to give greater recognition to the inherent limitations of any sampling approach, especially the margin of error that accompanies a sampling estimate.

<u>Census vs. Sample</u>

There are obvious reasons to prefer a census of every member of the population. Calculating the central tendency of the whole census of private sector salaries would produce not an <u>estimate</u> but the <u>actual</u> central tendency itself. Although there might still be some uncertainty due to measurement error, this method would be least prone to error.

However, there are substantial reasons to prefer a sample to a census. First, achieving a truly comprehensive census on a voluntary basis would be extremely difficult. Second, the statutory requirement that salaries be adjusted <u>annually</u> probably makes a census approach prohibitively expensive. Finally, results of the salary survey must be available in time for use in the budget process each year.

Sampling the population is a more feasible alternative, requiring considerably less time, effort, and expense. It appears, therefore, that DPT has appropriately chosen a sample rather than a census.

Recognizing the Limitations of Sampling in General

Although the use of a sample or subset of the total population is appropriate, this approach has limitations which must be acknowledged in applying the results. The process of inferring the results of a sample to the entire population from which the sample is drawn almost certainly results in some error. This is a reality of any sampling process. Sample statistics may be shown mathematically to ensure confidence in the results within a certain margin of error, and that is the best that can be reasonably guaranteed of even the best sampling technique.

Current practice is simply to treat the salary estimate calculated from the sample as though it were identical to the actual value that would derive from the entire population. The margin of error is not taken into account in DPT's process. Ways to estimate such error will be discussed in the next chapter of this report.

Further Limitations of the Current Sampling Procedure

In an ideal sampling procedure, the sample would be randomly drawn from the larger population. However, the sample currently used for the salary survey is not randomly drawn. Such a random sample would be difficult to achieve in this case, for the same reasons mentioned in the discussion above about using a census population. To some extent, DPT must utilize what data is made available on a voluntary basis.

The fact that the sample is not randomly selected does not necessarily preclude using the resulting data. However, it does make certain kinds of errors (see "Non-random Errors" below) more likely Again, the current process does not recognize this sampling principle, and should be made to do so.

TYPES OF SAMPLING ERROR

Although sampling error is inevitable, the degree of error can be minimized through careful attention to, and adjustment of, certain factors. The nature of these factors and recommended adjustments are discussed in this section.

Sampling error may be classified into two types, random and non-random errors. DPT currently does not recognize and account for the presence of randomly

distributed error. Furthermore, a number of potential non-random errors, also not accounted for, may intrude on the salary estimates. Scientific sampling procedures exist to aid in the identification of error and provide estimates which accurately reflect the intended population with minimal uncertainty

Random Errors

Random errors are chance factors which confound measurement but do not have a systematic biasing effect. If many randomly-selected samples were drawn, it can be proved mathematically that these errors would be randomly distributed above and below the true value. While the exact value of random error remains unknown, it may be estimated statistically based on variation in sample values.

The precision of the estimate of random error depends on the size of the sample taken from the population. Random errors may be reduced, but can never be absolutely known, and cannot be shown to be present or absent in a given sample, but only estimated. With a given sample, it cannot be determined whether the population value has been exactly estimated or not, but some degree of error must be expected.

While it is not possible to know how much or in what direction a sample estimate errs in predicting the population value, it is possible to estimate a range around the sample estimate which should contain the population value with a stated probability Public opinion polls typically make use of this mathematical characteristic of randomly-selected samples by stating their range of accuracy

The size of the range around a given estimate which contains the population value itself varies. The greater the sample size, the smaller this range of random error, and the closer the sample estimate to the population value. The larger the sample of the total target population, the more of the unique features of the population are bound to be captured in the sample, and the greater the confidence that a single sample represents the population with only minimal error.

Conversely, smaller sample sizes can be shown to be more vulnerable to overrepresenting unusual and unrepresentative members of the population, in effect giving greater weight to unrepresentative features which would be counterbalanced by the bulk of the data from a census or even a larger sample. It is in this sense that larger samples are better and a census is best.

No single change can be shown to reduce random error more than increasing the size of the sample of firms in the DPT salary survey This change would require greater State resources for data collection, but the increased cost would be justified by the increased accuracy of the survey results. This recommendation is further discussed in Chapter IV

Random error is inevitable in a survey sample. This fact is not currently recognized by DPT or others using the salary survey, and its implications are

discussed in the next chapter for the significance of a difference in the observed salary estimates.

Non-random Errors

Non-random errors are systematic biases introduced into survey results due to flawed procedures which prevent the survey from accurately measuring what it is intended to measure. This form of error can be eliminated or substantially reduced. Unchecked, it has the effect of systematically increasing or decreasing the sample salary estimate relative to the true population value.

If the DPT sample were randomly-selected and all other procedures were sound, there is 100 percent certainty that only randomly-distributed errors would occur during sampling. This property makes random samples clearly preferred to non-random samples. But, because the current DPT method uses a non-randomly-selected sample, the certainty of having only randomly-distributed error in the salary survey does not exist.

It should be noted that a non-randomly selected sample may still contain only randomly distributed error. But safeguards are needed in this type of sample to eliminate the possible presence of non-random error. The next two sections discuss the potential sources of non-random error identified by JLARC staff in the current salary survey

SOURCES OF ERROR IN DRAWING THE SAMPLE

Non-randomly distributed error may occur when drawing the sample. Its identification and elimination are important if the sample is to remain representative of the population.

A sampling bias may occur if groups within the target population have an unequal chance of being represented, and if the salary levels of the over-covered firms are higher or lower than the under-covered firms. Further, if the sample is biased, the salary estimate may also be biased up or down.

Currently, DPT runs the risk of having biased results. Several sectors of the private economy may be over- or under-represented. However, if the safeguards discussed in this section are implemented to eliminate this non-random error, then it is reasonable to assume that any remaining error would be randomly distributed, and therefore acceptable.

Overcoverage of the Health Sector

Certain benchmark classes working exclusively in health care can only be matched to firms in the health sector. But the current salary survey also collects data on non-health care jobs within the health sector firms as well. DPT currently weights the non-health care jobs in the health sector disproportionately by simply averaging the health sector mean salary with the mean salary from all other private sector firms.

In some benchmarks, the health sector is weighted 50 percent of all firms. In other benchmarks, when Bureau of Labor Statistics (BLS) data supplement DPT survey data, the health sector is weighted 33 percent. However, the health sector actually represents only 7.2 percent of all non-agricultural employment in Virginia.

The current practice can be improved by weighting average salaries for non-health care jobs in the health sector proportionate to the percentage that the health sector is of the whole non-agricultural private sector. Thus, the mean salary for non-health care jobs in the health sector would be multiplied by 0.072, while the corresponding mean salary from firms outside the health care sector would be multiplied by 0.928. Adding the two resulting figures together would result in an appropriately weighted average value for each benchmark.

Recommendation (4). DPT should continue to include health sector data on non-health care jobs, but weight the data in proportion to the percentage of health sector jobs to all private, non-agricultural jobs in Virginia.

Coverage of Large Firms

While DPT has a mix of different firms by size, the sample intentionally over-represents large firms. Since there is presently no explicit definition of the target population of firms, there can be no attempt to appropriately weight these firms. DPT is vulnerable to the charge that firm size is not adequately considered. In addition, because it is possible that smaller firms appear to tend toward different salaries, this inequality might be seen as bias due to non-random error.

On the other hand, large firms are more likely to have levels of job specialization similar to the State's. Thus, the inclusion of many large firms in the sample may produce better matches with benchmarks. Having a higher proportion of large firms in the sample does not appear to produce any major non-random error, and therefore, a sweeping change in sample proportions by size of firm does not appear to be justified. As previously recommended, an explicit definition of the target population, if compatible with this present mix of sizes, is sufficient to address this concern.

Unequal Geographic Representation

In the 1987 survey, the proportion of State employees in some regions did not match the proportion of responding firms. Only in the Richmond area does this appear a substantial concern, with Richmond containing 31 percent of State employees but 44 percent of responding firms. DPT believes that these firms, being predominantly large, are good matches to the State as an employer. There is no evidence to suggest otherwise.

It should also be noted that Northern Virginia, which the Department reports has a consistently far higher cost of competing, is treated in a separate survey As a result of this separate survey, job classes in Northern Virginia are routinely monitored for comparability with the private sector; those classes requiring adjustment are regularly adjusted. Given the close monitoring of the Northern Virginia area, its inclusion in the statewide salary survey is unnecessary and might bias the statewide central tendency Therefore, current practice appears to be appropriate.

Existing data sources compiled by BLS offer the prospect of substantial improvements in the accuracy of salary data for two of the metropolitan areas in the state, Richmond and Norfolk-Virginia Beach-Newport News. Appendix B discusses the possibility of replacing DPT data for some specific benchmarks with BLS data for these areas.

Disproportionate Coverage by Industry Type

In the sample, the proportion of private sector firms by industry type varies widely from the actual proportion of employees in these industries statewide, as shown in Table 2. The industrial category of finance, insurance, and real estate appear to be over-represented in the sample, almost four times its actual proportion of nonagricultural, private sector employment. Conversely, wholesale and retail trade and services are substantially underrepresented, with the sample proportion about one-half of the actual proportion.

These proportions are only a problem if the actual target population has different industry proportions than the present sample, and if salary averages differ for the same benchmark jobs across different industries. If salaries are the same across industries for the same job, then the mix of industries is irrelevant. Further, some industries may have greater or fewer matches to state benchmark classes and therefore be unequally represented. For example, the retail trade with many sales clerks may present few potential matches to State jobs.

The amount of non-random error due to the sample proportions cannot be estimated at this point, because the industry proportions of the target population have not been defined. But possible non-random error would be reduced if the industrial mix of the target population were explicitly defined, and if more firms in

Table 3

Comparison of Actual to Sample Percentages of Private Sector Firms by Industry Type

Industry	Percentage* In Survey	Percentage Of Private Sector Employment
Mining	4	1
Manufacturing	30	22
Transportation and Utilities	15	6
Finance, Insurance and Real Estate	26	6
Wholesale and Retail Trade	15	28
Services	11	28
Construction	0	8

*Totals do not sum to 100 percent due to rounding error.

Source: Virginia Statistical Abstract and DPT Report on Salary Survey

currently under-represented industries (such as construction) were encouraged to participate.

Additional improvement of salary data by industry type appears to be possible through the use of existing data collected by the Virginia Employment Commission (VEC) from its survey of manufacturing wages. DPT previously used VEC data in the survey process. However, certain problems with the timing of VEC data prevented its continued use by DPT. Appendix B discusses the prospects for using VEC data.

OTHER AREAS FOR IMPROVEMENT

The previous section discussed potential sources of error in the current sampling procedure. There are, however, other areas in addition to the makeup of the sample in which the survey process could be improved. These areas are the design of the questionnaire used by DPT, administration of the survey, and the process of coding and entering data into the computer.

Design of the Questionnaire

Random error and non-random error may both be concerns if the questionnaire eliciting information from firms does not provide sufficient information for

accurate and precise measurement. For example, random error could be introduced into the survey because an insufficient description of a benchmark class may lead to unreliable matches (i.e., some appropriate matches are made while others are not). Worse, the insufficient information may result in invalid matches, creating non-random error by biasing the data with salaries that are inappropriately high or low

Current practice is to trim observations that are two standard deviations beyond the mean response for that benchmark job. This practice of removing observations that appear "too high" or "too low" should stop. A better method is to identify outliers and conduct follow-up interviews with firms to determine the reason for the atypical response. If there is clear evidence that the data item is invalid, then it should be eliminated; otherwise, it should remain in the data set and be included in the calculation of the salary estimate.

A range test may be another form of reliability check of the data. For example, in the 1987 salary survey, 17 out of the 43 benchmarks had firms reporting a wide range of average salaries: the highest reporting firm was at least 75 percent higher than the lowest reporting firm. This wide range may indicate unreliability of the data. Therefore, for over one-third of the benchmarks, questions arise about the degree of error in assignment of private firm jobs to a benchmark. Again, questions of this nature should spur follow-up interviews to clarify concerns regarding the use of such data items.

The use of trained interviewers to help firms match their jobs to the benchmark classes might overcome this data problem. DPT should plan to combine personal interviews with the present mail questionnaires for survey data collection. DPT should mail the survey instrument to respondents for completion prior to a scheduled personal interview During the interview, the responses should be validated to ensure that the survey responses are correct, thereby increasing the reliability of responses.

DPT's current level of staffing for the annual salary survey (including data collection, analysis, and generating the report) is one-fourth of a full time equivalent (FTE) position. In the 1987 salary survey, this staffing level may have been insufficient for arranging personal interviews with the 86 firms initially selected for the survey Improving the data collection through personal interviews would require a greater level of resources.

Recommendation (5). DPT should stop deleting outliers solely because a firm's average salary appears too high or too low DPT should institute follow-up procedures in cases where firms report average salaries either two standard deviations from the mean average salary reported by all firms for that class, or where firms report average salaries 75 percent greater than the minimum reported average salary for that class (in which case firms with extreme values would be contacted). Follow-up questions should address the degree to which the respondent has appropriately matched State benchmark class jobs with the firm's job. Only if an independent

reason accounts for the outlying value (such as a mismatch between State and private sector jobs) should an outlier be deleted.

Recommendation (6). In collecting survey data, DPT should attempt to follow-up all mail questionnaires with personal interviews. This step should substantially increase the reliability of responses, and may increase the response rate.

Administration of the Survey

Because firms participate in this survey on a voluntary basis, non-response is a potential source of error. Response bias, a form of non-random error, may occur if a firm's willingness to respond is in any way correlated with salary levels. DPT reports smaller firms and firms outside the State's major metropolitan areas are likely to have lower salaries and are also likely to respond with a lower frequency, perhaps skewing upward the private firm salary estimator. With a 47 percent response rate among private firms, the large number of firms not responding is a concern.

Greater vigor in pursuing respondents by phone and especially through personal interview is one remedy Greater effort toward providing participants with useful analysis and data based on their firm's results may be another way to promote higher participation, a possibility mentioned by DPT.

Another possible method that may increase the response rate involves the cover letter sent with the questionnaires. Having the cover letter sent through the Secretary of Administration, the Governor, or a member of the General Assembly may result in a higher proportion of contacted firms participating.

Recommendation (7). As DPT has suggested, DPT should increase the response rate of its sample of firms through the development of reports which summarize and analyze private sector salary data. The reports will be offered to participants free of charge as an incentive for participation.

Coding and Entering Data into the Computer

The process of coding and entering data could introduce additional error to data sets. Currently, DPT runs screens to catch the most easily-detected errors, but does not systematically proof all or even most of the individual salary survey data items. All error due to coding and data entry can be easily eliminated by proofing the data set. Given the amount of the State's total expenditure that is affected by payroll decisions, any errors of this sort should be eliminated by proofing every element of the data set.

It appears that proofing the data set could easily be accomplished in one working day There are three salary variables to proof: the minimum, the average,

and the maximum salary reported by each firm for each benchmark. In the 1987 salary survey, there were approximately 600 observations, where an average of 16 firms reported salary data for each of the 38 benchmarks represented in the DPT sample. The remaining five benchmarks were represented solely by Bureau of Labor Statistics data (rather than by DPT sample data), which had already been proofread before publication.

Recommendation (8). DPT should proofread every element of the data set without exception, and follow-up with respondents on any questionable items.

CONCLUSION

It is obvious that the State has an interest in reducing the error in estimating the salaries of comparable private firms. The State's goal should be to identify all potential sources of error and reduce or eliminate all errors within the bounds of practicality and resource constraints.

Improving the salary survey involves balancing three factors: accuracy, practicality, and economy Accuracy refers to the degree to which the sample can be used to compute valid estimates. Practical considerations demand that the survey recognize human and organizational limitations and that it be accomplishable as planned. Economy refers to the fulfillment of survey objectives with the most precision at the least cost.

Any survey design is likely to face trade-offs in attainment of these criteria, as between accuracy and the other criteria. For example, the time and money it takes to buy somewhat more accuracy of measurement is only justified by the strength of other elements of the design, available funds, and the practicality of implementing such a strategy Finding the appropriate balance should be emphasized in survey sample design. If certain weak links in the survey process stand out as clearly weakening the entire chain, there is no sense in strengthening other aspects of the design until these steps are strengthened.

The question of how well the sample represents the population depends on reducing random error and eliminating non-random error at several stages of the survey design and implementation process. Implementation of the changes suggested in this chapter should substantially improve the likelihood that the survey sample is representative.

Developing a survey sample design which better represents private sector employers will probably require more resources than are currently devoted to the salary survey The resulting quality improvements will allow the salary estimates from the survey to be analyzed and applied to State salary adjustments with greater confidence.

IV. Is There a Significant Difference Between State and Private Sector Salaries?

Calculating the overall difference between State and private sector salaries entails distilling data from both the State and the private sector down to a single number. Obviously, arriving at the "final" number is a crucial step in the process.

DPT currently uses the following steps to characterize the overall difference between State and private sector salaries. For each benchmark, DPT calculates the average salary for State employees, and the average salary of the private sector counterparts. Then DPT calculates the difference between private sector and State salaries for each benchmark, by subtracting the private sector average from the State average. This difference is then represented as a percentage of the State average salary, and called the "deviation"

Across all 43 benchmarks with private sector counterparts, the deviations are ordered from lowest to highest. DPT currently assumes that the most "typical" deviation is the median, or centermost value: that is, the deviation of benchmark number 22, out of the 43 rank-ordered benchmarks. In 1987, this centermost deviation was 7.11 percent. From this measure, DPT concluded that the private sector in general pays salaries that are 7.11 percent higher than salaries paid by the State for similar jobs.

In analyzing the current process, JLARC staff found cause for concern in several areas: (1) the overall difference appears to be subject to arbitrary fluctuation, (2) salaries in some pay grades appear to have a disproportionate influence in the calculations, and (3) sampling error is not taken into account.

However, an alternative approach is available for overcoming these problems. Significant improvements could be achieved by weighting benchmarks proportionately to the number of State jobs in each benchmark, and by expressing the salary differential as a range which takes sampling error into account.

OVERALL DIFFERENCE IS SUBJECT TO ARBITRARY FLUCTUATION

Under DPT's current method, if there is error in the estimate of the centermost deviation, using it to represent the difference between all private sector and State salaries creates an inaccurate overall estimate. Table 3, which illustrates the range of the rank-ordered deviations used by DPT, provides some perspective on this problem. The current method relies too heavily on the accuracy of the estimated deviation of one benchmark (the centermost deviation, number 22).

It should be noted that a substantial degree of error may exist in the deviation estimates of individual benchmarks. Some benchmarks in the 1987 salary survey have deviations based on average salaries from as few as seven private sector firms. Having so few observations within a benchmark makes the average private sector salary for that benchmark highly sensitive to the specific individual firms observed. In this situation, the average salary could be more a reflection of the idiosyncracies of the individual firms sampled than of the broader population of private sector firms.

This situation could cause the estimated average private sector salaries, and the resulting estimated deviations, to fluctuate in value across a wide range from one benchmark to another. Table 3 shows that the estimated deviations in the 1987 salary survey ranged from -30.32 percent to +14.45 percent. This wide range may be due in part to the instability of deviation estimates on the individual benchmark level.

A separate but related problem is that the benchmark which becomes "central" could vary according to arbitrary factors such as the addition or subtraction

Table 3

Illustration of Rank-Ordered Deviations

Rank-Order	Benchmark Job Title	Deviation*
1	Public Relations Director	-30.32
2	Motor Vehicle Operator	-27 45
3	Groundsman	-25.91
21	Programmer	-7.39
22	Secretary	-7.11
23	Office Services Aide	-3.36
41	Dietician	+8.68
42	Systems Analyst	+9.12
43	Food Operations Assistant	+14.45

*The deviation is the average State salary minus the average private firm salary for each benchmark, represented as a percentage of the average State salary

Source: JLARC analysis of data from DPT 1987 Annual Salary Survey.

of other benchmarks. And, if the median benchmark changes, so does the salary differential associated with it. For example, had the median deviation been observation number 23 instead of number 22 in the rank order, the overall difference would have been -3.36 percent instead of -7.11 percent, or less than half the amount reported in 1987

This example could have been a reality had DPT added two new benchmarks in 1987 Then the centermost benchmark would be number 23 in rank-order rather than number 22. If these two additional hypothetical benchmarks both had deviations ranking in order above number 23, the new median would be -3.36 percent instead of -7.11 percent. Even without adding two benchmarks, it is not clear why -7.11 is a more "typical" difference than -3.36, except for the fact that one value happens to be in the exact center of the rank-order and the other happens to be next to it.

Averaging the private firm salary estimates across all benchmarks, rather than taking a single "typical" benchmark estimate as a precise summary of all other benchmarks, might overcome some of the effects of arbitrary fluctuation. Averaging across all benchmarks uses all of the data collected, rather than relying heavily on the precision of the few private firm data points that appear in the "typical" benchmark job.

EMPLOYEES IN HIGHER SALARY GRADES ARE GIVEN TOO MUCH INFLUENCE

There is wide variation in deviations across benchmarks, as shown in Table 3. Yet these deviations are summarized by a single number, which is used to adjust the entire salary structure. The variation in deviations indicate that if some job classes are adjusted appropriately by this single number, others will not be appropriately adjusted by it. An important question is whether some job classes should have a greater influence on this single number than others. DPT currently weights each benchmark equally This practice, however, presents a major problem.

DPT justifies the current practice by the following rationale. The Commonwealth needs to be equally competitive with the private sector at grade 1 and grade 23. It is as important, in terms of the structure, to be as competitive for a job class with two employees as for a class with two thousand. Unequal weighting could limit the impact of many of the job classes and many of the salary grades. However, this line of reasoning has limitations.

It must first be understood that making the entire State salary structure competitive involves two different types of adjustments. One is the annual adjustment of the salary structure by a single number, to keep pace with overall salary movements in the private sector job market. But expecting a single number to make

all grades of the entire salary structure equally competitive is unrealistic, because not all State salaries differ from the private sector in the same way

Therefore, a second type of adjustment is also made: one-time-only changes to specific grades of the salary structure (or to specific job classes with staffing problems). These one-time adjustments require surveys independent of the annual State salary survey, and are not assessed in this study

The primary purpose of the annual salary survey process is to make the first type of adjustment: an annual single-number adjustment of the entire salary structure. However, since this adjustment will always be more appropriate for some job classes than for others, it should be made in a way that is appropriate for a higher number of State employees.

Conversely, the current method of weighting all benchmarks "equally" actually gives greater weight to the salaries of the relatively few individual employees in the higher grades. Approximately 63 percent of all State classified employees are in grade 7 or below, as shown in Figure 4. In other words, roughly two-thirds of all State classified employees are in one-third of the salary structure. Therefore, under the current methodology and the current goal of equal weight for each grade, the State is adjusting the salaries of two-thirds of its employees (those in the lower seven grades), based on a salary structure adjustment which may give them half as much influence as the remaining third in grades 8 through 23.

In conclusion, weighting the benchmarks proportionately would make more sense than weighting them equally If some benchmarks represent larger groups of employees, they should have greater weight in any number that summarizes the difference between State and private sector salaries, rather than having equal weight with benchmarks representing very small groups of employees.

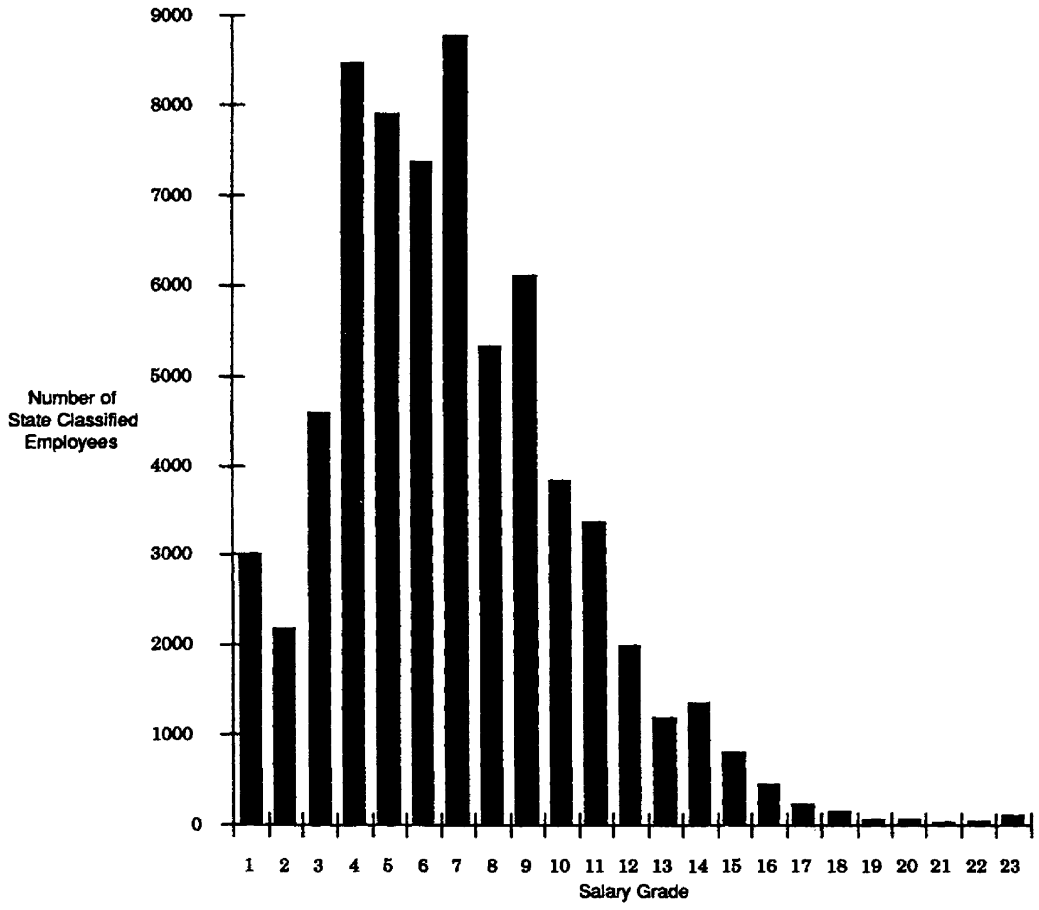
SAMPLING ERROR IS NOT TAKEN INTO ACCOUNT

A third problem relates to the fact that error due to sampling is inevitably present. There is almost always some discrepancy between what is observed in a sample and what really exists in the entire population. This discrepancy is inevitable, because a relatively few firms in the sample are directly observed, and they represent as proxies a much larger number of firms in the broader population which are not directly observed.

But the current method provides no way to determine how much the estimated overall difference in salaries is likely to be an artifact of sampling error. Further, the current method assumes that this estimate from the sample is perfectly on target with the corresponding salary difference of the entire population. So the question of whether the difference between State and private sector salaries is statistically significant is not considered.

Figure 4

Distribution of State Employees by Salary Grade



Source: DPT 1987 State Salary Survey

AN ALTERNATIVE APPROACH FOR REPRESENTING SALARY DIFFERENCES

The previously discussed weaknesses in DPT's current process can be improved through the application of two accepted statistical concepts: the weighted mean and the standard deviation.

Summarizing State Salaries Across Benchmarks With a Weighted Mean

When summarizing State salaries with a single number, a fundamental question is: What measure of central tendency is most appropriate? The most

commonly used measures of central tendency are the mode, the median, and the mean. Appendix C discusses why the use of the mode, the median, and the simple mean present problems in summarizing State salaries.

These problems can be solved by using a weighted mean as the summary measure for State salaries. Each benchmark State salary would be weighted according to the proportion of State employees represented by that particular benchmark position, out of all State employees represented by all benchmark positions.

Summarizing Private Sector Salaries With a Weighted Mean

The central tendency measure of private sector salaries should provide a single number to compare with the weighted mean State benchmark salary It should summarize what private sector counterparts to State employees in benchmark positions are paid. Therefore, it should parallel the weighted mean State benchmark salary

The weighted mean salary for the private sector can be calculated in three steps. First, within each benchmark job class, an average private sector salary should be calculated across all firms sampled. (This average can be calculated as a weighted average, where the weights are proportional to the number of employees a given firm has in a given benchmark job.) Second, a weight should be assigned to each average private sector salary of the benchmark job class. These weights would be the same ones applied to the weighted mean State benchmark salaries: each benchmark weight would be the proportion of all benchmark State employees represented by that particular benchmark job class. Third, the average private sector salaries would be multiplied by their corresponding weights, and summed. This sum would be the weighted mean private sector salary

How Using the Weighted Means Improves the Estimate

As stated previously, a problem with the current use of the median deviation is that it is highly subject to arbitrary fluctuation. One reason for this problem is that many of the estimated average salaries appear to be unstable on the individual benchmark level. Rather than using a single "typical" benchmark deviation as a precise summary estimate of all deviations, the weighted means serve to average salaries across all benchmarks. This averaging helps to overcome the arbitrary fluctuation on the individual benchmark level. The weighted means use all of the data collected, rather than relying on the precision of the few private firm data points that appear in the "typical" benchmark job.

In addition, it was shown that under the current method, the median salary difference is highly sensitive to how many benchmarks are in the sample. In

fact, adding many new benchmarks could cause drastic swings in the value of the median salary difference, even if the new benchmarks represented few State employees.

The use of weighted means reduces this possibility Because each benchmark is weighted according to how many State employees are represented, the estimated overall difference between these weighted means is much more stable compared to the median deviation when new benchmarks are added. Adding the benchmarks refines the estimated difference between the weighted means by having more State employees represented, but only in proportion to how many more are represented. Further, analysis presented in Chapter II indicated that the current set of benchmarks already represents the largest groups of State employees with private sector counterparts.

The second problem with the current method, that employees in higher grades are given too much influence, is also reduced by using weighted means. Each benchmark would be weighted by the number of State employees it represents. Therefore the weighted means would be more sensitive to those grades having more State employee, and less sensitive to those having fewer.

Recommendation (9). DPT should use weighted means to summarize the private sector salaries and State salaries across benchmark jobs.

Estimating the Standard Deviation of the Weighted Mean Private Sector Salary

The third problem discussed for the current method was that sampling error is not addressed. Assuming the use of the weighted means as recommended above, sampling error can now be taken into account through the use of a standard deviation.

The weighted mean for private sector salaries is calculated using sample data. This estimate is bound to be different from one taken from the entire population, if it were possible. Therefore, a standard deviation of this sample weighted mean is needed, to determine how much error in the weighted mean estimate could be attributed to sampling.

The standard deviation is calculated as follows. Within each benchmark, the variance within that subgroup is computed, and divided by the number of firms in that subgroup. Then this within-benchmark variance is weighted (by the square of the proportion of all State benchmark employees represented by that particular benchmark). All of these weighted within-benchmark variances are then summed. The square root of this sum equals the standard deviation of the weighted mean.

Using the Weighted Means and the Standard Deviation to Address Salary Differences

Once the weighted mean State benchmark salary, the weighted mean private sector salary, and the standard deviation of the private sector weighted mean have been calculated, the difference between State and private sector salaries can be addressed. If this difference is determined to be genuine, then it is reasonable to adjust the salary structure accordingly But if the difference appears likely to result from sampling error, then basing a salary structure adjustment on it would not be sensible.

Determining Whether Salary Differences Are Statistically Significant. The method for determining whether the salary differences are significant can be explained best with the following hypothetical example.

> *Suppose that the weighted mean benchmark State salary is $16,700, the weighted mean salary from the private firm sample is $18,464, and the standard deviation of this private firm weighted mean is 861. Further, assume that the error around the sample weighted mean is randomly distributed, and that alternative sample draws would also have randomly distributed error*
>
> *The private sector weighted mean salary in this example would lie between $16,788 and $20,151, at the 95 percent level of confidence. In other words, there is less than a five percent chance that the private sector weighted mean salary is less than $16,778 or greater than $20,151, judging from what is observed in the sample. Appendix D explains in greater detail how to calculate this range.*
>
> *Because the weighted mean State benchmark salary lies outside of this range, the difference between private sector and State weighted mean salaries is statistically significant (at the five percent level of significance).*

In this example, there is less than a five percent chance that, had the entire population been used instead of drawing a sample, there would really be no difference in salaries and that the difference observed from the sample mean is simply due to an unusual draw of the sample. That is, there is less than a five percent chance that the difference observed from the sample data is attributable to sampling error.

The "level of significance" concept is important because it indicates how likely it is that the estimate from a sample is merely an artifact of sampling error, rather than a genuine difference. Therefore, the smaller the level of significance, the

better: five percent or less, for example, is conventionally considered by users of statistics to be a sufficiently low probability much of the time.

But this five percent is merely a commonly-used convention, not a "magic number" for a level of significance. Salary differences could also be considered genuine at the ten or fifteen percent significance levels. In these situations, there would simply be a higher (ten or fifteen percent, as opposed to five percent) degree of doubt than at the level that is most often considered conventionally acceptable. This higher level of doubt may still be tolerable in some situations.

Using Ranges to Represent Salary Differences. The mandate for this study directs JLARC to assess "the methods used to determine the minimum percentage salary scale adjustment." The word "minimum" implies that the salary survey process should produce not just a single point estimate for adjusting salaries, but a minimum and a maximum value: a range.

Furthermore, as discussed earlier, error is inevitable when using a sample to represent a broader population. In particular, there is virtually 100 percent certainty that a single point estimate of the private sector weighted mean salary, taken from a sample rather than the entire population, is not perfectly on target.

Therefore, it makes sense to characterize the estimated difference between private sector and State salaries in terms of a range. In this way the error attributable to sampling is considered when stating the difference between State and private sector salaries.

> *For instance, in the example used above, at a 95 percent level of confidence, the difference between State and private sector salaries is $1764 (plus or minus $1688), or 10.6 percent (plus or minus 10.1 percent) of the State weighted mean benchmark salary. In this case, there is only a 2.5 percent probability that the difference is actually below this range, and a 2.5 percent probability that the difference is actually above it.*

But if a higher level of uncertainty can be tolerated, the range can be made narrower.

> *For example, at an 80 percent confidence level, the difference is $1764 plus or minus $1104, or 10.6 percent plus or minus 6.7 percent of the State weighted mean benchmark salary. At this level of confidence, there is a ten percent chance that the difference is actually below the range, and a ten percent chance that it is actually above it.*

Overall, the higher the probability of being wrong that can be tolerated, the narrower the range can be.

It should be noted that, when calculating a range, the midpoint should be selected as the best single-number estimate of the gap between State and private sector salaries. For example, if the lower end of the range is always selected over the years instead, there is a higher probability that the State will always lag private sector compensation. Similarly, if the higher end of the range is always selected, there is a higher probability that State compensation will in time exceed the private sector's. By using the midpoint of the range, the probabilities of these two undesirable outcomes are balanced.

Recommendation (10). DPT should estimate the error attributable to sampling through the use of the standard deviation, and should use it to derive minimum and maximum values of the estimated difference between State and private sector salaries. The midpoint of the range should be selected as the best single-number estimate of the gap between State and private sector salaries.

Narrowing the Range of the Estimate by Increasing the Sample Size

A better way of narrowing the range is to increase the sample size in future years. For example, if DPT were authorized an additional Full Time Equivalent (FTE) position to work on the salary survey (DPT currently has one-fourth of an FTE working on the salary survey) and if this increase enabled DPT to collect data from four times as many firms as it does now, then the 95 percent confidence level range would be $1,764 plus or minus $860 (instead of $1,764 plus or minus $1,688), or 10.6 percent plus or minus 5.1 percent of the weighted mean State salary The 80 percent confidence interval would be $1,764 plus or minus $552, or 10.6 percent plus or minus 3.3 percent of the weighted mean State salary These estimates are based on the assumption that the additional firms sampled would have just as random a distribution of errors as those currently sampled.

Recommendation (11). DPT should increase the size of the sample of private sector firms. The magnitude of random error that would be due to sampling would be reduced. This change would require greater State resources for data collection, but the increased cost would be justified by the increased accuracy of the survey results.

DPT's Concern about Fluctuating Estimates Across Years

A final concern expressed by DPT staff is the stability of the observed differences in salary from one year to the next. DPT has indicated problems with fluctuating point estimates of private sector salaries from one year to another. A major reason for some of the fluctuation may be the inevitable error from using a sample to represent a broader population, especially when the particular firms included in the sample may vary from one year to the next.

Having the sample consist of the same firms across years may initially appear to reduce this problem, because the estimated private sector salaries may appear to be stable across years. But this practice actually makes the problem worse, because it locks in whatever bias the sample may have in one year for future years as well, and gives the false appearance of stability in the estimate over time.

Again, the best way to resolve this problem is to recognize up front that there is error due to having a sample represent a broader population. Characterizing the estimated difference in State and private sector salaries as a range of possible values, rather than as a point estimate, allows for this fluctuation in the sample of private sector salaries.

CONCLUSION

Of all the factors examined in this report, the single number used to represent salary differences has the greatest potential financial impact on the State. Therefore, it is critical that the magnitude of error associated with this number be reduced. Because DPT's current method for characterizing the difference between State and private sector salaries has weaknesses, the alternative approach outlined in this chapter should be used instead. This alternative involves using a measure of central tendency that makes more sense than the measure DPT currently uses. Because a central tendency measure in this case should summarize all of the salary data rather than simply pick the most "typical" salary and ignore other values, a weighted mean should be used.

The use of this alternative approach would also necessitate that DPT discontinue, as recommended in Chapter III, the current practice of trimming outliers simply because some observations have salaries that appear "too high" or "too low." If there is clear independent evidence that a data item is not valid, then it should be eliminated. Otherwise, it should be included when estimating the sample weighted mean, even though it may cause the estimate to appear to fluctuate more across years.

But this apparent problem would be reduced by acknowledging the existence of error due to sampling. Using a range to characterize the difference in salaries not only reduces reliance on the precise value of a point estimate, but the impact of outliers is also reflected in the estimated sampling error, which determines the range as well. Increasing the sample size is the best way to reduce the sampling error itself.

V. Are Fringe Benefits Represented Adequately?

DPT's current approach to fringe benefits gives only a rough estimate of the difference in employee fringe benefits and weakens the precision of the total compensation estimates. The State needs to improve fringe benefit estimates. Improvements can be made in two ways: better data collection, and better analysis of the data.

FRINGE BENEFIT DATA COLLECTION

Random error and non-random bias may both be problems because of the questionnaire currently used for gathering benefit information from private sector firms. The questionnaire has some limitations which may weaken confidence in the total compensation estimate.

Limited Information on Benefit Levels

Current DPT practice relies on describing a typical employee profile, and asking the private firms what they would pay this employee in benefits. This typical employee profile consists of an employee with six years of seniority with the employer, unmarried, and without dependents. DPT does not check the profile to ensure that it fits the average State employee.

Of course, employees with different characteristics (such as having dependents covered by benefits) may require different fringe benefit costs from the employer. If a single profile of a typical employee must be used, it would be improved by reflecting the average State employee better in terms of: average years of seniority, whether married or unmarried, and the average number of dependents. DPT could use its records on State employee characteristics to improve its typical employee profile.

DPT currently collects a single set of benefits information from each firm, without considering the possibility of varying fringe benefits for different benchmark jobs. Fringe benefits may vary across job classes, as some benefits are tied to salary levels and others may be reserved for only some positions in the firm.

Whether benefit data should be collected by benchmark class is an issue. This change would achieve greater reliability in comparing benefit levels of the "average" employee, since more than one type of employee would be accounted for in the data. But there is one disadvantage with this approach: the amount of data to be collected and analyzed would increase dramatically (Appendix E discusses this possible future refinement.)

Recommendation (12). DPT should improve its typical employee profile to match the average State employee better, using its records on State employee characteristics. DPT should use this improved profile to collect fringe benefit information from each private firm.

How to Represent the Value of Benefits

There are two possible approaches for representing the value of fringe benefits: cost to the employer, and value to the employee. Current DPT practice uses the cost to the employer to estimate the economic value of benefits for the State and the private sector. This practice is widely accepted and in fact recommended by experts in the field.

However, more complete methods could be considered in the future. For example, from the employee's perspective identical employer costs for benefits may not yield identical benefits to employees, since employers may purchase different types of benefits. A recent trend in benefits is to allow employees to select from a menu of optional benefit packages. Estimating the value of fringe benefits to employees would be a complex task, outside the scope of the present study As discussed later, a one-time comprehensive study of fringe benefits could be used to consider the respective merits of the employer-cost and the employee-value approaches.

FRINGE BENEFIT DATA ANALYSIS

After appropriate data on fringe benefits are collected, the data must be appropriately analyzed. First, the specific benefits to be analyzed must be selected. Second, a summary statistic must be chosen to represent the overall levels of fringe benefits provided by the State and the private sector. Third, the difference between State and private sector fringe benefits must be represented. Then it must be added to the estimated difference in salaries, to represent the difference in total compensation.

Selection of Benefits to Analyze

Private firms may not only choose unique levels for benefits, but may offer unique mixes of benefits. In particular, some private firms may offer types of benefits to employees that are unavailable to State employees. Rather than including all benefits when analyzing the difference in benefits between State and private sector practices, DPT selects only the private sector benefits which are offered by the State:

Holidays	Social Security	Disability Plan
Vacations	Health Plan	Life Insurance
Sick Leave	Retirement Plan	

This practice excludes other forms of compensation which may be of considerable importance to private sector employees, and may introduce a systematic bias. For example, under-representation of private sector total compensation may occur if stock options and profit sharing form a significant portion of an employee's total compensation.

Additionally, some forms of benefits available to some fraction of State employees but not widely available are excluded. For example, DPT reports that lunch discounts are available for State employees at some institutional facilities of the Department of Corrections and the Department of Mental Health, Mental Retardation, and Substance Abuse Services. Also, lunch allowances are available for some employees with substantial fieldwork responsibilities, such as game wardens and State Police. DPT notes that taken together these forms of compensation represent a very small percentage of total statewide compensation, but are nevertheless omitted and therefore slightly understate State employee total compensation. DPT explains that it would be difficult and perhaps inappropriate to prorate these selected benefits to all State employees.

Current practice concerning matching of comparable State and private sector benefits appears acceptable. However, Appendix E discusses refining the method by including all private sector benefits in future surveys.

Summarizing the Value of Fringe Benefits with a Single Number

Table 4 shows how DPT currently represents the value of fringe benefits. DPT currently collects private sector employee fringe benefit costs to the firm as a percentage of salary, using a hypothetical salary for a single employee profile. The State employee fringe benefits are also calculated as a percentage of the same hypothetical salary, $20,000 in 1987 For example, using this method DPT found in 1987 that the State retirement plan cost 12.84 percent ($2,568 per year based on a $20,000 per year salary) per employee as compared to private firms, whose average retirement plan cost for the same hypothetical employee was 5.06 percent ($1,012) based on the same salary

Next, all eight fringe benefit percentages are totalled for each employee. In 1987, total fringe benefits were estimated as 41.74 percent of salary for State employees and 38.41 percent of salary for private firm employees, as shown in Step I of Table 4.

Finally, the benefit percentages are converted to dollars. The State salary base remained at $20,000, and the private sector salary base was increased from the $20,000 salary by the median deviation of private firm benchmarks (7.11 percent), resulting in private sector salary compensation of $21,422. Then the salary compensation was added to the benefit compensation for the respective employees. The total compensations are shown in Step II of Table 4.

Table 4

Steps in the Comparison of 1987 Total Compensation

STEP I. *Benefit Cost Summary as Percentage of Salary*

Benefit	State of Virginia	Private Comparitors
Holiday	4.24	3.44
Vacation	5.77	5.79
Sick Leave	5.77	10.64
Health Plan	4.94	4.86
Life Insurance	1.04	0.89
Disability	0	0.59
Social Security	7.15	7.15
Retirement	12.84	5.06
TOTAL	41.74	38.41

STEP II. *Comparison of Total Compensation*

Cash Compensation	$20,000	$21,422
Benefits	$8,348	$8,228
TOTAL COMPENSATION	$28,348	$29,650
CURRENT DIFFERENCE	-4.59%	

Source: DPT Report on Salary Survey, 1987

Problems with the Current Methodology

This method of summarizing employee fringe benefits in dollars presents several problems. First, DPT presents fringe benefits as percentages of a base salary This practice introduces error when these benefits are actually a fixed dollar amount contributed by the firm to all employees equally, regardless of salary Error occurs in this case because the percentage is reported from a different private sector base, a hypothetical salary of $20,000 in 1987, than the private sector base that later is used to convert the percentage to dollars, the estimated private sector salary of $21,422 in 1987

As a hypothetical example, if all fringe benefits were fixed regardless of salary, the 38.41 percent of 1987 salary which is calculated to be the private sector benefits is either $7,682 or $8,228, a $546 difference depending on whether $20,000 or $21,422 is used as the base.

DPT cannot correct this potential discrepancy between fixed and variable fringe benefits under the present format. Correction would require knowledge of the conditions under which fringe benefits vary from employee to employee within private firms. DPT currently does not collect such data. Appendix E discusses methods for collecting and analyzing more detailed fringe benefit data which would ameliorate this possible problem.

Another problem with DPT's calculation of fringe benefit dollar amounts is that the use of a hypothetical salary figure as a base for State employee benefits clearly introduces error. The average State employee salary was not $20,000 in 1987; therefore, the average State employee benefits were not $8,348, as reported by DPT. The actual average State employee salary should be used, again distinguishing fixed benefits from variable ones.

Additional problems may result from the simplification of fringe benefits to a single observation for each firm. This practice does not account for possible complications of multiple benefits within a firm based on different employee characteristics, salary levels, and place in the firm's hierarchy Collection and analysis of benefit data by benchmark class as well as by individual firm is one way to address this possible problem. Possible future refinements are discussed in Appendix E.

DPT currently uses a simple average of all firms' fringe benefits to represent a single estimate of private sector fringe benefit levels. This approach does not account for the fact that some firms compete more often with the State for benchmark employees than do others. A weighted mean which accounts for frequency of competition for State benchmark employees should be used instead of a simple mean. This weighted mean of firm benefit levels is similar in concept to the weighted mean salary discussed in Chapter IV Appendix E explains how the values of the weights could be derived.

A final problem in DPT's benefit statistic is the assumption that the figure is free from error. As discussed in Chapter III, no sample statistic should be used in this manner, without reporting the error of the sample estimate. DPT does not consider the sampling error in estimating fringe benefit compensation. Rather, DPT treats its total compensation estimate as the population value. DPT could develop a range to represent total compensation, using the following procedure.

As noted above, the weighted mean for private sector benefits would be calculated using sample data and is bound to differ from the true population figure. The standard deviation of the weighted mean for fringe benefits could be derived, using a method similar to that discussed in Chapter IV It would be used to determine how likely it is that the difference observed between private sector and State fringe benefits is genuine, rather than due to sampling error When reporting the fringe benefit average dollar amounts, a range can also be provided, to take sampling error into account.

Recommendation (13). When better data for estimating fringe benefits become available, DPT should provide a weighted mean fringe benefit value, and an estimate of the sampling error. The total compensation difference can also be characterized as a value plus or minus sampling error. The minimum dollar value of the range for fringe benefits should be added to the minimum dollar value of the salary range to yield a minimum level of total compensation. The same procedure would be applied to the maximum.

CONCLUSION

Given current practices for estimating fringe benefits, it is unknown whether any significant difference exists between State and private sector benefits, and if so, whether currently estimated differences are subject to high levels of error or not. It is possible, given the limitations of existing fringe benefit information, that its use in a measure of total compensation adds random error and perhaps bias to the salary difference, and therefore may obscure rather than improve the comparison of State and private sector compensation.

Consequently, the House Appropriations and Senate Finance Committees may wish to have a one-time comprehensive study of fringe benefits conducted. The results from this study would be matched against the results derived from the current method. The study would be designed to gather more detailed information than is currently available on fringe benefits actually provided by private firms. This more detailed information would include benefits provided to different types of employees, both between firms and within a given firm.

Such a study should also consider the question of how best to value benefits, as a cost to employers or the dollar value to employees. Such a comparison would indicate how well the current procedure represents the economic value of State and private sector fringe benefits. This study should also highlight the points requiring improvement, if improvement is shown necessary to meet the requirements of the statute with accuracy This one-time study could be used in conjunction with the framework developed in Appendix E to revise the fringe benefit comparison.

Recommendation (14). The House Appropriations and Senate Finance Committees may wish to commission a one-time comprehensive study of fringe benefits.

VI. Are Projections of Future Differences in Compensation Adequate?

There is an 11-month gap between the survey data collection and the salary structure adjustment. Three methods have been used to bridge that gap through projections. One of these methods for estimating the projection is clearly superior to the others, but still needs major improvements.

WHY IS A PROJECTION NEEDED?

In the previous chapter, differences in salaries and benefits were examined in terms of the date when the DPT survey data are collected: August 1 of each year. But those who use the survey results to budget for the next fiscal year may wish to know what the corresponding differences would be eleven months later, when the new fiscal year begins. Consequently, a projection may be desired: from the estimated difference as of August 1, to estimates of what those differences may be as of the following June 30.

An alternative to projecting the future difference is simply to use the August 1 difference. The advantages of this approach are that it eliminates the additional error that forecasting into the future brings, and that its relative simplicity makes it much easier to implement. But the main disadvantage to this approach is that the State would always have an 11-month lag in responding to changes in the private sector job market.

Projections should attempt to take into account the anticipated changes in State and private sector compensation. But these projections themselves may be misleading if something important is left out. Even if all important variables are included, forecasts almost always have some degree of error, which adds to the error in the August 1 estimated difference. Furthermore, if the error in the August 1 estimated difference is of a large magnitude, the additional fine-tuning that is intended in the projection may be inconsequential.

METHODS FOR CALCULATING PROJECTIONS

Three methods have been used to project compensation differences to June 30 of the following year. These methods can be called the "Private Sector Only" approach, the "Annualized Proficiency Increase" approach, and the "Proficiency Increase Plus" approach. Each approach is discussed below Overall, it appears that the "Proficiency Increase Plus" approach comes closest to making an adequate projection. However, this approach still appears to need some correction and some refinement.

The "Private Sector Only" Approach

This approach assumes that State salaries and fringe benefits stay the same from August 1 to June 30, while salaries and fringes in the private sector increase. For example, in 1987 this approach predicted an increase of 4.90 percent in private sector compensation over the 11-month period.

Each year DPT projects the market movement in private sector salaries, which is used in this approach. Yet data from the DPT salary survey itself indicates that this estimate must be regarded as a rough guess, rather than as a precise number. For example, in the 1987 salary survey report, DPT states:

> Those firms in the survey which have planned salary structure adjustments during the next year project an average increase of 4.4%. Other reliable estimates of 1987 market movement are:
>
> American Compensation Association estimate - 5.2%
> Conference Board estimate - 5.5%
>
> If the 5.2% and 5.5% figures are averaged, the result is 5.35%. This average annual estimate is then adjusted to the eleven-month period between August, 1987 and July, 1988, and a market movement of 4.90% is predicted. This is somewhat higher than the projection derived from the survey, which was based on few responses.

This DPT practice of rejecting the 4.4 percent figure from its own sample because there are too few responses, and averaging the two alternative estimates, indicates that DPT as well recognizes that projections of this sort are highly prone to error.

The main problem with this approach is that it assumes the average State salary does not increase from August 1 to June 30, while assuming that the average private sector salary does. There is reason to believe that the average State salary would in fact increase due to thousands of employee salary actions occurring during this time period. Therefore, if a difference between average salaries is to be projected into the future, the State average salary must be treated in a manner that is consistent with the way the private sector average salary is handled. Changes should be assumed to occur in both.

The "Annualized Proficiency Increase" Approach

This approach assumes that the private sector compensation does not increase, but that State compensation does. In particular, this approach represents the 11-month change in State compensation as an annualized proficiency increase.

The proficiency increase is the 4.56 percent step increase a State employee receives after being in the same job for an additional year and receiving a satisfactory performance evaluation. Not all State employees are eligible for proficiency increases. State employees who have been in a job class for less than one year during a given time period, or those who are already at the top of their pay range at Step 8, are not eligible.

In summary, this method annualizes the cost of proficiency increases to the State, based on the estimated anniversary dates of State employees. Appendix F describes this method in greater detail. This approach is appropriate for projecting what the State could expect to pay in additional salary costs for a given fiscal year. This method indicates, as shown in Appendix F, that the State could expect to pay a salary cost increase of 1.50 percent due to proficiency increases from July 1, 1987 to June 30, 1988.

But this calculation does not adequately represent the average State employee salary increase due to proficiency increases. For example, when employees with merit reviews in the second quarter of the fiscal year receive proficiency increases, they do not receive an annualized 62.5 percent of a proficiency increase (as calculated in Appendix F); they receive 100 percent of a proficiency increase. Therefore, annualizing the salary costs is not an appropriate way to project change in average State salary levels.

This approach has other problems as well. The most fundamental is the inconsistency of ignoring market movement in private sector salaries while projecting increases in State salaries. The second problem is that other factors affecting changes in State average salaries, such as turnover and other changes in the mix of State personnel, are not taken into account.

The "Proficiency Increase Plus" Approach

This method assumes that private sector salaries could increase (in the same way as in the "Private Sector Only" approach), and that State salaries could increase because of proficiency increases and other salary actions. In early 1988, this approach predicted for FY 1988 an average State salary increase of 2.4 percent due to proficiency increases and other State salary actions.

This method appears to take more factors into account than the other two methods, and does not have the fundamental problem of inconsistently treating State and private sector salary changes. But this method has room for improvement as well. The biggest improvement would be to correct the time period of the projection.

Currently the 2.4 percent estimate represents the change in the average State salary over 12 months, from July 1 to June 30 of the following year. But the time period for projecting the difference between State and private sector salaries should

be 11 months, because DPT collects private firm data as of August 1, and comparable State compensation data should also be as of August 1. This problem can be easily reduced by pro-rating the 2.4 percent for eleven months.

Additional refinement can be made to individual components of this method. In the 1988 session, the estimated 2.4 percent average State salary increase consisted of two main components: the effects of (1) proficiency increases and (2) other salary actions.

Proficiency Increases. The current approach for projecting the effects of proficiency increases seems reasonable. It consists of multiplying the individual employee's proficiency increase by the proportion of individuals who are eligible. The proficiency increase for an individual employee is a step increase of 4.56 percent. As of early 1988, 60 percent of statewide employees were determined to be eligible for proficiency increases. This percentage is then assumed to apply for the entire 1988 fiscal year. This estimate appears to be taken from a single point in time, and has fluctuated from one year to the next.

The accuracy of the projection may be enhanced by calculating, for each of the most recent 24 pay periods with available data, the proportion of employees eligible, and then using the average of these 24 proportions as the estimated proportion of eligible employees for the next fiscal year. Alternatively, if the 24 pay periods show a steady downward trend in the proportion of eligible employees, then use of time series regression may be appropriate. Time series regression would be used to estimate the magnitude of the trend over the 24 pay periods, and to forecast the corresponding proportions for each pay period in the next fiscal year. The average value of the forecasted proportions would be used to project the effects of proficiency increases.

Other Salary Actions. The "other salary actions" component reflects several factors. It reflects turnover, promotions and demotions, increases or decreases in number of employees in each job class, regrades of individual job classes that have been targeted as unusually competitive and for which DPT has conducted separate salary surveys, and any other factor that is not represented by the annual salary structure adjustment and the proficiency increase estimate.

The "other salary actions" component is currently estimated as a projection from previous years' data. For instance, the "other salary actions" component for FY 1988 was calculated using the following three steps. First, for each year from FY 1981 to FY 1987, the actual average State employee salary, change in actual average salary from one year to the next, and the estimated change due to proficiency increases are calculated. For example, in FY 1987· the actual average State salary was $19,854, the change in actual average salary from FY 1986 to FY 1987 was 7.35 percent: and the estimated change in average salaries due to proficiency increases was 2.95 percent.

Second, for each year, the amount of change in actual average salary is divided by the salary structure adjustment and by the estimated proficiency increase. The residual amount of change is attributed to "other salary actions" For example, in FY 1987, the salary structure adjustment was 4.57 percent. Therefore, for FY 1987, 1.0735 (representing total change in actual average salaries) is divided by 1.0457 (representing the salary structure adjustment) and by 1.0295 (representing proficiency increases). The residual amount of change attributed to "other salary actions" in FY 1987 is -.28 percent.

Third, the projected "other salary action" factor for FY 1988 is simply the average of residuals from selected years assumed to be more typical (such as fiscal years 1981, 1983, 1986 and 1987).

Using the previous years' residuals is a reasonable way to guess what some future year's residual may be, if only a rough, easily-calculated guess is needed, and if it is reasonable to assume that conditions affecting "other salary actions" remain the same over the years. But there are problems in using this method if a precise estimate is desired, especially if it has to be sensitive to changing conditions over time.

For example, in projecting the "other salary actions" component for FY 1988, three of the previous seven fiscal years were considered too atypical to be included in the projection. This method implies that the year being projected has roughly a 43 percent chance of being so atypical that the projection would not appropriately apply Yet, one can reasonably argue that years in which no salary structure adjustments or proficiency increases are made should not be used to extrapolate for years in which they probably are.

Consequently, there are very few points from which to extrapolate using this approach, meaning that any resulting prediction is likely to be inaccurate, even though it is still probably better than one simply ignoring "other salary actions" of the past. This resulting prediction is still better, however, because there is systematic error occurring in the residuals (due to factors such as turnover, changing mixes of personnel in various job classes, and so on). But better predictions probably could be generated by estimating those systematic components of error more directly, rather than indirectly by simply using residuals.

The two systematic components of error in "other salary actions" that are the most feasible to estimate directly would be (1) turnover and (2) increasing or decreasing numbers of employees in each grade. These two factors would include the effects of promotions and demotions, and can be represented by projecting the change in employee mix (that is, the change in the proportion of total State employees in each step of each grade). One way to estimate directly the effect of these systematic components on the average State salary is shown in Appendix G.

Other factors affecting the "other salary actions" residual are much more difficult to predict. Regrades of specific job classes targeted for individual salary

reviews are very difficult to anticipate ahead of time, as are the effects of experimental merit increases that are currently being pilot tested. In addition, error in the proficiency increase and employee mix estimates would still be left in the remainder of this residual. Therefore, the best method currently available for projecting the remaining residual (after factoring out the change in employee mix) would still rely simply on remaining residuals observed in past years.

Estimating the future remaining residual should be improved. An improved calculation would entail three steps. First, separate adjustments for change in employee mix would be calculated for the last two or three years. Second, after taking out the effects of changes in employee mix, the remaining residuals from the last two or three years would be calculated. Third, these remaining residuals would then be averaged. This average remaining residual would be used as the projected remaining residual. In this way, the projected remaining residual is more sensitive to recent changes over time, compared to a more static projection based on an average including numbers from years long past.

The fundamental assumption that is made in projecting any residual for a future year, however, is that some factors have effects that simply cannot be estimated separately ahead of time. Therefore, any projection over time is subject to error. Keeping the error to a minimum, by pulling out systematic, predictable factors affecting the average State salary, is the best that can be expected of a projection.

CONCLUSION

Of the current approaches, the "Proficiency Increase Plus" approach seems to make the most sense for generating an approximation of the projected difference between State and private sector compensation. But this method needs to be corrected as an 11-month, rather than a 12-month, projection. Furthermore, refinements can be made, such as separately estimating the effects of change in mix of employees across grades and steps.

But a large amount of error may still exist in any projection, because the future may take unanticipated twists and turns. Therefore, when basing a budget on these projections, the additional error that projections introduce must be recognized, rather than assuming that projections taken to the second decimal place really have that high a degree of precision.

Recommendation (15). The method for projecting future differences in State and private sector compensation should be a corrected and refined version of the "Proficiency Increase Plus" approach.

VII. Implementing Study Recommendations

Some of the changes recommended in this study can be implemented in the 1988 or the 1989 salary survey Others require additional study of fringe benefits, which entails a longer time frame before results can be implemented. Further, JLARC staff recommend that DPT submit a plan for implementing the technical recommendations made in this study

Recommendations to be Implemented for 1988 or 1989 Salary Survey

(1) Change benchmark job classes according to annual review of existing and potential benchmarks.

(2) Stop sampling out-of-state or publicly-run medical centers to represent private sector employers in Virginia.

(3) Write clear, systematic definition of target population.

(4) Weight health sector data in sample in proportion to population.

(5) Stop deleting outliers solely because they appear too high or low

(6) Use personal interviews to follow up mail questionnaires.

(7) Provide reports of results to encourage participation.

(8) Proofread every element of sample data set.

(9) Use weighted means to represent State and private sector salaries.

(10) Estimate difference between State and private sector salaries taking sampling error into account.

(11) Increase the sample size.

(12) Collect fringe benefit data using employee profile that better matches average State employee characteristics.

(15) Correct and refine projection method.

Longer Term Recommendations

(13) Use weighted means to represent fringe benefit estimates, and calculate a range based on estimated sampling error.

(14) Commission comprehensive study of fringe benefits.

Recommendation for Implementation Plan

Recommendation (16). DPT should submit a plan by December 1, 1988, for implementing the technical improvements outlined in this study to the Governor and to the House Appropriations and Senate Finance Committees. In this plan, DPT should specify how much, if any, additional resources are needed to implement the changes recommended in this study

Appendixes

Appendix A
Possible Additional Benchmark Job Classes

class code	job class title	# of State Employees (w/related classes)	% of Total State Employees	comparable private sector jobs	related job classes
63043	highway equip mechanic A	499	0 69	equipment mechanic	63041 63042 63044
34102	facilities coordinator	467	0 64	facilities coordinator	34101 34102 34104 21032 21033 21034 61281 61282 61283 61284 72051 72052 72053 72054
72263	learning ctr supervisor B	401	0 55	youth home supervisor/director	72262 72264
44352	special activities asst	368	0 51	special activities assistant	44351 44353 44354
45011	psychologist B	224	0 31	psychologist	
34112	enrollment & student svcs specialist	207	0 28	admissions counselor	34111 34113
34093	instructional assistant	201	0 28	instructional asst	34094 34095 34096 34097 34098
62202	laundry worker B	189	0 26	laundry worker	62201 62204 62211 62212 62213
61222	power plant shift supervisor B	187	0 26	power plant shift supervisor	61221 61223 61224 61225
81022	agricultural technician B	180	0 25	agricultural technician	81021 81025 81026 81027
42311	rehabilitation physician	169	0 23	physician	42322 42323 42242 42244 42245 42246 42291
61091	laboratory instrument maker	164	0 23	lab instrument maker	61092
61153	printing press operator B	157	0 22	printing press operator	61154 61156 61158 61171 61174 61184 61185 61186
27333	employee relations manager	155	0 21	employee relations mgr	27331 27332 27301 27302 27311 27312 27341 27351 27352
22011	hospital administrative asst A	140	0 19	hospital administrative asst	22012 22013 22014 22015 12071 12072 12073
42242	resident physician (licensed)	136	0 19	physician	42244 42245 42246
22054	hospital accounts collection mgr	123	0 17	hospital accounts collection mgr	22051 22052 22053
27304	human resource director	123	0 17	human resource director	27301 27302 27303 27305 27311 27312 27331 27332 27333
63012	highway equip electrician	121	0 17	equipment electrician	63011 63013 63014 63015
61174	printing/bindery worker	120	0 17	bindery worker	61171 61154 61156 61157 61158
63046	highway equipment repair foreman A	116	0 16	equipment repair foreman	63047
12031	switchboard operator A	111	0 15	switchboard operator	12032 12033 12034
44362	central sterile supply aide B	106	0 15	sterile supply aide	44361 44363 44364 44365
61213	stationary boiler fireman B	102	0 14	stationary boiler fireman	61212
44314	physical/occupational therapist aide	101	0 14	physical/occupational therapist aide	44313 43014
43512	recreation supervisor B	94	0 13	recreation supervisor	43511 43513
44332	dental assistant B	94	0 13	dental assistant	44331 44333
23422	business manager B	93	0 13	business mgr(univ dept, agency div)	23421 23423
54173	drafting technician B	93	0 13	drafting technician	54172 54151 54152 54162 54163
42423	dentist	88	0 12	dentist	42412 42413 42414
32031	medical records technician	86	0 12	medical records technician	32032 32033
22023	research administrative officer B	81	0 11	research programs administrator	22022 22024 22027
35143	graphic artist illustrator B	79	0 11	graphic artist	35142 35144
15067	data base analyst	77	0 11	data base analyst	15061 15062 15063 15064 15068 15069
34072	institutional housing manager A	73	0 10	institutional housing manager	34073 34074 34062 34063 34064
53102	microbiologist A	67	0 09	microbiologist	

Appendix A (cont.)
Possible Additional Benchmark Job Classes

class code	job class title	# of State Employees (w/related classes)	% of Total State Employees	comparable private sector jobs	related job classes
11052	office manager	65	0 09	office manager	11053
27341	personnel development specialist	62	0 09	personnel development specialist	27342 27343
43031	speech pathologist	62	0 09	speech therapist	43032
52022	electrical engineer B	61	0 08	electrical engineer	52021 52023
52042	institutional plng/constr engineer B	61	0 08	institution planning & construction eng	52041 52043
53052	geologist B	53	0 07	geologist	53051 53053 53057
35103	photographer	46	0 06	photographer	35101 35104 35105
44383	animal care technician B	45	0 06	animal care technician	44382 44384 44386
35211	television production technician	43	0 06	television production technician	35212 35213 35215 35216
61184	printing services supervisor A	42	0 06	printing services supervisor	61183 61185 61186 61187 61188
44174	operating room tech	39	0 05	operating room technician	
52203	architect C	38	0 05	architect	52201 52202
62182	seamstress B	38	0 05	seamstress	62181 92183
61162	phototypesetting specialist	36	0 05	phototypesetting specialist	61164 61166 61167 61168 61169
61272	welder B	36	0 05	welder	61271
22062	hospital quality assurance coordinator	35	0 05	hospital quality control coordinator	22061 22063 22064
63101	highway sign fabricator	33	0 05	sign maker	63102
53082	marine scientist B	30	0 04	marine scientist	53081 53083 53084
62211	laundry manager A	30	0 04	laundry manager	62212 62213 62204
61111	locksmith	26	0 04	locksmith	64112
63045	highway equipment body repairman	25	0 03	body repairman	63021
14135	information technology manager	24	0 03	information technology mgr	14136 14139
81352	veterinarian	24	0 03	veterinarian	81351 81353 81356 81357 81358 81359
43242	respiratory therapy technician B	23	0 03	respiratory therapist technician	43242 43241
43275	radiation safety specialist	23	0 03	radiation safety specialist	43272 43274
44132	child care charge technician	21	0 03	child care charge technician	44131
41081	audiologist	17	0 02	audiologist	41082
33053	pilot command	16	0 02	pilot	
61293	barber/beautician	16	0 02	barber; beautician	
54292	survey chainman	15	0 02	survey chainman	54293 54294 54295 54296
64051	forklift operator	15	0 02	forklift operator	
45032	psychology test technician	14	0 02	psychological testing technician	
43262	electroencephalograph technician	12	0 02	electroencephalograph technician	43263
21521	legal assistant	11	0 02	legal asst	
35223	telecommunications services specialist	10	0 01	telecommunications services specialist	35222 35224

Total State Employees: 72,696 (April 1, 1988)

Appendix B

USING EXISTING DATA SOURCES TO ENHANCE THE PRECISION OF CURRENT ESTIMATES

DPT currently makes limited use of data from BLS; in the past it has also used VEC manufacturing salary data, though this practice has stopped. DPT's use appears relatively sporadic: used for some benchmark classes, not used for most classes; used merely as a check sometimes, substituting for DPT's salary survey data other times.

The principle guiding use should be to take full advantage of the strengths of all existing data sets, whether from another source such as BLS, or in-house as with the DPT salary survey The following sections outline current practice and future possibilities for the integration of existing data sets with the DPT salary survey, making maximum use of the strengths of each set of data.

The sections that follow outline how BLS or VEC data could be used for certain benchmarks, for some geographic areas or industry types or both, recognizing that the heart of the State's salary comparison must continue to be based on data collected by DPT in its own salary survey

Geographic Regions and the Use of BLS Data

DPT currently uses BLS Area Wage Surveys as a supplement to 10 benchmark classes and a substitute for five others, but treats them as another source of statewide data rather than for two regions only This practice is inappropriate and should be discontinued. Since BLS data are only representative of the Richmond and Norfolk metropolitan areas, BLS data should only replace DPT salary survey data from those two locations and be integrated with survey data for the rest of the State.

In the 1987 salary survey, DPT used data from BLS to supplement DPT data for 10 benchmark jobs. More importantly, DPT used five salary averages from BLS data to form exclusive benchmark job classes which were not available through the DPT survey· Highway Equipment Operator, Senior Secretary, Fiscal Technician, Senior Executive Secretary, and Computer Lead Operator. These additions are important as three of these five classes are among the 15 largest classes in the State in terms of number of employees, and represent about 5,000 State employees.

Current practice is to weight the BLS benchmark job salary average as equal to the average of private sector non-medical firms and also the average of the medical firms, if either or both is available. Therefore, BLS data for some benchmark classes may carry a weight of: 100 percent, where no other data are collected by DPT; 50 percent, where DPT collects only data from non-medical private firms; and, a

weight of 33 percent, where DPT collects both medical and non-medical data. This weighting scheme is clearly inappropriate. All existing data should be weighted according to its occurence in the population of interest, either the population of State employees covered by that data (e.g., for BLS data, the proportion of State employees in Richmond and Tidewater) or the population of private sector employees (e.g., for health sector data on non-health job classes, the proportion of health employment to all private employment in the State).

Each year, BLS obtains wage and related benefit data from manufacturing and non-manufacturing firms, exclusive of construction and mining industries and firms with fewer than 50 employees. BLS uses field representatives to obtain data by personal visits every third year, with mail and telephone data collection on other years. A new randomly-selected sample is selected every three years to coincide with personal visits. Annual area wage surveys are collected for Northern Virginia, Richmond, and Norfolk-Virginia Beach-Newport News.

Some obvious advantages are suggested by the availability of this data. First, the sample is randomly selected with a large sample size, over one hundred and twenty five firms were selected for both the Richmond area and the Norfolk area in 1987 Therefore, the BLS data is certain to contain less randomly-distributed error than data currently available through the State salary survey Second, the data are available at nominal cost. Third, small firms are represented to a greater degree in the BLS Area Wage Survey In short, BLS salary data is almost surely more accurate, where it applies, than the current salary survey

The use of secondary data from BLS can represent problems as well as opportunities. DPT cannot control the job matching, though BLS procedures for obtaining a match appear similar to those employed by DPT. Further, the State cannot expect to control the timing of BLS releases, although both relevant surveys have been reported annually in recent years. Also, DPT is concerned with the high proportion of production industries surveyed by BLS, which may be appropriate for BLS but not match the State's true target population. Further discussion of this point must await action by DPT to specify more clearly its target population.

The most important limitation of BLS Area Wage Surveys is that only the State's largest metropolitan areas are covered by annual reports; Northern Virgina, Richmond, and Norfolk-Virginia Beach-Newport News. Following the practice of excluding Northern Virginia from the statewide survey, this leaves only two geographic areas, with less than one-half of the State's employees.

DPT acknowledges that the use of BLS data reduces the effects of bias which may occur in the State salary survey by its present usage of that data. In this context, taking full advantage of the strengths of the data means replacing DPT survey responses from Richmond and Tidewater with BLS data, and weighting the estimate from BLS data proportionate to the proportion of State employees in those areas (0.43). The estimate for the rest of the State should be weighted according to its proportion of State employees (0.57).

Industry Type and the Use of VEC Data

The Virginia Employment Commission (VEC) currently conducts a survey of manufacturing data two out of every three years. In contrast to the eight manufacturing respondents surveyed by DPT for the present salary survey, VEC surveys 3,300 firms of which 40 percent responded in 1987 Consideration may be given to substitution of VEC data for some DPT salary data.

Factors favoring this substitution include the fact that with a far greater sample size, more accuracy should be obtained by the VEC data. Further, the survey is already conducted two out of three years, therefore requiring only somewhat more work from VEC to make the survey annual.

However, there are also obstacles. The first is the VEC timetable for publication of results. Currently, results for a given year are due in mid-summer of the following year, and would have to be pushed forward to accomodate the need for data in the fall of the same year it is collected. Second, VEC would have to collect data every year, not two out of every three years. Third, VEC and DPT occupational classifications would have to coincide or be made to coincide.

Assuming VEC data were available for every year on a consistently timely basis, DPT could substitute the VEC results in place of its manufacturing firms where VEC data contains a State benchmark class. Where state benchmark classes cross industry types, VEC data could be used to substitute for that portion of DPT data which is collected from manufacturing firms, with DPT data comprising the remainder of salary data for that class: all data weighted according to the occurence of that industry in the State economy Since manufacturing makes up 20 percent of the State's economy, estimates from VEC data should be weighted .20 and DPT other-sector estimates, .80.

In the past, DPT made selected use of VEC data, employing it in nine benchmark classes in 1982. VEC data may be expanded to replace DPT data for all manufacturing firms, and weighted in accordance to the percentage of manufacturing employment to total nonagricultural employment in the target population.

In order to accomodate DPT's needs in this way, VEC should reschedule its Survey of Manufacturing Firms and coordinate its use as part of the data base for the State salary survey

Four Categories of Benchmarks for Integrating Existing Data

There are four types of benchmarks which must be handled differently if existing data sources are to be appropriately integrated with DPT's salary survey

Benchmark Type I. For this type of job class, only DPT sample data can be used. Such classes would have job descriptions unique to the DPT survey and not

found in either the BLS or VEC surveys. Another type of job class which would fall in this category is one with a BLS or VEC job description that is close but not exactly matching that of the DPT benchmark job class.

Benchmark Type II. For this type of job class, DPT data would be supplemented only by BLS data. In this case, BLS would have a comparable job description to DPT's benchmark class description. BLS data would then be weighted by 43 and the BLS weighted estimate averaged with the weighted estimate from the DPT survey (the weight being .57), after deleting any DPT sample responses from the two BLS regions. This class would not be matched with VEC data because no VEC job description corresponds to DPT's.

Benchmark Type III. For this type of job class, DPT data would be supplemented by only VEC data. In this category, VEC would have a comparable job description. The VEC estimate would be weighted by .2 and averaged with the weighted estimate from the DPT survey, subtracting out any manufacturing respondents from the DPT sample before averaging. This type of job class would not be matched with BLS data because no BLS job description is comparable.

Benchmark Type IV. For this type of job class, DPT data would be supplemented by both BLS and VEC data. In this category, both BLS and VEC would have comparable job descriptions to DPT's. Also, the DPT survey for that benchmark would include a match with some manufacturing firms' jobs. BLS data would replace DPT data for the two large metropolitan areas and VEC data would replace DPT data for all manufacturing firms outside the two metropolitan areas that are covered by BLS. DPT sample data would be used for non-manufacturing firms from all other regions. Weights would be applied as follows: the BLS estimate would be weighted 43, the VEC estimate would be weighted by .2, and the remaining DPT responses would be averaged and weighted .37

Appendix C

USING THE MODE, THE MEDIAN, AND THE MEAN TO SUMMARIZE STATE BENCHMARK SALARIES

In Chapter IV, the mode, the median, and the mean were mentioned as possible measures to summarize State salaries.

THE MODE

The mode in this case would be the salary which happens to occur the most frequently This measure of central tendency is the crudest because it does not in any way take into account what the other salary values may be, when the median and the mean do. Therefore, it makes more sense to use the median or the mean instead of the mode in this situation.

THE MEDIAN

The median is determined first by rank-ordering values (in this case, salaries) from highest to lowest. Then the centermost value in this rank order is taken when there is an odd number of observations. With an even number of observations, the average of the two centermost values is taken. This centermost value (or average centermost value) is the median.

The advantage of a median in general is that when a distribution of values is skewed, the median is not influenced by extreme values. Because the rank order of values determines the median, it is not influenced by how distant an extreme value may be from the center of the distribution. Therefore the median is resistant to being influenced by the skew of the distribution. But this property is also a disadvantage, if the value of every observation should be taken into account, rather than focusing on the centermost value only When summarizing State or private sector benchmark salaries, it makes more sense to take the values of all salaries into account and summarize them, even if the distribution is skewed, rather than ignore all except the centermost values.

THE MEAN

The mean is the sum of all values divided by the number of observations. Of the three measures of central tendency mentioned above, the mean is the most

sensitive to all values in the distribution. This sensitivity, however, can be a disadvantage if the "typical" value is expected to fall in the middle of the central cluster of values, especially if the distribution is skewed. In this case, the mean would be influenced by the extreme values, so that it may be distant from the middle of the central cluster of values.

But in the present situation of summarizing State or private sector salaries, the "typical" salary as the central value of a cluster should not be the focus of attention. Rather, the measure of central tendency should summarize all benchmark salaries, especially extreme values if they happen to represent larger numbers of State employees. So a mean appears to be the more appropriate measure of central tendency for this situation.

But a problem with using the simple mean as a summary measure for State salaries is that it gives as much weight to those job classes with relatively few State employees as it does to those job classes with larger numbers of employees. The consequence of not resolving this weighting problem is explained in Chapter IV

Therefore, a weighted mean should be used. The benchmark State salaries representing greater numbers of State employees in those benchmark positions should have greater weight when summarizing across job classes.

Appendix D

CALCULATING CONFIDENCE INTERVALS

Because a sample is used as a proxy for the entire population of private sector salaries, the observed weighted mean private sector salary derived from the sample is almost certain to be different from one derived from the entire population (if it were possible to observe it). To be reasonably confident that an inference about a weighted mean is correct, a confidence interval is often constructed, which takes the form:

Population Weighted Mean = Sample Weighted Mean ± Sampling Error

The crucial question is: How wide must this allowance for sampling error be? The answer depends on how much the sample weighted mean would fluctuate if alternative samples were drawn.

The first step is to decide on the desired degree of confidence that the estimated interval is right: that it does indeed bracket the value of the population weighted mean. The 95 percent level of confidence is commonly chosen. According to statistical theory, this level of confidence would give a correct interval estimate 19 out of 20 times if alternative samples were drawn.

The next step is to calculate the sampling error at the 95 percent level of confidence. Statistical theory indicates that the sampling error which would produce the narrowest interval estimate is:

Sampling Error = 1.96 x Standard Deviation of Sample Weighted Mean

In the example in Chapter IV, the sample weighted mean of private sector salaries is $18,464. The standard deviation of this sample weighted mean is 861. The confidence interval at the 95 percent confidence level is:

$$18,464 \pm 1.96 \times 861$$

which produces a minimum value of $16,778 and a maximum value of $20,151.

Appendix E

AN ALTERNATIVE APPROACH TO CALCULATING PRIVATE SECTOR FRINGE BENEFITS

Currently, DPT collects a single set of benefit information from each firm. The firm reports its practices regarding several benefits, and levels are reported based on a single hypothetical employee. DPT's current data collection process reveals that different firms offer different levels of the same benefits. However, this survey only captures a rough estimate of the actual provision of fringe benefits for several reasons: DPT limits the number of benefits used in the comparison, DPT limits the accuracy of the employee profile used to measure the benefit level, and DPT currently does not consider the possibility of variable benefits by benchmark job class.

This appendix discusses a more complete method for collecting and analyzing benefit information. First, several aspects of an ideal model for collection and analysis of benefits is presented, and obstacles to implementation of this ideal model are considered. Then, a workable method which incorporates some of the ideal model's improvements on present practice, while dealing with these obstacles, is presented.

Whatever process is selected, the final result should be a single number which reflects the average cost of employee benefits offered by the private sector to an employee comparable to the average State employee. The better the process, the better that single number reflects the bulk of the data on fringe benefit levels supplied by the private sector.

AN IDEAL APPROACH FOR REPRESENTING FRINGE BENEFITS

An ideal model for representation of private sector fringe benefits should capture all of the important ways in which fringe benefits are likely to vary between firms and between employees within a given firm. Then the ideal model would use a summary statistic, including a margin of error, which best summarizes this information for comparison with State fringe benefits. The aspects of private sector fringe benefits which require alteration from present practice are (1) expansion of the number of fringe benefits, (2) alteration of the employee profile, and (3) variation in fringe benefits by benchmark class. However, data collection difficulties appear to make implementation of the ideal model impractical.

Expansion of the Number of Fringe Benefits

Private firms not only choose unique levels for benefits, but offer unique mixes of benefits. In particular, some private firms may offer types of benefits to

employees that are unavailable to State employees. Rather than including all benefits when analyzing the difference in benefits between State and private sector practices, DPT selects only those benefits available to State employees. Exhibit 3 shows the types of benefits DPT was collecting as of 1983. The underlined benefits are the only ones currently collected and used to analyze the total compensation difference. The other benefits have never been used in the total compensation analysis and are no longer collected.

Exhibit 3

TYPES OF FRINGE BENEFITS

Holidays	Social Security	Product Discount
Vacations	Disability Plan	Savings or Thrift Plans
Sick Leave	Life Insurance	Stock Plans
Other Leave	Service Facilities	Bonus or Profit-Sharing
Health Plan	Social and Miscellaneous Services	Parking
Pension Plan	Tuition Reimbursement	Gifts

Note: Underlined benefits are presently used in calculating a total compensation difference.

Source: DPT Issue Paper on Current Survey Methodology, December 1983.

This practice excludes other forms of compensation which may be of considerable importance to employees, and may introduce a systematic bias. For example, under-representation of private sector total compensation may occur if stock options and profit sharing form a non-negligible portion of an employee's total compensation.

DPT currently collects both a percentage of salary and a dollar amount for selected benefits. A ideal model survey would average the total dollar value of all benefits whether widely offered or not. The result would be added to salaries to form a picture of total compensation which is closer to an actual total. However, data collection difficulties can be expected (see "Problems with the Ideal Approach" below). A one-time comprehensive study of fringe benefits can suggest whether inclusion of all benefits is necessary, based on their actual availability

Variation in Fringe Benefits by Employee Personal Characteristics

Rather than offer a single uniform benefit to all employees, firms are likely to pay different levels of benefits for employees with different characteristics DPT's

use of a single set of employee personal characteristics may result in misleading summaries of a firm's benefits. DPT should ask private sector respondents to report benefit amounts using an employee profile based on the actual average of State employee characteristics.

Certain benefits are supplied to employees based in part on personal characteristics. In particular, the cost to the employer of retirement benefits and annual or sick leave may vary according to the employee's years of service. Health benefit provision may vary based on the number of dependents. Reliance on a single, hypothetical profile for years of service and number of dependents to be covered leaves benefit information only as accurate as the profile's accuracy

The present profile of the typical State employee appears somewhat arbitrary Therefore, the level of benefits offered by the average private firm which is currently reported may not be characteristic of that firm's benefit level for an employee which better reflects the average State employee. For example, assume the average State employee actually has eleven years of service, not the six presently used. Further assume that most private firms do not vest employees in their retirement system until the tenth year of service. Therefore, the current employee profile represents an employee whose private firm retirement benefits are understated relative to the actual average employee under the same system.

Capturing the value of fringe benefits that best reflects the personal characteristics of a average State employee is a straightforward matter. The central tendency of State employee characteristics could be calculated from DPT records and used to replace the present employee profile on the fringe benefit questionnaire.

Variation in Fringe Benefits by Job Class

Rather than offer a single uniform benefit to all employees, firms may selectively offer certain benefits based on an employee's position within the firm. For example, profit sharing or stock may only be offered to higher level employees. DPT's use of a single salary without reference to a benchmark job may produce misleading summaries of a firm's benefits. An ideal approach to fringe benefits by job class includes both data collection and data analysis changes to current DPT procedures. However, these changes may create substantial data collection difficulties, requiring an alternative approach which is more workable.

Data Collection Changes. Data collection for fringe benefits would include not only information on each benefit for a given firm, but each benefit by benchmark class for a given firm. This represents an ideal approach to capturing the full variablility of fringe benefits. Obviously, substantially more data would be collected under this approach. DPT notes that the response rate for the fringe benefit section of the survey is already below the salary section, and this addition may cause greater declines in response rates.

Data Analysis Changes. Despite the greater volume and variety of data created by the addition of fringe benefits by benchmark class, a single fringe benefit dollar amount is still needed to compare to the State figure. However, the single summary statistic would better reflect the central tendency of actual fringe benefit offerings across all benchmarks comparable to State jobs, if firms vary their benefit package by job class. One purpose of a one-time, comprehensive study of fringe benefits could be to determine whether private sector benefits do vary across benchmark job classes sufficiently to warrant data collection at this level of detail.

DPT currently reports a fringe benefit amount for each firm and then averages that amount to form a single mean benefit level for the private sector to be compared to the single State employee benefit level. With the addition of data not only by firm but by benchmark class, a different approach is needed to arrive at a central tendency which reflects the average benefit level, accounting for diverse job classes: a weighted mean of the firm's benefit levels.

The weighted mean for all private sector fringe benefits can be derived from the following formula:

$$\sum_{i} \sum_{j} \sum_{k} D_{ijk} B_{j} F_{jk} \qquad (1)$$

where:

- Dollar amount for fringe benefit i, benchmark j, and firm k: D_{ijk},
- Weight corresponding to the proportion of State employees in benchmark j: B_j, where the sum of all B_j equals one, and
- Weight corresponding to the inverse of the number of firms with jobs in benchmark j: F_{jk}, where the sum of all F_{jk} equals one.

This formula includes each of the fringe benefits selected for the survey, which is currently eight but could ideally be expanded to all eighteen shown in Exhibit 3. The resulting summary statistic represents what private sector counterparts pay their comparable employees in fringe benefit compensation. This formula accounts for varying fringe benefits, varying number of benchmark jobs represented by a given firm, and single firm's proportion of all firms with that benchmark. The single dollar amount will represent a weighted mean fringe benefit level for the private sector. It better reflects actual conditions in the private sector for positions comparable to State jobs.

Once the formula is computed, it must be used to replace the dollar amount currently used to represent the value of fringe benefits in the private sector. Therefore, this ideal average dollar amount of fringe benefits for the private sector will be added to the dollar amount of private sector salaries to yield a more realistic

private sector total compensation amount. A final step computes the percentage deviation between the total compensation packages of the private sector and the State.

Problems with the Ideal Approach

The greatest obstacle faced by this more ambitious fringe benefit calculation occurs in the collection of detailed fringe benefit data. DPT currently reports difficulty in eliciting responses to the fringe benefit portion of the survey The ideal approach described in this appendix increases data collection in two ways; (1) DPT would return to collecting data on eighteen benefit categories rather than the present eight and (2) DPT would collect benefit data within each firm by benchmark class, potentially multiplying the information a firm is asked to supply

The response rate to DPT's fringe benefit survey may suffer substantially due to vastly increased demands on the respondent. This problem could seriously bias the results, or even make the fringe benefit portion of the salary survey impractical. Because of this concern, an alternative approach which takes data collection problems into account is appropriate.

A WORKABLE ALTERNATIVE APPROACH

Concerns about data collection difficulties with the ideal model require compromises to achieve a workable survey of fringe benefits, but one that improves the current survey Data collection would change slightly but no greater demands on respondents are anticipated at present. Data analysis changes provide a middle ground between the current approach and the ideal described above.

Data Collection

Rather than collect a mix of fringe benefits by benchmark class within the firm, it makes more sense to continue the current approach of basing the fringe benefit data on a single hypothetical employee, correcting the profile as noted above. This approach merely changes the employee profile on the survey and requires no additional work on the part of the respondent. Further consideration of breaking down responses by benchmark class should await the recommended one-time study of fringe benefits, which would provide better information on the relative importance of this step than is currently available. There is no reason to undertake the more involved data collection if few firms offer differential benefits by job class.

In further recognition of data collection difficulties, no benefit categories should be added until the recommended one-time study suggests benefits which provide important forms of compensation not available to State employees.

Data Analysis Using Unique Weights for Each Firm. Variability of benefits by benchmarks can be captured by proxy Since firms typically have only a few benchmark classes, the variation witnessed between firms may result from different mixes of benchmark jobs. Therefore, firms may act as a proxy for benchmark variation, assuming all else is constant across benchmark classes. Each firm can be assigned a weight. This weight is determined by: (1) the number of job classes the firm has which match the benchmarks, and (2) the proportion of State benchmark employees that are represented by each particular benchmark matched by the firm. For each firm responding to the survey, determine:

- Dollar amount for fringe benefit i and firm k: D_{ik},
- Weight for firm k which represents how frequently the firm competes with the State for benchmark employees: W_k, where the sum of all W_k equals one.

The weight for firm k can be derived from the following formula (using notation described in expression 1):

$$W_k = \sum_j B_j F_{jk} \qquad (2)$$

The weighted mean for all private sector fringe benefits can be derived from the following formula:

$$\sum_i \sum_k D_{ik} W_k \qquad (3)$$

DPT can implement this approach without asking the firms for more information. The firm's benefit amount would be weighted appropriately by summing the weights of the benchmarks it contains. A weighted mean will be established to represent the private sector. Then, the State mean, reflecting the average employee profile, will be calculated.

As with the weighted mean for salaries (discussed in Chapter IV), the weighted mean for private sector fringe benefits is calculated using sample data. This estimate is bound to differ from one calculated using data taken from the entire population, if it were possible. Therefore, a standard deviation of this sample weighted mean must be calculated, which can be used to determine how much error in our weighted mean estimate is attributable to sampling.

This standard deviation can be calculated as follows. Within each fringe benefit category, the variance between firms in that benefit category is computed, and divided by the number of firms featuring that benefit. Then this within-benefit variance is weighted (by the square of the proportion of total State benchmark employees that firm represents, W_k). All of these weighted within-benefit variances are then summed. The square root of this sum equals the standard deviation of the weighted mean.

From this point, the difference between State and private sector fringe benefits is calculated by applying the standard deviation to the weighted mean, exactly as it is done in Chapter IV for salaries, using the same level of significance chosen for salaries. The total compensation difference is calculated by adding the minimum value of the range for fringe benefits to the minimum value of the salary range to yield a minimum level of total compensation. The same procedure would be applied to the maximum.

Appendix F

METHOD FOR CALCULATING ANNUALIZED COST OF PROFICIENCY INCREASES

The following explanation is taken from DPB's Central Accounts Manual.

Simply stated, the proficiency factor is the resultant annualization of a proficiency increase an employee receives during the year. For example, employee "A" has a merit review date of January 1, and he expects a one step proficiency of 4.56% every year on that date. On July 1, 1986 his salary was $20,000 (includes the July 1, 1986 pay adjustment of 4.57%, or $874). On January 1, 1987 his salary was $20,919. The agency will pay this employee during 1986-87 $20,456 — not $20,919. The additional $456 is the actual cost in 86-87 The annualized proficiency factor is $456 divided by $20,000 which is 2.28%. The first year cost of the salary increases are $874 (pay adjustment) + $456 (6 months of proficiency) or $1,330. The base adjustment increase is $874 + $919 or $1,793. Accordingly, the first year salary regrade allocation for this employee would be $1,330.

On July 1, 1987 the employee is granted a pay adjustment of 4.56%. His salary on July 1, 1987 will be $21,872. His July 1, 1986 salary has now been increased $919 due to first year proficiency and $953 due to pay adjustment — total increase $1,872. The $919 is the continuation proficiency and is the full step increase that was granted during year one continued into year two. It will cost the agency a full merit step. On January 1, 1988 this employee will again receive a merit review and corresponding proficiency increase of 4.56% and his salary will be $22,869, but the agency will have to pay only 2.28%, of the adjusted base or $499. The total cost in the second year of the biennium for this employee's salary regrade is $874 + $953 + $919 + $499 or $3,245. His base salary, however, has increased by $3,743.

Obviously it would be impracticable to do the above individual analysis on all 90,000 state employees. A report called the 1B/1C, although not perfect, provides agency proficiency costs for each year. Specifically, the report takes a snapshot of PMIS data (based on the most recent payroll data input) and projects the proficiency costs by agency for each year of the next biennium. Merit dates are factored in the projections. Agency proficiency factors are then manually calculated using the data from the 1B/1C.

There is a method used to calculate statewide proficiency factors. These results are used during the development process to make projections. The following describes the methodology·

Merit review dates for proficiency adjustments occur virtually every pay period throughout the fiscal year. The percent of merit reviews by quarter is displayed below·

First Quarter	29.4%
Second Quarter	22.8%
Third Quarter	26.7%
Fourth Quarter	21.1%
TOTAL	100.0%

Not all employees receive a proficiency adjustment. The Department of Personnel and Training calculates that 64.5% of statewide employees are eligible for proficiency increases.

If we make the assumption that the midpoint of the quarter is a reasonable weighted apportionment for each quarter, the following can be determined:

(A) Quarter	(B) Months Remaining At Quarter Mid Point	(C) Proportion of Fiscal Yr Remaining	(D) Proficiency Frequency From Above (col B/12 mo.)	(E) Proportion of Annual Sal Increase (col C x col D)
1	10.5	.875	.294	.25725
2	7.5	.625	.228	.14250
3	4.5	.375	.267	.10013
4	1.5	.125	.211	.02638
TOTAL				.52626

This calculation tells us that of the 29.4% first quarter reviews, the annualized equivalent is 25.725%; of the 22.8% second quarter reviews, the annualized equivalent is 14.25% etc. The annualized total is 45.626%.

Based on the proportion of annual salary increase required, as calculated above, the first year statewide proficiency factor can be derived as follows:

Step Increase x % Eligible x Proportion of Annual Salary Increase Required = Statewide Proficiency Increase Required

4.56 x .646 x .52626 = 1.5502 say 1.55%

The statewide continuation proficiency factor is calculated in the same fashion with one exception — the proportion of annual salary increase factor is 1.0. The continuation proficiency adjustment begins on the first day of the fiscal year for each employee. The calculation is displayed below

4.56 x .646 x 1.0 = 2.94576 say 2.95%

The *Code of Virginia* § 2.1-114.6 states in part, "it is a policy of the Commonwealth that its employees be compensated at a rate comparable to the rate of compensation for employees in the private sector of the Commonwealth in similar occupations. An annual review shall be conducted by the director of Personnel and Training to determine where discrepancies in compensation exist as between the public and private sectors of the Commonwealth." The compensation review requires an analysis of the Commonwealth's workforce to determine the occupational groups and geographical locations in which the Commonwealth must compete. The outcome displays the data necessary to provide an informed impression of the competitiveness of the Commonwealth's compensation plan.

The measure of competitiveness involves projecting the Commonwealth's market position from the date of the survey — August of each year — to the normal date that the State's salary structure is adjusted, normally on July 1 each year. The August 1986 review indicated a current deviation of 5.13% and a projected deviation on July 1, 1987, of 10.43%. The recommended pay adjustment for July 1, 1987, was applied to the current deviation of 5.13% (This is the known deviation, not a projected variable.) The 5.13% represented the entirety of the pay adjustment, i.e., it contains the pay structure adjustment and the proficiency adjustment.

We have calculated the statewide proficiency for the first year as 1.55%. Since the 5.13% increase includes the 1.55%, we must now calculate the pay structure adjustment. The formula is depicted below:

Structure Adjustment x Merit = Market Movement (Deviation)

or,

Structure Adjustment = Market Movement/Merit

Structure Adjustment = 1.0513 / 1.0155 = 1.0352

say 3.52%

The General Assembly may increase the total pay package as it did in the 1987 session. An additional 1.04% was added to the structure that gave us a total of 4.56% instead of the 3.52%. The additive total was 6.17% (5.13% + 1.04%). The purpose was to reduce the 10.43% projected July 1, 1987 deviation rather than to just address the current deviation.

In August 1987, the Commonwealth lagged its competition in total compensation by 4.59%. The projected market movement from August 1987 through June 1988 is 4.90% and when coupled with the August current deviation, the projected deviation on July 1, 1988 will be 9.72%.

The current policy had been to provide a pay adjustment that equalled the August current deviation. As was discussed earlier, this adjustment is made up of two

parts, a structure adjustment and an annualized proficiency adjustment. Updating the merit review data from DPT, the following new factors are calculated:

First Quarter	32.8%
Second Quarter	24.6%
Third Quarter	21.2%
Fourth Quarter	21.4%
TOTAL	100.0%

Again, if we make the assumption that the midpoint of the quarter is a reasonable weighted apportionment for each quarter, the following can be determined:

(A) Quarter	(B) Months Remaining At Quarter Mid Point	(C) Proportion of Fiscal Yr Remaining (col B/12 mo.)	(D) Proficiency Frequency From Above	(E) Proportion of Annual Sal Increase (col C x col D)
1	10.5	.875	.328	.28700
2	7.5	.625	.246	.15375
3	4.5	.375	.212	.07950
4	1.5	.125	.214	.02638
TOTAL				.54663

This calculation tells us that of the 32.8% first quarter reviews, the annualized equivalent is 28.70%; of the 24.6% second quarter reviews, the annualized equivalent is 15.37% etc. The annualized total is 54.7%.

The Department of Personnel and Training now estimates that 60% of statewide employees are eligible for proficiency increases.

The proficiency step increase is fixed at 4.56%.

Based on the proportion of annual salary increase required, as calculated above, and adjusting for those that do not receive proficiencies, the first year statewide proficiency factor can be derived as follows:

Step Increase	x	% Eligible	x	Proportion of Annual Salary	=	Statewide Factor Increase Required
4.56	x	.60	x	.547	=	1.4965 say 1.50%

Accepting the annualized proficiency increase of 1.50%, then the pay structure adjustment is calculated by dividing the August deviation by the annualized proficiency increase:

1.0459 - 1.0150 = 1.030443 say 3.04%

Appendix G

METHOD FOR DIRECTLY ESTIMATING EFFECTS OF CHANGING EMPLOYEE MIX ON AVERAGE STATE SALARY

Turnover, promotions, demotions and vacancies affect the average State salary by changing the mix of State employees in various grades and steps. One way to estimate directly the effects of a changing mix of State employees is outlined in the following steps.

For the 24 most recent pay periods for which data are available, determine:

- Total number of employees entering each grade i and step j at pay period t: p_{ijt}.
- Total number of employees leaving each grade i and step j at pay period t: q_{ijt}.

For the pay period immediately prior to the 24 most recent pay periods, determine:

- Number of employees in each grade i and step j: r_{ij}.
- Salary in each grade i and step j: s_{ij}.

The proportional change in the average State salary due to changes in the mix of State employees can then be estimated with the following formula:

$$\frac{\sum_i \sum_j \left[\sum_t \left(\frac{1}{24}\right)\left(p_{ijt} - q_{ijt}\right)\right]\left(s_{ij}\right)}{\sum_i \sum_j r_{ij}\, s_{ij}}$$

This estimate assumes that the proportion of employees entering and leaving each given step and grade for the year examined (represented by the 24 pay periods) will be the same in the predicted fiscal year. But if there are known changes in staffing levels for particular steps and grades in the upcoming fiscal year, then this estimate can be modified.

For example, suppose that it is known that a certain number of new employees in grade x and step y will be hired in the next fiscal year, which can be represented as h_{xy}. Then the estimate can be modified to take this known upcoming change into account:

$$\frac{\sum_{i \neq x}^{} \sum_{j \neq y}^{} \left[\sum_t \left(\frac{1}{24}\right)\left(p_{ijt} - q_{ijt}\right)\right]\left(s_{ij}\right) + \sum_x \sum_y \left[h_{xy} - \sum_t \left(\frac{1}{24}\right) q_{xy}\right]\left(s_{xy}\right)}{\sum_i \sum_j r_{ij}\, s_{ij}}$$

This modification substitutes the known number of entering employees in the upcoming fiscal year for the average number of entering employees in the 24 previous pay periods. In other words, instead of assuming that the upcoming fiscal year will have the same average proportion of entering employees as seen in the 24 previous pay periods, a more certain estimate for a given grade and step can be substituted into the formula. This modification requires knowing ahead of time how this known change will affect the total number of employees entering a specific grade and step.

Furthermore, suppose that one knows ahead of time that certain job classes will be eliminated and others created; and suppose that we can infer ahead of time how these known changes will affect the total number of employees entering or leaving a specific grade and step. Then the formula can be modified to take this known change into account as well:

$$\frac{\sum_{i\neq a,x}\sum_{j\neq b,y}\left[\sum_{t}\left(\frac{1}{24}\right)\left(P_{ijt}-q_{ijt}\right)\right](s_{ij})+\sum_{x}\sum_{y}\left[h_{xy}-\sum_{t}\left(\frac{1}{24}\right)q_{xy}\right](s_{xy})+\sum_{a}\sum_{b}\left[\left(\sum_{t}\left(\frac{1}{24}\right)\left(P_{abt}-f_{ab}\right)\right)\right]}{\sum_{i}\sum_{j}r_{ij}s_{ij}}$$

where f_{ab} represents the known number of employees leaving grade a and step b.

Appendix H

STUDY MANDATE

1988 Appropriations Act, Item 13

> "The Joint Legislative Audit and Review Commission shall conduct a study of the methodology employed in the annual state salary survey The study shall include, but not necessarily be limited to 1) the methods used to compile and evaluate data reported in the survey, and 2) the methods used to determine the minimum percentage salary scale adjustment for state employees. The Commission shall report its findings to the Governor and the Chairmen of the House Appropriations and Senate Finance Committees by September 15, 1988."

(This amendment requests JLARC to conduct a study of the Annual State Salary Survey)

Appendix I

AGENCY RESPONSE

As part of an extensive data validation process, each State entity involved in a JLARC assessment effort is given the opportunity to comment on an exposure draft of the report. This appendix contains the response by the Department of Personnel and Training. Appropriate technical corrections resulting from the written comments have been made in this version of the report.

OCT 2_ --

COMMONWEALTH of VIRGINIA

Department of Personnel and Training

CHONG M. PAK
DIRECTOR

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101 N. 14th STREET
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October 15, 1986

Mr. Philip A. Leone, Director
Joint Legislative Audit and
Review Commission
Suite 1100
General Assembly Building
Capitol Square
Richmond, Virginia 23219

Dear Phil:

Attached is the Department of Personnel and Training response to the exposure draft of your report The State Salary Survey Methodology.

I appreciate the opportunity to comment on this exposure draft. In particular, I am most appreciative of the time that you and Dr. Greg Rest afforded me and my staff in the various discussions concerning your findings.

As indicated in our detailed response, there are several important issues that require further consideration as we move forward to develop the implementation plan.

A determination should be made that either the August survey data or the projected data for July 1 of the following year, will be used to adjust salaries.

A decision should be made as to whether the survey is to be based upon empirical statistics or upon descriptive statistics which focus primarily on market movement.

Random samples and error estimates are not the basis used for compensation management. Our experience has shown that statistical surveys often result in undesirable fluctuations from year to year. We think therefore that there is risk associated with the proposed "weighted average" approach and that it should undergo careful testing before implementation.

Consideration should be given to compensating responding firms as a means of increasing participation. This could provide a meaningful incentive, particularly for smaller firms at a modest cost.

-Removal of medical classes from the survey is preferred rather than simply deleting out-of-state and public medical centers. Medical salaries are kept current through a separate survey, not unlike surveys in the Northern Virginia pay area.

The development of an implementation plan will provide us with the opportunity to continue our discussions on these and related issues. In particular, we look forward to working with you in developing that portion of the plan which will address the resources necessary to effectively accomplish the various changes in the current methodology.

The review of the Annual Salary Survey has been a positive experience for us. It has required that we make a comprehensive examination of how we develop this most important report. Through the combined efforts of our staffs I believe that the Commonwealth and its employees will have an improved Annual Salary Survey.

Sincerely,

Chong M. Pak

attachment

cc The Honorable [illegible] J. Moss

RESPONSE OF

THE DEPARTMENT OF PERSONNEL AND TRAINING (DPT)

TO THE

Joint Legislative Audit and Review Commission

Exposure Draft

" Technical Report: The State Salary Survey Methodology "

Department of Personnel and Training

October 18, 1988

INTRODUCTION

The comments in this written response were prepared based on a review of the exposure draft and discussions with JLARC staff. The response is divided into five parts. It begins with a discussion of DPT's role in the JLARC review. Then, following, are an overview of current survey methodology and a detailed analysis of the report. The final chapter is a summary of DPT's responses to JLARC recommendations, followed by selected attachments relating to various issues.

DPT agrees with JLARC that improvements can be made in the salary survey process, and agrees with the JLARC approach to dealing with most of the issues. Discussions of DPT's approach to addressing the issues are included in the detailed analysis and summary portions of this response.

DPT'S INVOLVEMENT IN THE JLARC REPORT

DPT has assisted in several reviews of the methodology used in preparing the Annual Salary Survey. Previous studies have generally endorsed the current survey process, as did the JLARC review which stated "..DPT's current methods are consistent with legislative intent and are adequate for producing an approximation of the gap between State and private sector compensation." Because of the past attention that the survey methodology has received and its acceptance, DPT has maintained consistency in the survey methodology from year to year.

DPT has considered the JLARC study as an opportunity to improve the survey process. DPT also sees this study as an opportunity for the General Assembly to become more active partners in the survey, thus making the survey results more useful to the General Assembly.

CURRENT SURVEY METHODOLOGY

The current survey methodology dates back to recommendations made by Executive Management Services, Inc. (EMSI) in a November, 1972 report to the "Commission to Assist the Implementation of the Report of the Governor's Management Study." The survey process has evolved gradually from the original EMSI design. In general terms, the annual survey

- Provides an indicator of the market position of the overall salary and benefits structure of the Commonwealth,
- Tracks private industry market movement from year to year,
- Includes data for jobs which are representative of the Commonwealth's work force,
- Gathers data from employers who compete in the job market with the Commonwealth and who are willing and able to provide matching salary and benefits data.

The survey process is very efficient. It gathers and compiles a large amount of information in a very short period of time. The data is accurate. Gathering the data is accomplished with a minimum amount of inconvenience to responding firms.

DPT acknowledges that there are limitations to the data it gathers. For this reason, DPT does not make adjustments to individual classes based on the survey results. DPT asserts, however, that the central tendency of a large amount of reasonably accurate data results in an acceptable evaluation of competitiveness.

DPT recognizes that there is no perfect evaluation of the labor market. Reasons for a lack of precision include the subjectivity required in matching jobs, the variability of the geographical market for various jobs, and the fact that salary ranges in the private sector are influenced by company policy and profitability. Employers are able to attract workers in most job classes at varying salary levels, so there is no right or wrong salary for most employees.

The current survey methodology allows the Commonwealth's total compensation to maintain the same relative position within the market, although there is a time lag before the adjustment is made. The current survey process has resulted in a fairly stable trend. This has meant that employees have received some increase each year. This annual increase is an important factor in employee motivation.

DETAILED ANALYSIS OF THE JLARC REPORT

The comments which follow discuss specific details of the JLARC report. These comments concentrate on those parts of the report where DPT agrees or disagrees with conclusions drawn from the information, or has additional information or alternatives which should be considered.

The comments on each issue include a designation that the issue is of minor, moderate, or major consequence. These designations refer to the extent to which the issue could influence the survey process or future adjustments of the Commonwealth's salary structure.

CHAPTER I. INTRODUCTION

- In Assumptions of This Study, Assumption 1, JLARC notes that competitiveness with the private sector is a "goal" and not a "policy". (MINOR ISSUE) DPT agrees and will change the 1988 survey to include this correction.

- In Current Survey Methodology and Related Study Issues, JLARC indicates five steps which DPT uses. (MINOR ISSUE) The fifth of the five steps is to "project changes in salaries, and adjust salary structure". Structure adjustments based on the survey are not approved by DPT.

CHAPTER II. ARE BENCHMARK JOB CLASSES REPRESENTATIVE OF STATE EMPLOYEES?

- In Changing the Benchmarks to Represent More State Employees, Recommendation 1, JLARC states that DPT should review benchmark classes to substitute current classes for obsolete ones. (MODERATE ISSUE) DPT already does keep classes current by changing benchmark descriptions, titles and salary data each year as classes change.

  The recommendation also suggests that the number and variety of survey classes should be increased. DPT agrees that the more information available, the better the survey product. However, DPT will exercise care in expanding the survey because any additional classes will increase the burden on responding employers. This may have the effect of lowering survey response rates. Using the same classes each year simplifies the work of responding firms since they can refer to the previous year's survey to determine the job for which they should provide matching data.

CHAPTER III. DOES THE SAMPLE REPRESENT THE POPULATION

- In the introduction to this chapter, JLARC recommends that additional resources be devoted to the salary survey. (MODERATE ISSUE) DPT agrees with this recommendation, but would like to emphasize that refinements suggested by JLARC, such as personal interviews, increasing the number of firms and weighting the salary data, would add to the complexity of the survey process if adopted. This would lessen some of the survey's current efficiency, which results from a high degree of automation. Therefore, it may require more than twice the current one-fourth staff year to meet the additional survey requirements suggested by the report.

- In the section Why a Definition is Necessary, Recommendation 2 states that out-of-state and/or public medical centers should not be included in the survey. **(MAJOR ISSUE)** A large percentage of the medical care employees of the Commonwealth are employed at the UVA and MCV teaching hospitals. Competition for these employees is intense - much more so than for most State employees. Large numbers of employees are needed to staff the Commonwealth's medical centers. These centers must compete daily with private and public medical centers in the Southeast, as well as those in the Northeast and North Central states.

  To illustrate why UVA and MCV compete outside the Commonwealth, the size of the various hospitals should be considered. UVA hospital has 950 beds, MCV 1060. Among out-of-state medical centers in the 1987 survey, 6 of 7 have 500 beds or more, although none is as big as the Virginia centers. Of the Virginia hospitals responding, only 1 of 14 has 500 beds or more. The smaller hospitals do not require large numbers of medical employees and much of their recruitment can, therefore, be more localized.

  Individual medical class salary ranges are adjusted based on a semi-annual survey conducted by UVA and MCV. The survey information is from the out-of-state medical centers and hospitals in Virginia. Deleting the medical centers from the Annual State Survey, while retaining the local Virginia hospitals, would result in individual class salary ranges being measured according to one market definition and the structure being adjusted according to another.

If the individual medical classes are adjusted, in part, because of rates paid by out-of-state and/or public medical centers, and if those medical centers tend to pay more than Virginia hospitals, a State Survey including only Virginia hospitals will result in an understatement of the deviation by which the Commonwealth trails the market. Conversely, if Virginia hospitals pay more than the out-of-state medical centers, the deviation will be overstated.

Recognizing these problems in gathering representative private industry salary data for medical classes, DPT recommends removing most or all medical classes from the survey process. While medical employees make up a significant part of the Commonwealth's work force, compensation experts often recommend that classes in a highly active market not be included in general surveys. This is because they can show major fluctuations, depending on how well the employer (the Commonwealth) responds to the changing market. It is, therefore, not reasonable to adjust the average employee's salary based on how well the Commonwealth reacts to these changes.

o In Improving the Process through Definition, Recommendation 3, JLARC recommends that the market target population be defined. (MODERATE ISSUE) JLARC indicates that the DPT working definition appears reasonable.

DPT agrees that this approach would help to identify which firms should be sampled. A general statement can be written defining the target population in terms such as that it should include employers from throughout the Commonwealth, in various industries and of various sizes, based to the extent possible on the relative competition with employers in those categories.

A more specific definition, based on numerical relationships, should be developed as a goal. However, DPT cannot exercise strict control on the mix of employers in the survey because response is voluntary. It is difficult to accurately determine the numerical targets, and matching responses exactly to numeric criteria would be nearly impossible.

Numeric targets could also add subjectivity to the survey process. For example, if 5 responses have been received from manufacturing firms in the survey and 6 are required to meet pre-defined goals, DPT would have to pick one firm from among the remaining manufacturing firms in the sample and concentrate follow-up efforts on that one firm. The choice of the firm to contact could be influenced by biasing factors, such as salary levels.

- In Overcoverage of the Health Sector, JLARC recommends that salary data provided by hospitals for non-medical classes be weighted according to the portion of total non-agricultural employment in the State which hospitals represent. (MODERATE ISSUE) DPT agrees that current procedure needs to be modified and this recommendation can be included in the 1988 survey.

  If the medical component of the survey is restricted to a few classes or eliminated, this should no longer be an issue. The number of hospitals surveyed for non-medical classes could be reduced to a percentage of total survey firms comparable to the 7.2 percent weight suggested by the report.

- In the section Unequal Geographic Representation JLARC cites that Richmond firms are over-represented in the survey, with 44 percent of responding firms, but only 31 percent of State employees. (MODERATE ISSUE) DPT does not have data to dispute this finding.

  It should be pointed out that **DPT cannot control which employers will respond to the survey.** Of twenty-eight firms which did not respond, only ten were in the Richmond area, eighteen were outside that area (See Attachment 1).

  Reasons for greater responses in the Richmond area include a greater interest in the Commonwealth's ranges by the Richmond employers, because of more frequent competition for employees, and closer working relationships between DPT staff and the Personnel staffs of the Richmond firms.

  Also, the central headquarters for a number of statewide firms, and thus their Personnel offices, are in the Richmond area. Many of their employees, however, are not in the Richmond area, although all are included in the 44 percent total. These statewide firms are the companies which are most like the Commonwealth organizationally.

  While the percentages of Richmond survey firms and Richmond State employees are not the same, there is a logical relationship between them. DPT does not object, however, to attempting to gather more data from outside the Richmond area.

- In the same section, JLARC concludes that the Northern Virginia area should continue to be treated as a separate area and not included in the survey (MAJOR ISSUE) DPT is in strong agreement with this JLARC conclusion.

- In the section Disproportionate Coverage by Industry Type, JLARC reports that Finance, Insurance and Real Estate (FIRE) firms are over-represented by four times that industry's portion of private sector employment. (MODERATE ISSUE) DPT has selected the FIRE employers based on their industry, but that is only one factor considered. Also important are the facts that they have formalized salary structures, that they can, and are willing to, provide a significant amount of salary and benefits data, and that they compete in the same markets with the Commonwealth.

  The Non-Agricultural Wage and Salary employment figures should not be accepted at face value. In the manufacturing industry, a high percentage of the employees are working on production lines, performing duties which are not comparable to those of any Commonwealth employees. In Wholesale and Retail Trade, a high percentage of employees are sales staff, also not found in the Commonwealth. In FIRE firms, on the other hand, a higher percentage of the employees would be performing duties found among Commonwealth employees.

  DPT recognizes the need for balance of firms by industry, and that improvements can be made in this regard. However, the current practice is, generally, appropriate.

- In the section Design of the Questionnaire, JLARC discusses the fact that insufficient descriptions can lead to bad data. The implication is that this is occurring with the current survey process. (MODERATE ISSUE) The current data-collection process used by DPT has been developed in accordance with accepted salary survey practices. It has several features to ensure appropriate matches. DPT provides a capsule description which describes the nature and the level of the work, including the normal requirements of each job.

  In addition, the responding firm is asked to provide its corresponding job title and the number of employees it has in the class. Both of these items can identify problems with matches. The firm is also asked to designate that the job it has is "very similar", "slightly higher", "slightly lower", "considerably higher", or "considerably lower". DPT removes from the survey those matches which are designated as "considerably higher" or "considerably lower". Finally, the firm is invited to provide additional comments which may help to clarify the degree of match. A sample page from the survey questionnaire is provided as Attachment 2.

- Further in the same section, in Recommendation 5, JLARC indicates that DPT should stop deleting responses more than two standard deviations from the mean as a method of ensuring close matches. (MODERATE ISSUE) DPT does not use the two standard deviations as a measure of closeness of fit. Rather, DPT recognizes that there is a broad range of rates paid by various firms for any job class. That range tends to be skewed, typically toward the higher rates.

  DPT has identified problems with the current procedure and is in agreement that it should be discontinued. The influence of atypical responses will be minimized if efforts to increase the number of participating firms are successful (see Recommendation 11).

- Also in Recommendation 5, JLARC indicates that follow-up should be undertaken when the highest response exceeds the lowest response by more than 75 percent. JLARC further states that "this wide range may indicate unreliability of the data." (MODERATE ISSUE) DPT has recognized a pattern that some employers pay more than others for all jobs. This provides a likely reason for the distribution.

  DPT would recommend as an alternative approach that the pay line (average salary by grade) for each firm be compared with the firm's response for each class. While it is possible that the firm may value jobs differently in relation to one another than the Commonwealth, atypical responses identified by this means could reasonably justify a follow-up interview. It should be emphasized that DPT currently does make follow-up calls in situations where indicators of match closeness show that there may be a problem. DPT, however, does not consider salary level alone as being an indicator of a poor match.

- In Recommendation 6, JLARC recommends personal interviews to follow up on all mail questionnaires. (MAJOR ISSUE) DPT supports the use of personal interviews in gathering data from small firms (those under 100 employees) and new firms added to the survey. Larger firms that have participated in prior surveys typically have experienced personnel staffs who are dependable in providing good salary data and, therefore, interviewing these staffs may not be necessary. It should also not be necessary to conduct the interviews at any firm every year, once good matches have been established. DPT can provide small firms with the job match from previous surveys, when new surveys are mailed, to ensure continuing good matches from them.

There are concerns in using personal interviews in the survey process. They require a considerable addition of cost and time for the completion of the survey. Also, the interview process shifts the subjectivity in matching jobs from the responding firm to the DPT interviewer. This makes DPT vulnerable to claims from responding employers that DPT may have misrepresented the facts, although DPT has staff with the skills necessary to ensure good matches.

- In Administration of the Survey, Recommendation 7, JLARC states that DPT should increase its response rate by providing participants with summaries and analysis of the salary data. (MODERATE ISSUE) DPT agrees with this recommendation. Currently, DPT does provide responding employers with the same comprehensive summary report which is provided to the General Assembly and also provides individual company pay lines on request. Additional reports showing salary trends could also be generated.

  The JLARC report also suggests that having a cover letter signed by the Governor could help to increase responses. DPT agrees with this assessment and supports the idea.

- Under the section Coding and Entering Data into the Computer, Recommendation 8, JLARC states that DPT should proof each data item that is keyed. (MINOR ISSUE) DPT agrees that this recommendation is appropriate if resources are available. However, DPT would like to clarify current practice. The keying is not done by a production-oriented data entry operator, but by a skilled survey professional. It is done slowly and carefully and entries are reviewed as they are keyed.

  After the data has been keyed, two automated programs are run which may indicate inaccurate data entry. Major differences which may represent errors can easily be identified by reviewing these printouts. In cases where a number identified as a potential error has been keyed correctly, the responding firm is typically contacted for verification that it was reported accurately. It should be noted that the report provides no evidence from the 1987 survey that data entry errors occurred.

CHAPTER IV. IS THERE A SIGNIFICANT DIFFERENCE BETWEEN STATE AND PRIVATE SECTOR SALARIES?

- In the section "OVERALL DEVIATION IS SUBJECT TO ARBITRARY FLUCTUATION", JLARC finds that the current use of the median deviation places too much reliance on the central value and that the middle value is subject to too much arbitrary variation. **(MAJOR ISSUE)** This issue is related to further discussions in this chapter concerning weighting and determining error rates.

  DPT agrees that there are limitations to the current procedure and that it can be improved. The primary reason for this need is that the array of deviations do not follow a normal curve around the median. The difference between the 22nd value (the median), and the 23rd value in 1987 was large enough to cause DPT staff concern.

  The JLARC report goes on, in Recommendation 9, to suggest weighting the data as a solution to this problem. That recommendation will be discussed in detail below. There are other alternatives which should be considered. Rather than look only at the middle percentage value, the middle range of values can be averaged to arrive at a single percentage. This means that the one-fourth highest and the one-fourth lowest values are not considered.

  This approach of discarding the highest and lowest values is similar to dropping the highest and lowest scores in judging at the Olympics. It is simple to process and understand, it does not allow atypically high or low values to influence the deviation, it minimizes the effect of possible skew in the deviations, and it is based on a recognized measure of central tendency - the interquartile range.

  Another alternative is to not use deviations at all, but to use the average percentage change from the prior year in average salary reported by all firms for all classes in the survey. This approach is a purely market movement approach. Its limitation is that it requires the assumption that the relationship between the Commonwealth and the private sector in the prior, base period was correct and should be maintained.

- In the section "EMPLOYEES IN HIGHER SALARY GRADES ARE GIVEN TOO MUCH INFLUENCE", the statement is made that a uniform structure adjustment results in some classes not being appropriately adjusted, because of the differences in deviations found for various classes. (MINOR ISSUE) This may occur with the structure adjustments that any employer implements.

DPT would like to emphasize that there is no attempt to ensure a very high level of accuracy for each individual class. The use of a measure of central tendency to determine the deviation has meant that some classes with extreme values could be tolerated. It has been recognized that atypically high or low-paying firms can influence the deviation for individual classes, depending on which classes these firms can match and which classes they cannot match.

Second, in administering the Commonwealth's pay plan, the alignment of classes and the degree of distinction between salary grades can influence individual class deviations. For example, the Commonwealth has the classes Practical Nurse A and Practical Nurse B, in Grades 5 and 6, respectively. The survey may show that the Commonwealth is 2 percent behind for the "A" , but 3 percent ahead for the "B". Given the same responding employers, this means that other employers are making less than the 9.3 percent distinction the Commonwealth makes between the two jobs. The Commonwealth, however, can make no smaller distinction with the graded pay plan currently in effect. The data in this case, therefore, is not a cause for concern.

- Also in the same section, JLARC states that two-thirds of the Commonwealth's work force is in grades one through seven, but that these employees may get only one-half the weight of the one-third of employees in grades eight through twenty-three. (MODERATE ISSUE) If the structure were adjusted based on one value for each of the twenty-three grades, the statement would be true. DPT does not view this as a problem, however, because the Commonwealth must compete for employees at all levels.

  Under current methodology, each survey class gets an equal weight. Currently, there are 24 survey classes in grades 1 through 7, and 19 survey classes in grades 8 through 23. Therefore, the two-thirds of employees in grades one through seven get 126 percent of the weight of the employees in the higher grades, rather than the reported possible 50 percent.

- In Summarizing State Salaries Across Benchmarks With a Weighted Mean, Recommendation 9, JLARC recommends using a weighted mean to represent the overall salary deviation. (MAJOR ISSUE) DPT agrees to try this approach, but there are important concerns which should be addressed before the current methodology is replaced by the "weighted mean." DPT recommends testing both approaches simultaneously and consulting with JLARC staff to develop the best method for the Commonwealth.

This recommendation moves away from the market movement concept to a more statistically-based approach. DPT's experience has shown that statistical surveys often have problems providing smooth data movement from year to year. This could result in a large structure adjustment one year and none the next year. Such fluctuation could undermine the motivation of the work force.

The current survey includes a few classes which would have a major effect on the survey findings if the data were weighted

- the four largest classes - Custodial Worker, Highway Equipment Operator, Office Services Assistant, and Secretary Senior - would have approximately fifty percent of the survey's total weights,

- More than one-third of the weights would be concentrated at grade four.

Assume that the deviation for all survey classes is zero (0.0 %), except that the four largest classes have a deviation of -5.0 percent. Weighting the data would result in all classes being adjusted about 2.5 percent in this situation, even though most classes were on the market already.

The Commonwealth must be somewhat more concerned with its ability to attract employees to classes with large numbers of positions than to classes with very few positions. However, DPT ensures that major staffing problems are solved through individual class regrades. The goal of the structure adjustment is to keep the entire structure, overall, relatively competitive.

There are other possible problems with weighting. It places great importance on high-population classes. There are, however, a number of high-population classes without comparisons in the private sector. This means that a limited number of the high-population classes will greatly influence the adjustments for all other classes, small and large.

The report suggests that private industry data could be weighted according to the number of employees hired by each firm, as well as by the number of Commonwealth employees in the class. If the statistically-based survey approach is adopted, with many small firms and weighted salary data, then DPT supports weighting based on the number of employees the firm has in the class. This would be consistent with the statistical approach.

- In the section Using the Weighted Means and the Standard Deviation to Address Salary Differences, JLARC cites the study mandate to assess "the methods used to determine the minimum percentage salary scale adjustment" as suggesting that it is appropriate for the survey to result in a range of deviations. JLARC recommends that DPT compute an estimate of the error in the survey deviation and that future adjustments be based on the midpoint of the resulting range of deviations. **(MAJOR ISSUE)**

  While DPT does not know the legislative intent of the mandate, the following is offered for consideration. Each year the survey has been conducted in August. The survey deviation has then been adjusted downward (by staff of the Department of Planning and Budget) in anticipation of State employees receiving proficiency increases during the year. DPT would suggest that the resulting, adjusted deviation is, in fact, the "minimum percentage salary scale adjustment." The mandate may have been so stated because in some prior years the General Assembly has approved July 1 adjustments in excess of the adjusted deviation.

  DPT is concerned that error ranges could be so wide as to be unacceptable from a compensation management standpoint. DPT is also concerned that most future adjustments could vary between the computed minimum deviation and the midpoint deviation, depending on the availability of funds. This would mean that the adjustment would fluctuate more from year to year than it does under current procedures. Staffing stability, employee morale, and budget projections could suffer as a result.

  Structure adjustments based on the minimum deviation of the error range could not be defended statistically. The amount of the deviation would vary according to the number of responding firms, so that the more firms responding, the greater salary increase would be provided, regardless of the actual data the firms reported.

  Adjustments which vary over the lower one-half of the range would result in an average increase over time which would approximate the first quartile of the range. In other words, the average adjustment would be in the middle between the minimum and midpoint deviations. Thus, the Commonwealth would tend to be somewhat less competitive than under the current practice, which controls the adjustment at a single value.

- In the section Narrowing the Range of the Estimate by Increasing the Sample Size, recommendation 11, JLARC suggests that error rates should be reduced by increasing the number of firms represented. (MAJOR ISSUE) DPT agrees with this recommendation. Increasing the sample would be a logical use of increased resources. This action will reduce random error and any bias in the data, if the selection of additional firms is not biased. However, it is not necessary to compute error rates or a range of deviations in order for the increased sample to have the desired effect.

  DPT again stresses the importance of stability in the process, even if the cost of the stability could be some bias. DPT recommends making a one-time major change, such as add 200 private firms to the survey, make every effort to secure responses from as many of these employers as possible, and continue to gather information from the same group of employers in future years. Additional changes in the sample would result in the addition and deletion of a very limited number of firms each year, as is the current practice.

  The importance of this recommendation is that the one-time change may not actually result in the anticipated increase in responses. The actual responses may also not conform to predetermined goals in terms of the employers' industry, size or location. The alternative approach would be to continue making changes in the list of surveyed firms in an attempt to meet such goals. Such efforts could require several years and cause the survey deviation to fluctuate over that period.

CHAPTER V. ARE FRINGE BENEFITS REPRESENTED ADEQUATELY?

- In the section Limited Information on Benefit Levels, Recommendation 12, JLARC states that DPT should improve its typical employee profile, using actual employee characteristics. (MODERATE ISSUE) DPT does not think that this change is necessary. The employee profile **should** attempt to represent a typical employee. However, it should also be selected so that providing data is as easy as possible. **Experience has indicated that employers are reluctant to compute benefit values even if the simplest profile is used.**

  The current profile used by the State Salary Survey is reasonable. For example, the average State salary on the 1987 survey date was $ 20,714, a $ 20,000 salary figure was selected for the 1987 employee profile. It is easier for firms to compute percentages with a rounded dollar figure.

The employee profile approach relies on the concept that a change in the characteristics will have a similar effect on both the Commonwealth and private employers. Thus, it is assumed that choosing $ 21,000 rather than $ 20,000 would have had little effect on the cost of the Commonwealth's benefits relative to the cost for private employers.

The actual average length of service for Commonwealth employees is approximately nine years. The selection of six years, however, has little effect on the survey results. The number of years in most cases affects only the provision of sick and vacation leave days. Most employers who provide variable amounts of leave based on years of service (as the Commonwealth does for vacation leave), provide increases after increments of five years. Therefore, leave granted after six or nine years would be the same.

Choosing a single employee with no dependents again has been based on allowing responding firms the simplest possible computation. In this case, the major variable is medical insurance. Again, the assumption is made that family coverage will cost the private employer more than employee-only coverage, just as it costs the Commonwealth more. Changing to a married employee with two dependents, for example, could add considerable variability and complexity to the computation of private firms' cost and, also, of the Commonwealth's cost.

- In Problems with the Current Methodology, JLARC notes that error may be introduced because some benefits are fixed dollar amounts and not percentages of salary. (MODERATE ISSUE) DPT agrees that this occurs and that it should be corrected. DPT computes the average salary for private industry, based on the Virginia salary added to the salary deviation. Next, benefits costs for private industry and the Commonwealth are computed, based on the average costs as percentages of salary. In cases where private firms are providing a benefit(s) to all employees, regardless of salary level, at the same cost, private employers' costs are overstated.

  Typically, only medical insurance coverage is based on a fixed dollar amount for all employees. DPT recommends asking firms to designate which of their benefits are percentages and which are flat dollar amounts and then using the prevalent response for each benefit to apply to the average response for all employers.

o In the same section, in Recommendation 13, JLARC suggests that, when better benefits data becomes available, the benefits data should be weighted. In addition, JLARC suggests that error rates should be computed and a range of deviations reported rather than a single value. (Additional discussion is included in Appendix E.) **(MAJOR ISSUE)**

JLARC proposes weighting benefits data by class, using the proportion of State employees in each class and the inverse of the number of firms with jobs in the benchmark. JLARC recommends, as an alternative, weighting by firm only, rather than by class and firm, using the number of job classes each firm has and the proportion of total benchmark employees represented by the benchmark classes the firm has matched. While DPT has no strong objections to this approach, it is not currently supported for reasons cited below.

The benefits computation is much less accurate than the salary computation due to the many variables involved and the difficulty in providing a reasonable estimation of their value. Measuring total compensation is certainly a worthwhile goal, but DPT's experience indicates that accurately measuring the benefits portion of total compensation may not be feasible.

As JLARC states, current estimates of benefits ignore benefits not provided by the Commonwealth. Examples are profit-sharing, stock plans, product discounts, and service facilities. These benefits are parts of total compensation and do affect the ability of each employer to attract and retain employees. In most cases, they would increase private sector compensation relative to the Commonwealth.

The inclusion of these additional benefits would add to the complexity of the survey process. In addition, it is very difficult to determine the value of such benefits as, for example, stock plans. In past years, DPT has attempted to gather information on the benefits recommended by JLARC. In 1984, for example, there were 33 firms which provided benefits data. Of the 33, only ten provided information on the additional benefits.

Responses in 1984 included:

BENEFIT	NUMBER OF RESPONSES
Other Leave	0
Service Facilities	0
Social/Miscellaneous	3
Tuition Reimbursement	2
Product Discount	4
Savings Plan	6
Stock Plan	1
Bonus/Profit Sharing	2
Parking	2
Gifts	1

These few numbers of responses would not provide the basis for reliable conclusions. Also, some of the responses, such as product discounts of "25% of sale price", would be difficult to use in measuring total compensation.

JLARC recommends that DPT compute error rates for the benefits computation when better data becomes available. DPT considers the benefit computation a rough approximation, with weaknesses that will be very difficult to overcome. The use of error rates would result in a range of deviations, which would then add to the range JLARC has suggested for the salary data. This would widen the range of possible deviations. DPT recommends evaluating the use of weighting and computing error rates after better benefits data is available.

DPT recommends that current procedures be retained unless a detailed benefits study, as is proposed in the next section of this response, reveals a better, feasible computation method. DPT agrees that weighting benefits would be consistent with weighting the salary data, if that approach is adopted.

- In Recommendation 14, JLARC suggests that the General Assembly may wish to commission a one-time comprehensive study of fringe benefits. (MODERATE ISSUE) DPT supports this and would logically take a lead role in the review. However, DPT cautions that the study will result in a large volume of information which will be difficult to reduce to a single measure, or even a reasonable range of deviations.

CHAPTER VI. ARE PROJECTIONS OF FUTURE DIFFERENCES IN COMPENSATION ADEQUATE?

- In the section "The Private Sector Only Approach," JLARC discusses the method by which DPT estimates private industry market movement. JLARC indicates that "DPT ... recognizes that projections of this sort are highly prone to error." **(MAJOR ISSUE)**

  DPT does not dispute that the market movement projections are rough approximations. In past years, structure adjustments have typically been based on the August 1 deviation. Using the August 1 figure has some serious limitations, because it will determine the level of the structure for the following fiscal year. This means that the resulting structure level will be in effect during the period eleven months through twenty-three months after the survey date. Using the August figure each year also makes the Commonwealth slow to respond to changes in the rate of market movement.

  On the positive side, the past practice has resulted in reasonable stability in the amounts of increases granted, with employees receiving some increase each year. If adjustments are based on projections, an overstated projection could lead to little or no increase for employees following the next survey.

  Because the August figure has been used, highly accurate projections have not been essential. DPT has used the projections provided by national consulting firms and organizations simply to illustrate that the Commonwealth will fall farther behind by the subsequent July 1. The precise additional amount is not known. DPT has not projected the movement of State employees. DPT assumes that turnover could cause the average salary for State employees not to rise, particularly if the deviation is great. If the July 1 projection is to replace the August survey figure as the basis for future adjustments, DPT will begin to project the movement of State employees' salaries.

  JLARC did not identify ways to improve the market movement projection, which is an important part of the projection. This may be a part of the survey where a range of possibilities might be appropriate. JLARC's discussions focus on projecting State employees' salary movements. DPT asserts that market movement is important and that, if movement of State employees' salaries are to be considered in the projections, market movement projections should also be entered into the equation.

- Regarding The "Annualized Proficiency Increase" Approach, DPT agrees with JLARC that this method for projecting employee salary movement is not based on any measurable data. Therefore its use is not supported. (Additional discussion of this approach is included as Appendix F of the report.) (MINOR ISSUE)

- In the section The "Proficiency Increase Plus" Approach, and in Recommendation 15, JLARC recommends that the Proficiency Increase Plus approach be used to estimate the movement in average State salaries. It also recommends that this procedure be refined by adjusting from 12 months to 11 months, and by improving the estimate of residuals. (MAJOR ISSUE)

  DPT will continue to study this very complex issue and propose a detailed projection method in its implementation plan (see Recommendation 16). The measure of change in employee mix proposed by JLARC is desirable, but it has some limitations. Some of the change in the number of employees in various steps and grades make the Commonwealth more competitive and some do not.

  An alternative might determine the residual based on a weighted average salary increase by class, using the average current salary for each class. The employment in the prior (base) period by class would be used as a weight. This computation would measure the change in salaries for all employees for reasons which would be related to the Commonwealth's competitiveness and which would be comparable to expected salary movement in the private sector during the same period.

  DPT agrees that any estimates of State salary average movement should represent the same time period as the market projection, normally eleven months.

APPENDIX B. USING EXISTING DATA SOURCES TO ENHANCE THE PRECISION OF CURRENT ESTIMATES

- In Appendix B, JLARC discusses the use of BLS and VEC data in the survey process. JLARC recommends integrating these sources with survey data. (MODERATE ISSUE)

  Currently, DPT uses BLS data to supplement survey data because it represents a large number of employers, including many more small employers than are present in the DPT survey. DPT has used VEC data in past years, but discontinued that use because the data was not available when needed.

The BLS has, in 1988, begun to survey in the Richmond area only in odd years. Therefore, BLS data has become less useful. Survey data generated by DPT provides the most consistent, comprehensive and dependable source of information. If the number of firms in the Commonwealth's survey is expanded significantly, the use of the outside surveys should no longer be necessary.

The VEC and BLS surveys are designed for different purposes, under U. S. Department of Labor guidelines. It is not reasonable to expect their survey dates to be changed to meet the Commonwealth's needs. It also should be noted that the VEC survey is not processed as quickly as the DPT survey, so if VEC data were available for the DPT survey, it might be outdated.

In using the BLS data, DPT has also noted that there are unexplained fluctuations in the data for some classes. This has an undesirable effect on the stability of the Adjustments from year to year. BLS data should continue to be used with caution, therefore.

SUMMARY

JLARC RECOMMENDATION

(1) Change benchmark job classes according to annual review of existing and potential benchmarks. **DPT RESPONSE:** Benchmark classes should be kept current, additional classes should be added with care because using the same classes each year makes responding easier and adds stability to the annual adjustments, adding a large number of classes would reduce response rates.

(2) Stop sampling out-of-state or publicly-run medical centers to represent private sector employers in Virginia. **DPT RESPONSE:** Medical classes should be dropped from the survey because the market for them is not typical of the market for all employees, they are adjusted through a separate survey, and much of the Commonwealth's competition is outside the State for these workers.

(3) Write a clear, systematic definition of the target population. **DPT RESPONSE:** DPT agrees that a definition would be helpful in determining firms to be surveyed. Numerical relationships, however, should be considered goals rather than survey requirements, due to the difficulty of controlling responses.

(4) Weight health sector data in sample in proportion to population. **DPT RESPONSE:** Non-medical classes should be removed from the survey of hospitals and medical centers. This will not be an issue if the medical classes are no longer surveyed.

(5) Stop deleting outliers solely because they appear too high or too low. **DPT RESPONSE:** This recommendation should be implemented.

(6) Use personal interviews to follow up mail questionnaires. **DPT RESPONSE:** Personal interviews would be helpful for small and new firms. After the interviews have established good matches, they should not be necessary in most subsequent years.

(7) Provide reports of results to encourage participation. **DPT RESPONSE:** Detailed data summaries are currently provided. DPT supports providing additional trend analysis, if resources permit.

(8) Proofread every element of the data set. **DPT RESPONSE:** This recommendation should be implemented, although no data entry problem has been identified.

(9) Use weighted means to represent State and private sector salaries. **DPT RESPONSE:** An average of the middle range of class deviations may remedy current problems. Weighting should be tested to ensure that survey results will be consistent from year to year and will not be undesirably influenced by a few large classes.

(10) Estimate sampling error and represent salary differences as a range. **DPT RESPONSE:** Error rates, which are related to the weighting recommendation, should be tested. A very broad range would be of little use from a compensation management standpoint. Structure adjustments should be granted only on the basis of the range midpoint if this approach is adopted.

(11) Increase the sample size (number of employers). **DPT RESPONSE:** DPT supports this recommendation as being very helpful in providing meaningful data. DPT agrees that providing additional summary reports and having the Governor sign the survey cover letter would be helpful in increasing responses.

Many employers are not interested in the survey and are not willing to participate simply to help the Commonwealth determine its salary structure. DPT recommends consideration be given to compensating firms for their responses. This is consistent with the concept of participant discounts most consulting firms allow to participating firms. A good return could be expected from a modest investment. For example, a fifty dollar annual payment might ensure continuing responses from 300 employers at an annual cost of $15,000. This cost is minor considering the amounts of appropriations which depend on the survey.

(12) Collect fringe benefits using an employee profile that better matches average State employee characteristics. **DPT RESPONSE:** The current profile is adequate. It provides a reasonable approximation of the average State employee and allows responding employers a relatively easy computation of benefit costs. Characteristics which might change under this proposal would have little effect on survey results.

(13) Use weighted means to represent fringe benefit estimates, and calculate a range based on estimated sampling error (longer term). **DPT RESPONSE:** This recommendation should be evaluated after weighting the salary data has been tested and a comprehensive review of benefits has provided improvements to the benefits survey process.

(14) Commission comprehensive study of fringe benefits (longer term). **DPT RESPONSE:** DPT supports this recommendation. DPT should take a lead role in the review.

(15) Correct and refine projection method. **DPT RESPONSE:** DPT will continue to study current projection procedures and develop a procedure which predicts market and State employee salary movement as accurately as possible. Future salary survey reports will include these projections.

(16) DPT should submit an implementation plan by December 1, 1988. **DPT RESPONSE:** DPT will comply with this recommendation.

ATTACHMENT 1

LIST OF 1987 NON-RESPONDING PRIVATE FIRMS BY LOCATION

RICHMOND AREA	OTHER AREAS
Data Systems Corporation	Action Executive Services
Circuit City Stores	General Electric, Salem
Richmond Newspapers	Wayn-Tex
Safeway Stores	Meredith-Burda
Figgie, International	Capitol Records
Travelers Insurance	Hampton Institute
Philip Morris	Newport News Shipbuilding and Drydock
Continental Telephone	Eli Lilly
Life of Virginia	Martin Processing
Robertshaw Controls	Sprague Electric
	Dan River
	Rite Aide
	Radford Army Ammunitions
	Ingersoll Rand
	Walker Manufacturing
	Cupp Tool
	W. B. Meredith
	Hampton Roads Tractor & Equipment
Richmond Total	Other Areas Total
10 Firms	18 Firms

It should be noted that some of the firms listed have provided data in surveys for previous years, while others have never responded

ATTACHMENT 2

GRADUATE-ACCOUNTANT

This is the beginning level of professional accounting. Performs work of moderate difficulty requiring the application of accounting theory and principles. Duties include developing and modifying accounting systems and procedures; analyzing, interpreting, and recording data on financial transactions; allocating funds; and maintaining complete accounting records. Requires college degree in accounting or equivalent training and experience. Does not require a CPA.

TITLE USED BY YOUR FIRM: _____

NUMBER OF EMPLOYEES WITH THIS TITLE: _____

NORMAL HIRING SALARY for employees in this job	AVERAGE SALARY paid to employees in this job	MAXIMUM SALARY (excluding longevity pay) attainable by employees in this job
$_____per_____	$_____per_____	$_____per_____

In terms of complexity of duties/level of responsibility, is your class (circle one):

Considerably Higher	Slightly Higher	Very Similar	Slightly Lower	Considerably Lower

Other Comments:

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Former JLARC staff who contributed to this report:

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