REPORT OF THE
JOINT LEGISLATIVE
AUDIT AND REVIEW COMMISSION ON

Virginia's Correctional System: Population Forecasting and Capacity

TO THE GOVERNOR AND
THE GENERAL ASSEMBLY OF VIRGINIA

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PREFACE

The 1984 Appropriations Act directed the Joint Legislative Audit and Review Commission (JLARC) to review several specific topics related to Virginia's correctional system. A major concern reflected in the Act was the impact of the projected inmate population and the present capacity of the system on capital outlay and staffing. This study, one in a series on the correctional system, evaluates the methodologies used for forecasting the inmate population and estimating the system's capacity to house inmates.

Virginia's correctional system has undergone a period of growth that is scheduled to subside with the opening of a new medium-security institution in 1986. In other states, prison experts are predicting that inmate populations, which have grown over the past decade, will decline. For Virginia, however, the question remains: will the inmate population exceed the capacity of the system?

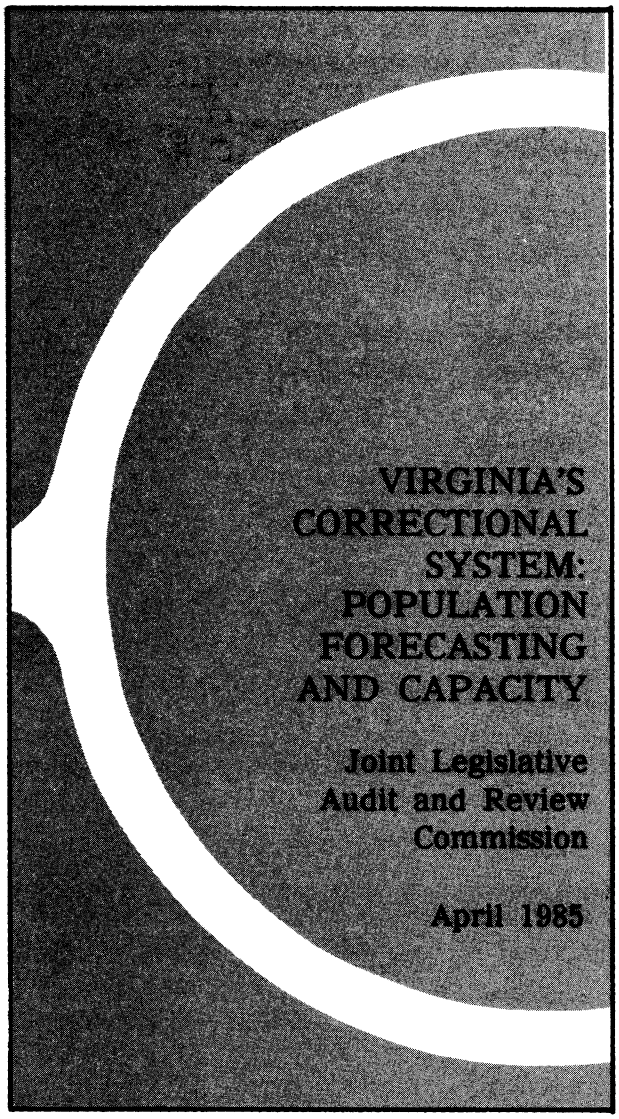
Findings presented in this report are the outcomes of two processes. First, JLARC conducted a technical analysis, based upon the information available in June 1984, of the Department of Corrections' capacity and forecast methodology. Specifically, the department's response to House Joint Resolution 152 was analyzed. Second, subsequent to the presentation of the analysis, DOC and JLARC staff worked cooperatively to develop a technically adequate forecast methodology based upon the report recommendations. That objective has been accomplished, and the results are reported herein.

In future studies the options for dealing with increases or decreases in the inmate population will be further explored. Furthermore, the impact of local jail population and capacity on State facilities will be investigated. These endeavors, along with the improvements herein recommended in the areas of forecasting and capacity, should provide the General Assembly with more reliable information for assessing the changing environment of corrections.

On behalf of the Commission staff, I wish to acknowledge the cooperation and assistance of the employees in the Department of Corrections and the Parole Board.

Ray D. Pethtel
Director

April 8, 1985



Recently, Virginia's correctional system has undergone a period of steady growth. New facilities have been constructed to accommodate an increase in inmate population. Two medium-security facilities were added in FY 1983, another has opened in FY 1985, and the final facility that is currently planned will open in April 1986. The correctional system planners must now begin to examine the sufficiency of the system's capacity to house the inmate population expected in the future.

This report, the second in a series on corrections in Virginia, addresses two fundamental components of any viable plan: the capacity of the system and the inmate population forecast. The body of the report concentrates on an evaluation of the Department of Corrections' method for determining the capacity of the correctional system, and the department's method for forecasting inmate population. Before discussing these evaluations, this summary will provide an overview comparing inmate forecasts with capacity.

Alternative Scenarios for the Correctional System

Previous DOC forecasts indicated that the inmate population would reach as high as 15,000 by 1990. Recent analysis, however, indicates that the inmate population growth evidenced in the seventies has slowed. After evaluating technical aspects of forecasting and capacity calculations, JLARC staff corrected technical errors and refined DOC's methods to develop alternative scenarios for the correctional system in 1990.

A JLARC REPORT SUMMARY

After the interim briefing on this report (November 1984), the JLARC and DOC staffs worked cooperatively. During that period, new data became available, and DOC implemented most of the recommendations in the report. While a few possible refinements are still being considered for later inclusion, DOC now has a technically adequate methodology.

The revised DOC forecast methodology projects 11,225 inmates by 1990. This represents a growth of more than a thousand inmates over five years. As with any forecast, of course, this forecast assumes that conditions that existed in the correctional system in the past will continue to hold.

Several factors related to this leveling off of the expected growth have been cited in other states and are occurring in Virginia. The crime-prone population is growing more slowly since the "baby boom" children have passed out of this age group. Virginia's economy is expected to be strong, keeping unemployment and the tendency to commit crime low. Changes in statutes, such as increased serving time before parole eligibility for recidivists, have apparently been offset by other actions such as changes in

the good conduct program and the Parole Board administrative changes that reduce serving time.

The forecast can be combined with some alternative configurations of the system's capacity to yield several possible scenarios for the next five years. Three possible scenarios are discussed below, and each is illustrated graphically in an adjacent figure. These scenarios are illustrative of the possible future direction for the system; they do not exhaust the range of alternatives.

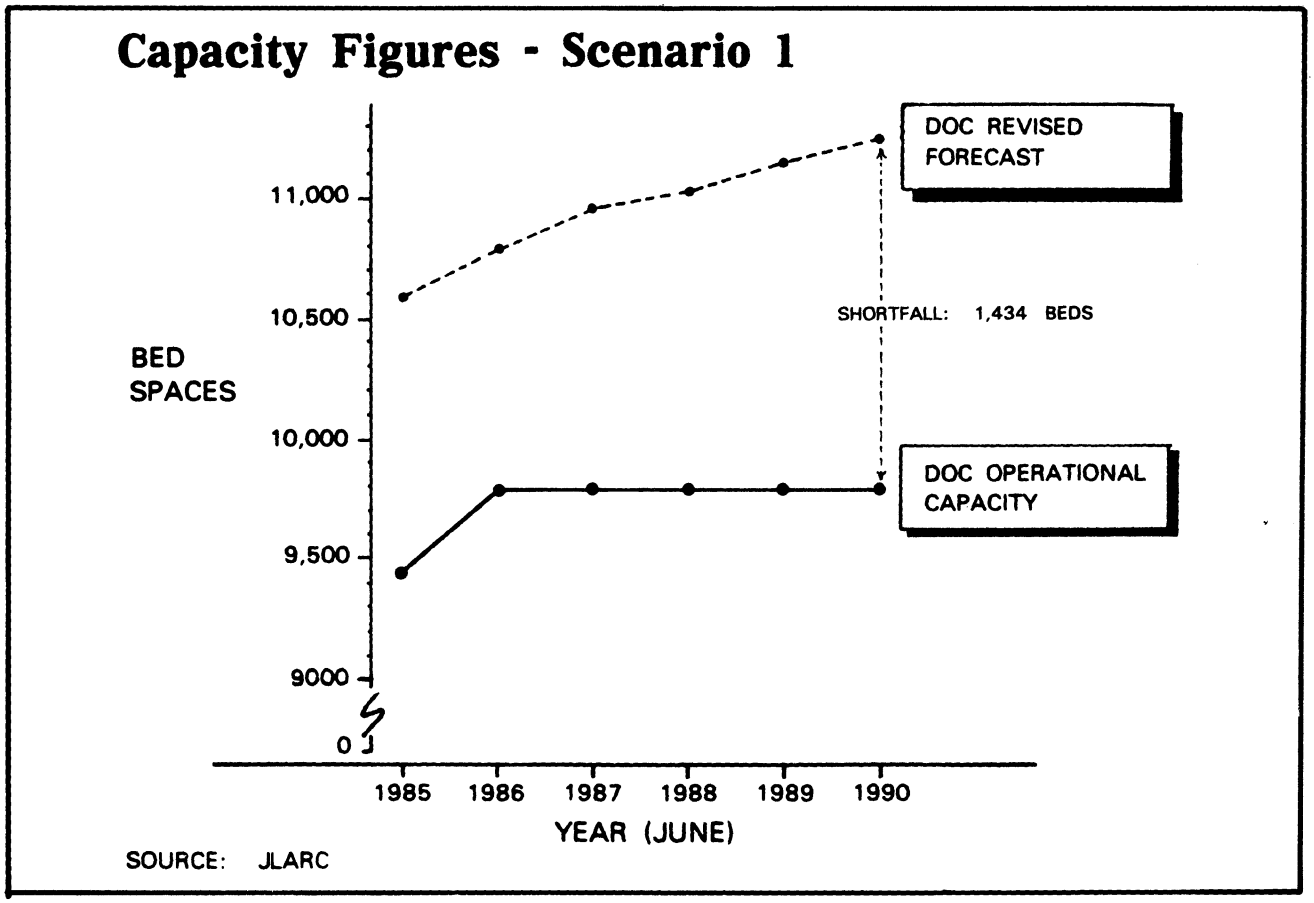
SCENARIO 1

The Department of Corrections currently employs a measure of capacity called "operational capacity". Operational capacity is defined as the level of occupancy at which the facilities can be safely operated. The measure generally includes one inmate per cell, some number of special purpose (medical, isolation, segregation, etc.) beds, and multiple beds in dorms. While some inconsistencies exist in the way the capacity is calculated in different facilities (see the next section on the evaluation of capacity for detail), the measure does reflect DOC's desired operating level.

The operational capacity is plotted in Figure 1. The graph shows an increase in the capacity for FY 1986 due to the opening of the new facility at Augusta. All four of the recently constructed medium security institutions (MSIs) are included, at 500 beds each. The operational capacity also reflects DOC's current plan to close only the "A" building of the Penitentiary during this time frame.

The comparison of operational capacity and the revised DOC inmate population forecast indicates that a bed space shortage will occur by 1990. The capacity at that time will be 9,791 beds, while the population is forecast to be 11,225, leaving a shortage of

Figure 1



1,434 beds. That year has the largest shortfall in this scenario; it occurs because the population is gradually increasing while capacity remains level after FY 1986.

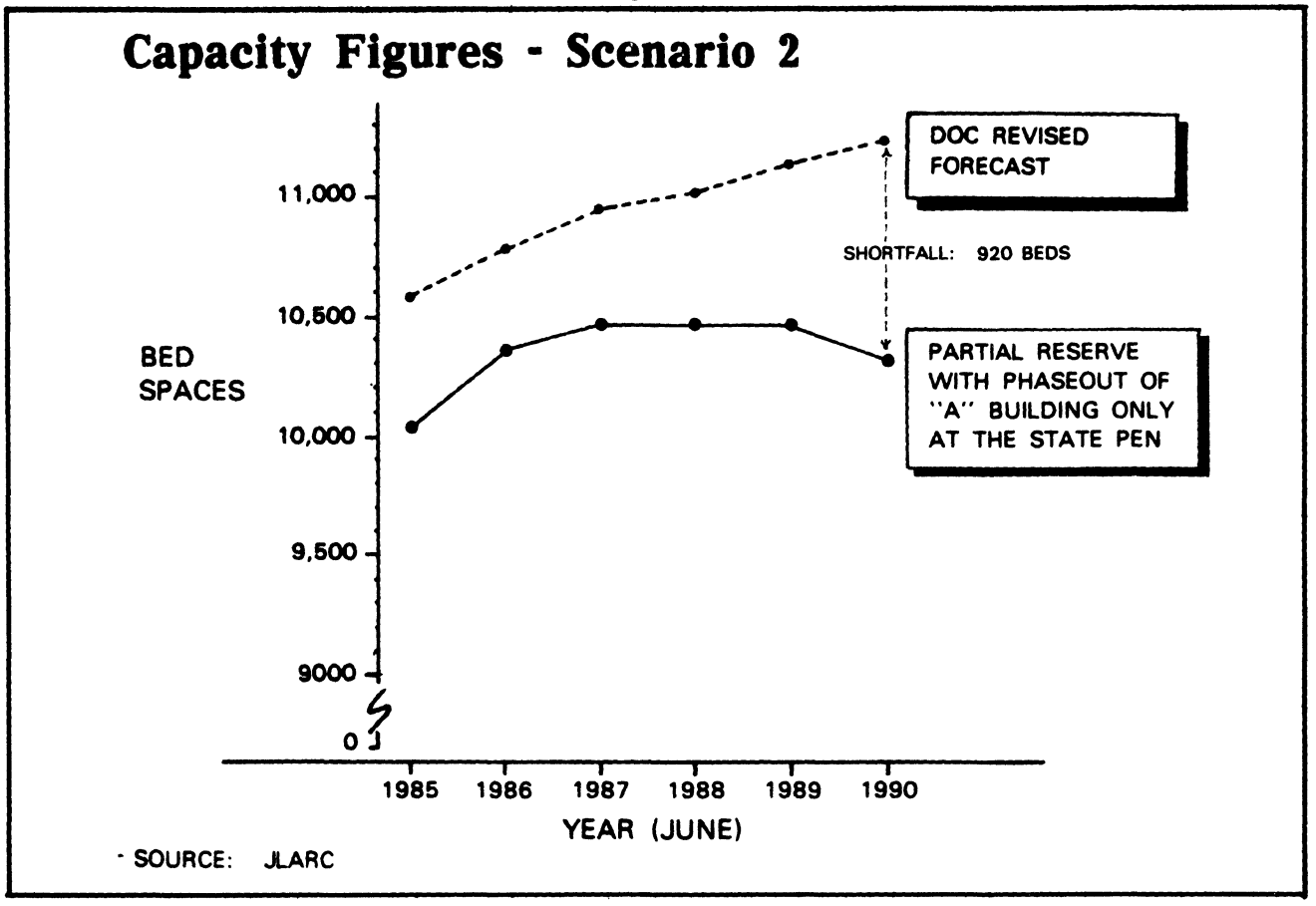
SCENARIO 2

DOC's definition of operational capacity does not include doublebunking at the MSIs, and contains an inconsistent amount of space for each inmate in dormitory areas, especially in field units. JLARC therefore developed another capacity term, "reserve capacity". Reserve capacity involves the use of a level of doublebunking that has been achieved in the MSIs in the past and the use of a maximum amount of space per inmate in dormitory areas.

Maximum use of the reserve capacity would involve the addition of over 1,300 beds to operational capacity. However, this level of use is not considered feasible for planning purposes. The maximum reserve capacity allows a short-term solution for unforeseen circumstances and probably could never be fully utilized.

A moderate use of reserve capacity, however, could be used for planning purposes, especially when the inmate population and the capacity are reasonably close. JLARC used these assumptions to develop a second scenario, employing the same population projection as in the first. Figure 2 shows the bed space comparison if part of the reserve capacity were included. The capacity shown in FY 1990 could be realized by doublebunking the four MSIs for a total capacity of 615 inmates each, and by using a guideline of 55 square feet maximum per inmate in the field units, and 70 square feet maximum per inmate in major institutions. These changes would add 514 beds to the operational capacity in 1990. The use of a portion of the reserve capacity reduces the bedspace shortage to approximately 900 beds in 1990.

Figure 2



SCENARIO 3

Scenario 3 offers a look at the correctional system with another assumption altered. The "A" building at the Penitentiary is currently scheduled to close by June 1986. The loss of 316 beds is reflected in the operational capacity. The Appropriations Act indicates that "B and C buildings" should be scheduled for closure by FY 1990. The third scenario uses the partial reserve capacity, but removes part of the remaining 552 Penitentiary beds beginning in FY 1989 and completes the closure in FY 1990.

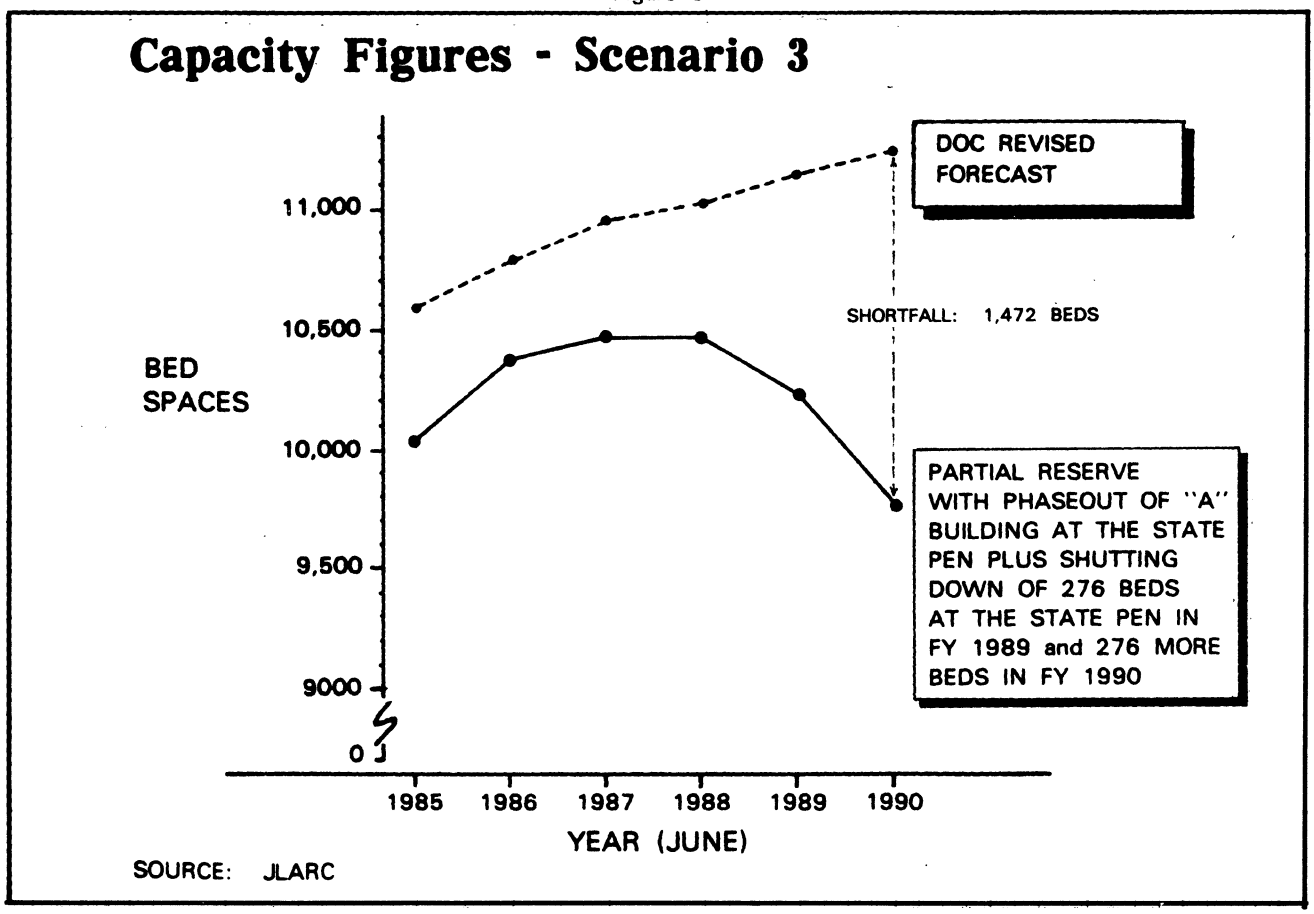
The result of making this change is shown in Figure 3. With the partial use of reserve capacity, the bed spaces would fall by 552, yielding a net deficit of 1,472 bed spaces.

These three scenarios illustrate three possible outcomes for the correctional system in FY 1990. While all of the scenarios indicate a bed space shortage by 1990, the magnitude of the shortage is different. There are several alternatives for meeting the shortages, some involving the expansion of capacity and some the reduction of inmates. Continuing the use of the Penitentiary beyond 1990, reestablishing an institution at Deep Meadow, expanding one of the current facilities, or building a new facility are options for increasing capacity. Increased use of community corrections, sentencing guidelines, or a cap on the number of inmates are alternatives used in other states to limit prison population. An evaluation of the full range of alternatives should be conducted by DOC.

Evaluation of the Correctional System's Capacity

DOC's operational capacity has generally been determined by departmental judgements about what capacity should be for each facility, rather than by empirical evidence. The judgements are based on the department's considerations for maintaining safety in the

Figure 3



new facilities. The judgements do not reflect the maximum capacity which might be achievable during periods of heavy demand for extra inmate housing.

The department's approach to operational capacity has important consequences. First, the lack of a consistently applied method has meant that there is significant variation in the amount of space which is provided per inmate in dormitories, even in similar housing units. For example, the average amount of space per inmate in large permanent field units ranges from 47.9 square feet in Caroline to 69.7 square feet in Tazewell.

Second, the fact that operational capacity reflects DOC judgements about desirable, safe operating levels has meant that these figures in many cases do not reflect the levels at which many facilities have been operated. In 10 of the 18 major institutions, for example, the actual average daily population exceeded operational capacity for at least one month during FY 1984. The most dramatic examples were Buckingham and Brunswick, where the actual average daily population levels for June of 1984 were over 690, yet the operational capacities were 500. The reason for this major difference is that DOC does not include the doublebunking of single occupancy cells in its operational capacity, even though doublebunking is being done. At Buckingham and Brunswick, approximately 40 percent of the general population cells are currently doublebunked.

To supplement DOC's operational capacity, JLARC developed an alternative measure of capacity called reserve capacity. Reserve capacity reflects how far capacity can be reasonably increased to accommodate short-term population increases or forecast errors.

JLARC's first step was to identify some guidelines which could be used to identify potential reserve capacity. In the new medium-security institutions, a level of doublebunking which had already been achieved was included as part of potential reserve capacity. For identifying a potential reserve in dormitories within major institutions, 60 square feet per inmate was set as a maximum amount of space, and 50 square feet per inmate was used for field units. The guideline for field units, for example, indicated a potential reserve of 237 beds over operational capacity.

The second step in the process was to estimate a portion of the potential reserve capacity which might be used for capacity planning purposes. To identify this partial reserve, additional capacity factors were considered in interviews and observations at a number of facilities. Factors considered included: the availability of floor space for additional beds; potential security problems; work, educational, or recreational opportunities for inmates; and the capacity of support facilities, such as freshwater and waste-water capacity or food services. The fieldwork indicated that for some facilities, additional resources might be necessary to achieve additional capacity.

Table 1 shows operational, potential reserve, and partial reserve capacities for

Table 1

Capacity for DOC Facilities January 1985

Facility	Operational Capacity Included	Potential Reserve Included	Partial Reserve Included
Penitentiary	818*	818	818
Powhatan	596	596	596
Staunton	527	611	540
Brunswick	500	682	615
Buckingham	500	682	615
Nottoway	500	682	615
Southampton	474	474	474
Bland	440	562	504
St. Brides	423	456	423
Mecklenburg	335	335	335
Women's Center	325	325	325
James River	321	321	321
Deerfield	290	309	290
Powhatan R&D	245	245	245
Marion	145	160	160
Southampton R&D	116	116	116
Southampton YOC	100	115	100
Powhatan North	92	115	98
Augusta**	-	-	-
Field Units & Work Rel.	2,180	3,104	2,941
Total	9,557	10,708	10,131

*These figures reflect the phasing out of 50 beds at the Pen "A" building. An additional 266 beds at the "A" building are to be phased out under DOC's plans by the end of FY 1986.

**Augusta scheduled for operation in April 1986.

DOC facilities in FY 1985. The partial reserve reflects a 25 percent level of double-bunking at the medium security institutions. JLARC recommends that DOC review the capacity issue and contribute its perspective to defining reserve capacity for the system.

Recommendations 1-2. DOC should report a figure for the reserve capacity of its facilities to supplement operational capacity. Reserve capacity should reflect how far capacity can be reasonably increased to accommodate short-term population increases or forecast errors. Reserve capacity should be based on doublebunking of the cells in facilities like Buckingham and Brunswick. Reserve capacity should also be based upon precisely defined guidelines for DOC facility ward areas, such as square footage per inmate.

Evaluation of DOC's Forecast Methodology

The current methodology used by DOC to forecast inmate population was originally developed within the Florida Department of Corrections. The methodology was adapted for use in Virginia by consultants and DOC staff. The adaptation of the Florida model, dubbed SLAM II (Simulated Losses and Admissions Model II), began in spring of 1983, and the first forecast was produced by December.

The December forecast predicted 2,500 fewer inmates by 1990 than the previous forecast. Given the lower projection and the spate of recent corrections construction projects that were nearing completion, the General Assembly asked DOC for a short-term forecast and a description of the methodology employed to make the forecast (HJR 152). Also, the General Assembly requested in the Approrpiations Act that JLARC examine the forecast and its impact on staffing and prison design.

The current forecast methodology consists of three components: admissions, releases, and manual adjustments. The admissions component forecasts the number of admissions that DOC can expect annually. The release component computes a probability of stay for each inmate currently confined or expected to be confined in the system, and the probabilities are then summed to yield a forecast of the number of inmates incarcerated in each month in the future. Manual adjustments attempt to correct the forecast for legislative and administrative changes that have occured since the data base for the other components was established.

Admissions Component. The admissions component is based upon a sound methodology; however, there are several technical problems with the way the method is carried out. First, admissions are inconsistently measured during the forecast period. An attempt has been made to estimate the number of felons backed up in local jails, but the data cannot be verified. Furthermore, an estimate of parole violators is included as an adjustment to the data. Neither the need for the adjustment nor the method of making the adjustment appears to be justified.

Recommendations 3-6. Admissions should be measured from existing, verifiable data sources. Another method for estimating the number of felons backed up in local jails should be developed separately from the current admissions component.

Currently, two separate equations are used to predict admissions, one for whites and one for non-whites. Recent increases in the number of females incarcerated in the State system, and technical problems with the inclusion of females in the equations using predictor factors based upon the male population, indicate the need for a separate equation for females.

Recommendation 7. Females should not be included in the admissions equations which are forecast by male admissions. A separate equation should be developed for female admissions.

The admissions equations used by DOC include the crime-prone population and unemployment as predictors of admissions for the first two years of the forecast. After that period, unemployment is dropped from the equations and admissions are forecast by crime-prone population alone. Leaving out

unemployment removes the effect of a factor that provides a linkage between economic conditions and incarcerations.

The omission of unemployment from the equations further exacerbates technical problems in the admissions component. The problems can be related to the omission of other relevant variables, such as crime rate and commitment rate. Using these factors should be explored by DOC as a long-term solution to the technical problems. In the short term, incorporating the number of admissions in the previous year will partially account for the omissions and improve the statistical properties of the model.

Recommendations 8-12. The admissions component should use crime-prone population, unemployment, and the previous years' admissions to forecast admissions throughout the forecast period. The effect of different expectations for unemployment should be routinely examined and reported. Other factors, particularly those related to the commission of the crime and the adjudication process, should be tested to see if they would improve the forecast.

Release Component. The release component of the forecasting model uses the amount of time served by inmates confined and released during FY 1982 to estimate the time to be served by inmates throughout the forecast period. The model assumes the inmates' sentences and serving times in this period will be the same in future years. Analysis of sentencing patterns over the past six years indicates that sentencing patterns have changed; therefore this change should be accounted for in the release component.

The complexity of the component may contribute to a significant problem in the future. The component is not flexible enough to easily make changes in the assumptions and look at the impact on the forecast. The error rate is difficult to estimate and the documentation is not sufficient to replicate or update the component. This creates a high risk of error in producing the forecast.

The complexity and structure of the component restrict the ability to estimate the impact of administrative and legislative changes on the inmate population. The need for five manual adjustments to the model attests to this problem. The lack of flexibility of the component makes it necessary to have two forecast approaches, one for the official forecast and one for legislative impact statements. The two are inconsistent in their assumptions and are not used to cross-check one another.

Recommendations 13-20. For the short-term, the release component should be updated by DOC to include the most recent years' data and to modify the assumptions for sentence distribution to more closely resemble the recent past. This should be done before significant decisions are considered regarding building new facilities.

By the end of the 1985, the release component should be replaced with a simpler, more flexible forecast model. Data and resources needed to update the component should be available to produce and publish a forecast update by November of each year. The forecast should indicate the impact of anticipated policy changes or the sensitivity of the forecast to changes in the model's assumptions.

Manual Adjustments. Manual adjustments have been added to the results of the admissions and release components to account for five administrative and statutory changes:

- recidivist serving time requirements;
- Parole Board administrative actions;
- firearm legislation;
- the Community Diversion Incentive Act;
- three serious offenses law.

The net effect of the adjustments is to reduce the forecast through 1990.

Recommendations 21-37. The manual adjustments should be incorporated into the other components of the model as soon as data is available. The actual impact of the changes should be estimated after they have been in place for a full year.

Model Performance and Maintenance. The final forecasting issues in the report deal with the performance and maintenance of the model. If a model is to be useful for planning purposes, it must produce accurate

results. For the model to continue to be reliable, it must be adequately maintained and updated.

The data which is available to date indicates that DOC's model has performed reasonably well. The department's revised admissions and population forecasts are shown in Table 2.

Table 2

DOC Revised Admissions and Population Forecasts

Year	Admissions Forecast	Inmate* Population Forecast
1985	5,337	10,595
1986	5,345	10,795
1987	5,342	10,950
1988	5,284	11,062
1989	5,303	11,137
1990	5,320	11,225

*June of each fiscal year is forecast.

Source: JLARC alternative forecast methodology.

A simulation of the model's performance showed an average error of about three percent between July 1982 and May 1984. This is significantly better than the department's objective of keeping the error of the forecasting at less than ten percent.

However, there are several concerns about forecasting issues. First, DOC's performance objective of keeping error within ten percent allows for an error of up to 1,000 inmates. Second, a simulation of DOC's model indicates that it tends to consistently over-predict the population. This consistent over-prediction may weaken the credibility of the model. Third, there is a concern as to whether a high level of performance can be sustained with DOC's model. A long-term, high-level of performance is difficult to achieve with any model, as assumptions prove invalid and factors that are not accounted for begin to affect the system. This difficulty may be particularly acute with the DOC model due to the model's complexity. It is for this reason that DOC's efforts to maintain the model are also a performance concern.

The maintenance of a forecast model involves an ongoing effort to understand the theoretical basis of the model, the execution of the model, and the ways in which the model needs to be adjusted to account for changes. The key concern about the maintenance of DOC's model is whether or not sufficient priority will be placed on maintaining the model. A priority on maintenance was not placed on the initial DOC forecast model.

This report identifies several components which appear essential for the adequate maintenance of a forecast model. These components lead to several recommendations for the maintenance of DOC's model.

Recommendations 38-41. A single detailed source document on the DOC forecast model needs to be compiled. This document should contain all the material necessary to explain how to replicate and update the model. An ongoing commitment to forecasting should be made by DOC. Emphasis should be placed on anticipating factors which may change the forecast. To achieve this goal, it may be useful for DOC to involve participants from outside the department.

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I. INTRODUCTION

Accurate figures on the current capacity of the State corrections system and a reliable forecast of inmate population are essential to provide a framework for developing plans for the system. Capital outlay planning, prison design, and projected staffing requirements are based upon the population that will need to be incarcerated and the space used to house them.

A comparison of population projections and capacity estimates gives policymakers insight into the type of changes that may be needed. For instance, if predicted populations exceed capacity, capacity may have to be expanded; or the population size can be altered by changing sentencing or parole practices. On the other hand, if capacity exceeds predicted population, the closing of less efficient facilities can be considered.

JLARC was mandated in the 1984 Appropriations Act to conduct a series of studies on these and related issues in the corrections field. Specifically, the Act requires JLARC to study DOC's "plans to increase manpower in relation to projected growth in the adult inmate population." In addition, the Act requires that "the effect of projected local jail population and capacity on the State correctional system shall be considered."

The purpose of this study is to lay the groundwork necessary for future planning of Virginia's corrections system. This initial report will first analyze the capacity of the system as set by DOC to give the forecast information a context for planning discussions. Next, the report will provide information on the forecasting of the inmate population, and assess the model used by DOC to make these forecasts. A review of local jail populations and capacity will follow in a later report.

BACKGROUND OF PRISON CAPACITY ESTIMATION

Virginia's incarcerated population has soared from 4,133 in 1968 to 9,192 in 1982. This greater than twofold increase is consistent with increases in other states as well as in the federal correctional system. Generally, growth of inmate populations has been accompanied by capital outlays for new, renovated, and expanded facilities. By the end of the 1980's, four new 500-inmate, medium security prisons will have been constructed in Virginia at a cost of greater than $100 million.

DOC has estimated the capacity of the State system to be 9,791 by 1990. This compares to DOC's revised inmate population projection of 11,225. Thus, there does not appear to be sufficient space to house all of the inmates that have been projected. However, the current capacity figures are based upon many assumptions. For instance, they do not reflect current practices such as the level of double-bunking currently being carried out in Brunswick and Buckingham.

The Current Corrections Process

The process through which a convicted felon moves into the State corrections system and resides in the system is a complex one that involves numerous participants from each branch of government. The General Assembly specifies the legal framework within which the system operates and designates the responsibility for carrying out the operations. Judges sentence the convicted felons and exert influence over whether the felon will come into the State system, remain in a local jail, or report to some alternative correctional program. The Department of Corrections is responsible for the custody of most felons, and the Parole Board makes decisions about the release of inmates prior to their mandatory parole date.

The process leading to entry into a State corrections facility effectively begins after conviction, when the judge pronounces sentence. Upon sentencing, felons are usually placed in local jails while court clerks process their paperwork. All felons and in some cases misdemeanants may be considered eligible for commitment to the State system. However, inmates with less than six months to serve on their sentences and those sentenced to local jails usually will not be transferred to a State institution. Moreover, some felons with sentences greater than one year are permanently assigned to local jails.

When there are no further charges pending, the court orders are sent to the court and legal services unit of DOC for processing. This unit issues warrants to commit felons with greater than one-year sentences to the State system. An identification number is assigned and exact sentence length and parole eligibility dates are set. Inmates are given credit for pre-conviction jail time and post-conviction time served awaiting appeal or transfer. Generally, a felon with greater than six months to serve on his/her sentence will have a warrant issued, to bring him/her into the State system.

Once a warrant has been issued, the inmate may be brought to one of the State reception centers or put in the queue to go into a reception center. If the reception centers are filled to capacity, DOC personnel work with the sheriffs to set up a priority listing for transfer to the State system. Inmates move on to the reception centers as other inmates move to their permanent assignments in the major institutions or field units. The department estimates that in

some months during FY 1984 as many as 300 felons were awaiting transfer into the State system.

The department uses the term "State responsibility" to define all those inmates who would be in the State system if there were no capacity limitations. State responsibility includes all inmates in State facilities as well as all felons in local jails who have more than six months left on their sentences and are ready for transfer to the State system when space is available. The department estimates that during FY 1984 approximately 700 felons with more than six months remaining on their sentences were not available for transfer to the State system. Many of these inmates were awaiting trial on another charge or were in local jails by agreement with the sheriff.

The amount of time that an inmate will spend in the institution is based on a number of factors: sentence length; number of prior incarcerations, if any; time deducted from the sentence for good conduct; and the Parole Board's decision during reviews. Thus, judges, wardens, and the Parole Board influence the lengths of stay for all inmates. However, felons who are sentenced to local jails for less than 12 months are not eligible for discretionary parole, and therefore are not affected by the Parole Board. If an inmate does not receive discretionary parole from the Parole Board, he/she must receive parole six months prior to the end of his/her sentence, provided the inmate has served a minimum of three months.

The flow of inmates into and out of the State system is depicted in Figure 1. From July 1983 to June 1984 the average daily population in Virginia's corrections system increased by 355 inmates. This means that the 5,144 new confinements and parole violators who came into the system were only partially offset by 4,789 releases.

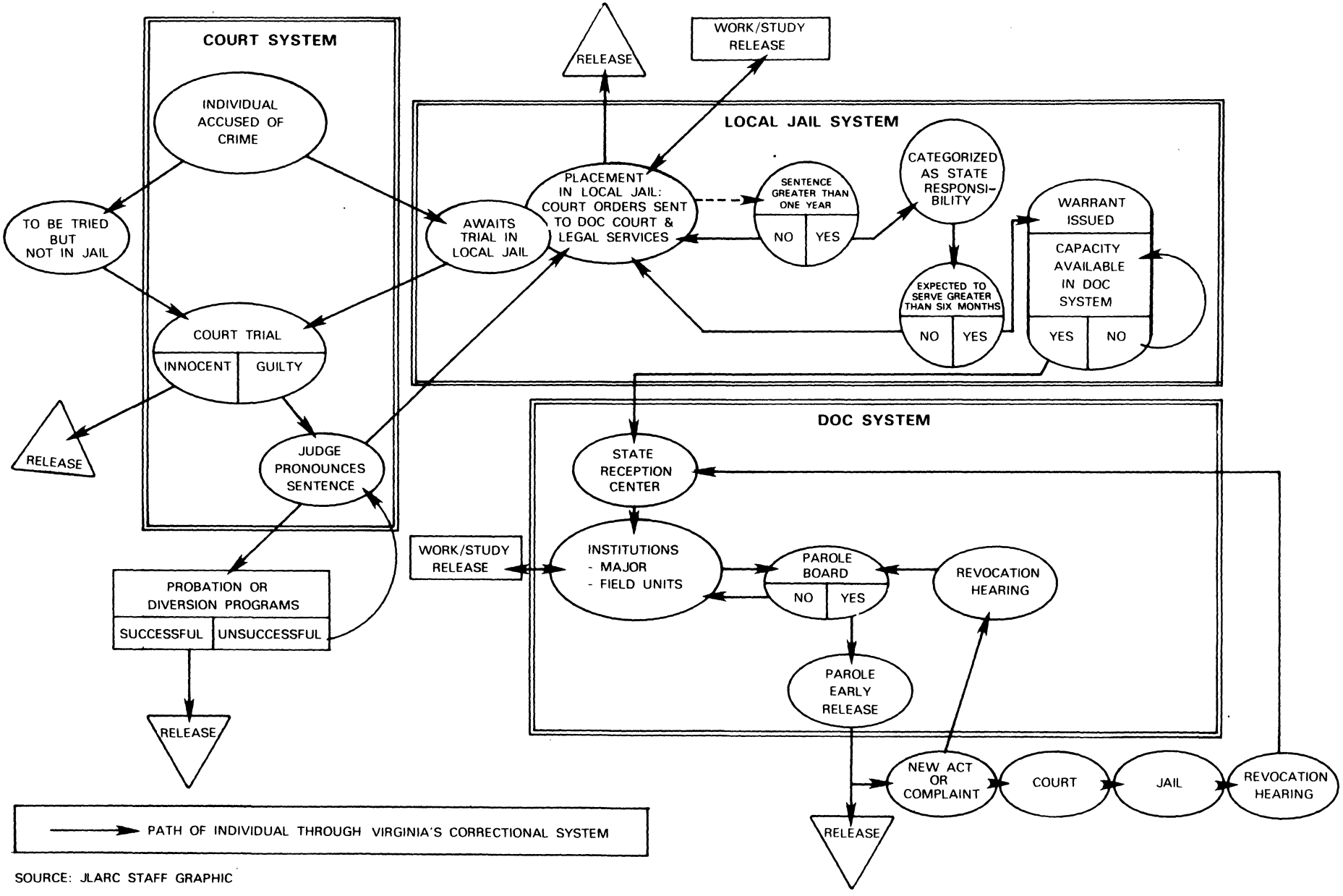
DOC System Capacity

System capacity refers to the number of inmates which a correctional system can hold. Estimates of system capacity provide a context for understanding the significance of inmate population forecasts. The determination of the system's capacity relies on different assumptions and different criteria which constrain the number of inmates that each facility in the system can be expected to hold.

Capacity always represents the effect of a limitation or constraint on the system. Therefore, two interrelated decisions must be made in defining capacity. First, the type of constraint which will be applied in defining capacity must be determined. While a number of constraints can be considered, three have generally been used in Virginia: design, budgeted, and operational capacity.

Figure 1

The Corrections System in Virginia



SOURCE: JLARC STAFF GRAPHIC

Design capacity limits the capacity to the number of inmates a facility was designed to accommodate. *Budgeted* capacity limits the number of inmates to those which the facility has requested or been provided funds to house. *Operational* capacity represents the maximum number of inmates that can be housed in a facility and allow the facility to operate safely. Operational capacity, or "safe operating capacity," is the major term now used by DOC to set capacity for the system.

Next, the method for applying the definition of capacity must be selected. Capacity constraints can be determined through the use of empirical evidence or through the use of professional judgement. DOC's view of operational capacity as a safe level of operation has been based on judgement.

The department applied its concept of operational capacity to the three types of beds in DOC facilities: beds in general population cells; beds in wards; and special purpose beds. General population cells are small enclosed compartments with bars or lockable doors that are intended for the routine occupancy of one or a limited number of inmates. General population wards contain shared space designed for multiple occupancy. Special purpose beds include isolation or segregation beds, medical beds, death row beds, and mental health beds.

For each of these types of beds, DOC has made some judgements as to the maximum number which can be counted in capacity. These assumptions are:

(1) In general, for every cell, only one bed should be included in capacity. DOC considers it unsafe to operate a facility when two or more inmates occupy a cell designed for single occupancy.

(2) In wards, the safe operating constraint relates primarily to DOC's judgement concerning the square footage per inmate in the ward area or to a number of beds which has been safely accommodated in the past.

(3) A portion of the special purpose beds are included in operational capacity. The number is based on their average occupancy and on judgements made from experience.

Table 1 shows the current operating capacity defined by DOC. Also included are budgeted capacity and average daily occupancy.

BACKGROUND OF INMATE POPULATION FORECASTING

Development of a Forecasting Model

In 1974, DOC began to develop a quantitative tool for forecasting the department's inmate responsibility. At that time,

Table 1

DOC-REPORTED OPERATIONAL CAPACITY FOR FY 1985

MAJOR INSTITUTIONS	FY 1985 Operational Capacity	FY 1985 Budgeted Capacity	FY 1984 Avg. Daily Population
Bland	440	440	445
Penitentiary	818	818	869
Southampton	474	474	473
Deerfield	290	290	282
Southampton Rec. Unit	116	116	109
Southampton YOC	100	100	79
Powhatan	596	596	566
James River	321	321	311
Powhatan North	92	92	75
Deep Meadow	365	365	383
Powhatan Rec. Unit	245	245	228
Women's Center	325	325	329
Staunton	527	527	514
Mecklenburg	335	335	283
Marion	145	160	143
St. Brides	423	423	421
Brunswick	500	615	651
Buckingham	500	615	548
FIELD UNITS	2,653	2,653	2,539
WORK RELEASE	157	157	162
TOTALS	9,422	9,667	9,410

Source: DOC reports.

DOC responsibility included the total population in the adult facilities plus felons in jails with warrants to be transferred to DOC facilities and some misdemeanants. DOC staff developed the initial model over a two-year period.

The first forecast was produced in August 1977. The model was never rerun, but the forecast was manually updated four times by July 1982. The manual adjustments were intended to improve the forecast by accounting for recent legislative changes. Despite the adjustments, however, a pattern of increasing over-projections began in October 1982 and continued through September 1983, when it reached 9.4 percent.

In February 1983 the Secretary of Public Safety ordered a review of the original forecast methodology. DOC staff had become acquainted with methods used by other states for forecasting inmate populations. Rather than patching up the original model with manual adjustments, DOC's staff proposed and the Secretary approved the development of a new model.

DOC decided that a forecasting method used in Florida would be appropriate for Virginia. Florida's Simulated Losses/Admissions Model (SLAM) had been released in July 1977. A revised version, SLAM II, was reportedly producing consistently accurate estimates for total inmate population in Florida. A consultant hired by the Secretary concurred with the selection.

DOC staff were involved in adapting SLAM II by deciding on the data base, developing a functional translation of the original computer program, and making manual adjustments. Staff worked with the model's originators, who had been hired by DOC as consultants. The first forecast was produced in December 1983.

In that same month, the Governor announced the new forecast model, its results, and a major error in DOC'S earlier forecast of inmate population. The actual population in State facilities was over 900 inmates less than the first forecast had predicted. The new model indicated that the 1990 predictions presented to the General Assembly during the previous session should be lowered by 2,500 inmates.

The Governor's statement indicated that the cap on recidivist sentences would cause the estimated error of 2,500 inmates by 1990. However, the 900 inmate error in September 1983 indicates that the original model contained more problems than failure to account for the cap. Even though the original model had been extremely accurate in the past when the manual adjustments were added, it was not able to reflect changes in the rate of commitments and releases. Structural problems with the model brought about its precipitous loss of accuracy.

The Governor also committed DOC to the development of a "parallel short-range projections model." The two models were to be run concurrently to validate each other.

Inmate population forecasts were the topic of much discussion during the 1984 session, as the closure of the State Penitentiary and the opening of facilities in Augusta and Nottoway were scheduled. Two pieces of legislation focused attention on inmate population and the capacity of the State system. As mentioned, the Appropriations act mandated this JLARC study. In addition, House Joint Resolution 152 required the Department of Corrections to prepare a five-year forecast, and to submit the forecast and the methodology used to develop it to the General Assembly by July 1, 1984.

Structure of the Model

The original forecasting model had three components: admissions; releases; and a calculation of the number of individuals admitted, confined, and released each month. The population for any period was calculated by taking the population from the prior period,

adding the admissions, and subtracting the releases in the period. These components are standard for all simulation models currently used to forecast corrections populations. Manual adjustments were made to the results. Although the components apparently relied on standard regression and trend analysis techniques, the model was not documented adequately enough to be certain of the specific methodology.

A comparison of the forecast developed by this method and the actual inmate population is shown in Figure 2, which clearly indicates that the model projected a rapidly increasing population. This was caused in large part by the fact that the time period upon which it was based was a period of large inmate population increases.

Errors in the original model stimulated the development of a new population projection model. However, rather than developing concurrent short-range and long-range models, DOC has refined its original long-range model to meet the requirements of the Governor's commitment and HJR 152.

This document focuses on the model presented in the June release of DOC's Virginia Inmate Population Forecast and supporting documentation. A general overview of the current DOC model follows. A more complete technical description of the model is included in Chapter III.

Admissions. The first component of the model predicts total adult admissions for which DOC is responsible. DOC admissions responsibility includes new commitments, parole violators, and felons awaiting transfer in local jails. Those serving less than six months will generally serve their sentences in local jails because of the processing time required to place an inmate in a State facility. Therefore, they are not included in total admissions responsibility.

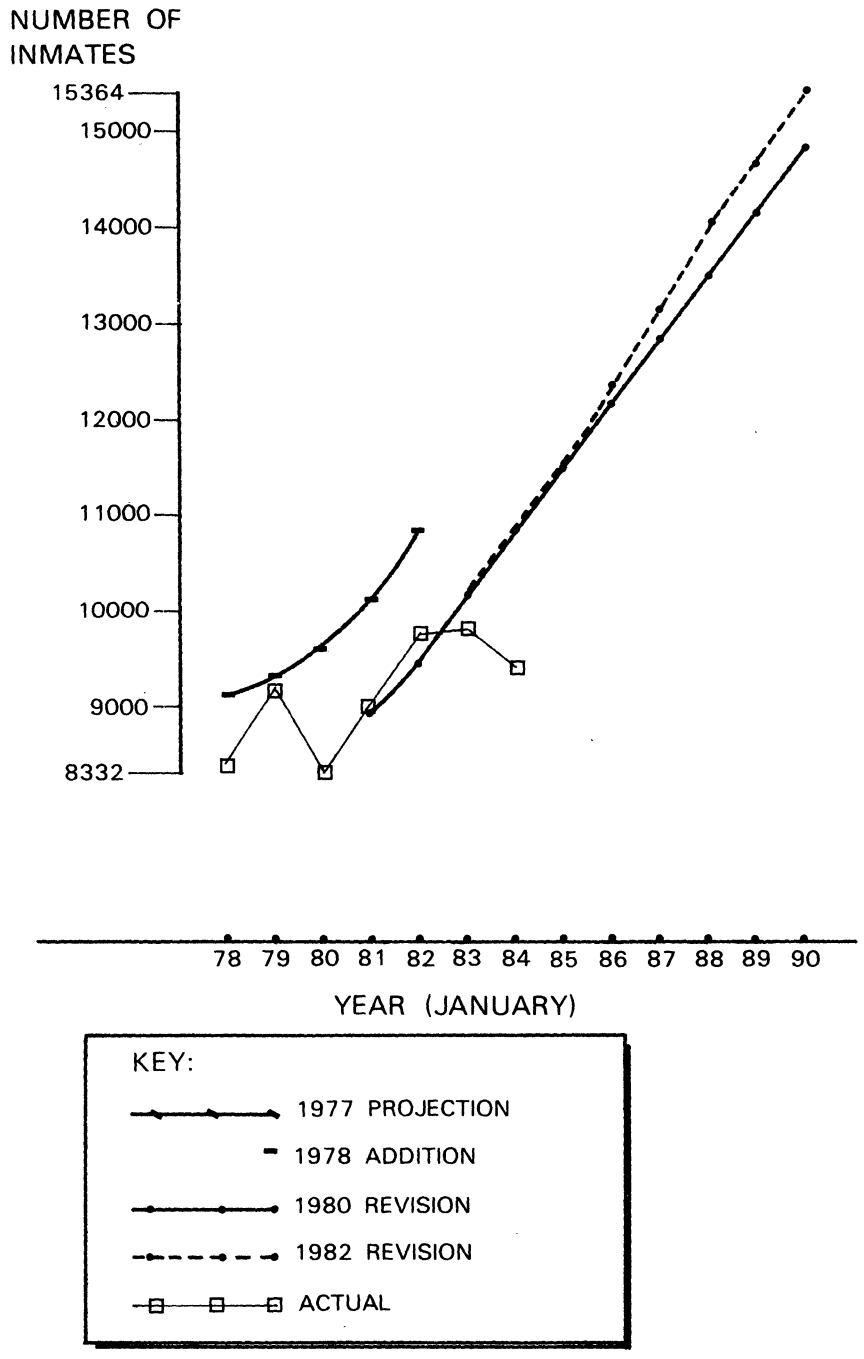
White and non-white admissions are predicted separately using linear regression techniques. Both equations use the size of Virginia's 'crime-prone' population (males between the ages of 18 and 34) for each racial category and the overall Virginia unemployment rate. For forecasts after 1986, equations using the relevant crime-prone population but without unemployment are used to predict both white and non-white admissions.

The equations using unemployment explain 82 percent of the variation for white admissions and 92 percent for non-white admissions. However, this still leaves a sizable error component associated with the estimate of admissions: 151 and 226 inmates for the non-white and white equations, respectively. Further, the equations for 1987 and beyond do not explain as much variation in admissions and have significantly higher error components.

Release Component. The release component estimates the probability of stay for inmates and calculates an unadjusted prediction of DOC responsibility. This is the most complex and

Figure 2

DOC Original Model Projections & Actual DOC Inmate Responsibility



SOURCE: DOC

unique component of the model. The calculations are carried out in two distinct steps: the estimation of the probability that an inmate will serve a particular month of his/her sentence, and the application of that probability to the calculation of DOC's inmate responsibility for each month through the year 2000.

The probability calculations are based upon inmates incarcerated in June 1981 and those released during FY 1982. A separate set of calculations is carried out for 13 sentence groups. The data base is limited to one year's data. The number of inmates is reduced by a decision to exclude recidivists admitted after July 1, 1979, when a new statute that was expected to increase the time served by recidivists was put in effect (the impact of this legislation is addressed in a manual adjustment.)

The second part of this component calculates DOC's responsibility by bringing the probability of serving a particular month for currently confined inmates together with the probabilities associated with the admissions groups. To accomplish this, new admissions which are predicted annually are assumed to fall into the same sentence categories and to be admitted at the same rate as admissions in FY 1982.

Manual Adjustments. Manual adjustments are made to the results of the SLAM II model to account for recent policy changes within the corrections system. These changes have been handled by additional analyses, not as part of an internal adjustment to the model. Therefore, DOC staff determine the effect of each individual change and add or subtract the effect to the SLAM II projections. The five manual adjustments are described in Table 2.

The DOC model has been used to generate three forecasts, each a slight update of the previous forecast. A revised version of the model, using most of the recommendations contained in this report was generated in April 1985. Figure 3 shows the revised forecast which DOC is currently using for planning purposes.

JLARC STUDY APPROACH

Approach and Methods

The study approach taken was to first address prison population and capacity issues separately. Then the results from the two areas were compared to look at the differences between the expected inmate population and the capacity to house inmates.

To examine the capacity of the current State corrections system, a survey was developed to gather information on the amount and type of bedspace within each institution. Data was also collected on design capacities, budgeted capacities, and average daily population levels. DOC staff were interviewed about capacity

Table 2

MANUAL ADJUSTMENTS TO THE FORECASTING MODEL

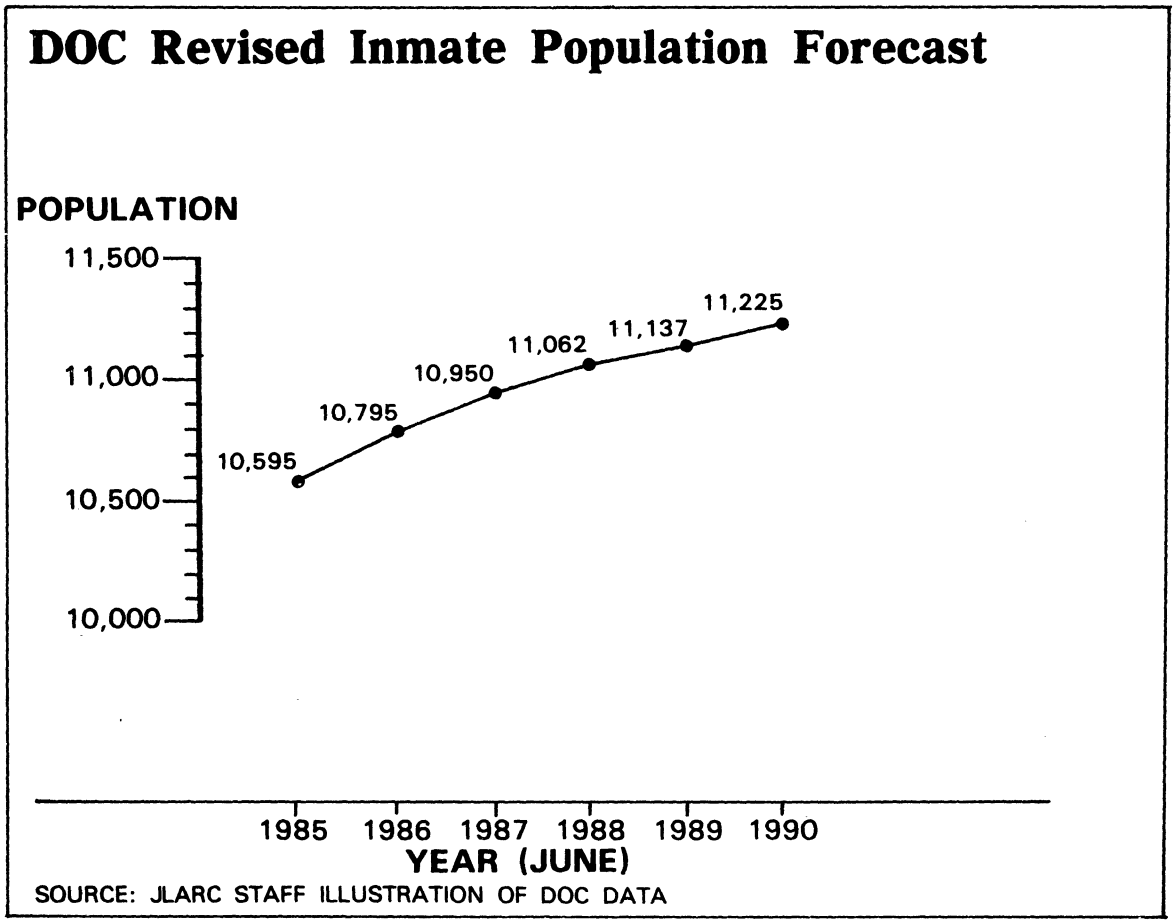
Change	Description	Year Initiated	Source of Adjustment
Firearm Legislation	Increases sentence for use of firearm in commission of crime	July 1982	DOC Research and Reporting Unit
Recidivist Legislation	Increases length of stay for inmates with prior Va. convictions	July 1979 amended July 1982	DOC Research and Reporting Unit
Three time loser legislation	Excludes from parole persons convicted of 3 separate counts of murder, rape, or armed robbery not in same act	July 1982	DOC Research and Reporting Unit
Community Diversion Act	Directs felons to alternatives to incarceration	July 1980	DOC Research and Reporting Unit
Parole Board Policy	Five changes that reduce incarceration time for inmates eligible for discretionary parole	Ongoing	Parole Board

Source: JLARC review.

judgements. Also, interviews were conducted to determine the changes in capacity through 1990. Several facilities were visited to validate the analysis.

To examine inmate population levels, the forecasting methodology presented by DOC in response to HJR 152 was reviewed in detail. The results of that review, including the nature of the changes which should be made to that methodology, are presented in this report. Since its response to HJR 152, DOC has made some refinements to its model in consultation with JLARC staff. This report shows the resulting forecast numbers. However, the analysis of the components of DOC's model necessarily centers on the methodology previously presented by DOC for HJR 152.

Figure 3



There were several steps to the review of DOC's forecast methodology. After becoming familiar with all aspects of DOC's forecasting model, JLARC evaluated the accuracy of the model by assessing its performance when measured against the actual prison population. However, the comparison is limited, since the model is relatively new and only a few observations were available for performance.

Second, the three components that make up the model were examined. For the admissions component, the approach, the data, the factors used in the model, and the statistical properties of the component were all reviewed. For the release component, JLARC reviewed the structure of the model, the requirements on the data, the stability of the data, and the calculations used to predict releases from the prison system. For the manual adjustments, the reliability of the methodology and calculations used to adjust the population forecast were reviewed.

The third approach to the evaluation of the forecast model was to compare some criteria for how a forecast should be maintained with DOC's processes for maintaining forecast models. Among the methods used were a review of the personnel resources assigned to model, a review of DOC's record in maintaining its previous forecasting model, and a review of DOC's documentation for the

current model. Forecasting consultants and DOC staff were interviewed. Literature on correctional forecasting was also reviewed.

The final approach to the evaluation of the forecast model was to determine the most technically sound forecast which could be produced within the current model's structure. Each aspect of the current model was analyzed thoroughly, and improvements were suggested when problems were found.

The findings on capacity and forecasted populations are brought together in this report to present some preliminary conclusions about the type of planning activities that should be undertaken.

Study Organization and Use

The findings of this study can be divided into two groups: a technical analysis of DOC methodology in producing population forecast and capacity data, and an analysis of the differences in capacity and expected populations through 1990.

Examination of the issues concerning DOC's capacity information are presented in Chapter II. The Chapter discusses various definitions of capacity used by DOC and gives data on the differences in capacity generated by each definition. Included is an estimate of the space available for short-term housing needs, which has been labeled reserve capacity.

Technical analysis of the forecast model is presented in Chapters III through VI. The third chapter describes the model. The other three chapters explain problems with, and some proposed solutions for, each of the three components of the forecast model.

Chapter VII deals with the model's performance and maintenance. Concerns about the resources used to keep up the model are brought out. The final chapter provides recommendations for improving the model, both in the short term and the long term. In addition, a comparison of the estimated capacity and the population forecast through 1990 are presented, and some options for corrections planning are discussed.

II. CAPACITY OF THE STATE CORRECTIONAL SYSTEM

Capacity refers to the number of inmates which a correctional system or facility can hold. There are many different assumptions and different criteria which can be used in determining capacity figures. In general, capacity reflects the maximum number of inmates which can be accommodated using particular constraints. These constraints are developed through judgements or empirical data.

While there may be no definitive guidelines as to how capacity should be set, it is still important to estimate the capacity of correctional systems. Capacity estimates provide a context for understanding the significance of inmate population forecasts.

If population forecasts significantly exceed the estimated capacity of the correctional system, then options such as building new facilities or changing sentencing practices or parole requirements may be considered. If population forecasts are significantly less than capacity, then options such as the closing of obsolete facilities, or a stiffening of sentencing practices or parole requirements, may be feasible. While the decisions which are made under these scenarios depend on the goals for the corrections system, the main point is that forecast numbers will not aid in decision-making without capacity estimates for comparison.

Actual figures given to represent capacity depend on the objectives, constraints, or conditions that are specified for the correctional system. For all facilities, there are facts about the physical plant which set some upper limits on what capacity can be. These facts might include the amount of space, the number of cells, or the fresh water or sewage capacity. However, there are other criteria in addition to the physical plant which may constrain capacity. For example, empirical data or the professional judgements of correctional staff may indicate that safety considerations should constrain capacity to certain levels.

The terms which DOC has used at various times in representing the capacity of the system are design, budgeted, and operational. Each of these terms involves different assumptions:

> *Design capacity* is related to the number of inmates which the facility was designed to accommodate. This number of inmates was used by facility designers in planning factors such as the number of cells which the facility should have, or the amount of space which should be available. The design capacity of DOC facilities in operation at the end of FY 1984 was 8,925.

- *Operational capacity* is the maximum number of inmates with which DOC judges it should be required to operate. DOC defines operational capacity as the maximum capacity level for which it will state it can operate the facilities safely. The operational capacity of DOC facilities at the end of FY 1984 was judged to be 9,544.

- *Budgeted capacity* refers to the number of inmates which the department anticipates being able to house in a fiscal year, given the size of its appropriation. The budgeted capacity for each facility equals the average annual cost per inmate divided by the facility's budgeted amount. Budgeted capacity for DOC facilities for FY 1985 was 9,789.

In addition, a fourth way to look at capacity is to consider the levels of inmate populations which the department has actually accommodated in the past. Capacity could therefore be represented by the maximum actual occupancy levels of facilities during a certain time period. During FY 1984, the maximum average daily population levels actually accommodated by each facility for any month indicated a capacity of 9,946. Thus, it is clear that the actual occupancy of some facilities during FY 1984 exceeded the operational capacity levels determined by the department.

Of all the capacity terms, the key term currently used by DOC is operational capacity, or the capacity level at which the department has made a professional judgement that the facilities can be operated safely. The department needed to apply its concept of capacity to three basic types of beds which are in DOC facilities: beds in general population cells, beds in general population wards, and special purpose beds. For each of these types, the department has made judgements about the maximum number of beds with which the system can be safely operated. These judgements are:

(1) In general, for every cell, one bed should be included in capacity. DOC considers it unsafe to operate a facility where two or more inmates occupy one cell designed for single occupancy.

(2) In wards, operational capacity should relate to DOC's judgement concerning the square footage per inmate in the ward area or to the number of beds which have been safely accommodated in the past.

(3) Only a portion of special-purpose beds can safely be included in operational capacity.

DOC's view of operational capacity is useful as one piece of capacity information to compare against population forecasts for the correctional system. It illustrates one set of assumptions about how the long-term capacity of the system should be defined. However, it also appears that a second type of capacity information would be useful in making comparisons with population forecasts. This type of

capacity is reserve capacity, which relates to how far the capacity of the system can be reasonably increased during the short term to accommodate short-term population increases or forecast errors.

Thus, the first section of this chapter will include the concepts of operational capacity and reserve capacity in its discussion of the capacity of the DOC system.

DOC SYSTEM CAPACITY

An important source of information for the capacity review was a JLARC capacity survey which was sent to the department. The survey covered DOC facilities which were open at the end of FY 1984. Thus, a facility such as Nottoway, which was not opened until August of 1984, is not included in the survey results and in the discussion of this section. Facilities with planned openings or closings (e.g., Deep Meadow) after FY 1984 will be included in a discussion of changes in DOC capacity in the next section.

Since the survey covered all types of DOC facilities, capacity questions were asked about DOC's major institutions, field units, and work release centers. Because a basic understanding of these three types of facilities is important to the capacity review, a brief description of each is provided below:

- *Major institutions:* Secure residential facilities with a high degree of supervision by correctional officers. Design for these facilities reflects the major concern with security: the institutions have a wall or double fences, and guard towers on the perimeter. The residential quarters usually are either cells or open wards.

- *Field units:* These units are not designed to provide as high a level of security as major institutions. They are residential quarters established to house less violent inmates, who often are assigned to work on local roads. Units typically house inmates in open dormitories.

- *Work release centers:* These centers are supervised facilities to which low security risk inmates return at night from jobs they hold during the day. These units also typically house inmates in open dormitories.

The survey distinguished between beds in general population cells, beds in ward or dormitory areas, and special purpose beds. As mentioned earlier, DOC has made assumptions or judgements about how to determine operational capacity for each of these different housing arrangements. The capacity of each of these three types of beds will

be discussed in this section. The three types will then be aggregated for a discussion and evaluation of the total system capacity.

Capacity for General Population Cells or Rooms

Most of the housing in DOC major institutions occurs in general population cells or rooms, or small enclosed compartments with bars or lockable doors that are intended for the *routine* occupancy of one or a limited number of inmates. In general, these cells or rooms have been designed with the space to accommodate one inmate. Thus, DOC has generally counted one bed in its operational capacity for each cell or room in the major institutions. Most field units and work release centers do not have cells or rooms.

For each facility in the DOC system with general population cells or rooms, Table 3 shows: (1) the number of cells or rooms, (2) the number of beds in those cells or rooms, and (3) the number of the beds which have been included by DOC in operational capacity for FY 1984. As the table indicates, while the number of general population beds (and the number of beds included in operational capacity) exactly equals the number of the cells or rooms in eight facilities, DOC also operates six facilities with general population cells or rooms containing more than one bed. As is shown in Table 3, multiple occupancy of cells or rooms occurs in six facilities: Buckingham, Brunswick, St. Brides, Marion, Staunton, and the Halfway House for Women. As a consequence of this multiple occupancy, there are 634 more beds than cells or rooms in general population areas of the DOC system.

The central issue for the general population cells or rooms is determining the circumstances under which multiple occupancy is reasonable. The multiple occupancy of general population cells or rooms is counted by DOC in operational capacity for some facilities, and in other facilities it is not. In Marion there are 12 multiple occupancy rooms containing 42 beds. The extent to which multiple occupancy has been recognized in operational capacity at Marion is not clear from the data provided by DOC. The data does indicate, however, that the multiple occupancy of cells or rooms is included in operational capacity for three DOC facilities -- Staunton, St. Brides, and the Halfway House for Women. For these three facilities, more beds than cells or rooms are included in operational capacity.

On the other hand, existing doublebunking practices in Buckingham and Brunswick are not included by the department in operational capacity. The department maintains that it is neither safe nor reasonable treatment of inmates to plan for their permanent doublebunking.

The department's position against including doublebunking at Buckingham and Brunswick in capacity is supported by American Correctional Association (ACA) guidelines. These guidelines call for the single occupancy of cells, with the cells providing "a floor area of

TABLE 3

GENERAL POPULATION CELLS OR ROOMS:
CAPACITY IN THE DOC SYSTEM

Category	Facility	General Pop. Cells	# of Beds	Beds Included in Operational FY 1984 Capacity
	Penitentiary	806	806	806
	Southampton	468	468	468
Equal	Powhatan	324	324	324
Number of	Mecklenburg	318	318	318
Beds and	Va. Women's			
Cells or	Center	305	305	305
Rooms	Powhatan			
	Rec. Unit	245	245	245
	Bland	150	150	150
	Southampton			
	Rec. Unit	116	116	116
More Beds	Buckingham	480	662	480
Than Cells	Brunswick	462	662	462
or Rooms	St. Brides	53	210	210
	Marion	158*	188*	145**
	Staunton	51	104	104
	Halfway House			
	For Women	13	25	25
TOTALS FOR ALL FACILITIES		3,949	4,583	4,158

*Includes 10 cells and 10 beds which are actually used at Marion as special purpose beds (the isolation or segregation of patients), but DOC has not defined these cells or beds as special purpose.

**DOC operational capacity currently excludes 15 beds which were in cells being renovated at the time of the DOC capacity review. The renovation of these cells has been completed, but to date the cells have not been included in DOC's FY 1985 operational capacity.

Source: JLARC analysis of DOC responses to JLARC capacity survey - August and September, 1984

at least 60 square feet, provided inmates spend no more than 10 hours per day locked in." Single-bunked, Buckingham and Brunswick satisfy these guidelines, for the cells offer 74 and 70 square feet of space respectively.

There are also reasonable justifications for including the multiple occupancy of rooms in capacity for Staunton, St. Brides, and the Halfway House, while excluding it from Buckingham and Brunswick. The rooms which have multiple occupants in the former three facilities were designed for the occupancy of multiple inmates. Staunton offers two sizes of multiple occupancy rooms with 49.5 and 68.5 square feet per inmate, respectively. At St. Brides, there are 27 rooms with multiple occupants, and all offer 56 or more square feet per inmate. All of the multiple occupancy rooms in the Halfway House for Women offer more than 60 square feet of space per inmate. Double-bunked, Buckingham and Brunswick offer less than 40 square feet per inmate.

The difference in counting multiple occupancy as part of capacity is also supported by the nature of the inmates involved. The inmates at Staunton, St. Brides, and the Halfway House are generally less violent than at Brunswick and Buckingham. For example, DOC incident reports indicate that, on average, there was one assault against an inmate or DOC staff member for every 6.6 inmates in the average daily population at Brunswick and Buckingham during FY 1984. The ratio for Staunton, St. Brides, and the Halfway House was only one assault per 34.2 inmates.

There are arguments in favor of doublebunking a portion of the beds at Brunswick and Buckingham. First, the Supreme Court has held that the housing of two inmates in a single room does not necessarily deprive the inmates involved of constitutional rights. Second, many other states and localities have found that they must double-occupy cells because of rising inmate populations.

Third, Brunswick and Buckingham are already doublebunked to a significant extent. At Brunswick, there are 462 cells and 662 beds in those cells; with the use of special purpose beds, the average daily population in July of 1984 was therefore able to be as high as 699. At Buckingham, there are 480 cells and 662 beds in those cells; with the use of special purpose beds, the average July 1984 daily population there was 691. Finally, doublebunking can be used as an economy measure, to the extent that: (1) it is used to prevent the need to build another facility, and (2) and operating costs under the arrangement are efficient.

It appears that doublebunking may be a desirable strategy to cope with short-term shortages in housing space, and to avoid unnecessary capital outlay projects. For example, doublebunking would be a desirable alternative to building new facilities when inmate forecasts indicate that the population will peak and then significantly fall. However, the rejection of capital outlay needs based on plans to permanently doublebunk these facilities is not recommended.

Therefore, it appears reasonable to report two capacity figures. The first figure, or operational capacity, would represent the capacity of facilities under a general assumption of one inmate per cell. A second figure would be reserve capacity. Reserve capacity would reflect the maximum number of inmates which can be reasonably accommodated during housing shortage situations, and would therefore include a degree of double-bunking.

Capacity for General Population Wards

Housing in ward or dormitory areas occurs in DOC major institutions, field units, and work release centers. This type of housing features a larger, more open common space (in contrast to cells), and is designed for the occupancy of several inmates. DOC has reported that operational capacity in these facilities is generally related to the square footage available per inmate.

Table 4 shows the total ward space in each DOC facility that has ward areas. It also shows how many beds DOC has set up in that space, and the number of those beds which are included in operational capacity.

As the table shows, DOC's data indicates that virtually all of the beds which are set up in DOC ward areas are included in operational capacity. All of the ward beds in major institutions are counted, and all but 11 beds in field units and work release centers are counted.

There are two issues involved in the determination of capacity for DOC ward areas. The first issue is whether standards are available to support DOC's operational capacity figures for the various facilities with ward areas. The second issue is whether the general application of a reasonable standard could lead to the identification of a potential reserve capacity in ward areas. This concept of reserve capacity would parallel the notion of reserve capacity discussed for general population cells.

Use of standards. DOC staff determined operational capacity figures for ward areas in the spring of 1983, when they conducted a capacity study. In general, the department's method was to accept the number of beds in ward areas at the time of the study (whether filled or not) as a minimum capacity. The department used this method, even for facilities which it considered overcrowded, for two reasons: (1) a belief that the facilities could be operated safely at these levels, and (2) a belief that it would be politically unacceptable to reduce capacity below levels which had already been achieved. In a few cases, capacity above the existing number of dormitory type beds in the facilities was added.

A key question for ward housing capacity therefore is how DOC determined the number of beds which would be located in ward areas in the first place. The JLARC capacity survey asked the

Table 4

GENERAL POPULATION BEDS, WARD AREAS:
CAPACITY IN THE DOC SYSTEM

Major Institutions	Square Feet, Ward Areas	Beds	Beds Included, Operational Capacity
Staunton	30,046	421	421
Deep Meadow	27,648	432	432
Bland	24,440	285	285
Powhatan	19,472	200	200
Deerfield	18,432	288	288
James River	17,130	319	319
St. Brides	13,824	197	197
Southampton YOC	6,912	100	100
Powhatan North	6,912	92	92
	164,816	2,334	2,334
Field Units and Work Release Centers			
Pocahontas	12,464	212	210
Halifax	10,518	184	184
Fairfax	7,980	150	150
Chesterfield Pre-Release Center	7,000	100	100
Baskerville	6,972	104	104
Tazewell	6,972	100	100
Caroline	6,232	130	130
Patrick Henry	6,232	102	102
Harrisonburg	6,232	100	100
Rustburg	6,232	100	100
Pulaski	4,225	65	65
Tidewater	3,990	99	95
Chatham	3,990	95	95
Dinwiddie	3,990	90	90
Stafford	3,990	90	90
Wise	3,990	90	90
Greenville	3,990	86	85
White Post	3,990	86	85
Haynesville	3,990	85	85
New Kent	3,164	95	95
Botetourt	3,164	90	88
Fluvanna	3,164	90	90
Haymarket	3,164	90	90
Nansemond	3,164	90	90
Smith Mt. Lake	3,164	90	90
Capron	3,164	85	85
Culpeper	3,120	66	65
Southampton Work Release	2,462	32	32
TOTAL	140,709	2,796	2,785
GRAND TOTAL ALL FACILITIES	305,525	5,130	5,119

Source: Data from the DOC response to the JLARC capacity survey.

department how operational capacity was determined for these areas. DOC's response indicated that this capacity was based on a certain number of square feet per inmate (including corridor space). The problem was, however, that there was a great deal of variation in the square footage of space available per inmate under DOC operational capacity. Figure 4 illustrates this variation.

It therefore does not appear that any space standard was applied. For major institutions, the number of beds in ward areas was generally tied directly to design capacities. However, design capacities were apparently based on different assumptions about the number of square feet which should be available to inmates.

For field units, additional factors were used in determining capacity which could explain the variation. For example, the department indicated that within construction or design categories, the amount of space available per inmate would be very similar. Four categories were identified: large permanent units, small permanent units, stick camps, and unique units. But while these categories account for some variation (for example, all of the units with less than 40 square feet of space are stick camps), there is still significant variation within the categories. Thus, the average amount of space per inmate in large permanent field units ranges from 47.9 square feet in Caroline to 69.7 square feet in Tazewell. It also is unclear as to why operational capacity for some field units should be based on a guideline of over 60 square feet per inmate at the same time that less than 40 square feet is used for stick camps.

Department personnel later explained that operational capacity levels for field units have evolved as a result of three additional considerations besides space. These considerations are: (1) the constraints of the design of the facility, such as the capability of the wastewater treatment system, (2) the number of inmates that experience or judgement indicate could be housed safely, and (3) the size of the inmate work program in the area. However, the department has not documented how these factors determined operational capacity levels.

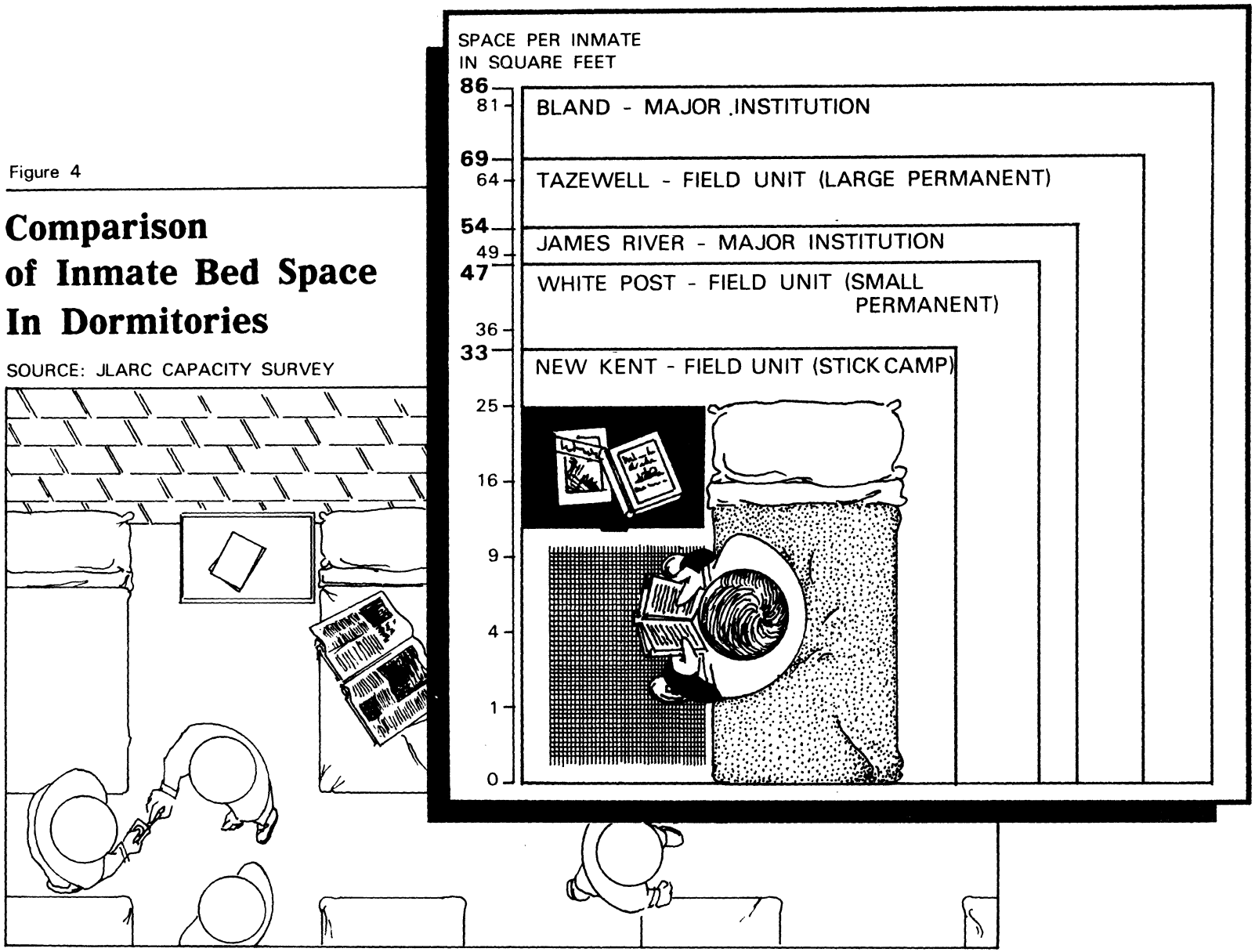
DOC therefore should report on the factors which were involved in determining the number of beds which would be located in ward areas. How these factors were used to determine the number of beds should also be precisely identified for each facility.

Reserve capacity. It may also be possible to identify a reserve capacity for ward areas to supplement the operational capacity figures. For example, the application of the ACA minimum guideline of 50 square feet of space per inmate would have added 294 beds to capacity in FY 1984 for the nine field units and two work release centers which offered more space than the guideline. In the ward areas of major institutions, where the inmates tend to be greater security risks, the use of a 60 square feet guideline would have resulted in the addition of 324 beds to capacity. This addition would have occurred in the eight institutions offering more space

Figure 4

Comparison of Inmate Bed Space In Dormitories

SOURCE: JLARC CAPACITY SURVEY



than the guideline. (The analysis excludes Powhatan, where the number of beds has been determined by court order.) A portion of these 618 beds might be reasonably added to a reserve capacity figure.

It is important to note that there may be factors which would make it impractical to use some of this potential reserve capacity. It also could be the case that while the use of the reserve capacity would not be impractical, its use could be expected to require additional resources or cause some problems. For example, fire safety code standards, physical barriers in the ward area, or sewage capacity considerations might make a portion of the reserve capacity impractical. The implementation of some reserve capacity could lead to a need for more staff. The implementation of other elements might cause some problems, such as visibility problems for inmate supervision or straining the capacity of the facility's food service operations.

Thus, the strict application of space guidelines may not be desirable in making final determinations of reserve capacity. DOC should follow two steps, therefore, in defining reserve capacity. First, it should present guidelines which it considers an acceptable basis for reserve capacity. Second, DOC should document the reasons for exceptions to those guidelines. This documentation should be very specific for each facility where an exception is made and identify and discuss the exact constraint(s) that limits capacity below the guidelines.

For example, if the problem is that the addition of certain beds in a ward area would unsafely limit the visibility of the supervising security officers, then the documentation should specifically identify the beds involved and the nature of the visibility problem. If the perceived problem is staffing, then the documentation should specify exactly how many positions would be required to handle the reserve capacity, and why those positions would be justified. Specificity in the documentation would be essential to allow individuals outside of the department to review DOC's concept of reserve capacity, and to make decisions about the use of reserve capacity.

Special Purpose Beds and Capacity

DOC also has a significant number of special purpose beds. These beds include isolation or segregation beds, medical beds, death row beds, and mental health beds. The major issue for special purpose beds is deciding which, if any, of these beds should be included in capacity figures.

In some cases, special purpose beds tend to be the permanent quarters for an inmate during his/her stay in a facility. This is generally the case for mental health beds and death row beds. In other cases, such as with medical beds or isolation beds, inmates usually leave general population beds to go to the special purpose beds.

DOC formerly did not count special purpose beds in either of these cases in its capacity figures. However, in response to legislative input, the department began in early 1983 to prepare FY 1984 operational capacity figures based on the inclusion of some special purpose beds of both types.

In the case where the special purpose beds tended to be permanent quarters for the length of an inmate's stay, the inclusion of the beds in capacity does not appear to create problems. However, department staff have claimed that there are problems with including those special purpose beds in capacity that are filled with inmates drawn from the general population. This practice is known as "double-encumbering". Double-encumbering is the inclusion in capacity of both special purpose beds and the general population beds from which inmates in the special purpose beds have been drawn.

The problem with double-encumbering is that an inmate may not be able to return to the same general population bed after a stay in a special purpose bed. This may not be reasonable, for example, when an inmate goes to a medical bed. In effect, the inmate is then penalized for the illness, because the inmate may be moved from an area where he or she has become established. On the other hand, it may be appropriate that an inmate taken to a special purpose isolation cell for punishment could face this additional penalty.

DOC's operational capacity is intended to reflect safety considerations, so the department used professional judgements in determining the number of special purpose beds which could be double-encumbered. As shown in Table 5, a total of 735 special purpose beds are in the DOC system; 267 of these beds, or 36 percent, have been counted in operational capacity.

A DOC study in the spring of 1983 determined how many special purpose beds would be included in operational capacity. No special purpose beds in field units were included in this capacity. In major institutions, a decision was made to include a portion of the average daily population of special purpose beds in capacity. This portion was set at a level which the wardens and the study team agreed could be safely double-encumbered.

JLARC has compared DOC's operational capacity for special purpose beds with the number of special purpose beds which are regularly put to use. A sample of every fourth working day, starting with a randomly selected day, was used to review DOC daily head count sheets for FY 1984. The lowest level of occupancy for special purpose beds on the sampled dates was identified for each facility.

This analysis led to two conclusions. First, DOC's decision to exclude special purpose beds in field units from capacity appears reasonable. Field units typically have only three or four special beds, and all of these beds are in facilities designed for isolation or segregation. For all field units, there are a number of days during the year when no special purpose beds are occupied.

Table 5

SPECIAL PURPOSE BEDS: CAPACITY IN THE DOC SYSTEM

Major Institutions*	Beds	Beds Included in Operational Capacity	Field Units**	Beds	Beds Included in Operational Capacity
Penitentiary	170	62	Halifax	7	0
Powhatan	154	72	Pocahontas	4	0
Mecklenburg	46	17	Fairfax	4	0
Va. Center For Women	46	20	Caroline	4	0
Brunswick	44	38	Baskerville	4	0
St. Brides	42	16	Patrick Henry	4	0
Buckingham	32	20	Harrisonburg	4	0
Bland	27	5	Rustburg	4	0
Southampton	22	6	Tazewell	4	0
Staunton	17	2	Chatham	4	0
James River	16	2	Tidewater	4	0
Deep Meadow	12	5	Dinwiddie	4	0
Deerfield	8	2	Wise	4	0
Southampton YOC	4	0	Stafford	4	0
Powhatan North	2	0	Greenville	4	0
			Haynesville	4	0
			White Post	4	0
TOTALS	642	267	New Kent	3	0
			Fluvanna	3	0
			Haymarket	3	0
			Nasemond	3	0
			Smith Mt. Lake	3	0
			Botetourt	3	0
			Capron	3	0
			Culpeper	1	0
			TOTALS	93	0

*The Marion correctional facility has 10 beds used for the isolation or segregation of its patients, and 32 beds for cadre inmates. However, these beds have not included under the special purpose category for this table.

**The Pulaski field unit, and each of the work release centers, do not have any special purpose beds, and therefore are not included in this table.

Source: JLARC analysis of data provided by DOC in response to the JLARC capacity survey.

Second, DOC's operational capacity for special purpose beds in major institutions closely approximates the minimum occupancy of those beds on a system-wide basis (although there was some significant variation in a few facilities). A capacity figure reflecting the minimum usage of special purpose beds in the major institutions would have been 302, instead of DOC's 267.

It is appropriate that DOC has included its judgement on the safety of special purpose operations in its capacity findings. Because DOC's numbers are reasonably related to the minimum usage of these beds, no change is currently recommended. In actually running the system, however, DOC should ensure that double-encumbering does not work to penalize inmates with legitimate health problems who are moved to medical beds.

Total System Capacity

The number of beds counted by DOC in capacity for each of the three preceding sections (general population cells, general population wards, and special purpose beds) can be aggregated to look at total capacity for the DOC system. Table 6 shows DOC operational capacity compared to the number of beds available in the system. This is broken down by facility and bed types. Current DOC operating capacity for the system is 9,544, or 91 percent of the 10,448 beds available.

DOC's operational capacity figures can be compared with what the system's capacity would be using different assumptions or judgements. As mentioned earlier, DOC's operational capacity is not equal to design capacity, budgeted capacity, or actual maximum occupancy levels.

For example, if DOC had not included any special purpose beds in operational capacity during FY 1984, then its capacity figure for major institutions would have been set 134 beds lower than the design capacity for those facilities. With special purpose beds included, the operational capacity for those facilities was set 133 beds higher than design capacity. For field units, the department has included 491 more beds in its capacity figure than was planned in design capacity.

The definition of operational capacity has also led to a situation where the official DOC capacity level is less than the capacity level for which the General Assembly has provided appropriations. Moreover, it is less than the level of inmate populations which the department has actually accommodated in the past. Thus, operational capacity is less than budgeted capacity and less than actual maximum occupancy levels. Table 7 shows the differences between design capacity, operational capacity, budgeted capacity, and maximum actual occupancy levels.

Table 6

DOC SYSTEM: OPERATIONAL CAPACITY COMPARED TO TOTAL NUMBER OF BEDS

	General Cell Beds	General Ward Beds	Special Purpose Beds	Total
MAJOR INSTITUTIONS				
(Oper. Capacity)	4,133	2,334	267	6,734
(Number of Beds)	4,558	2,334	642	7,534
FIELD UNITS				
(Oper. Capacity)	0	2,653	0	2,653
(Number of Beds)	0	2,664	93	2,757
WORK RELEASE CENTERS				
(Oper. Capacity)	25	132	0	157
(Number of Beds)	25	132	0	157
TOTAL				
(Oper. Capacity)	4,158	5,119	267	9,544
(Number of Beds)	4,608	5,130	735	10,448

Source: JLARC analysis of data from the DOC response to JLARC's capacity survey.

Table 7

DOC SYSTEM: COMPARING VIEWS OF CAPACITY

	Design Capacity	Operational Capacity FY 1984	Budgeted Capacity FY 1985	Max. Occupancy Levels, FY 1984*
MAJOR INSTITUTIONS	6,601	6,734	6,979	7,130
FIELD UNITS	2,162	2,653	2,653	2,654
WORK RELEASE	162	157	157	162
TOTAL	8,925	9,544	9,789	9,946

*This column reflects the maximum average daily population level actually held by the facilities for any month during FY 1984.

Source: DOC response to capacity survey; DOC Population Summaries.

Overall, the range in system capacity across these four terms is 1,021 inmates (from design capacity to actual maximum occupancy levels). With special purpose beds included, DOC operational capacity is 107 percent of design capacity, but it is only 96 percent of FY 1984 actual maximum occupancy levels.

In comparing capacity with population forecasts, however, it appears that two critical pieces of capacity information are needed. First, it is important to know the capacity level which appears best for the long-term operation of the system. Second, it is important to know how far the capacity of the system can reasonably be stretched during the short-term if the inmate population suddenly increases. Neither piece of information necessarily emerges from the four capacity terms presented above, although DOC's operational capacity appears to be a useful starting point for defining what the long-term capacity of the system should be.

Table 8 therefore compares DOC's operational capacity for FY 1984 with the potential reserve capacity which was outlined in this chapter. This reserve capacity is oriented towards defining a maximum capacity level under which the system can be operated to accommodate short-term population increases or forecast errors. It reflects: (1) some doublebunking at Brunswick and Buckingham, (2) the use of a 50-square-feet-per-inmate space guideline in the ward areas of field units and work release centers, and a 60-square-feet guideline in the ward areas of major institutions, and (3) the same capacity for special purpose beds which DOC has defined in operational capacity.

CAPACITY CHANGES

The operational capacity of the department as of the end of FY 1984 was 9,544. Capacity changes have taken place since that time, and more changes are anticipated over the next several years.

The main changes which are already taking place are the phasing out of the Penitentiary, the closing of Deep Meadow, and the opening of Nottoway. Nottoway is a medium-security facility similar to Buckingham and Brunswick.

Table 9 shows the impact of facility changes on operational capacity as planned by DOC. Capacity will peak at 9,994 in August of 1984 with the opening of Nottoway. Then, as Deep Meadow and the Penitentiary are phased out, capacity is expected to remain at 9,449 until April of 1986, when Augusta will open and capacity is expected to be 9,870. As the department moves to continue phasing out the Penitentiary, capacity will decline to 9,791 in June of 1986. No further changes in capacity are expected until June of 1990.

As mentioned, there are other ways to look at capacity and capacity changes besides the department's view of operational capacity. For example, various elements of reserve capacity could be

TABLE 8

POTENTIAL RESERVE CAPACITY BY FACILITY FY 1984

Facility	Operational Capacity FY 1984	Potential Reserve In Cells	Potential Reserve, Ward Areas	Potential Reserve Capacity
Bland	440	0	122	562
Penitentiary	868	0	0	868
Southampton	474	0	0	474
Deerfield	290	0	19	309
Southampton Rec. Unit	116	0	0	116
Southampton YOC	100	0	15	115
Powhatan	596	0	0	596
James River	321	0	0	321
Powhatan North	92	0	23	115
Deep Meadow	437	0	28	465
Powhatan Rec. Unit	245	0	0	245
Women's Center	325	0	0	325
Staunton	527	0	84	611
Mecklenburg	335	0	0	335
Marion	145	0	0	145
St. Brides	423	0	33	456
Brunswick	500	182	0	682
Buckingham	500	182	0	682
Field Units & Work Rel	2,810	0	294	3,104
TOTALS	9,544	364	618	10,526

Source: JLARC analysis of DOC capacity data.

utilized. The potential reserve capacity identified in this chapter would add up to 982 beds to the 9,544 base. Using DOC's assumptions for a partial closing of the Penitentiary during the forecast periods, the potential reserve capacity of the system increases from 10,526 at the end of FY 1985 to 10,942 by the end of FY 1986, and remains at a level of approximately 11,000 to the end of FY 1990.

CONCLUSION AND RECOMMENDATIONS

The concept of capacity is imprecise, and subject to different interpretations and changing standards. A number of assump-

Table 9

DOC OPERATIONAL CAPACITY CHANGES

Date		Expected Capacity Changes	Capacity, at End of Month
JUN 1984			9,544
AUG 1984	+500	Open Nottoway	9,994
	- 50	Close Penitentiary "A building"	
OCT 1984	-437	Close Deep Meadow	9,557
NOV 1984	- 40	Penitentiary phase-out #2	9,517
DEC 1984	- 34	Penitentiary phase-out #3	9,483
JAN 1985	- 34	Penitentiary phase-out #4	9,449
APR 1986	+500	Open Augusta	9,870
	- 79	Penitentiary phase-out #5	
MAY 1986	- 57	Penitentiary phase-out #6	9,813
JUN 1986	- 22	Penitentiary phase-out #7	9,791
JUL 1986 - JUN 1990		No Change	9,791

Source: DOC Research and Reporting Unit.

tions and judgements must be made in defining and determining capacity. DOC's view of capacity is operational capacity, which the department has defined as the maximum level at which facilities can be operated safely. The actual numbers DOC offers for capacity are based on judgements rather than empirical evidence.

DOC's view of operational capacity is useful as a starting point for defining what the long-term view of capacity should be. However, DOC should also report on the reserve capacity of the system, or the maximum number of inmates which can reasonably be accommodated during short-term periods of heavy demand for space. Therefore, two recommendations are offered.

Recommendation (1). DOC should report a figure for the reserve capacity of its facilities, in addition to the operational capacity which it currently reports. Reserve capacity should reflect how far capacity can be reasonably increased during the short-term to accommodate short-term population increases of forecast errors.

Recommendation (2). Reserve capacity should be based on some double-bunking of the cells in facilities like Buckingham and Brunswick. Reserve capacity should also be based upon some precisely defined guideline or guidelines for DOC facility ward areas, such as square footage per inmate. A guideline for ward areas is considered useful to facilitate an identification of potential reserve space, and to facilitate reviews of DOC's capacity situation.

It is recognized that the strict application of any minimum guideline may not lead to an appropriate definition of capacity for all facilities. Therefore, it is also recommended that DOC document the reasons for exceptions to reserve capacity guidelines which it considers necessary. This documentation should be very specific in identifying and discussing the exact constraints that might limit reserve capacity below the guidelines in certain facilities. The department should also report on the problems that the utilization of various portions of reserve capacity is expected to cause.

III. MODEL STRUCTURE

In 1983, the Department of Corrections implemented its current forecasting model. This model is based on a revised version of Florida's Simulated Losses/Admissions Model (SLAM II). SLAM II contains an admissions component and a release component which together yield an unadjusted prediction of inmate responsibility. This model now constitutes the first two components of a three-component DOC system. The final component is a series of manual adjustments which DOC staff developed or commissioned. The adjustments reflect recent policy changes in Virginia.

Before DOC's current model can be evaluated, the structure and purpose of each component must be understood. This chapter will describe and analyze each of the three major components of the forecasting model: admissions, releases, and manual adjustments. Following chapters will discuss problems identified in each component and possible solutions.

ADMISSIONS COMPONENT

An accurate admissions forecast is crucial, because a population forecast is derived by adding predicted admissions to the population at the beginning of the period and then subtracting releases. Errors in the admissions forecast can be magnified by errors in the release forecast, causing large overpredictions or underpredictions of State inmate populations.

To calculate an admissions forecast, DOC uses two factors that have historically and theoretically influenced inmate admissions: the unemployment rate and the crime-prone population. Past data for these two factors and for admissions are statistically analyzed to determine the relationship between them. Equations that describe this relationship are then used to predict future admissions.

It is important to note that in order to predict *future* admissions, the values used in the equations for unemployment and the crime prone population must themselves be predicted. Another important assumption is that the relationship existing in the past between these factors and admissions will continue into the future.

In addition, unlike the original SLAM II model, the DOC adapted version uses two sets of equations to predict admissions. They predict white and non-white admissions separately, and the total forecast is the sum of the two. According to DOC, the two sets of equations are needed because of the changing demographics of the Commonwealth. If different equations were not used, then changes in

the demographic distribution of whites and non-whites would not be reflected in the forecast. Also, historical data suggest that non-whites have a higher commitment rate than whites. This difference would not be accounted for if only one equation were used.

Thus, to assess the reliability of this forecasting component, both the data used and the relationship of that data to admissions must be considered.

Crime-Prone Population

In theory, the population should have a positive relationship with admissions because as the number of crime-prone individuals increases, so do admissions to State institutions. Population figures for the years 1950, 1960, 1970, and 1980-1990 were obtained from the Department of Planning and Budget. Population data was available every ten years, and the intermediate values had to be interpolated.

In defining the crime-prone population, DOC experimented with several subgroups: ages 18-24, 18-29, 18-34, and 18-49 (still being tested) by white and non-white males. The 18-34 population is currently being used to forecast admissions. Studies in other states have also tended to use this population.

In additional testing, DOC discovered an apparently significant trend in the committed population that could affect the equations. The percentage of committed population in the 35-49 age group had increased from 11.8 percent in 1981 to 17.2 percent in 1983. Including the older group in the crime-prone population variable proved to provide a better forecasting equation, and hence two admission forecasts were developed. One uses the 18 to 34 group, while the second uses the 18 to 49 group. Since the cause of the commitment ratio cannot be determined, DOC intends to study the trend to determine if the older group should be included in the crime-prone population.

Unemployment Rate

Unemployment is also theorized to have a positive relationship with admissions. Higher unemployment means more idle time, with more opportunity and greater motivation to commit a crime. The forecasting equations are based on annual data from 1950-1983. Past unemployment rates were obtained from the Virginia Employment Commission, and future unemployment forecasts were obtained from the Department of Taxation's Large Scale Econometric Model.

However, DOC feels that unemployment data is difficult to forecast. Each quarter, unemployment forecasts can change significantly, changing the admissions forecast as well. For this reason (and the fact that DOC feels that the Virginia Large Scale

Econometric model has not been fully tested as an unemployment predictor) DOC considers it inappropriate to use the Virginia unemployment rate as an independent variable for forecasting more than three years into the future. Therefore, unemployment is used in the equations for FY 1984-86, and is deleted for FY 1987-90.

Admissions

Currently, admissions are calculated differently for the years 1950-1972, 1973-1975, and 1976-1983. The first 23 years of admissions data includes new commitments plus parole violators. The last eight years of data is comprised of new commitments plus parole violators plus the change in jail backlog. Both white and non-white admissions variables include men and women.

The admissions data described here are based on information furnished by the DOC's Research and Reporting Unit, and on JLARC's replication of the unit's results. Admissions will be examined in five segments: (1) the calculation of admissions before 1973; (2) the calculation of admissions for the years 1973 to 1975; (3) the calculations of admissions for the years 1976 to 1983; (4) the calculation used for jail backlog; and (5) the method used for dividing parole violators into white and non-white admissions.

Admissions 1950-1973. During this period, the calculation of admissions was based on the inclusion of parole violators as new commitments. They were counted as such because when they returned to the State system, they were given new inmate numbers and were not specifically identified as parole violators. Thus, data on parole violators were not recorded during that period, and admissions therefore could not be separated into new commitments and parole violators.

Admissions 1973 to 1975. Another calculation for admissions was used during the years 1973 to 1975. For this period, parole violators were included in admissions in the same way as for the years 1950 to 1973. However, the measurement of admissions for the period differs because an estimate of the effect of jail backlog was included for the first time.

Admissions 1976-1983. For the period 1976 to 1983, a third method was used by DOC to calculate admissions. Admissions were equal to new commitments plus parole violators plus an estimate of those State felons backed up in local jails. Starting in 1976, when a parole violator was returned to the State system, the individual's old inmate number was reassigned to him; he was no longer considered a new commitment. To be consistent with the 1950-1975 admission data, it was also necessary to include parole violators in the admissions variable. A different method for accounting for parole violators was developed. Parole violators were counted from the DOC data base and added into admissions.

Jail Backlog. Another factor important to understanding DOC's calculation of admissions is jail backlog. Starting in 1976, an attempt was made to estimate the number of felons housed in local jails who were the State's responsibility. Due to the limited capacity of the State system, convicted felons were being forced to spend a longer portion of their sentence in local jails, causing a backup of State felons in local jails. DOC believed that any backup of prisoners in local jails was primarily due to the lack of capacity in the State system. Had ample capacity existed, the department maintains these inmates would have been transferred to State institutions.

The values for new commitments, parole violators, and jail backlog are shown in Table 10.

Table 10

NEW COMMITMENTS, PAROLE VIOLATORS, JAIL BACKLOG
1976 - 1983

Year	New Commitments	Parole Violators	Jail Backlog	Total Admissions
1976	2862	189	+618	3480
1977	3755	370	-478	3277
1978	3231	264	- 97	3134
1979	3151	419	+ 44	3195
1980	4215	551	+ 12	4227
1981	4063	662	+473	4536
1982	5415	840	+ 88	5503
1983	6203	807	-636	5567

Source: DOC Felon Information System.

Parole Violators. DOC used an indirect method to calculate the racial composition of parole violators. DOC assumed that the racial composition of parole violators in any given year is the same as that for new commitments. The method used was to calculate the proportions of whites and non-whites in each year's new commitments. Parole violators and jail backlog were then multiplied by these percentages in order to add each to their respective white and non-white admissions variable. This was performed for each individual year from 1976 to 1983. The percentages of new commitments by white and non-white catagories and the corresponding values for parole violators and jail backlog are given in Table 11.

Using the Factors to Forecast Admissions

The admissions component of the forecasting model uses four equations to generate the forecast. Two of the equations include the

Table 11

PERCENTAGE OF ADMISSIONS, PAROLE VIOLATORS, AND JAIL BACKLOG BY WHITE AND NON-WHITE

Year	Percent of White Admissions	Percent Non-White Admissions	Parole Violators White	Parole Violators Non-White	Jail Backlog White	Jail Backlog Non-White
1976	46	54	87	102	284	334
1977	45	55	167	203	-215	-263
1978	46	54	121	143	- 45	- 52
1979	48	52	201	218	21	23
1980	50	50	215	276	6	6
1981	51	49	338	324	241	232
1982	49	51	412	428	43	45
1983*	49*	51*	395	412	-313	-323

*Estimated

Source: DOC Research and Reporting Unit.

unemployment factor, and predict admissions for the period 1984-87. The other two equations omit the unemployment factor, as previously discussed, and predict admissions for 1987-90. In addition, two sets of the equations are used: one set uses the 18-34 age group as the crime-prone population factor, and the other set uses the 18-49 group. Although the data for the 18-49 group is still being tested, it appears to yield better statistical properties.

The general forms of the equations used by DOC to forecast admissions are shown below:

FY 84-87

(1) $\text{Admissions} = a_0 + b_1 \times (\text{white crime-prone population}) + b_2 \times (\text{unemployment})$

(2) $\text{Admissions} = a_0 + b_1 \times (\text{non-white crime-prone population}) + b_2 \times (\text{unemployment});$

FY 87-90

(3) $\text{Admissions} = a_0 + b_1 \times (\text{white crime-prone population})$

(4) $\text{Admissions} = a_0 + b_1 \times (\text{non-white crime-prone population})$

The values for a_0, b_1, and b_2 define the relationship between admissions and the population and unemployment figures, and are estimated by a statistical procedure called regression analysis. Since past values for admissions, crime-prone population, and unemployment are known, the regression procedure can supply a statistical description of their relationship. That relationship can then be applied, along with future estimations of crime-prone population and unemployment, to predict future admissions.

The total forecast of admissions is calculated by adding the forecast for white and non-white admissions. The results of the forecast are shown in Table 12. The detailed statistical properties of the regression analysis are provided in the Technial Appendix to this report.

Table 12

DOC FORECAST ADMISSIONS

Year	18-34 Group	18-49 Group
1984	4170	4416
1985	4197	4503
1986	4251	4642
1987*	4399	5077
1988*	4446	5262
1989*	4504	5459
1990*	4534	5630

*Denotes that the forecast is derived from the equations that do not use the unemployment rate as a variable.

Source: DOC Research and Reporting Unit.

RELEASE COMPONENT

After admissions to the State system have been predicted, the number of felons leaving the system must be estimated for future periods. The release component of DOC's model carries out this function. It computes the likelihood that an inmate will actually serve each month of his/her sentence. The model calculates "probability distributions functions" for 13 groups of inmates. The categories are based upon the length of sentence that inmates have received.

The current release component methodology was extracted entirely from the Florida's SLAM II Model. Consultants who developed the Florida model worked with DOC personnel to adapt the release component for use in Virginia. A highly touted advantage of the

release component is that inmates currently confined in the system can be included in the release calculations. However, this feature also makes the model's calculations very complex.

This section describes the calculations used in DOC's version of SLAM II to produce release forecasts.

Sentence Categories

Several specific factors may become important in determining when a particular inmate will be released from the system:

length of sentence given by the judge;
parole eligibility dates;
Parole Board decisions;
additional crimes committed while incarcerated;
amount of good time lowering serving time; and
mandatory parole dates.

While these factors may affect an individual inmate's length of stay in the State system differently, the release component must isolate the factors most likely to impact the length of stay for all inmates taken as a group. A method must then be developed for incorporating the differences into the forecasting procedures.

The release component used by DOC accounts for differences in the lengths of stay which are caused by different sentence lengths. Each of 13 sentence groups are analyzed separately. The groupings include a range of sentence categories from less than one year to life imprisonment or death. The 13 groups and some of their characteristics are shown in Table 13.

For each category, the component calculates a probability that an inmate will serve each month of his sentence. In most models the release component is calculated on the inmates that have been released recently. However, the SLAM II component includes probabilities for both the recently released (release cohort) and those currently confined in the system. The two types of inmates, released and confined, have their probabilities calculated differently.

The methodology used for these calculations is described in the next section. Then three other elements of the release component are described: application of probabilities to confined inmates, application of probabilities to admissions, and forecast calculations.

Calculation of Probability of Stay

The first step in calculating releases is to estimate the probabilities of stay for each sentence group. The theory behind this model is that by taking the inmates in the system during one

Table 13

SENTENCE CATEGORIES AND
ASSOCIATED CHARACTERISTICS

Sentence Category	Length of Sentence	Average Length of Stay	Number of Releases
1	Up to 1 year	2.22	361
2	1 to 2 years	4.70	480
3	2 to 3 years	9.76	376
4	3 to 4 years	14.59	410
5	4 to 5 years	18.14	508
6	5 to 6 years	23.78	245
7	6 to 8 years	29.81	353
8	8 to 10 years	38.51	335
9	10 to 15 years	55.18	359
10	15 to 20 years	70.78	223
11	More than 20 years	115.33	207
12	Life Sentences	193.28	31
13	Death Sentences	112.00	1

*Source: DOC documentation.

time slice, all inmates in the system are represented. For the theory to be correct the system must be stable. That is, the proportion of individuals sentenced into each sentence group must generally be the same, and the flows into and out of the system must be steady functions, although not necessarily equal. Each factor which may affect the lengths of stay in each sentence group must be contained in the data to the extent it is expected to occur during the forecast period.

Probabilities of stay are currently calculated with a data base that includes all inmates in the system as of June 30, 1981, and all those confined or released between July 1, 1981, and June 30, 1982. The calculation excludes recidivists admitted after July 1, 1979, and all State felons housed in local jails that have not been committed to the State's custody. The data base prior to the exclusions for these calculations includes over 12,000 inmates. For comparison, the Florida data base included three fiscal years and nearly four times as many cases.

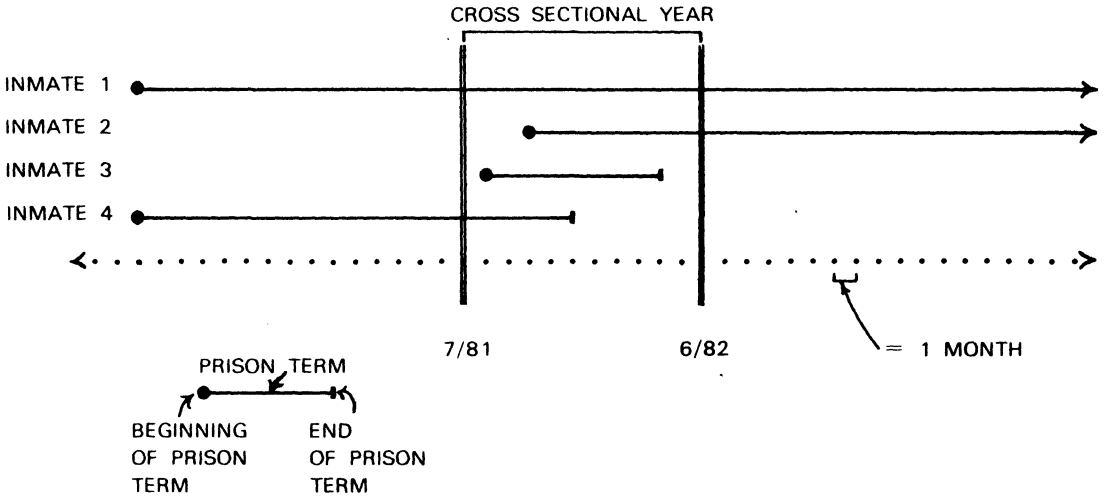
The calculations can be illustrated by examining the calculations for four examples assumed to be in the same sentence group:

Inmate 1: admitted 9/80; confined through 6/82
Inmate 2: admitted 10/81; confined through 6/82
Inmate 3: admitted 8/81; released 4/82
Inmate 4: admitted 9/80; released 12/81

Figure 5 illustrates these four cases.

Figure 5

Four Case Examples of Probability of Stay Computations



SOURCE: JLARC STAFF GRAPHIC.

The four inmates are used in Figure 6 to illustrate the probability calculations for four months: the first month of an inmate's sentence, the 16th month, the 17th month, and the 50th month.

These illustrations point out that the probabilities are computed for each successive month of an inmate's sentence, instead of for a calendar month. Futhermore, the first month an inmate is included in the calculations is the month of his/her sentence being served in July 1981. If the inmate is released during FY 1982, the inmate is included in the numerator and the denominator of each subsequent month of his sentence as a 0 and 1, respectively. If an inmate stays through the entire month of June 1982, that month of his sentence is the last month for which the inmate is included in the calculation.

The result of the probability calculations for all inmates is a probability table with a row for each sentence group (13) and as many columns as the months the forecaster desires to forecast. Each row represents the probability that an inmate in that sentence group will be incarcerated for each month of the sentence. In all cases the probabilities for the first month of each sentence category are one. Examples of the probabilities in five sentence groups for selected months are shown in Table 14.

Figure 6

EXAMPLES OF PROBABILITY CALCULATIONS

For the first month, the probability that an inmate would serve the first month of his/her sentence is equal to the probability that any inmate serving the 1st month of their sentence during FY 1982 stayed the first month. Inmates 2 and 3 served the 1st month of their sentence during FY 1982, therefore, the probability for the four examples is calculated as follows:

	Inmate 1	2	3	4
Numerator	Not Included	1	1	Not Included
Denominator	Not Included	1	1	Not Included

$$p = \frac{1 + 1}{1 + 1} = 1$$

For the 16th month, the calculation of probability that an inmate would serve the sixteenth month of his/her sentence is similar to the first month, but Inmate 2 is excluded because he did not serve the 16th month during FY 1982 and Inmate 3 has been released. The calculation is as follows:

	Inmate 1	2	3	4
Numerator	1	Not Included	0	1
Denominator	1	Not Included	1	1

$$p = \frac{1 + 0 + 1}{1 + 1 + 1} = .67$$

For the 17th month, the probability that an inmate would serve the seventeenth month of his/her sentence is the same as the sixteenth month, except Inmate 4 has also been released:

	Inmate 1	2	3	4
Numerator	1	Not Included	0	0
Denominator	1	Not Included	1	1

$$p = \frac{1 + 0 + 0}{1 + 1 + 1} = .33$$

For the 50th month, Inmates 1 and 2 are excluded because they did not serve the 50th month during FY 82 and Inmates 3 and 4 have been released:

	Inmate 1	2	3	4
Numerator	Not Included	Not Included	0	0
Denominator	Not Included	Not Included	1	1

$$p = \frac{0 + 0}{1 + 1} = 0$$

Table 14

SELECTED EXAMPLES OF PROBABILITY OF STAY

Sentence Group	MONTH 1	2	3	4	5	10	30	60	80
up to 1 year	1.0	.65	.29	.06	.04	.008	0	0	0
2 - 3 years	1.0	.99	.96	.89	.82	.45	.01	.003	0
4 - 5 years	1.0	1.0	.998	.99	.98	.748	.21	.007	0
15 - 20 years	1.0	1.0	1.0	1.0	1.0	1.0	.977	.538	.24
Life	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	.984

Source: DOC June 1984 forecast.

Application of the Probability Table to the Confined Population.

The probability table described in the previous section becomes the base for calculating the probabilities that inmates confined as of June 1982 will remain incarcerated throughout the forecast period. Rather than using the probability table directly, however, four steps are followed to compute adjusted probabilities for each inmate:

Step 1: The month of the inmate's sentence to be served in June 1982 is calculated.

Step 2: The probability that an inmate in that sentence category will serve that month of his sentence is found in the table.

Step 3: This probability is used to divide into all the remaining probabilities to adjust the probabilities for that inmate.

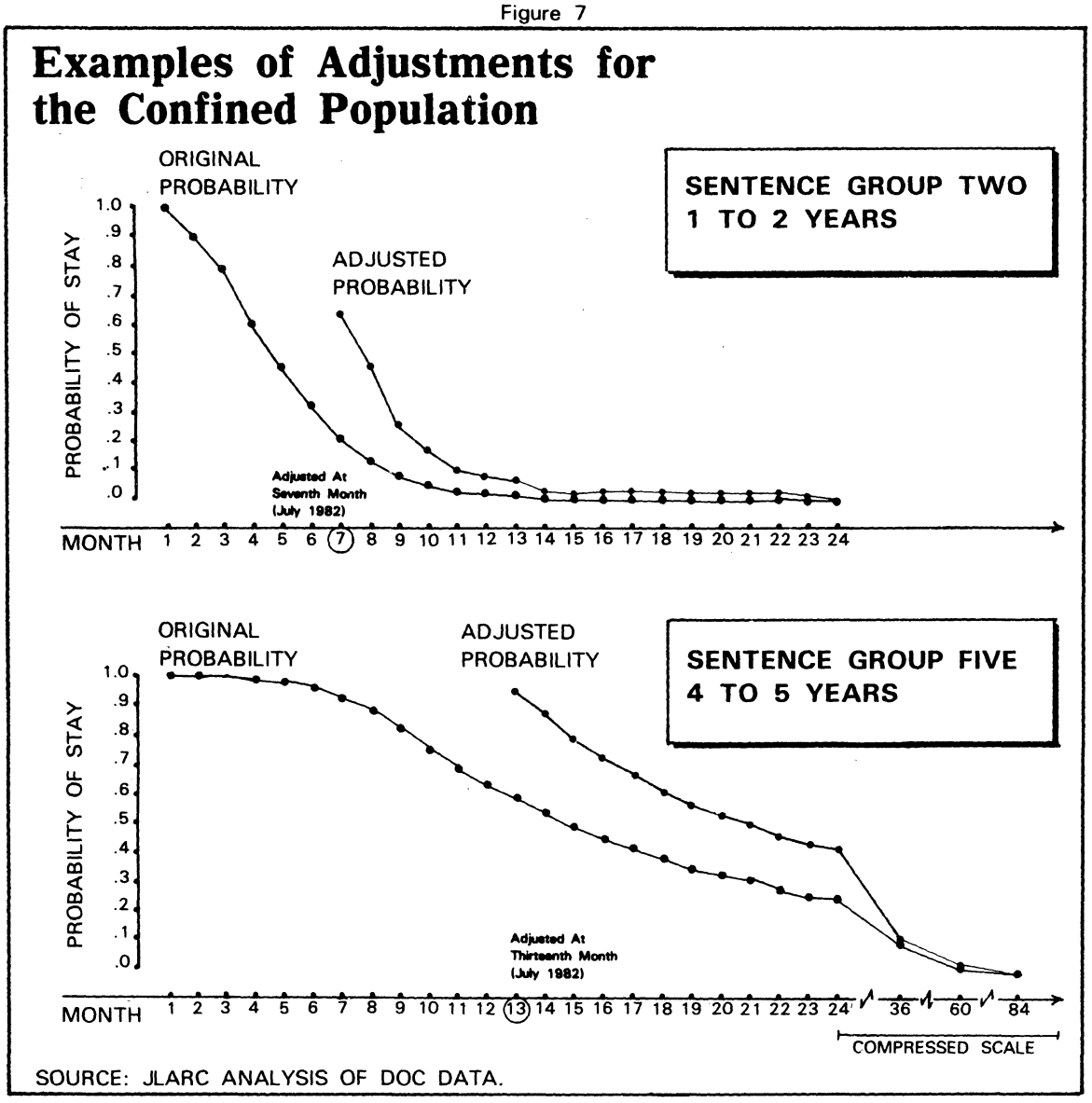
Step 4: The three steps are repeated for all confined inmates and their adjusted probabilities are added together. This step is taken to determine how many of the confined group can be expected to remain incarcerated during each month of the forecast period.

Two examples of adjustments are shown in Figure 7.

DOC's consultant explains the need for the adjustment by pointing out that an inmate incarcerated in June 1982 represents the larger group of all inmates incarcerated during the same month with the same sentence. The adjustment compensates for the release of some of the inmates admitted during the same period as the inmate

that is currently confined. In all subsequent months until the probability equals 0, the adjusted probability of stay is greater than the probability in the original table. Figure 7 shows the adjusted probability line is always greater than the original, until they both equal zero.

Figure 7



Probability of Stay for New Admissions

The probability of stay for new admissions is calculated using the original probability of stay table and the actual admissions from FY 1982. For the first month of the forecast period, the actual admissions are used in the forecast. The second month adds in the admissions for August 1982 as well as the sum of the

probabilities that the first month's admissions will remain incarcerated. The process of simultaneously including new admissions, and excluding previous admissions by the probability of their being released, continues for the first 12 months of the forecast period. During the first month 423 inmates are added in. Subsequent months show the effect of admissions for each month less expected releases. The net effect of the calculations shows 3,422 inmates residing in DOC prisons. The model indicates that only 1,978 out of 4,595 inmates admitted in the first year will still be incarcerated after two years.

To calculate the admissions for the second year, admissions for the first year are multiplied by a factor. This factor represents the expected increase or decrease in admissions predicted by the admissions component. For example, the admissions for FY 1985 are predicted to be 4,197 by DOC. The factor by which the first year's admissions is multiplied is 4,197 divided by 4,575, or .917. Thus, when the new admissions are predicted to be less than admissions in FY 1982, the factor will be less than one. Conversely, when the new admissions are expected to be greater than the admissions in FY 1982, the factor will be greater than one.

Admissions are treated as an annual factor in the model. That is, FY 1982 admissions are a cumulative total of all incoming inmates minus the inmates which are released. Therefore, the admissions being added into the model increase throughout the first 12 months as new admissions are coming in, then decline during the remainder of the forecast period as those new admissions are released.

Figure 8 illustrates the way in which admissions are added in. The second year's admissions begin in the 13th month of the forecast period and follow the same pattern as the first year. Each subsequent year in the forecast period is generated in the same manner (with a new admissions factor added during the 25th month, 37th month, 49th month, etc.).

Forecast Calculations

The fourth step in computing the forecast involves the summation of the adjusted probabilities for the confined population and the admissions groups. This process begins with the confined probabilities and adds in the admissions groups one by one. This approach assumes that admissions in each month of the forecast period will be the same proportion of total annual admissions as the corresponding month in FY 1982. The approach also assumes that the distribution of sentences in each month of the forecast period will be the same as in the corresponding month of FY 1982. This approach necessitates that FY 1982 admissions be representative of all future years.

Admissions and releases are calculated for each month. Admissions are computed as increments (or decrements) to admissions

Figure 8

EXAMPLE OF ADMISSIONS ANNUALLY AFFECTING DOC FORECAST MODEL
First 24 Months

MONTH											
1	2	3	4	5	6	7	8	9	10	11	12
423	682	982	1313	1471	1339	1969	2161	2451	2775	3072	3427

MONTH											
13	14	15	16	17	18	19	20	21	22	23	24
3249	3080	2927	2789	2661	2539	2427	2319	2223	2135	2054	1978
+423	+682	+982	+1313	+1471	+1339	+1969	+2161	+2451	+2775	+3012	+3427

Source: JLARC analysis of DOC model program.

in each month of FY 1982. For example, the proportion of admissions that occurred in December 1982 is used as the proportion which will be expected every December. Releases are calculated using forecasted population and forecasted admissions. The calculation adds admissions during a year to the population forecasted at the beginning of that year and then subtracts the population forecast for the end of the next year. The final part of the model simply involves printing out the forecast results and some actual and estimated values for State responsibility.

MANUAL ADJUSTMENTS

Manual adjustments are made to the admissions and release components to account for administrative and policy changes that are not included in the model as other components. The SLAM II model does not account for all of the factors that affect inmate population levels. Therefore, a failure to make any adjustments could severely distort the population forecast and lead to large misallocations of money or a shortage of bedspace for confined inmates. The need for these adjustments is based on the need to respond to relevant changes in the judicial and correctional environments that directly affect the planning of bedspace for inmates.

Currently five manual adjustments are made to the results of the SLAM II model. These adjustments are performed in order to bring the results of the model in line with changes in policy and statutes in Virginia. Three of the manual adjustments -- those related to

recent recidivist legislation, firearm legislation, and the 'three-time' loser law -- effectively increase the prison population. Two of the adjustments -- those related to the Community Diversion Incentive Program and changes in the Parole Board policy practices -- decrease the population.

The impact of the five adjustments are shown in Table 15. According to DOC's methods, the adjustments collectively decrease the forecast through 1989 but increase the prison population thereafter. The magnitude of the adjustments varies from an increase of 15 inmates due to the three-time loser law to an increase in 952 inmates due to the recidivist changes.

Table 15

IMPACTS OF MANUAL ADJUSTMENTS

	1 Recid-ivist Law	2 Gun Law	3 3-time Loser	4 *** CDI	5 Parole Board	Net Effect
June 84	+572	0	0	-305	-689	-422
June 85	+677	0	0	-467	-843	-633
June 86	+748	+118	0	-467	-843	-444
June 87	+801	+117	0	-467	-843	-392
June 88	+845	+266	0	-467	-843	-199
June 89	+886	+399*	0	-467	-843	-25
June 90	+919	+399	0	-467	-843	+ 8
June 91	+947	+399	0	-467	-843	+ 36
June 92	+967	+399	0	-467	-843	+ 56
June 93	+971	+399	0	-467	-843	+ 60
June 94	+971	+399	0	-467	-843	+ 60
June 95	+971	+399	0	-467	-843	+ 60
June 96	+969	+399	0	-467	-843	+ 58
June 97	+965	+399	0	-467	-843	+ 54
June 98	+961	+399	+5	-467	-843	+ 55
June 99	+956	+399	+10	-467	-843	+ 55
June 2000	+952	+399	+15**	-467	-843	+ 56

*Cutoff date in HJR 152 documentation.

**Maximum effect in 2008 -- documentation continues to 2015.

***This is the only change in the manual adjustments from the most recent forecast (Version A -- December, 1983).

Source: DOC documents.

DOC personnel have developed or approved the adjustments that are made to the SLAM II results. The SLAM II components could be effectively used to internally account for legislative and policy changes. The adjustment for the Community Diversion Incentive Program could be made to the admissions component of the model. The remaining four adjustments could be accounted for by alterations of the release component.

This section will review the rationale behind each adjustment and examine the methods used in making them.

Adjustments Related to the Parole Board

The Parole Board has implemented five administrative policy changes that are intended to reduce the number of inmates in DOC institutions. Each policy change provides a method for saving beds in the prison system. The changes focus on particular aspects of Parole Board policies that are <u>not</u> controlled by statutes, and represent efficiencies and improvements in the operations of the Parole Board.

The policy changes apply to particular types of parole cases which are considered for discretionary parole. These are first time interviewees, subsequent review cases, and parole violators. The first time cases are inmates who are eligible for discretionary parole for the first time in their current sentences. The subsequent review cases are inmates who have been denied parole at least once while serving their current sentences. Parole violators are those parolees who have violated one or more conditions of their paroles.

The Parole Board had limited resources to accomplish the policy changes but made the necessary personnel increases to handle the increased workload. All of the policy changes that are examined in this section were implemented during the period of the current Parole Board's seating from July 1982 to June 1984.

Adjustments Related to Elimination of Extra Serving Time. This policy is intended to reduce the time delay between the Parole Eligibility Date (PED) and the release date for inmates who are granted discretionary parole. The time delay results from the scheduling and interviewing by the Parole Board of inmates who are under consideration for discretionary parole. In the past, a significant number of inmates have waited until after their PED or subsequent review date to be interviewed by the Parole Board. Thus, if they were granted discretionary parole, they stayed in the prison system longer than they needed to stay. These cases include both first time interviewees and review cases.

The policy change is intended to eliminate these extra serving days by conducting interviews on parole-eligible inmates a quarter before their PED or review date. This allows ample time for the prison officials and the Parole Board to prepare for the inmate

leaving the prison system, and eliminates the extra serving time for both types of parolees.

The Parole Board's methodological approach was to estimate the "potential" bed savings this policy would have. The "potential" savings are based on the extra serving days in the year which are avoided with the implementation of this policy.

Using data for FY 1982, the Board could judge the size of possible savings, since the policy change was implemented in FY 1983. A computer printout of all discretionary parolees for FY 1982 was taken from the Offender Based State Correctional Information System (OBSCIS). This listing produced 1,747 inmates who received discretionary parole. This group was assumed to be first-time interviewees. The extra serving days for this group totalled 56,747; this number divided by 365 days produces 155 potential annual beds saved. To account for missing data not listed on the printout, the researcher added an additional 77.5 beds to the potential beds savings, yielding a total 232.5 potential beds saved. For review cases, a similar empirical method for estimating potential beds savings was not performed. The review cases potential bed savings were assumed to be the same level, 232.5 beds. Therefore, the total potential beds savings that was recommended using this method was 465 beds per year.

Adjustments Related to Release Review Cases. This policy change is meant to save beds by making decisions on discretionary parole one quarter in advance of review dates for inmates who are under review for discretionary parole. These inmates have previously been denied parole on their current sentences but are reconsidered each year. Reconsideration of inmates one year after their previous denials is a policy of the Parole Board. The review of each inmate denied parole is required by the *Code of Virginia*, but the Parole Board has latitude in deciding when this will occur.

This policy change is intended to move up the hearing in order to reduce the serving time for review cases that are successfully granted parole. An inmate is released from incarceration as soon as parole is granted. The inmate does not have to wait until the actual review date for release.

Because these are review cases, they are handled differently from first-time hearings. The Parole Board intends to aim for targets of fewer days served by approximating the number of serving days that can be eliminated from the incarceration of inmates. Review cases are released immediately upon granting of parole. Therefore, if interviewed earlier than his review date, an inmate's serving days can be reduced by the number of days before the scheduled review date. The previous policy aimed at the review date for the release of inmates. This policy moves up the potential release date by 30 days per inmate. However, there is no saving from extra serving days as in the first policy change. Savings come in the form of a reduction in the overall stay of inmates released upon review.

Potential savings are based on the number of parolees in the previous year multiplied by the targeted reduction in serving days for each parolee. The savings in serving days are not established in an empirical way but are estimated as a target that the Parole Board reasonably expects to achieve. There is some disagreement on the target figure, as the Parole Board's original estimate of 60 days per inmate was reduced to 30 days by the Research and Reporting Unit in the most recent forecast.

The method is straightforward in estimating the potential bed savings for this policy. The number of review cases released on discretionary parole during FY 1982 are used as a base. For each case the method estimates an average bed savings of thirty days. These savings occur by moving the review date of inmates forward. The days are simply added up and divided by 365 to produce an annual savings figure. The current application produces 113 savings per year.

Adjustments Related to Re-Docketing for Early Review. This policy change is designed to reduce the review date for certain inmates from one year to six months. The bed savings would result from redocketing cases denied parole earlier than has been the practice. The *Code* requires a yearly review of all inmates denied parole; if this review could be made at six months for certain types of inmates, then there could be a bed savings for the prison system.

The Parole Board's approach is to estimate the potential bed savings based on the FY 1982 number of review cases. This policy was not fully implemented until December 1983, which means an entire year's worth of data is not available to empirically check the bed savings. The Parole Board instead makes several assumptions about the number of review cases, the grant rate of the attested cases, and the reduction in serving time for each case.

The basis for this analysis has three elements: the number of review cases, the grant rate (percentage of inmates who successfully receive parole), and the reduction in serving time. The Parole Board uses FY 1982's total number of review cases as a starting point. This number is 1,417 cases. This is the entire population of review cases for that year. A grant rate of 53 percent is applied to this number to get the size of the affected population. The number of days the serving time is reduced is next applied. The number used is 180 days, which is six months prior to the previous review date. This produces 135,180 days of potential savings, or 370 potential bed savings per year.

This number is then adjusted for any overlap with the second policy adjustment -- that is, the reduction in serving time of 60 days for all review cases. The result of the second policy adjustment's bed savings, using 60 days as a reduction average for each parolee, is 233 beds. These 233 beds subtracted from 370 potential bed savings is 137 beds per year, which is rounded up to 140 annual bed savings for this policy change.

Adjustments Related to Local Jail Review. This policy is intended to achieve bed savings by interviewing inmates at local jails for discretionary parole instead of waiting for mandatory parole. In general, local jails house inmates who are less serious offenders than inmates in DOC facilities. Local jail inmates are characterized by shorter sentences. In many cases the discretionary parole date and mandatory parole date are very close, or within 90 days of each other. In these cases the Parole Board has often saved its resources by not interviewing inmates for discretionary parole and simply waiting for the mandatory parole date to apply. The Board has proposed to do the discretionary parole interview regardless of the closeness of the two parole dates.

The basis for the potential bed savings at local jails is the number of inmates released on mandatory parole from local jails in FY 1982. Using this total, the analysis multiplies a grant rate of 40 percent for the inmates. This produces the potential group for bed savings. For each parolee in this group, a target of 30 days serving time is estimated. For the 300 parolees in this group, this allows a potential for 25 annual bed savings.

Adjustments Related to Revocation Cases. This policy change relates to parole violators. The Parole Board feels that bed savings can be achieved in three ways by adjusting its present practices. In the past, the policy has been to revoke parole and reincarcerate almost all of the parole violators for breaking any of the parole conditions. The conditions are rather extensive and can include such infractions as drunkenness or failure to report a traffic violation within three days of its occurrence. The Parole Board asserts that the majority of revocation cases are at a relatively minor level which can be handled in ways other than reincarceration -- for example, substance abuse programs for drug and alcohol-related violations.

A second way to achieve bed savings is by redocketing certain cases ahead of the standard docket practices. Normally, when parole is revoked and a violator is reincarcerated, the violator is treated as a standard review case and is reconsidered for parole a year after reincarceration. This means that all cases are treated equally without regard to the seriousness of the violation. By reducing the review date to six months instead of a full year, the Parole Board believes that bed savings can result.

A third way to achieve bed savings is through the use of revocation practices in cooperation with other states. Technically, a person on parole who commits a crime in another state is violating Virginia's parole conditions and is responsible for at least one year's serving time in Virginia prisons. If the crime committed was serious enough to warrant imprisonment in another state, the violator would be responsible for serving time in Virginia after the term in the other state was completed. The Parole Board feels that the imprisonment in the other states could substitute for the required Virginia reincarceration, and save Virginia a number of beds each year.

The basis for establishing the potential bed savings from these methods is the approximate number of parole violators for FY 1982, or 900. These policy changes were not fully implemented until December 1983, so there is not yet a year's worth of data that can demonstrate empirically the amount of compliance with the changes.

For the first policy change relating to alternatives to incarceration, the Parole Board assumes that 5 percent of the total number of parole violators can be affected. The types of alternatives include community treatment plans and substance abuse programs that can adequately substitute for reincarceration. Five percent of the 900 parole violators who would be affected each year allows an annual bed savings of 45 beds.

The second policy change relates to redocketing certain types of parole violators for review at six months instead of a full year. This policy change will save the system 180 days of incarceration for 10 percent of the total number of parole violators. This amounts to approximately 45 beds saved per year.

The final policy change relates to out-of-state revocations. This policy change amounts to crediting the parole violators for prison time that they served in another state. Here, the analysis relies on a target of 10 cases per year for this policy change.

The total number of beds saved for these policy changes relating to parole violators is 100 beds.

Adjustments Related to Recidivists

The recidivist adjustment is based on several legislative changes that occured between July 1, 1979, and July 1, 1981, which together are expected to increase the prison population. This recidivist legislation affected all convicted felons with previous felon convictions in Virginia.

The primary legislative change required that all recidivists satisfy a greater proportion of their sentences before they can be parole eligible. Instead of being eligible after serving one quarter of their sentences, recidivists must satisfy (combining serving time less accumulated good time) a greater proportion of their sentences. The proportion of the sentences that must be satisfied depends upon the number of previous Virginia felonies a particular inmate has. The legislative changes also include limits on the sentences each type of recidivist must serve. The law is structured as shown:

Type of Recidivist	Sentence Proportion	Parole Eligibility Ceiling
1st Term Felon	1/4	12 years
2nd Term Felon	1/3	13 years
3rd Term Felon	1/2	14 years
4th Term Felon (or more)	3/4	15 years

The following additional legislative changes also affect the serving time of recidivists:

(1) Beginning on July 1, 1979, a proportion of earned good time credit was applied to all inmate's serving times in order to reduce the serving time to their parole eligibility dates.

(2) On the same date, all inmates were granted a mandatory parole date six months prior to their scheduled discharge in order to guarantee that every inmate who was in the system received some parole supervision.

(3) Beginning July 1, 1981, the General Assembly passed legislation that changed the good time calculation from the Good Time Credit (GTC) system to the Good Conduct Allowance (GCA) system. The GCA system is an incentive based system that is characterized by DOC as generally allowing shorter serving times to both parole eligibility dates and mandatory parole eligibility dates.

The net effect of the legislative changes is expected to increase the serving times for those inmates affected. Depending on the length of the current sentence and the number of previous Virginia felon convictions, an inmate will have to serve additional prison time before he is eligible for parole. The SLAM II forecasting model was judged by DOC to be inadequate for estimating the impact of these changes. Therefore, recidivists who were admitted after July 1, 1979 are excluded from the SLAM II model; their impact on the prison population is estimated manually.

The methodology applied to produce the estimates is not clearly detailed. DOC experienced personnel turnover of the individuals who were responsible for this adjustment. The documentation which exists is not adequate for detailing the steps in the analysis. For these reasons, the Research and Reporting Unit manager stated that the method that was used to perform this adjustment is not "replicable nor is it defensible." The numbers that were produced are used in the forecast but will be replaced when the forecast is updated for the November forecasting conference. Therefore a full description of DOC's manual adjustment is unavailable.

Adjustments Related to the Community Diversion Incentive Program

The purpose of the 1980 Community Diversion Incentive (CDI) law was to provide the courts with an alternative to incarceration for certain types of convicted offenders. Localities that have CDI programs divert offenders from jails and prisons to programs in the community. In turn, the clients of the program are required to repay the community for their crimes by performing some type of community service. This may involve repayment or restitution to the victims.

Diversion clients are a special pool of non-violent offenders who might require less punishment than incarceration, but who require more supervision than probation. CDI is not restricted to first-time offenders or felons.

DOC recognizes the reduction in the inmate population that results from the diversion of State felons into CDI and therefore produces an estimate of future inmate reductions based on CDI. Using data on diverted clients through FY 1983, DOC developed an analysis of the characteristics of the diversion population and made projections based on this analysis. The method used to estimate the diverted population is based on three major components.

(1) DOC expects 24 CDI programs to be in operation beginning in FY 1985. The expected number of clients who would otherwise go into the State prison system for FY 1985 and each succeeding year is 552.

(2) DOC expects the success rate of the CDI programs to be 53.6 percent. Those felons who do not successfully complete a particular CDI program must satisfy their sentences in the standard way. This rate is based on the FY 1983 experience. DOC notes that the success rate increased to 54.3 percent in FY 1984. But the FY 1983 figure is used because it is more conservative.

(3) The average serving time for those clients diverted is estimated at 1.58 years. This average is based on a comparison of CDI clients with the actual serving times of first-time offenders who had identical sentences and were released in FY 1982.

The three components are included in a multiplicative function:

(1) Diversions for each year = D = 552
(2) Success rate for CDI clients = R = 53.6%
(3) Serving time of CDI clients = T = 1.58 years

D x R x T = Beds saved per year

(552) x (.536) x (1.58) = 467 beds saved per year.

Adjustments Related to the Three-Time Loser Law

The purpose of this legislation is to exclude from discretionary parole eligibility all those persons convicted of three separate felony offenses of murder, rape, or armed robbery when the offenses were not part of a common act. The effect is to extend the serving time of those inmates convicted under the guidelines of the law. This produces an increase in the future prison population to allow for the longer-serving inmates.

DOC estimated the impact of this legislation through an analysis of confined inmates who match the criteria specified in the legislation. The mechanics of the analysis follow six steps:

(1) Select the number of inmates affected by the legislation. DOC examined a 25 percent random sample of FY 1982 commitments in order to determine the number of felons who would be affected by the law. The sample produced one inmate who qualified under the guidelines. Therefore, DOC expected that four to five inmates would annually be admitted under the guidelines of the law.

(2) Estimate current sentences and future sentences for affected inmates. Based on the sentences levied on third-time felons for armed robbery, an average sentence length of 41.0 years was predicted.

(3) Estimate current serving time and future serving time for affected inmates. The analysis examined the serving times of armed robbers who were released in FY 1982 in order to estimate the average serving time. All armed robbers were included in this analysis, rather than only third-time offenders. The proportion of their sentences served was 39.4 percent. Therefore the average serving time is 16.2 years for current offenders.

The predicted serving time was based on a 33 percent reduction in sentence due to good time allowance and the stipulation that the individual would <u>not</u> be eligible for parole. Therefore the predicted serving time for current offenders is 27.1 years.

(4) Calculate the increase in serving time. The analysis estimates the increase in serving time based on the difference between the current serving time and the predicted serving times. This number is 10.9 years.

(5) Calculate the total impact of the legislation. The analysis estimates the impact of this legislation by assuming five inmates admitted per year with an increased serving time of 10.9 years. The law has a cumulative effect that peaks at 55 inmates (5 x 11 years).

(6) Calculate the dates when the impact begins and when the impact peaks. In order to produce the time estimates, the current serving time is added to the effective legislation date (the law was implemented July 1, 1982). This places the initial impact year as 1998 with five inmates staying an extra year for the next 11 years. Successively, five additional inmates begin to stay an extra year in each of the following years until 2009. At that time, the effect of the law peaks and thereafter stabilizes at 55 additional inmates.

Adjustments Related to Firearm Legislation

The purpose of this legislation is to increase the sentences for those who use or display a firearm in the commission of certain types of felonies. The provisions of the law increase the sentences by one to five years for the first conviction, and three to four years for a second or subsequent conviction. The overall expected effect is to increase the serving time of inmates, which will in turn increase the prison population.

The legislation details six specific crimes that are affected by the provisions of this law: murder, rape, robbery, burglary, malicious wounding, and abduction. This law covers the commission or attempt of these crimes. The legislation was implemented on July 1, 1982.

There are generally six steps involved in building the population estimate for this legislation:

(1) Select crimes that are specified in the legislation. Using FY 1983 data on confined inmates, the analysis uses all committed cases of murder, assault, robbery, burglary, abductions and rape/sex assault.

(2) Select target crimes where a firearm was actually used and the crime was affected by the firearm legislation. 606 target crimes were affected by this legislation and used firearms. This number is assumed to be the annual affected population.

(3) Sample the affected population in order to determine the type of convictions within the population. A sample of 99 cases out of the affected population of 606 (a 16 percent sample) was drawn to determine the percentage of first and second (or subsequent) conviction offenders. These percentages were applied to the affected population in order to get an estimate of the number of felons in each type of conviction category.

1st conviction - (96/99) = 96.3 %
2nd conviction - (3/99) = 3.5 %

1st conviction total = (96.9%) x (599) = 579
2nd conviction total = (3.1%) x (599) = 19

(4) Apply average sentences and average serving times to each type of convicted felon. The analysis develops an average sentence and serving time for each type of conviction in order to estimate when the prison population will be affected by this legislation.

	1st Conviction	2nd Conviction
Average Serving Time	6.0 years	6.0 years
Average Sentence	20.8 years	25.3 years

(5) Apply expected increases in serving time to each of the conviction groups to get an estimate of additional beds. The analysis produces an estimate of eight additional months serving time for both conviction types. The total additional beds required are a product of the total number of convicts affected by the legislation multiplied by (.66) years (equivalent to 8 months).

(579 x .66) + (19 x .66) = 399 additional beds per year

These beds will be required beginning in April 1989. This is exactly 6 years plus 8 additional months after the date the new legislation went into effect. DOC assumes partial effects prior to this date that build up to the total needed -- 399 additional beds.

6. Adjust total for non-compliance. The analysis recognizes that it is possible that the law is not being fully complied with. A record search of all cases included in the analysis revealed that only 79 percent received an extra sentence. Therefore it is possible to reduce the additional population estimate by 21 percent. However, DOC does not do so in its analysis.

SUMMARY

DOC's current forecasting model consists of several very complex and interrelated components. Such complexity demands a rigorous adherence to proven statistical principles and necessitates great vigilence on the parts of those who supply and handle the data used in the model. In the following chapter, an analysis of the problems inherent in both these areas will be presented, along with recommendations for improvements.

IV. EVALUATION OF THE ADMISSIONS FORECASTING COMPONENT

Once an admissions forecast is generated, the values are used in the release component to forecast total inmate populations. Any error in the admissions forecast will carry over to the release component. Thus, an accurate admissions forecast is essential if the DOC expects to forecast future inmate populations correctly. To enable DOC to produce such a forecast, accurate, verifiable data and a theoretically sound methodology are mandatory. Also, the projection models must not violate their basic statistical assumptions.

The problems associated with the admissions component of the DOC forecasting model can be described in three main sections: (1) the measurement error in the admissions variable, (2) the measurement and specification error with the factors related to admissions, and (3) the statistical problems and specifications of the final model.

THE ADMISSIONS VARIABLE

Problems with the data used by DOC for measuring admissions fall into two general categories: either the calculations are incorrect, or inadequate documentation exists as to how the admission values were determined. Using data that is not measured correctly or is of unknown origin will not produce an accurate forecast and is contrary to general forecast principles. Instead, the equations that are generated by the data will forecast admissions with some amount of unmeasurable error. In essence, the researcher would not know exactly what value was being forecast by the equation.

Problems with Admissions Data

DOC presently calculates admissions separately for three separate time periods, 1950 to 1972, 1973 to 1975, and 1976 to 1983. Only the period of 1976 to 1983 includes any jail backlog or a separate addition for parole violators. There are three major problems with the DOC admissions data: (1) an inaccurate estimation of parole violators is used for the entire data series, (2) jail backlog is included in admissions for 1973 to 1983, and (3) women are included in the admissions variable.

Inaccurate Estimation of Parole Violators. Analysis showed that the calculation of the admissions variable for the years 1950-1972 is equal to new commitments multiplied by 1.0896. The reason for multiplying new commitments by 1.0896 has not been documented, although DOC staff have speculated that it is an

adjustment for technical parole violators. Multiplication by a constant violates the requirement for accurate, replicable data for admissions. This multiplication, for whatever reason, ensures that an inaccurate forecast will be produced.

To properly measure admissions for this period, the value for new commitments should not be multiplied by 1.0896. Prior to 1976, the only available record of inmates entering the State system included new commitments and parole violators. This should be the figure used in the model.

Also, the separation of parole violators into white and non-white is important, because two separate equations are being used. DOC currently estimates the number of white and non-white parole violators based on the percentage of each group's new commitments. The problem with this measurement is that it does not accurately select the number of white and non-white parole violators. The true value of white and non-white parole violators, as obtained from the FIS tapes, are shown in Table 16 along with the DOC calculated value, and their differences. The error in measurement ranges from a low of 9 inmates in FY 1976, to a high of 88 in FY 1982. The available data which provide an accurate separation into the two groups should be used.

Table 16

DIFFERENCES IN THE NUMBER OF PAROLE VIOLATORS AS CALCULATED BY DOC AND FIS

Year	DOC White Admissions	Actual White Admissions	Difference	DOC Non-White Admissions	Actual Non-White Admissions	Difference
1976	87	78	9	102	111	9
1977	167	130	37	203	240	37
1978	121	106	15	143	158	15
1979	201	170	31	218	249	31
1980	275	226	49	276	325	49
1981	338	260	78	324	402	78
1982	412	324	88	428	516	88
1983*	395	311	84	412	496	84

*Denotes that no data were available for this year on the FIS. Calculations were based on the previous year's percentages.

Source: JLARC analysis of FIS data.

Problems with the Estimation of Jail Backlog. Jail backlog is one of the most complex data measurements used by DOC and the least understood. Estimated jail backlog is an attempt to account for those felons housed in local jails, but who would be

transferred to a State institution if sufficient capacity did exist. Although this is a reasonable method for accounting for those individuals housed in local jails, some major problems do exist in this computation.

First, jail backlog is not directly counted but must be estimated. The current estimates used by DOC cannot be verified. Two explanations of the source of the numbers have been offered; neither are accurate. According to the first explanation, estimated jail backlog was based upon the difference in felons with 6 months to serve in local jails at the beginning of the year and at the end. The second explanation indicated that differences between felons committed to the State and felons received had been used. Table 17 shows that neither explanation is accurate. The data cannot be replicated and are considered invalid.

Table 17

COMPARISON OF DOC EXPLANATIONS OF
ESTIMATES OF JAIL BACKLOG WITH THE DATA USED

Year	Data Used	Explanation 1: Felons With Greater Than 6 Mo. to Serve	Explanation 2: Felons Committed-Felons Received
1974	0	-	42
1975	0	-	319
1976	612	650	618
1977	-478	-630	-478
1978	-97	-160	-97
1979	44	44	44
1980	12	111	12
1981	473	372	473
1982	88	90	-526
1983	-636	-508	-636

Source: JLARC analysis of DOC data.

Second, DOC divides jail backlog into white and non-white based on the proportion of each among new commitments. This assumes that the racial breakdown of those in local jails are the same as those who are entering the system. However, during periods of large jail backlog, felons with longer sentences enter the system before those with shorter sentences. For FY 1982, 54 percent of new commitments in the sentence range of 1-4 years were white, while 46 percent were non-white. For the sentence group of 5-life, 46 percent were white and 54 percent were non-white. Because non-whites constitute the majority of the longer sentences, they are usually

transferred to State institutions sooner, and whites spend a larger portion of their sentence in local jails.

Finally, for calculating admissions, the values for jail backlog are added to new commitments starting in 1976, and no estimation for jail backlog is made before this time. This method for including convicted felons housed in local jails causes admissions to jump sharply starting in 1976. For 1975, new commitments and parole violators total 2331. In 1976, when jail backlog is included in the admissions variable, new commitments plus parole violators plus jail backlog equal 3480. This represents a one-year increase of 1149, or a 33 percent increase in admissions to the State system.

Regression analysis uses trends in the data to compute the forecasting equations. Therefore, suddenly increasing the data or adding a new figure to admissions in one year, while not accounting for this figure in previous year's data, can cause the procedure to calculate an inefficient forecast equation and an incorrect forecast. Jail backlog figures, if used, must be consistently included throughout the time series data to accurately represent those inmates housed in local jails.

Because the data available for estimating the jail backlog is severely limited, jail backlog should not be included in the admissions variable as it currently is specified. If a jail backlog figure is included, then an error is incurred whose source and magnitude is unknown. On the other hand, if the jail backlog figure is excluded, there is evidence that the misspecification will be known and will be insignificant over the long-term.

The key point is that jail backlog can either be positive or negative. A positive jail backlog represents an increase in the number of convicted felons who cannot be transferred to a State institution due to limitations in capacity. A negative jail backlog indicates that more beds became available in the State system (due to either an increase in capacity or an increase in releases), so fewer convicted felons have to remain in local jails. In the long run, when sufficient capacity exists to house convicted felons, then jail backlog should sum to zero. Thus, the exclusion of jail backlog does not systematically under-count or over-count admissions in the long term.

For example, Table 18 shows that from FY 1973 to FY 1984, DOC admissions with jail backlog included totaled 45,199. Admissions excluding the jail backlog totaled 44,918 over the same 12-year period. This is a difference of only 281, (less than 1% error) and suggests that in the long run total admissions are accurately represented by new commitments and parole violators. Therefore, new commitments and parole violators are the only elements that should be included in the admissions variable.

Table 18

DOC & JLARC ADMISSIONS, DOC JAIL BACKLOG
BY FISCAL YEAR

Year	DOC ADMISSIONS	JLARC ADMISSIONS	JAIL BACKLOG FIGURE
1973	2026	2230	-204
1974	2103	2061	+42
1975	2651	2331	+320
1976	3480	2862	+618
1977	3277	3755	-478
1978	3134	3231	-97
1979	3195	3151	+44
1980	4227	4215	+12
1981	4536	4063	+473
1982	5503	5415	+88
1983	5567	6203	-636
1984	5500	5401	+99
Total	45199	44918	281

Inclusion of Females in Admissions. The model used to predict admissions includes both males and females in the two equations' admissions variable. However, the population factor used to predict the changes in admissions is the male crime-prone population. Thus, the male crime-prone population is being used to predict the female admissions to the State system.

Theory suggests that the male crime-prone population should explain male admissions; and the female crime-prone population should explain female admissions. Women should be separated from the admissions variable and included in an equation of their own.

FACTORS RELATED TO ADMISSIONS

The factors used to predict admissions in the DOC forecasting model are the 'crime-prone population' ages 18-34 and unemployment. Because these variables are explaining changes in the variable admissions, careful measurement and specification are necessary to compute as accurate a forecasting equation as possible. Also, the exclusion of any data that should be included in the equation can lead to misspecification, or failure to explain all of the changes in admissions.

This section will discuss the following problems and implications with these factors: (1) dropping unemployment from the model for a forecast of more than 3 years; (2) the calculation of the unemployment and crime-prone population figures; and (3) theoretically related factors not included in the current equations.

Dropping Unemployment from the Model

For a forecast period of three years, DOC uses an equation that includes unemployment as a predictor, but after three years unemployment is not included. There are two problems with dropping unemployment from the model in this manner. First, the unemployment variable has proven over time to be a significant variable in predicting admissions to State institutions. Second, when unemployment is dropped, the amount of the variation in admissions explained by the model drops considerably, and serial correlation becomes a greater problem.

Significance of Unemployment Over Time. The model has shown that since the year 1950 unemployment has been a significant determinant for admissions to State institutions, and there is no reason to expect that this trend will not continue in the future. The t-statistics, which are a measure of the statistical significance of the variable, are shown below using unemployment in each equation:

White equation:	4.139
Non-White equation:	5.529

These statistics are generally considered significant when they are close to 2. Therefore, these values indicate that unemployment plays a significant role in the forecast.

Furthermore, unemployment is the only factor which can have a dampening effect on admissions growth. A forecast model is improved when the predictors can cause increases or decreases in admissions. Because population tends to increase, unemployment is the only variable that dampens the forecast.

Decrease in the Amount of Variation of Admissions Explained. The amount of variation of the admissions variable that can be explained by the independent factors is calculated by the R^2 statistic. When unemployment is dropped from the model, the R^2 statistic for each equation decreases:

	Unemployment	No Unemployment	Difference
White Equation	R^2=.7773	R^2=.5577	.2196
Non-White Equation	R^2=.9012	R^2=.8466	.0566

The problem with dropping unemployment is that the equations lose some of their ability to explain the changes in admissions, and

therefore, their ability to accurately forecast declines. Unemployment should be kept in the model for the entire forecast period. Also, changes to the final model will make it more advantageous to include unemployment while reducing the risk due to an incorrect unemployment forecast.

The Specification of Factors Affecting Admissions

Admissions used in the model are calculated from monthly data July through June, while unemployment and crime-prone population are calculated January through December. If admissions are to be explained by unemployment and crime-prone population, the time periods for each must be accurately matched. Fiscal year unemployment and population-at-risk should be used.

JLARC obtained fiscal year unemployment data by averaging monthly values by fiscal year. Fiscal year population-at-risk data were calculated by summing the two calendar years comprising the fiscal year and dividing by two. Although this does not give an exact measurement of fiscal year population-at-risk, it does give a good approximation, since no other data are available. Alternatively, admissions could be recalculated by calendar year and a forecast made on a calendar-year basis.

Omitted Variables

The admissions component of the DOC forecasting model relies on explanatory variables that are outside the corrections system -- the variables of crime-prone population and unemployment. However, these factors cannot explain changes that can occur within the system. The current admissions model assumes that police enforcement and judicial behavior remain constant over time. Changes in arrest rates, conviction rates, and police enforcement can all affect admissions to State institutions. A sudden increase in the court's propensity to incarcerate felons would not be reflected by the factors currently used.

In addition, to better explain the variation in admissions to State institutions, admissions from the previous period should be included as an independent variable. This "lagged" value of admissions is an independent variable because it has already occurred in the previous year and need not be explained in the current year. Also, with time series data, the current period's value tends to be highly correlated to the previous period's value. This is a result of the growth in capacity and population, and the greater criminalization trends in prison society. Inclusion of a lagged value for admissions will help correct the unemployment factor problem as well as the model's statistical problems. These solutions will be explained in the next section.

STATISTICAL PROBLEMS WITH THE FORECASTING MODEL

The effects on the model of violation of the regression properties as well as the measurement error found earlier must all be considered. Regression equations are based on certain assumptions. Violations of these assumptions can produce an inaccurate forecasting equation.

This section focuses on statistical problems and their implications. The forecast error attributed to the poor measurement of the dependent variable has been mentioned previously. The discussion here will concern itself with: (1) the serial correlation problem associated with each equation; (2) the deterioration of the statistical properties when unemployment is dropped from the model.

Serial Correlation

Regression assumes that an error in one period is not highly correlated with an error of the previous period, and that the errors from one period to the next are randomly distributed. Serial correlation occurs in time-series studies when the errors associated with observations in a given time period carry over into future time periods. An over-estimate in one year is likely to lead to an over-estimate in the following year if positive serial correlation exists. The Durbin-Watson statistic (DW) is a diagnostic statistic designed to measure the correlation between the error terms. The statistic will lie in the 0 to 4 range, with a value near 2 indicating no serial correlation.

The DW for both the white and non-white equations used by the DOC displayed a high degree of serial correlation. The DW for the white and non-white equations are:

FY 84-87 (unemployment included)

White equation:	.703
Non-White equation:	1.078

FY 87-90 (no unemployment)

White equation:	.242
Non-White equation:	.754

All four of the DW statistics indicate that serial correlation is a problem with the equations as they are presently specified. In the case of positive serial correlation, the standard error of the regression will be biased downward so that the estimates will appear more precise than they actually are. The true standard error may actually be much higher than the one that has been presented.

Dropping Unemployment from the Model

For the years FY 87-90, DOC drops unemployment from the model and forecasts admissions based on the crime-prone population only. Each equation's statistical properties rest with how well the equations are specified. When unemployment is dropped from the forecasting equations, three problems become apparent. First, the amount of variation explained by each equation drops (explained in an earlier section). Second, the standard error of each equation increases. Third, serial correlation estimated by the DW-statistic becomes more evident.

The standard error is used by DOC as a measure of the accuracy of the model for prediction purposes. When unemployment is dropped from the model, the standard error for each equation increases considerably. The standard errors before and after dropping unemployment from the model are shown below:

	Unemployment	No Unemployment	Difference
White equation	254.60	353.16	+ 98.56
Non-White equation	169.92	208.43	+ 38.51
Total	424.52	561.59	+137.07

When unemployment is dropped from the equations, the standard error for the model increases by 137.07, or 32.28%, compared to equations which include unemployment. Using a 95 percent confidence criteria for forecasting, the range for the forecast would vary from 1650 for the equations with unemployment to 2246 for the equations without unemployment.

It has already been shown that both the white and non-white equations display a high degree of serial correlation as evidenced by the DW statistic. When the unemployment variable is dropped from both of the models, the DW statistic decreases, which indicates that serial correlation is more of a problem than it was with unemployment in the model. So when unemployment is dropped from the equations, it is more likely that an over-forecast in one period will be followed by an over-forecast in another period. Also, the serial correlation implies that the error range given above is actually understated.

The inclusion of the lagged value of admissions now makes it more feasible to include unemployment for a forecast of longer than three years. By including the lagged dependent variable, the coefficients for population-at-risk and unemployment will not influence the forecast as much as the previous model that did not include the lagged dependent variable. The inclusion of unemployment in the forecast equations will allow different scenarios given changing assumptions of economic conditions.

ALTERNATIVE MODEL

The alternative model recommended is a composite of the changes mentioned above. Jail backlog has not been estimated in the admissions variable. The proposed equations do not drop unemployment from the model. For the longer term forecast they include separate equations for white and non-white males received. Also included is a separate equation for women in the system, which will use the female population-at-risk and the lagged dependent variable of female admissions. Unemployment is not used in the female admissions model because it did not prove to be a significant determinant of female admissions.

The alternative model includes the three new equations, which were used to compute a new forecast. A comparison of that forecast to the DOC forecast is presented. No attempt is made to account for persons in local jails, because no accurate way of measuring those individuals exists.

The results of the final equations are listed below with the associated t-statistics, R^2, standard error, and F-statistic for each equation:

White Males Equation:

1. $WM_t = 87.385\ (FYUNEMP_t) + .000826\ (WMPAR_t) + .709\ (WM_{t-1}) - 430.715$
   (2.331) (2.176) (5.484) (-2.911)

   $R^2 = .9075$ F = 94.822 S.E. = 150.968

Non-White Males Equation

2. $NWM_t = 82.40\ (FYUNEMP_t) + .00782\ (NWPAR_t) + .387\ (NWM_{t-1}) - 501.026$
   (2.074) (3.532) (2.382) (-3.664)

   $R^2 = .9033$ F = 90.277 S.E. = 170.196

Female Equation

3. $FEM_t = .0011\ (FPAR) + .49\ (FEM_{t-1}) - 118.969$
   (3.930) (3.134) (-3.759)

   $R^2 = .9088$ F = 149.406 S.E. = 22.999

where:

FYUNEMP = fiscal year unemployment
FYPAR = fiscal year crime-prone population
WM_t = white males admitted in current period
NWM = non-white males admitted
FEM = females admitted.

All of the equations had an R^2 above .90, which means that each equation is explaining more than 90 percent of the variation of admissions. Also, all of the t-statistics prove significant at the .05 percent level. The coefficients for unemployment in the male white and non-white equation are nearly equal. This suggests that unemployment has the same impact on white males and non-white males when predicting admissions. Unemployment, however, has no effect at all on female admissions. The non-white population-at-risk has a much larger effect on admissions than does the white population-at-risk when comparing their respective population coefficients. This means that the non-whites propensity to be incarcerated is larger.

The forecasts using equations 1, 2, and 3 from above are shown in Table 19 with the DOC forecast for comparison. The JLARC forecast is much higher than the DOC forecast and comes much closer to forecasting the actual number of 1984 new commitments and parole violators of 5,411.

Table 19

ALTERNATIVE AND DOC ADMISSIONS FORECASTS

Year	ALTERNATIVE	DOC 18-34*	DOC 18-49*
1984	5034	4170	4416
1985	4813	4197	4503
1986	4687	4251	4642
1987	4603	4394	5077
1988	4539	4446	5262
1989	4615	4504	5459
1990	4560	4534	5630

*Age group used.

Source: JLARC admissions forecast; DOC Research and Reporting Unit.

CONCLUSION AND RECOMMENDATIONS

The method used by the DOC to forecast inmate admissions is a widely accepted method in many states and fundamentally sound for use in Virginia. Separating admissions into whites and non-whites enables the forecast equations to compensate for changing demographics.

However, errors in the measurement of admissions, factors affecting admissions, and the specification of the model have all worked to produce a 1984 forecast that is more than 1200 below the actual admissions. The following recommendations could assist in improving the admissions forecast in future years.

Recommendation (3). The admissions data for years 1950 to 1975 should be the new commitments admitted for this time period with no adjustments.

Recommendation (4). The Felon Information System (FIS) should be used to calculate the number of white and non-white parole violator admissions for the years 1976 to 1983.

Recommendation (5). Jail backlog should not be included in the admissions data. The only data that should be used are new commitments and parole violators as defined by the FIS.

Recommendation (6). Jail backlog would be a useful tool for DOC if a sound method of measurement did exist; therefore, a more accurate tool for measurement should be developed.

Recommendation (7). Females should not be included in the admissions data which is forecast by male population. A separate equation should be used for female admissions.

Recommendation (8). Unemployment should be included in the model for the entire forecast period.

Recommendation (9). To assure that the admissions forecast would not change significantly with a new unemployment forecast, the admissions model should be run at least semi-annually.

Recommendation (10). Unemployment and the crime-prone population factors should be measured on a fiscal year basis.

Recommendation (11). A lagged value of admissions should be included as a factor affecting admissions to reduce the problems with the statistical properties and unemployment variable.

Recommendation (12). For future development of the admissions component, omitted variables such as arrest rates and commitment rates should be considered to explain variation in admissions from changes within the system. It is considered important to include a factor that has a dampening influence on admissions.

V. EVALUATION OF THE RELEASE COMPONENT

The release component complements the admissions component by accounting for the flow out of the system. For a time period, admissions minus releases gives the change in the population for that period. When admissions exceed releases, the population increases; when admissions are less than releases, the population decreases. Both components must perform well to produce an accurate overall forecast.

The release component used by DOC is based upon a unique approach. It does not directly forecast releases, but rather forecasts the probability of stay for inmates. Releases are then computed by subtracting the sum of the probabilities for each inmate in one period from their probabilities in the previous period. This difference represents releases for the period. The approach is not only unique among inmate population models, it is very complex and difficult to apply.

This chapter presents the findings of the evaluation of the release component, including several issues which surfaced during the analysis. First, the limitations on analysis are discussed. The ability of the model to analyze trends in releases of inmates and changes in corrections policy is paramount, and the structure of the component and computer program used to generate the results inhibit this function.

The second issue involves the assumption required by the model that the data base come from a stable or "steady state" time period. The third issue concerns the calculation of error for the component. No error rates had been formally calculated for this component. Finally, several assumptions that are necessary for the forecast to be accurate are examined and tested for validity. Many of these assumptions are shown to be unwarranted.

Overall, the release component seems to be impractical and deficient in many operational aspects. The theory that underlies it and its objectives are adequate, but the difficulty in understanding and using the component for analysis, and the assumptions that it necessitates render it unworkable for the long run. DOC should begin work immediately on a new release component that is more flexible, more readily comprehensible, and is proven for forecasting inmate populations in other states.

LIMITATIONS ON ANALYSIS

SLAM II's release component utilizes data from one time period for extrapolating events into the future. While there is nothing

inherently wrong with this approach, it makes numerous assumptions about the particular "time slice" that is selected. The approach differs from most forecasting work, which relies on time series data and statistical procedures to analyze trends in the data and extrapolate those trends into the future.

In this section some problems associated with a cross-sectional approach are discussed. The principal concern is that the model's cross-sectional approach does not allow the analysis of trends or factors affecting releases.

There are several factors that affect an inmate's length of stay: sentence length, use of sentencing discretion by judges, Parole Board policies, good time allowances, and mandatory parole. These factors are subject to change from time to time. In fact, they may be found to change in response to other factors.

For example, one correctional theory that has been useful in some settings is that judges' sentences are responsive to how full the local jails and corrections facilities are. When the facilities are at or near capacity, judges in some cases may use probation, community programs, suspended sentences, or other alternatives to incarceration. Parole boards may respond to similar pressures in granting more releases.

The SLAM II release component cannot provide information on the linkages in the system because it uses information from one time period or "time slice". The model does not, in its present form, yield information on how the system responds to various actions by different influences on the corrections system. Therefore, it is difficult to find trends in corrections and relate those trends to changes in releases.

The model does not preclude investigating those trends, but it necessitates that the investigation go on outside the model framework. Manual adjustments are examples of the kind of outside research the model structure makes necessary. Any effort to develop analyses outside the framework of the model "is likely to...create a manpower and attention drain," in the words of the consultants hired by the Secretary of Public Safety.

Both the structure of the release component and the complexity of the programming algorithms it uses contribute to a difficulty in using the model to answer "what if" questions. This type of question, sometimes referred to as scenario analysis, is important in understanding the impact of certain trends and policy changes on the correction system. The current release component does not include information on the impact of events and other changing conditions in the past because of the "time slice" approach. A small measure of this information is contained in the data, but the aggregation procedures in the computer algorithms make it nearly impossible to analyze.

As a final point in this section, it should be noted that an advantage in using the SLAM II release component is that data is used from the confined population as well as the release cohort. The advantage is that the more recent admissions convey information about the changes in length of stay. However, a problem is that the information is simply combined with the release cohort without analyzing the changes. The analysis could point to the need to adjust the probabilities for future admissions, rather than simply assigning probabilities for future admissions based on the proportional weighting of the confined and released.

Data and Model Structure Limitations

The release component of the DOC version of the SLAM II model has a stochastic structure. That is, there is a chance that each inmate may be released each month. Probabilities are computed including each confined and released individual within a sentence group and then imposed on the individuals. These probabilities are developed from a particular time period and applied to the future. This implies that the data must be taken from a time period that is expected to be similar to the future periods which will be forecast.

In addition to the requirement for stability of the time period from which the data were taken, there is a corollary requirement that the amount of data be sufficient to base the calculations on. The data must represent all factors that can significantly affect future lengths of stay.

However, the requirements for data stability and representativeness are difficult to meet. The corrections system is seldom in a stable period. Legislation that takes years to have its full impact on the system is often changed. The sentencing decisions of judges may change over time as new judges are appointed and public opinion changes. Parole Board policy and administrative practice may also change. Furthermore, it is difficult to capture all of the factors affecting lengths of stay with one year of data.

Two approaches were developed to illustrate the implications of structurally related data problems in the model.

Sentence length patterns. FY 1980 and FY 1981 data were used to recalculate the probability tables in order to examine the stability of the data. If the average length of stay for each sentence group is similar for all three years, a stable data base for the recent past can be confirmed. If, however, the results show a consistent pattern of change, then forecasting could be made more accurate by adjusting the length of stay for future years. Without a clear pattern, the results would simply cast doubt on the appropriateness of using the length of stay probabilities for forecasting purposes.

Under the first approach, the stability of the probability distributions was examined by (1) computing the probability tables for

FY 1980 and FY 1981, and (2) comparing those distributions with the probability table for FY 1982 which was used in the model. The results of this comparison is shown in Table 20. To facilitate a comparison, the table shows the mean length of stay in months rather than the entire distributions. The means from the current DOC model are the lowest for 12 of the 13 comparisons. In five of these cases, the means reflect a decreasing trend in the data, but in the other five cases the means show an up and down trend over the three years. In three cases, the means are stable from FY 1981 to FY 1982. This comparison leads to the conclusion that the probabilities have not been stable in the recent past, and therefore the assumption that FY 1982 would reflect a stable base for the forecast is unfounded.

Two additional factors should be pointed out in this regard. First, DOC staff have stated that the previous years have been unstable because of the changing legal umbrella under which the corrections system has operated. No empirical justification has been given as to why the effect of the changes supposedly stabilizes by FY 1982, however. Second, five manual adjustments have been added to the model results. The results are adjusted to attempt to correct for changes in the system due to legislative or administrative changes. The adjustments do not account for other changes that are taking place in the system, nor does a stable base exist to which the adjustments can be made.

Table 20

AVERAGE LENGTH OF STAY IN MONTHS
(Probability Distribution Functions)

Sentence Group	FY 1980	FY 1981	FY 1982
1	2.5	3.0	2.2
2	5.4	6.3	4.7
3	11.2	12.2	9.8
4	15.9	17.3	14.6
5	20.6	21.0	18.1
6	25.3	25.7	23.8
7	33.1	33.6	29.8
8	43.3	41.1	38.5
9	60.0	59.3	55.2
10	82.1	70.9	70.8
11	126.2	115.4	115.3
12	215.2	193.3	193.3
13	68.0	117.0	112.0

Source: JLARC analysis of DOC data.

Stability of Sentence Group Probability Functions. The pattern of probabilities for each sentence group was analyzed in order to examine the stability of the probability functions. A stable length of stay function and a sufficient data base would yield a probability curve that moves smoothly from 1 to 0. It is counter-intuitive for the probability of stay to be greater in any month than in the previous month. For example, it would be unrealistic for the likelihood of incarceration to be greater in the 10th month of an inmate's sentence than in the 9th month.

The model developers, however, have indicated that this phenomenon may occur because the lengths of stay are shorter for more recent admissions. Thus, the probabilities are unstable. An alternative explanation is that the structure of the model itself causes the bumps by allowing changes in the denominator as well as the numerator of the proability calculation from one time period to the next. At a minimum, the problem could indicate an insufficient data base.

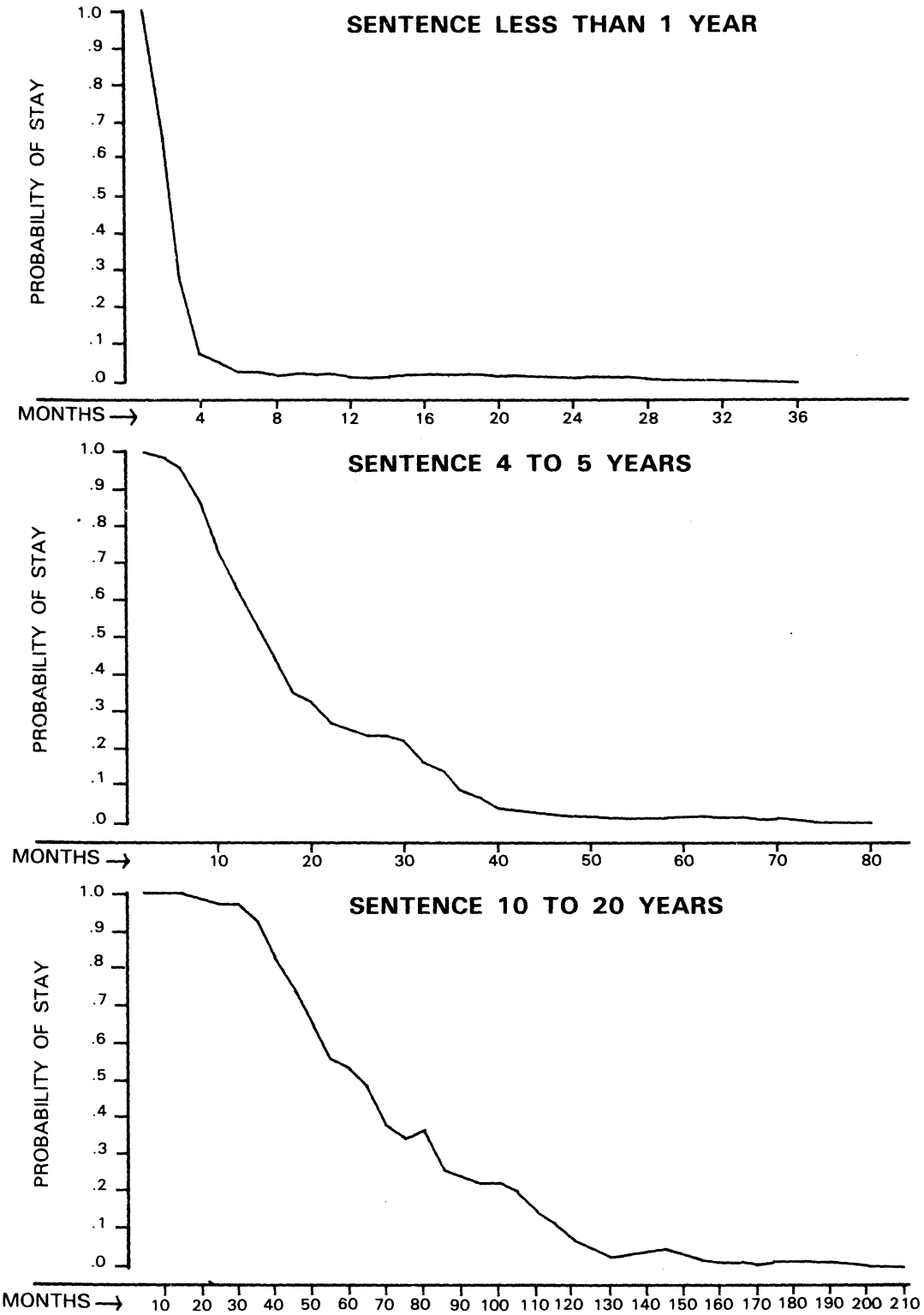
The stability of probability functions was reviewed for each sentence group. The probability of remaining in prison can be expected to decrease as the months of an inmate's sentence are served. Data plots for the first three sentence groups illustrate expected downward sloping curves. The remaining ten plots, however, show some aberrations from the expected shape. Figure 9 presents three of the curves for illustration. The first shows the expected pattern; the second represents some small problems; the third exhibits the "bumpy" aberration.

These aberrations may be interpreted in several ways. They could be related to the relative paucity of data currently used for the calculations. This is a plausible explanation, but simply adding more data may not cure the problem. Another interpretation of the increases could be that inmates incarcerated in early years are serving shorter time periods than those committed most recently. This means that the probability tables overstate the probabilities for those admitted from earlier time periods, and understate the probabilities for those admitted more recently or which will be admitted in the future. Either interpretation makes the use of the current probability tables to represent the probabilities of stay in the future suspect.

In conclusion, the specific problems outlined in this section fall within the general category of data inadequacies imposed by the structure of the model. Clearly the length of stay for those chosen for the data base is not stable. The mean lengths of stay are not stable over three consecutive years and they do not show a consistent pattern of changes. The increases in probabilities of stay over time also indicate a problem with stability or the model's structure and its data requirements.

Figure 9

Examples of Probability of Stay



SOURCE: DOC JUNE 1984 FORECAST.

Error Rate

A problem with the requirements of the model could be the number of cases on which the probabilities are calculated. The number of cases for each month's probability, by sentence group, can vary in this model. When the number of cases becomes small, the stability of the probabilities decreases. Also, from a statistical or sampling perspective, the confidence that the numbers are reliable diminishes. The actual number of cases for each probability was calculated by removing the weighting procedure for the differences in annual admissions and printing the numerator and denominator for each probability.

The approach was to examine the numbers of cases upon which the validity of the probability tables rest and calculate the standard error for the probabilities. The data base for the Virginia probability calculations contains over 13,000 inmates who were in the system for some time period during FY 1982. The Florida version of the model, on the other hand, contained data for three years that had over four times as many cases.

In the Virginia version, the most cases for any calculation is 525 and the minimum is 74, except for sentences of life imprisonment and death. For the maximum number of cases, the probability of stay for that month was estimated at .08. Ninety-five of 100 times, the true probability will range between .06 and .10. For the minimum number of cases, the probability was estimated at .54. The true probability will fall between .43 and .65, 95 percent of the time. A true range computed for a probability of .5 with 350 cases would be .45 to .55, 95 percent of the time. Thus, in this somewhat typical case an error of 10 percent in either direction is shown.

Problematic Assumptions

Any forecasting model depends in large measure on the accuracy of its assumptions. Most forecasting models require the assumption that the conditions that prevailed when the model's parameters were calculated will continue to exist. This assumption makes forecasting a judgemental process, because it requires that the forecaster exercise judgement in correcting for relationships that have begun to deviate from the prior conditions.

The release component of SLAM II requires numerous assumptions. The last two sections have dealt in depth with the assumption that the confined inmate population in June 1981 and the release cohort from FY 1982 will be typical of the length of stay experienced by inmates admitted in FY 1983 and beyond. Three manual adjustments were developed to account for changes in this assumption; a fourth, the gun law adjustments, was added to reflect anticipated changes in sentence distributions, another assumption of the release component.

Assumptions are necessary in any model. However, the assumptions must be reasonable and they must be tested. DOC staff acknowledge several key assumptions concerning the release component. Four assumptions and an analysis of their validity are presented below.

Consistency of Future Sentencing Practices. The section on the gun law's manual adjustments illustrates the fact that sentencing practices are not consistent from one year to the next, and that they do not necessarily vary in predictable ways. Judges weigh many factors when pronouncing sentences. Trends and relationships between the factors and the sentences need to be understood before this assumption can be accepted.

Distribution of the Inmates Among Sentence Groups. The release component uses the sentences of new admissions in FY 1982 by month to establish the probabilities of stay for all future admissions. Future releases may be severely impacted if the trend is toward longer or shorter sentences or if the distribution of sentences is changing in response to other factors.

Table 21 shows the distribution of inmates by sentence group for the six years and the FY 1982 distribution. Comparing the two shows some differences which may cause forecasting problems. It is not reasonable to assume that future time periods will resemble the FY 1982 distribution.

Table 21

SENTENCE GROUP DISTRIBUTION

Sentence Group	Six-Year Average	DOC Model Assumption
1	12.44	13.2
2	13.33	14.49
3	10.82	10.08
4	10.85	9.60
5	13.91	12.68
6	6.22	6.14
7	6.99	5.51
8	7.09	7.15
9	6.32	6.54
10	3.95	4.24
11	6.16	7.04
12	1.42	1.18
13	.05	.05

Source: DOC Felon and Recidivist Reports.

Parole Violators and Jail Backlog. Parole violators are assumed to have the same distribution of sentences and length of stay as the new confinements. Their stays in the system are also assumed to be continuous. Also, felons who are counted as jail backlog but are not committed to the State system are assumed to have sentence distributions and stays in the system just like those committed to the system. However, their serving time is likely to be shorter than other felons.

Adjustment for the Confined Population. Another assumption that is made in the model is that the probabilities of stay for the currently confined should be adjusted as indicated in Chapter III. The adjustment is done by increasing their probability of stay in July 1982 upward and adjusting their subsequent probabilities upward to resemble the curves for their sentence groups, but with steeper slopes. When computed with the current assumption, 8,748 inmates confined in June are expected to be incarcerated in July. This prediction of no releases appears to be unwarranted.

When the original probabilities are used, only 6,208 of the inmates would be expected to be incarcerated in July. The adjustment is a shortcut for the computation of conditional probabilities that is required in order to draw the release predictions in line with reality. While this makes the calculations easier, it is not necessarily accurate. It may indeed cause an overprediction of the population, especially in the months closest to the beginning of the forecast period.

CONCLUSION AND RECOMMENDATIONS

The previous section discussed several concerns with the release component used in the DOC forecasts. The requirements placed on the data by the model's structure were explained, and it was indicated that in many cases the requirements were not well fulfilled. Problems created by the cross-sectional or "time slice" approach were identified. Finally, some of the component's assumptions were pointed out and some problems associated with them were discussed.

This section will present solutions that may improve the results of the release component and the confidence in those results. Solutions are presented in two time frames, short-term and long-term. The short-term recommendations involve a range of activities that could bolster the current release component and test its reliability. The four long-term recommendations involve the use of some of the short-term exercises and the development of data bases in putting together a new release component.

Recommendation (1). The sentence distribution for future admissions should be altered to represent the average of the past few years.

Recommendation (2). The monthly admissions should be made proportional to the average monthly admissions.

Recommendation (3). The complete data from FY 1983 and FY 1984 should be added to the release component. Differences with earlier patterns should be analyzed.

Recommendation (4). The forecast should be updated using the recommendations presented here, as well as the admissions forecast recommendations. This update should take place for the 1985 General Assembly session.

Recommendation (5). The release component should be replaced with a more simple component. A regression approach or a "demographically disaggregated" model could be developed. The approach should be flexible enough for impact analyses and permit analysis of trends and changes in policy.

Recommendation (6). Development of the new release component should occur over the next year and its results should be available for the 1986 General Assembly session. A task force should participate in the development including DOC, DCJS, and JLARC staff. DOC should take the lead in the development.

Recommendation (7). DOC should allocate sufficient resources to the Research and Reporting unit to develop and maintain the data base for the forecast model. Data should be available within one quarter of the close of a fiscal year. The model should be updated each year and the forecast and its methodology presented to the General Assembly by November.

Recommendation (8). Each year, various scenarios should be developed and analyzed using the forecast model. The scenarios should be based upon trends or anticipated policy initiatives by the Governor, the Secretary of Transportation and Public Safety, the General Assembly or its committees or subcommittees, or the Department of Corrections.

For the short run, the distribution of sentences among admissions cohorts is a crucial element in validating the release component. Also methods allocating the annual admissions predictions to months need to be explored. Updating the model for FY 1983 and FY 1984 data may also help some of the problems associated with relatively few observations.

For the long run, DOC staff should undertake the development of a new release component. The time series approach used by the admissions component should be explored. If needed, new data systems or more resources toward validating current systems should be funded. JLARC and DCJS staff should participate with DOC staff in the development. Approximately one year should be allowed for this effort.

VI. EVALUATION OF THE MANUAL ADJUSTMENTS

Manual adjustments are made to the admissions and release components to account for administrative and policy changes that are not reflected in the forecast model. The purpose of this chapter is to evaluate the methodology used in producing the adjustments and to determine if these adjustments are adequately performed. To that end, the rationale for making the adjustments, the methods used, and the accuracy of calculations were reviewed. To evaluate the accuracy of each adjustment, an effort was made to replicate or validate DOC's analysis.

Each adjustment will be discussed separately. The discussions will include a description of the problems with the adjustments as they are currently performed, and proposed solutions to those problems.

RECIDIVIST LEGISLATION

There were several legislative changes which occurred between July 1, 1979, and July 1, 1981, that affected the parole eligibility of recidivists. These changes are expected to increase the prison population. Because the changes did not have their full impact upon the data DOC uses in the SLAM model, DOC developed a manual adjustment to account for the changes.

Problems and Implications. The major problem with the current DOC recidivist adjustment is that the method is not documented or understood by the current staff. Therefore, an exact replication of DOC's methodology could not be performed.

Proposed Solutions. First, there is a need to estimate the average serving times of recidivists who have been admitted, confined, and released under the guidelines of the recidivist changes. The experience of the recidivists who have been completely through the prison system during the time period these changes have been operative should be the basis for estimating the experience of remaining recidivists. Second, the number of recidivists needs to be estimated in order to project the impact of this legislation on the population.

The release component can be made to serve as a tool for this type of analysis. In five sentence categories all recidivists have been admitted, confined and released under the guidelines of the recidivist changes. These represented categories can be used as a basis for extrapolating the impact on other sentence categories. The

release component can then be adjusted to include information for the behavior of recidivists and produce a forecast that will not require a manual adjustment for changes in the recidivist statutes.

Thus, the proposed solution to DOC's recidivist adjustment is to develop an alternative adjustment utilizing the SLAM II model and rerunning the forecast after incorporating the effects of recidivists in the probability component. This approach provides an empirical basis for projecting the experience of recidivists. Over the years, this solution offers an opportunity to achieve greater accuracy, because the actual experience of recidivists under the legislation will be more fully reflected in the data and the methods of extrapolating to other sentence groups tested.

The methodological approach is to adjust the release component to account for both recidivists and nonrecidivists in the same table. This requires developing a weighted average of two sets of probability tables -- one recidivists and one nonrecidivists -- and then running the model.

The result of the alternative recidivist adjustment indicates that the legislative changes will have less impact in increasing the population than DOC projects. Figure 10 compares DOC's adjustment with this alternative. The increasing differences between the two methods are evident. The alternative method indicates that the increases in the inmate population will level off.

Because the alternative method provides a sound empirical basis for making the adjustment, and seems to produce reasonable results, it is recommended as a replacement for DOC's current method. No manual adjustment will then be needed. It is also recommended that DOC monitor the data base and include more sentence categories as the recidivists in those categories include only those admitted after the new legislation.

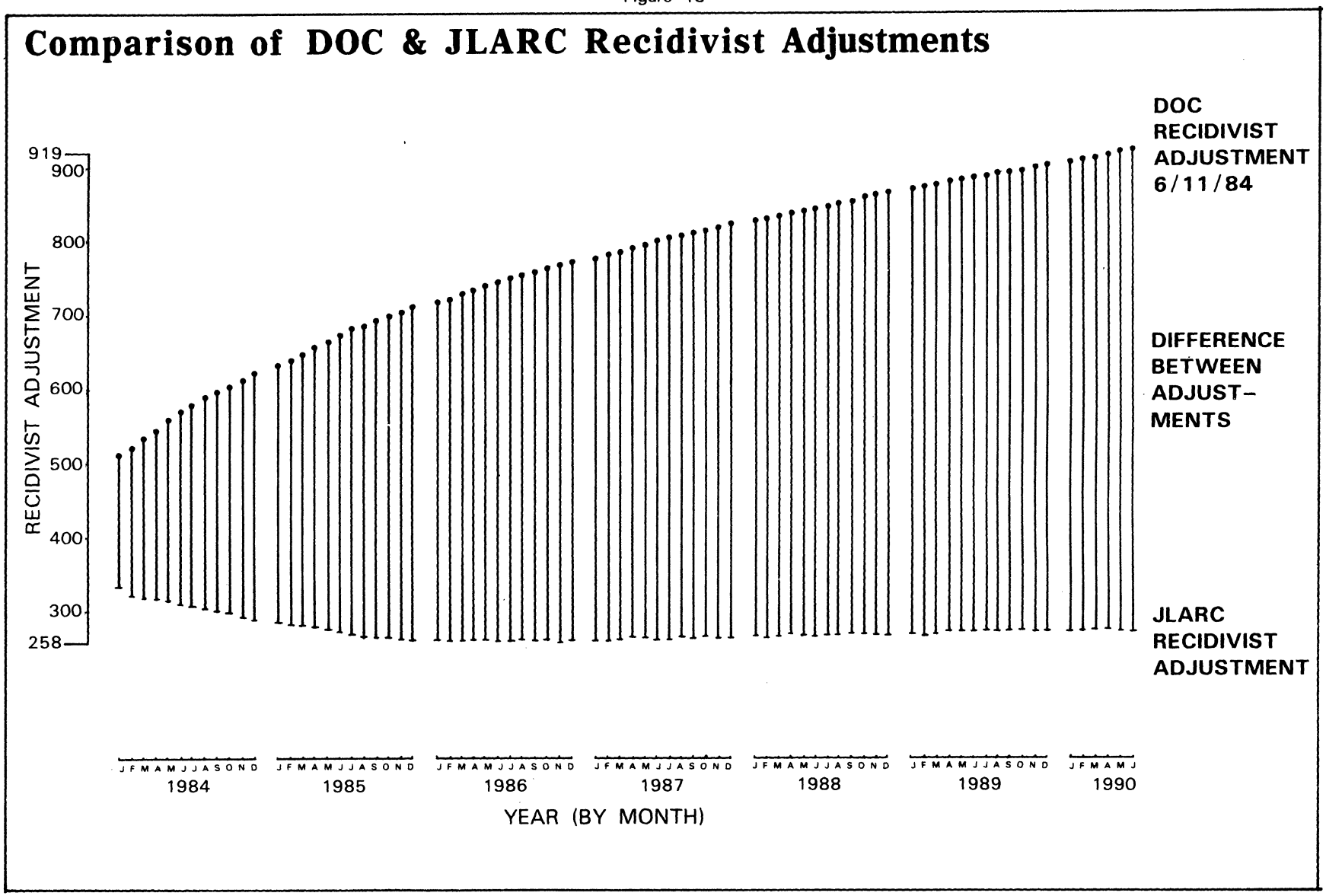
PAROLE BOARD POLICIES

The Parole Board implemented five administrative policy changes which work to reduce the number of inmates in DOC institutions. DOC's efforts to adjust for these changes are discussed in this section.

Eliminate Extra Serving Time

This parole board policy change is intended to eliminate extra serving days by conducting interviews on parole eligible inmates a quarter before their parole eligibility dates (PED). This change could have an impact on population levels, because it facilitates a more immediate release of inmates once parole is granted. Therefore, DOC has a manual adjustment to estimate the impact of this change.

Figure 10


Comparison of DOC & JLARC Recidivist Adjustments
RECIDIVIST ADJUSTMENT
919
900
800
700
600
500
400
300
258
DOC RECIDIVIST ADJUSTMENT 6/11/84
DIFFERENCE BETWEEN ADJUST-MENTS
JLARC RECIDIVIST ADJUSTMENT
J F M A M J J A S O N D
1984
1985
1986
1987
1988
1989
J F M A M J
1990
YEAR (BY MONTH)

Problems and Implications. There are several problems with DOC's current methodology to adjust for this change. First, the OBSCIS data base used for this analysis contains only 1,747 cases of the 2,943 cases that were released on discretionary parole during FY 1982. The OBSCIS system is a relatively new system that is improving with time. Using this data base (the computer run was executed in late 1982) limits the amount of information available for determining the potential bed savings.

Second, the research is performed empirically only on first-time interview cases. Review cases are not similarly identified and estimated for potential bed savings. They are simply assumed to have the same number of potential bed savings as first-time cases.

Third, the research shows no agreement between the type of cases listed on the OBSCIS printout and the actual number of cases shown in the manual counts of the Parole Board. The Parole Board's manual counts for the year are 1,526 first-time cases and 1,417 review cases. The research does not address this point and even appears to double count by simply doubling the potential beds savings after having accounted for all 2,943 cases.

Proposed Solutions. Two recommendations are offered to deal with these problems. First, for the short term, the current method should be replicated using a more complete data base and identifying review cases. This solution is offered as a substitute for DOC's current estimate.

The results of this analysis compared with the Parole Board's 1982 adjustment are shown in Table 22. Under two different scenarios, (using either a high or a low estimate for missing data points), the results of the proposed revision indicate larger bed savings: 493.8 beds saved per year in the former case, and 745.8 beds saved per year in the latter case. The higher end of the range is more likely, as the missing data is most likely to be of this type.

Table 22

ESTIMATED BED SAVINGS

	JLARC		Parole Board
	Low Estimate	High Estimate	
1st Time Parolees	163.9	163.9	155
Subsequent Review	251.9	251.9	155
Missing Data	78	330	155
	493.8	745.8	465

Source: JLARC analysis and DOC HJR 152 forecast.

Over the long term, DOC needs to examine the actual results of this policy change once the data for a complete year is available. Because the policy change was not fully implemented until December of 1983, it is difficult at this point to estimate its impact using actual experience. In addition, an alteration should be made to the OBSCIS file so that the actual review dates for inmates who were previously denied parole (under current sentence) are identified. In JLARC's analysis, an assumption about this date was made based on the parole eligibility date for each inmate. A more accurate method could be developed if the review date were included as a variable in the OBSCIS data file.

Release Review Cases

This policy change is intended to save beds by calling for decisions on discretionary parole one quarter in advance of interview dates for inmates who are under review for discretionary parole.

Problems and Implications. There are two problems with the methodology currently used to adjust for this change: (1) the selection of the number of review cases that will be heard each year, and (2) the target number of days saved per case. The former number is based on the manual count of cases for FY 1982. This is an accurate number for that year, but it is not clear that the number of review cases will be stable.

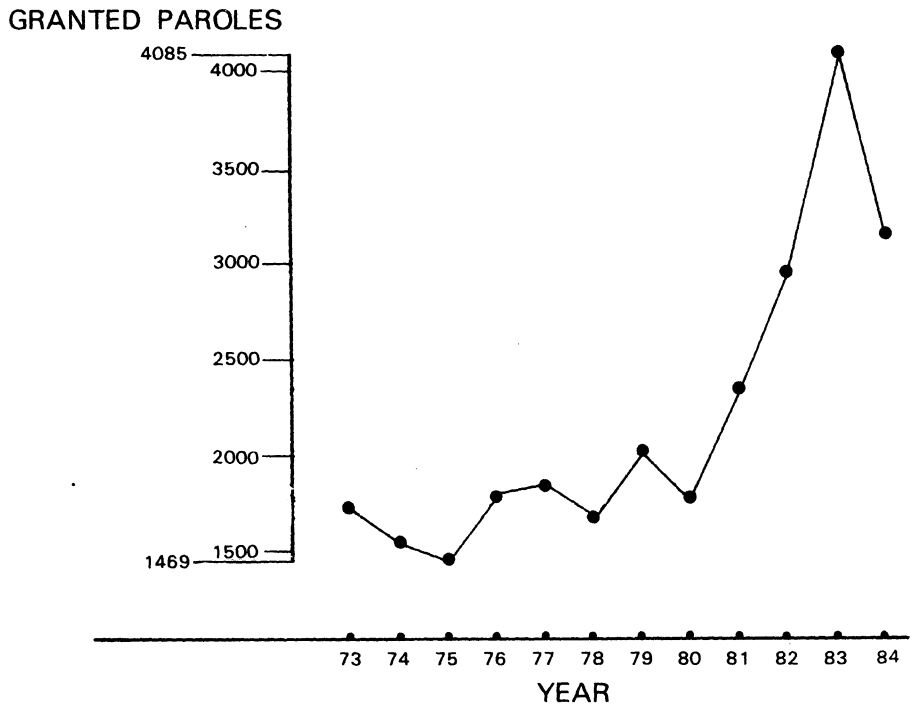
Figure 11 shows that the combined number of cases released on discretionary parole (first interview and review cases) has increased 134 percent from FY 1980 through FY 1983. As the figure shows, the number of review cases used in the estimate is only one point in a series. This number is equal to FY 1982's total, or 1,417 cases. This is used in the bed savings estimate for each of the following years. However, the trend seems to point to a much higher number. By using only one of the fiscal years in this series, the estimate may be too low.

The second problem relates to the target of thirty days serving reduction per review case. This is not an empirically based number. It is a target that the Research and Reporting Unit and the Parole Board have agreed upon. In the previous forecast of April 1984, the target number was 60 days. It has since been reduced to 30 days as a more "conservative" estimate of serving time reduction. The danger of using targets that are essentially educated guesses is that they could be very inaccurate. The actual amount of serving time reduction could be far greater or far less than these numbers. Also, there is a minor problem with the mathematics that are used. The actual result of using 30 days instead of 60 days should produce 116 beds, not 113.

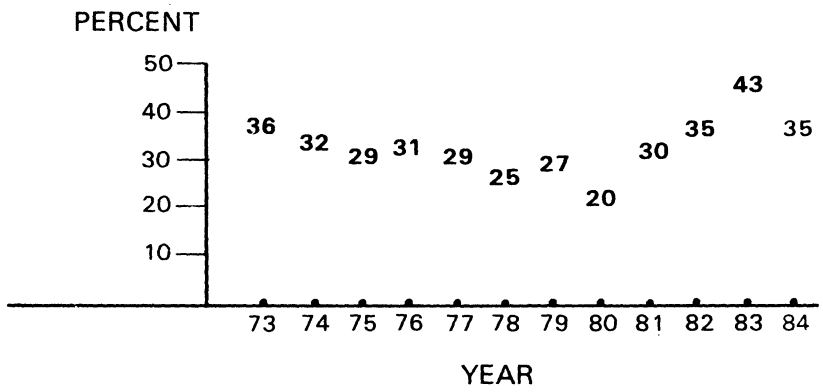
Proposed Solutions. Determining or estimating the actual sentence reduction per parolee is difficult because of the implementation of the policy. The final stages were not completed until

Figure 11

Granted Parole (Discretions)



Grant Rates for Discretioning Parole (First Time & Review)



July 1984. Therefore, the annual savings cannot be counted for an entire year. This means that the type of analysis that was performed in the first policy change for review cases cannot be done at this time.

Recommendations can be offered, however, to improve the adjustments related to this policy change. In the short term, the target date for the reduction in serving time -- 30 days -- should be used as an estimate of the savings. This is recommended because the full implementation of the policy has only been accomplished recently. DOC should use the 1417 figure as an estimate of review cases affected by the policy change.

In the longer term, DOC should produce a study of the actual effect on the prison population when an annual series of data is available. DOC should monitor the effect of the policy change in each subsequent year. The use of an interrupted time series method may facilitate the development of a more accurate estimate of the annual affected cases, as this number has increased in recent years.

Re-Docket for Early Review

This policy change is designed to reduce the review date for certain inmates from one year to six months. The change is expected to lead to bed savings which need to be reflected in the population forecast.

Problems and Implications. There are two major problems with the methods currently used to estimate the impact of this policy. The first is the use of all 1,417 review cases in the analysis. Only certain review cases are to be considered for these special hearings -- for example, "nonviolent offenders with short sentences who commit relatively minor institutional infractions." The Parole Board estimates the eligible cases to be approximately 20 percent of the total number of review cases. The current method ignores this fact and proceeds with all the review cases in the analysis, which will overstate the results.

The second major problem occurs in the adjustment to the results because of the overlap with the second policy adjustment. The original analysis on the second policy adjustment was reduced from 233 beds to 113 beds because the corrections analyst felt that the Parole Board's target of a 60-day reduction was too ambitious. The change is not accounted for in this analysis. The adjustment for the overlap should be redone to allow for the change in the second policy adjustment. This would have the effect of decreasing the 370 bed total by 113 instead of 233. The result of the analysis using this number would be 257 beds.

Proposed Solutions. The proposed adjustments to this methodology are to correct the two major problems and redo the basic analysis. In the short term DOC should incorporate the following changes into their current methodology:

(1) The analysis should include a factor of 20 percent, which is given from the Parole Board, for the relative proportion of affected review cases. The product of this calculation should more closely estimate the affected group than the current method.

(2) the estimate for this policy adjustment should take into account the change in the most recent estimate of the second policy change (a reduction from 233 beds to 113 beds). And since only 20 percent of these cases are actually overlapped, because the second adjustment includes all cases, this adjustment should be even further reduced.

The adjustment should therefore be calculated in the following way:

$$\frac{((1{,}417 \times .20) \times (.53)) \times 180}{365} = 74 \text{ beds}$$

Adjustment for review cases change:

$$74 - (.2)\ (113) = 51 \text{ beds}$$

When an annual series of data is available, DOC should produce a study of the actual long-term effect of this policy change on the population. DOC should also continue to monitor the effect of this policy change in each subsequent year. The use of an interrupted time series method may facilitate the development of a more accurate estimate of the annual affected cases, as this number has demonstrated positive growth in recent years.

Local Jail Review

This policy involves interviewing inmates at local jails for discretionary parole instead of waiting for mandatory parole. Its expected impact is to achieve bed savings.

Problems and Implications. In addition to reviewing DOC's methods for estimating the impact of this change, JLARC also examined local jail cases in a way similar to that used for the first policy adjustment. In that adjustment, the extra serving days per inmate were calculated and annualized to judge the potential bed savings per year if the Parole Board interviewed discretionary parolees one quarter prior to their PED. In the same way, JLARC examined 35 cases where inmates housed at local jails served extra days in jail because there was a delay in their hearings. The number of extra serving days for their cases totalled 1,714 days. If these days were eliminated, the potential annual savings would be 4.69 beds across the system.

Proposed Solution. This is such a small adjustment that any change will have minimal affect on the forecast. However, there are two proposals for improving the adjustment. In the short term, DOC should attempt to increase the bed savings by eliminating the extra serving days each parolee serves. This would increase the annual bed savings by 4.69 beds per year. In the long term, DOC should redo the analysis when a year's worth of data is available in order to estimate the actual savings due to this policy change.

Revocation Cases

This policy change involves three adjustments to present practices regarding parole violators. The Parole Board anticipates that these changes will result in additional bed savings.

Problems and Implications. The only number that is empirically based in the analysis of these changes is the annual number of parole violators. The number used in this analysis is fully in line with recent patterns and is therefore a reasonable estimate for the future. Yet the relative percentages used in the three analyses are not substantiated. If these are conservative figures, then they underestimate the bed savings. If on the other hand they are liberal estimates, they over-estimate the bed savings.

Proposed Solution. Because the Parole Board is in a position to effect these changes, and the Board feels confident in these figures, the analysis as it is currently maintained seems appropriate. One proposal is offered, however. It is recommended that the analysis should be redone when a year's worth of data is collected in order to estimate the actual savings due to these policy changes.

FIREARM LEGISLATION

The purpose of this legislation is to increase the sentences for those who use or display a firearm in the commission of certain types of felonies. Since the overall expected effect is to increase the serving time of inmates, the legislation is expected to increase the prison population.

Problems and Implications. The analysis of the firearm legislation produces a population adjustment that is not satisfactory. There are three problems that make the analysis suspect.

First, the analysis uses confined population instead of committed population as a base for the adjustment. This introduces the problem of overlap across years and the possibility of double counting the inmates who are included in the adjustment. Those 606 inmates that are affected by the legislation in FY 1983 are not independent of the succeeding years' population, and will probably be over-counted in the adjustment.

Second, DOC's documentation describing the analysis is ambiguous. The department's materials about the selection of the sample size and how the sample is used are not clear. Furthermore, the documentation does not show how numbers produced by the method are applied to the population estimate prior to April 1989.

Third, the non-compliance of judges, though mentioned in the analysis, is not accounted for.

Proposed Solutions. In addition to the evaluation of DOC's method, JLARC performed its own analysis of the firearm legislation. The approach to this adjustment was different from DOC's. JLARC's approach was to examine differences in sentences before and after the legislation was implemented. If differences were shown and were statistically significant, then it would be reasonable to make an adjustment to the population estimate.

To test for differences, 14 categories of expected length of stay were used as the comparative measure. Expected length of stay is measured as start of serving time to parole eligibility date. Testing for differences in mean length of stay (measured in days), the analysis was performed at the 95 percent confidence level. The results of the analysis are shown in Table 23.

Only three categories were shown to have statistically significant differences in their mean lengths of stay. Of these two the FY 1983 means for rape and burglary were less than the FY 1982 means. The one category that was in the expected direction and was statistically significant was "homicide: attempt". Of the total number of categories tested, seven showed FY 1983 greater than FY 1982 as expected, but seven showed differences in the opposite direction.

However, this analysis has several limitations. First, the analysis is not sensitive to differences between the two years in the circumstances of the crimes or the prior histories of the felons. Also, in some crime categories the sentencing differences in a given year were so large that the sentencing differences between years would have to be greater than the one-year increase mandated by the legislation in order to be statistically significant. Finally, the number of cases in some categories was limited.

Nevertheless, this preliminary analysis indicates that the firearm legislation does not yet appear to increase prison sentences. Combined with the apparent deficiencies in DOC's method, the adjustment that is made to the model does not appear warranted at this time.

Proposed Solutions. DOC's analysis could be redone incorporating three improvements. First, DOC should monitor or redo its analysis of this legislation and address the problems identified by JLARC. Until this is completed, no adjustment to the prison population should be made. Second, DOC should develop a clearer and more thorough documentation of its methodology so that it can be reviewed

Table 23

TESTING SENTENCING DIFFERENCES BEFORE AND AFTER CHANGE IN THE FIREARM LEGISLATION

Crime Category	Difference in Means	Confidence Interval	Statistically Significant Difference
Homicide: All	- 94.64	± 219.96	No
Homicide With Gun	- 514.43	± 927.08	No
Rape: All	409.09	± 230.45	Yes
Rape With Gun	-1914.9	± 2614.4	No
Robbery: All	49.62	± 153.53	No
Robbery With Gun	29.87	± 294	No
Kidnap/Abduction	- 84.19	± 961	No
Aggravated Assault	101.27	± 203.2	No
Burglary	140.97	± 71.05	Yes
Homicide Attempt	- 642.9	± 577.6	Yes
Rape: Attempt	352.7	± 471.3	No
Robbery: Attempt	- 106.29	± 220.2	No
Assault: Attempt	733	± 1320.9	No
Burglary: Attempt	- 361.3	± 484.5	No

*95% confidence level

X_1 = Mean length of stay, FY 1982
X_2 = Mean length of stay, FY 1983
Test of Significance: $H_0 : X_1 - X_2 = 0$

Source: JLARC analysis of DOC OBSCIS.

outside the department. Third, DOC should adjust its OBSCIS data base in order to allow for identification of the affected crime categories with or without the use of a firearm. Finally, when data from the post-FY-82 period is available for the release component, the need for the Gun Law adjustment should be eliminated.

COMMUNITY DIVERSION INCENTIVE PROGRAM

The CDI program was introduced in 1980. The number of felons diverted, their sentence lengths, and the success rate have been changing. The number of CDI programs reached a peak in FY 1984 with 24, but with the elimination of the Norfolk CDI program it has declined to 23 for FY 1985.

Problems and Implications. The methodology used by DOC in this adjustment appears sound, if the data used are valid. The newness of the CDI programs suggests that each data element used in DOC's population adjustment needs to be reviewed. Certainly, the number of diverted State felons will decline with the elimination of the Norfolk CDI program.

Proposed Solutions. The goal of a CDI adjustment to the forecast is to account for incarceration time in the DOC system which is saved because a convict is placed in CDI rather than in a prison. DOC's manual adjustment is based on an assumption that all convicts placed in CDI would have gone to prison, rather than to probation, in the absence of CDI. While this assumption reflects the intent for the CDI program, it does not appear to reflect actual implementation of the program. JLARC analysis indicates that approximately 70 percent of CDI divertees would probably have gone to prison if CDI did not exist. However, 30 percent of the CDI participants would probably have gone to probation (see JLARC's report on the community diversion program).

Thus, the first major step in making the CDI adjustment is to find the number of State felons who would actually have been incarcerated. If the size of the CDI program remains constant at FY 1985 budgeted levels, the program expects to serve approximately 557 per year. Based on JLARC analysis, 70 percent of these, or 390, would have gone to prison.

The number of CDI clients who succeed in the program must next be estimated. This step is important, because CDI participants who fail the program are sent to prison to serve their sentences and do not save the State incarceration time. The success rate of CDI participants for FY 1984 was approximately 58.5 percent, and this rate times the 390 annual divertees equals 228.1 successful divertees per year.

Finally, the time which CDI clients would have spent in institutions if there were no CDI program must be estimated. From a sample of CDI cases, the number of divertees in each sentence group was calculated. The average serving time for the CDI clients in each sentence category was estimated by using the average serving time of property offenders who actually served in the DOC system.

In the JLARC analysis, the sum of all the sentence categories totaled to 2,189.3 months of incarceration saved per year. Thus, assuming a program of constant size, the estimated number of savings per year which can be expected from CDI is 182.4 beds. The current adjustment used by DOC estimates that 467 beds can be saved per year.

The recommended long-term solution, however, is to eliminate this manual adjustment and instead account for the CDI impact by removing this population from the admissions factors included in the release component. It should be noted that the CDI program produces

a problem affecting the admissions data series. That is, the data series before and after the CDI program are no longer equivalent, and adjustments will need to be made to account for these differences.

THREE-TIME-LOSER LAW

The purpose of this legislation is to exclude from discretionary parole eligibility all those persons convicted of three separate felony offenses of murder, rape, or armed robbery when the offenses were not part of a common act. The effect is to extend the serving time of those inmates convicted under the guidelines of the law.

Problems and Implications. There are two problems with DOC's analysis of the three-time-loser law. The first major problem is that DOC's analysis is not built upon a sufficient number of cases. DOC selected a 25 percent random sample of 1982 commitments in order to determine the number of felons who would be affected by the law and the way they would be affected. This sample produced only one case on which DOC could base its analysis. On the basis of this one case, it is very difficult to make accurate judgments about the size and extra serving time of the affected population.

The one case that the sample produced was an armed robbery felon whose sentence was 41.0 years. Murder, armed robbery, and rape seem to have similar sentence lengths in general (excluding life and death sentences); therefore the general use of this type of case as an average for all types of affected cases seems to be reasonable. But with only one case in the analysis this application is questionable. The mean sentence length for all three types of felons for FY 1982 was approximately 19 years, as compared to the 41 years of the sample care.

The second problem is the increase in serving time DOC used for all cases. DOC selected a 26.6 percent increase in serving time for these cases. This selection did not have an empirical basis. There needs to be a clearer rationale in order to justify such an increase.

Proposed Solutions. The impact of the three-time loser adjustment is small. But to make the adjustment as accurate as possible, DOC should address the problems described above. The adjustment should not rest on a sample approach that yields only one case. The selection of a percentage to represent the increase in serving time should have an empirical basis. DOC should also monitor admissions in the immediate future to determine if changes occur in the population affected by this legislation. Furthermore, DOC should expand the OBSCIS data system to include a means for identifying felons convicted under the three-time-loser law.

These steps should be taken in the short term to improve the adjustment. The long-term proposal is to eliminate this manual adjustment altogether. Instead, the release component should be adjusted in order to account for these three-time-loser felons.

CONCLUSION AND RECOMMENDATIONS

As a result of the manual adjustment analysis, several recommendations to change DOC's current practices seem appropriate. In the short term, the inmate population forecast should include adjustments for all but one of the five manual adjustments. The exception is the three-time loser law, for which no justification for a change by 1990 was found. Over the longer term, it is recommended that methods should be used to incorporate several of the adjustments into the model, so that manual adjustments are not needed.

Recommendation (21). With regard to the recidivist adjustment, in the short term the effects of the recidivists should be incorporated in the release component and the forecast should be rerun.

Recommendation (22). With regard to the recidivist adjustment, as more sentence categories include only those admitted after July 1979, the data base should be updated.

Recommendation (23). With regard to the Parole Board's reduction of serving time adjustment, in the short term DOC's analysis should be replicated with a more complete data base and review cases should be identified. As changes occur in the results of the analysis, these should be incorporated into the population forecast.

Recommendation (24). With regard to the Parole Board's reduction of serving time adjustment, in the long term DOC should examine the actual results of this policy change once the data for a complete year are available.

Recommendation (25). With regard to the Parole Board's reduction of serving time adjustment, in the long term DOC should alter its OBSCIS file so the actual review dates for inmates who were previously denied parole (under current sentence) are identified.

Recommendation (26). With regard to the Parole Board's release of review cases adjustment, in the short term two numbers should be changed in the analysis. First, the target for the reduction in serving time -- 30 days -- should be used as an estimate of the savings. Second, DOC should use the 1417 figure as an estimate of review cases affected by the policy changes.

Recommendation (27). With regard to the Parole Board's release of review cases adjustment, when an annual series of data is available DOC should produce a study of the actual effect on the prison population.

Recommendation (28). With regard to the Parole Board's redocketing for early review adjustment, in the short term DOC should include a factor of 20 percent for the relative proportion of affected review cases. Also, the effect of the change in the second policy adjustment should be included in this adjustment.

Recommendation (29). With regard to the Parole Board's redocketing for early review adjustment, when an annual series of data is available DOC should produce a study of the actual affect on the prison population.

Recommendation (30). With regard to the Parole Board's local jail review adjustment, in the short term DOC should increase its bed savings by eliminating the extra serving days each parolee serves in local jails.

Recommendation (31). With regard to the Parole Board's local jail review adjustment, in the long term DOC should redo the analysis when a year's worth of data is available in order to measure the actual savings.

Recommendation (32). With regard to the Parole Board's revocation case adjustment, in the long term the analysis should be redone when a year's worth of data is available in order to estimate the actual savings.

Recommendation (33). With regard to DOC's firearm adjustment, DOC should first monitor or redo its analysis of this legislation and address the problems identified. Until this is completed, no adjustment to the prison population should be made. Second, DOC should develop a clearer and more thorough documentation of its methodology. Third, DOC should adjust its OBSCIS data base in order to allow for identification of the affected crime categories, with or without the use of a firearm.

Recommendation (34). With regard to DOC's CDI adjustment, in the short term the results from JLARC's CDI study should be substituted for DOC's current figures.

Recommendation (35). With regard to DOC's CDI adjustment, in the long term the manual adjustment should be eliminated, and instead the impact of CDI should be accounted for by removing this population from the admissions factor.

Recommendation (36). With regard to DOC's "three-time-loser" adjustment, in the short term DOC should do two things. First, they should address the identified problems with the current methodology. Second, they should expand the OBSCIS data system to include a means for identifying felons convicted under the three-time loser law.

Recommendation (37). With regard to DOC's "three-time loser" adjustment, in the long term this manual adjustment should be eliminated, and the release component should instead be adjusted to account for the three-time-loser felons.

The overall effect of the short-term adjustments is to decrease the DOC's projection of the inmate population through June of 1990. The results of these adjustments are summarized in Table 24.

TABLE 24

MANUAL ADJUSTMENTS:
DOC ADJUSTMENTS VERSUS JLARC RECOMMENDATIONS

	Recidivist Law		Gun Law		CDI		Parole Board		Total Adjustment	
	DOC	JLARC	DOC	JLARC	DOC	JLARC	DOC	JLARC	DOC	JLARC
June 84	+572	+311	0	0	-305	-182	-689	-1043	-422	-914
June 85	+677	+271	0	0	-467	-182	-843	-1043	-633	-954
June 86	+748	+259	+118	0	-467	-182	-843	-1043	-444	-966
June 87	+801	+260	+117	0	-467	-182	-843	-1043	-392	-965
June 88	+845	+263	+266	0	-467	-182	-843	-1043	-199	-959
June 89	+886	+266	+399	0	-467	-182	-843	-1043	- 25	-959
June 90	+919	+269	+399	0	-467	-182	-843	-1043	+ 8	-956

Source: JLARC and DOC documentation.

First, in the recidivist adjustment, the method JLARC used produces a much smaller population increase than DOC's. For each of the years prior to 1990, it appears appropriate to reduce the magnitude of the population increase expected by DOC to a lower level. Second, the refinements to the CDI adjustment lowers the impact of the diversions and increases the population forecast. JLARC's analyses of the several policy changes within the Parole Board adjustment produces several recommendations whose overall effect is to increase the bed savings due to the changing policy practices.

Table 24 compares DOC's original adjustments with JLARC's recommended adjustments. The combined effects of the adjustments on the population forecast are in the final column. As a result of JLARC's recommendations, the population forecast should be reduced through the short-term period -- June 1984 through June 1990.

VII. PERFORMANCE AND MAINTENANCE OF THE MODEL

Previous chapters have evaluated the structural soundness of the DOC forecasting model. In this chapter the focus is shifted to more pragmatic elements, the model's performance and its maintenance. Both of these areas are important for the continued usefulness of the model. If the model is going to be reliable for planning purposes, it must produce accurate results. For the model to continue to be reliable, it must be adequately maintained and updated.

Any forecast model's performance can be evaluated by looking at the accuracy of its predictions. The difference between the actual population and the forecast is considered error. Some error is inevitable in a forecast. However, large errors reduce the utility of the forecast, and consistent over- or underprediction weakens the forecast's credibility. The performance of DOC's model is difficult to judge because it has been in use for less than one year.

Without enough attention to maintaining a forecast model, its performance may deteriorate over time. The original DOC forecast model was inadequately maintained and began producing large errors very quickly. To produce accurate forecasts for a number of years, data systems and the quantity and quality of resources must receive adequate attention. Furthermore, both policy and technical level reviews must be carried out frequently.

This chapter discusses the criteria and findings from the evaluation of the performance and the maintenance of the model.

PERFORMANCE OF THE DOC FORECASTING MODEL

Forecasts of inmate populations are used in conjunction with capacity estimates to serve as a basis for capital plant decisions. If the forecast overestimates the population, then more beds may be added to the system than are necessary. On the other hand, an under-estimate could lead to overcrowding and related problems with maintaining control of the facility, and to court actions. Therefore, a major criterion for judging the usefulness of a forecasting model is the accuracy of its forecasts.

However, even accurate predictions may be "coincidental" if the other desirable characteristics are not present. Without adequate theory and statistical properties, a model that performs well in the beginning may quickly produce large errors. The original DOC forecasting model is an example.

It should be noted that the first forecast using this model was produced in December 1983 after a brief period spent adapting the model for Virginia conditions. Many changes occurred between the first forecast and the report DOC staff prepared in June 1984. Other changes, such as adding to the data base, are being tested now. Therefore, the model has only performed for a short period, and comparisons of actual and forecasted populations are of limited value.

To assess the performance of the model, three forecasts issued by the department will be examined. Then a test of the model will be presented which simulates its performance as if it had been put in place in July 1982.

Actual Model Performance

The analysis of the forecast performance can be carried out on three versions of the forecast released by DOC since December 1983. The basic descriptions of the three versions are given below:

December 1983	This version of the model used: (1) two regression equations to predict annual admissions, (2) the basic release component, and (3) the original manual adjustments. A regression coefficient had been miscopied, producing an error.
April 1984	This version corrected the coefficient error and updated unemployment data for 1983. It is the same as the December method with updated employment data for the admissions component and the forecast.
June 1984	This version changed the admissions component by substituting equations which exclude unemployment as a factor for the later years of the forecast. Unemployment data and some manual adjustments were updated.

To evaluate performance, each version of the DOC forecast has been compared to the average daily population in the State system during that time period, and to that average daily population with DOC's estimate of the felon backlog in local jails added in. Table 25 shows the results. It must be pointed out that the statistics are not true measures of performance in these cases. The April and June versions were revised after the period used to test performance had begun. Data were available at that time which would not have been available in December, the last point at which the forecast for this period could have been updated.

Measured by either the mean absolute error or the mean percentage error, the DOC forecasts have stayed well within the 10 percent error they have identified as an objective. Mean absolute

Table 25

PERFORMANCE OF THE DOC MODEL

Forecast Period	Average Daily Population	Population & Estimated Jail Backlog	12/83 Forecast (over/under)	4/84 Forecast	6/84 Forecast
January 1984	9297	9672	10021 (349)	10029 (357)	10072 (400)
February 1984	9319	9710	9989 (229)	9907 (197)	9955 (245)
March 1984	9545	9915	9966 (81)	9892 (-23)	9946 (31)
April 1984	9592	9887	10041 (154)	9920 (33)	9982 (95)
May 1984	9696	9908	10108 (200)	9935 (27)	10003 (95)
	Mean Percentage Error		2.01	1.30	1.78
	Mean Absolute Error		197	127	173

Source: DOC documents.

error is the average of the differences between the actual and the forecast. The forecasts were off by a range of approximately 125-200 inmates using this measure. The mean average percentage error is an average from the five periods. The error was 2 percent or less for all three forecasts.

However, three caveats about these performance measures must be considered. First, they have an advantage of containing more information than is normally available for forecasts. Each of the forecasts, except December 1983, incorporated data that would not have been available prior to the forecast period. Second, a goal of 10 percent error may not be appropriate.

Third, forecast results are most likely to be utilized in the three- to five-year time frame that is required to plan and build a new prison. To partially test performance in a longer time frame, a simulation of the model's performance using only data available in July 1982 was developed and is presented in the next section.

Simulated Model Performance

The limited amount of time that the model has been in use severely compromises the usefulness of the performance measures that

can be developed. To provide a more realistic test of performance, a simulation of the model's performance as if it had been put to use in July 1982 was developed. This date was chosen because the release component was developed from a data base including data through June 1982. The use of earlier data for the release component has been dismissed by the department due to the significant legislative changes that the system was undergoing.

The simulation involves changes in both the admissions component and the manual adjustments. The admissions component was revised by reestimating the equations for white and non-white admissions using the 18-34 age cohort. Currently, the actual data on unemployment and population from the forecast period is used in the simulation. A more accurate test would use the forecasted data available in July 1982.

The manual adjustments using the DOC methodology presented in the December 1983 forecast were used in the simulation. Since the gun law and the "three-time-loser" law were not expected to impact the forecast until after the time period covered by the simulation, they were excluded from the exercise. The manual adjustments for the other three legislative and administrative changes are shown in Table 26. The unexpected releases adjustment was not incorporated into the adjustments because it was not anticipated prior to its occurrence.

The simulation was carried out for 23 months from July 1982 through May 1984. The forecast results with manual adjustments were compared to the average daily population for each month plus the DOC estimate of the jail backlog. Error is defined as the difference between those two terms. The mean absolute error and the mean percentage error were calculated in the manner described above for the 23 periods. The results are presented in Table 27.

The error indicated in this comparison of forecast to actual is approximately 3 percent, or 283 inmates. Overall the performance is good. However, all except one of the 23 periods show an overestimate by the forecast even when the "jail backlog" has been added to the average daily population.

Conclusions

The data which is available to date indicates that DOC's model has performed reasonably well. For example, a simulation of the model's performance showed an average error of about three percent between July of 1982 and May of 1984. This is significantly below the department's objective of keeping the error of the forecast at less than ten percent.

However, there are several important facts about performance which also need to be considered. First, a performance objective of keeping error to less than 10 percent may not be appropriate. For a population of 10,000 inmates, an error of 10 percent represents 1,000

Table 26

MANUAL ADJUSTMENTS FOR THE SIMULATION

Month	(+) Recidivist Law	(+) Community Diversion	(-) Parole Board	Total
July 1982	202	85	21	266
August	222	95	43	274
September	242	104	64	282
October	262	109	85	286
November	282	125	106	301
December	302	142	128	316
January 1983	322	161	149	334
February	342	169	170	341
March	362	182	191	353
April	382	198	213	367
May	402	219	234	387
June	422	232	255	399
July	435	242	291	386
August	447	242	327	362
September	460	245	364	341
October	472	253	400	325
November	485	255	436	304
December	497	267	472	292
January 1984	510	276	508	278
February	522	273	544	251
March	535	278	581	232
April	547	291	617	221
May	560	307	653	214

Source: DOC documents

inmates, or the operational capacity of two of the more recent prototypes of medium security facilities. Under another option, such a large error would entail the use of virtually all of the system's reserve capacity. An error of five percent seems to be a more appropriate objective.

Second, there is a concern abut the consistent direction of the error of DOC's model. Under the performance simulation, the model overestimated the population for all but one of 23 forecast periods. The consistent overprediction of populations weakens the credibility of the model.

Finally, it is not yet known how DOC's forecast model will perform over a longer time period. A high level of performance over the long term is difficult to sustain with any model, as assumptions prove invalid and factors that are not accounted for begin to affect

Table 27

PERFORMANCE SIMULATION
(June 1982 - May 1984)

Month	Forecast w/ Adjustments	Actual & Estimated Jail Backlog	Error	Percent Error %
July 1982	10398	9711	687	7.07
August	10270	9914	356	3.59
September	10206	9946	260	2.61
October	10199	9919	280	2.82
November	10062	9769	293	3.0
December	10044	9886	158	1.6
January 1983	10014	9762	252	2.58
February	9943	9764	179	1.83
March	9991	9814	177	1.80
April	10088	9869	219	2.22
May	10176	9868	308	3.12
June	10316	9800	516	5.27
July	10314	9741	573	5.88
August	10204	9699	505	5.21
September	10125	9681	444	4.59
October	10098	9732	366	3.76
November	9946	9515	431	4.53
December	9904	9730	174	1.79
January 1984	9850	9672	178	1.84
February	9746	9710	36	.37
March	9765	9915	-150	2.51
April	9832	9887	55	.55
May	9888	9908	20	.20
		Mean Absolute Error	283.35	
		Mean Percent Error	2.99	

Source: JLARC simulation of DOC model.

the system. This difficulty may be particularly acute with the DOC model due to the model's complexity. It is for this reason that DOC's efforts to maintain the model are also a performance concern.

MAINTENANCE OF THE MODEL

Correctional forecasting involves more than developing, testing, and using a model to forecast inmate populations. If the

full benefit of developing a model is to be realized, then a process must be designed so that the model can be maintained and fine-tuned as time passes.

Concern about maintenance of the model arises from the fact that forecasting accuracy depends on an assumption that the future will be like the past. Forecast models are generally developed by extrapolating past relationships and past trends into the future. However, there are many ways in which correctional policies and practices can change and thereby cause any model to inaccurately predict the future population. Thus, the one-time development and execution of a model is not a desirable process for achieving forecast accuracy. Instead, resources must be devoted to understanding how the model works and how the model needs to be adjusted to account for changes.

There are, then, several key ingredients for the adequate maintenance of any forecast model. These ingredients are:

- awareness of the model's assumptions and limitations,
- preparation of adequate documentation about the model so that the model can be replicated and understood,
- ongoing commitment to work with forecasting,
- significant effort to anticipate the changes in the correctional environment which may impact the forecast, and
- willingness to carefully investigate the cause when the forecast model errs.

Description of DOC's Maintenance Efforts

DOC has had two forecast models. The initial model was developed by DOC over a period of two years, and the first forecast was produced in August of 1977. The model was used by the department for more than six years without a critical reexamination of its basic premises and without rerunning the model. Instead, the model was updated four times through the use of manual adjustments. A pattern of over-projections began in October of 1982, and continued through September of 1983 when it reached an over prediction of 800-900 inmates (9.4 percent error).

DOC had an explanation for the magnitude of the error associated with the forecast. The department stated that the large error was due to a failure to include a legislative cap on recidivist sentences when manual adjustments were made. However, there was also some doubt about the validity of the original model. The DOC staff member largely responsible for the model's development had not adequately documented the model's procedures. A decision was made to replace the old model with a new forecast and the results of the new model were announced by the Governor in December 1983.

The new model was an adoption of the SLAM II model originally developed for the Florida corrections system. It is a complex model, involving: (1) the use of four regression equations, (2) a lengthy computer program that applies probability tables for 13 sentence groups to DOC inmate data, and (3) five manual adjustments to the result of the model -- each of which is the product of separate methodologies. To adapt the model for Virginia, the model's originators from Florida were hired as consultants and worked with DOC staff.

There are currently six members of DOC's Research and Reporting Unit who are involved part-time in prison population forecasting. Between July of 1983 and September of 1984, these staff members spent approximately 2,670 hours on forecast development, and 1,740 hours in preparation for meeting the HJR 152 requirements and sponsoring a forecasting conference. In addition, two other individuals who have left the unit spent some time on the forecast development. Time spent on data base validation is not included in these figures because that activity had other purposes in addition to the forecast.

The manager of the unit has stated that the unit will have to make an ongoing effort in order to maintain the model. For example, three or four of the members of the Research and Reporting Unit staff will be assigned some permanent responsibility for the forecast. Each of these staff members will be asked to learn about all the model's components. If one person leaves, DOC staff believe the knowledge about a component will not be lost.

Problems and Implications

DOC's use of its initial model illustrates some of the problems which can occur in maintaining a model. In general, these problems appear to reflect a lack of priority which was given to the forecasting effort. For example, a programmer who worked on the original forecast stated that the model was:

> intended to produce projections of inmate population for the next three years .... the amount and nature of historical data, particularly commitment rates, is such that confidence levels would become unacceptable if the projection were to be extended.

However, the department used the model for over six years by simply tacking on manual adjustments to the model's results.

The result of this reliance on manual adjustments was that over time, DOC personnel did not understand the basic model. Documentation for the model was poor. When the employee who was primarily responsible for the development of the model left DOC, the

department lost the capability to rerun the model. No one in the unit today can explain how the model worked. As a result, when the model's adjusted forecast began to err the whole model had to be scrapped.

The lack of understanding of the initial model is illustrated by the explanation which was offered when the model began to produce significant errors. A failure to include a legislative cap on recidivist sentences in performing the manual adjustments was blamed. In fact, it was impossible that the cap on recidivists could have produced anything like the 900-inmate error discovered in September of 1983. The statute had been in effect only two years and would not have reduced parole eligibility until 1993.

There are also reasons for concern about the department's maintenance of the current model. The model was actually developed by an outside consultant. It is a very complex model which requires a significant investment of time and effort to understand. The model has not been well-documented to date. It will therefore not be an easy task to maintain the model. The computer program used to run the model is extremely complex. Detecting errors or making internal adjustments in the program will be very difficult.

Proposed Solutions

The current model can only be put to optimal use if DOC builds the organizational capacity to maintain it. Successful maintenance of the model will depend on several factors. First, the model's assumptions and limitations need to be recognized and documented.

Second, all of the material which is necessary to explain how the model works, and how the calculations are specifically performed, needs to be compiled into one source document. This is an important step to ensure that the forecast can be replicated.

Third, DOC needs to make an ongoing commitment to forecasting. Important decisions can rest on forecast results. Therefore, the data which is used in the model needs to be updated and reviewed on an ongoing basis. Actual executions of the model need to be given priority so that the performance of the model can be monitored, and so that decisions can be based on a model which is both up to date and carefully run. DOC needs to ensure that there is more than one individual in the department who is knowledgeable about all the phases and calculations involved in the model. This step needs to be taken to help ensure that the replication of the model is not dependent on any single person.

An ongoing departmental commitment means that the forecast needs to receive a high priority whether or not there is a crisis. Forecast results should be constantly monitored and updated; data

systems necessary for the model must be valid and available in a timely fashion. This means the capability to run and refine the model has to be retained by the DOC staff. Furthermore, during a period when the correctional system is not going through the rapid changes that generally precipitate a crisis, an opportunity exists to examine the factors that are affecting inmate population levels in the State. This work may be useful in improving the model or in considering alternatives.

Fourth, sufficient emphasis must be placed on anticipating the factors which may change the forecast, and on adjusting the forecast accordingly. The success of the SLAM II model in Florida, for example, has been generally attributed to the expertise and vigilance which was used in seeing that the model was adjusted according to changes in the correctional environment. The same type of monitoring is essential to the performance of all models.

To achieve this goal, it may be useful for DOC to supplement its own forecasting resources with the involvement of outsiders in the forecast process. The state of Washington, for example, involved the "Governor's Interagency Criminal Justice Work Group" in its forecasting work. This group included an administrator of the courts, two representatives of prosecuting attorneys, the chairman of a jail commission, the chairman of a prison terms and parole board, the Secretary of the Department of Social and Health Services, the Director of the Office of Financial Management, and the Secretary of the Department of Corrections.

This group helps set the major assumptions which will be used in making the forecast. The major advantage of forming such a group is that members can provide input as to how others involved in the criminal justice process expect the correctional environment to change.

There are two other advantages that this kind of group can offer. First, the group may be able to help provide insight into the historical determinants of fluctuations in prison populations. This can be used to help improve forecast models. In Washington, the work group studied 12 years of historical data to help isolate key prison population determinants in the state. Second, if the group involves judges, prosecutors, parole board members, and legislators, there is an opportunity to increase awareness of the comparison of prison population and institutional capacity among the other factors within the corrections system.

The final factor affecting the success of maintaining the model will be a willingness to carefully investigate when the model produces significant errors. The error may be correctable, such as errors in the data set used or in the mechanical execution of the model. The error could also be due to changes in the correctional system that had not been anticipated, but which can be adjusted for in the model. This scenario may not indicate a problem with the

basic model, because any forecast is only reliable so long as history is a fairly accurate indicator of the future. A monitoring system is necessary to determine the extent of the problem.

CONCLUSION AND RECOMMENDATIONS

The maintenance of a forecast model involves an ongoing effort to understand the theoretical basis of the model, the execution of the model, and the ways in which the model needs to be adjusted to account for changes. The key concern about the maintenance of the forecast II model is whether or not DOC will put sufficient priority on maintaining the model. A priority on maintenance was not placed on the initial DOC forecast model.

JLARC has identified several ingredients which appear essential for the adequate maintenance of any forecast model. These ingredients lead to several recommendations for the maintenance of DOC's model.

Recommendation (38). A single, detailed source document on the DOC forecast model needs to be compiled. This document should recognize the model's assumptions and limitations. The document should also contain all of the material which is necessary to explain how the model works, and specify how the calculations are performed. This documentation is an important step for ensuring that the forecast can be replicated.

Recommendation (39). DOC needs to make an ongoing commitment to forecasting. The data which are used in the model need to be updated and reviewed on an ongoing basis. Actual executions of the model need to be given priority. The department needs to ensure that the replication of the model is not dependent on any single person. Forecast results need to be constantly monitored.

Recommendations (40). Emphasis should be placed on anticipating the factors which may change the forecast, and on adjusting the forecast accordingly before major errors occur. To achieve this goal, it may be useful for DOC to involve experts or participants in the correctional process from outside of the department. Also, a monitoring system should be developed to anticipate errors that may be structural.

Recommendation (41). If the model does produce significant errors, DOC should carefully investigate the reasons for the error before replacing the model. It is important to determine if errors are due to deficiencies in the structure of the model. If so, then important information may be gained for improving future models. If the problem is not with the structure of the model, then it may be possible to correct the errors, such as by correcting errors in the data set, or by identifying changes in the correctional system which caused the error and which can be adjusted for in the model.

VIII. PLANNING ALTERNATIVES FOR VIRGINIA'S CORRECTIONAL SYSTEM

Virginia's correctional system is approaching a new phase. Rapid inmate population growth is no longer being predicted. A period of slow growth or stable populations is expected. Coinciding with this trend is the close of the recent spate of institutional construction projects. The last of the new medium-security institutions, Augusta, will be opened in April 1986.

Planning for the remainder of the 80's will involve decisions concerning building new facilities, closing or altering the function of current facilities, and renovating current facilities to improve capacity, security, or living conditions. To accomplish the changes necessary for achieving the Commonwealth's correctional objectives, the projected population and capacity of the system must be balanced.

To provide a perspective on the balance between population and capacity, an alternative forecast is presented in the first section of this chapter. The forecast represents technical corrections and refinements of the methodology used by DOC, following most of the JLARC recommendations presented earlier. The second section summarizes the capacity to 1990 under different assumptions and presents three scenarios comparing capacity to expected population. Finally, eight options for handling bed space needs are discussed.

ALTERNATIVE FORECAST METHODOLOGY

Since November 1984, when the initial draft of this report was exposed to DOC and briefed to the Commission, JLARC staff have worked with DOC staff on the implementation of the recommendations. An agreement on an adequate methodology was reached in April, and a forecast using that methodology was produced by DOC staff. The admissions and total inmate population forecast are shown in Table 28.

The forecast indicates that admissions will remain stable through FY 1990, while the total population forecast for Virginia will slightly increase. Two factors appear to explain these trends. First, the two variables that are being used to forecast admissions -- unemployment and the crime prone population -- both have the effect of stabilizing the admissions forecast. These factors influence the number of persons who are likely to commit a crime, and to be arrested, convicted, and thus admitted to a State institution.

Table 28

DOC'S REVISED ADMISSIONS AND POPULATION FORECASTS

Year	Admissions Forecast	Inmate* Population Forecast
1985	5,337	10,595
1986	5,345	10,795
1987	5,342	10,950
1988	5,284	11,062
1989	5,303	11,137
1990	5,320	11,225

*June of each fiscal year is forecast.

Source: JLARC alternative forecast methodology.

Currently, the Virginia population forecast shows the crime-prone population increasing slightly through 1990, when it begins to decrease. Also, the Virginia Large Scale Econometric Model forecast for unemployment is 5.15 percent in FY 1985, and is projected to peak in FY 1986 at 5.23 percent and then gradually decrease to 3.73 percent by FY 1990. These two factors have a damping effect on the admissions forecast.

The second factor affecting admission and population trends is the average lengths of stay, which have decreased for those released in FY 1983 and FY 1984. These lengths of stay are applied to the currently confined population as well as the future admissions to forecast the future inmate population. The average lengths of stay in months for each sentence group are compared to the FY 1982 lengths of stay in Table 29.

The largest decrease appears in those sentence groups of more than 8 and less than 20 years. These individuals constitute a small part of admissions each year; however, due to their long sentences they total over half of the forecast population. A decrease in expected serving time for these individuals decreases the forecast.

DOC's revised forecast presented in Table 28 was developed by making changes to the admissions component, the release component, and the manual adjustments of the original DOC Inmate Population Forecasting model. The changes are discussed in the following sections.

Table 29

AVERAGE LENGTH OF STAY
BY SENTENCE GROUP
(Months)

Sentence Group	FY 82 Data	FY 83-84 Data	Difference
Up to and including 1 year	2.23	2.80	.57
More than 1 and including 2 years	4.70	4.83	.13
More than 2 and including 3 years	9.76	9.36	-.40
More than 3 and including 4 years	14.59	14.03	- 56
More than 4 and including 5 years	18.14	16.79	-1.35
More than 5 and including 6 years	23.78	20.14	-3.64
More than 6 and including 8 years	29.82	25.91	-3.91
More than 8 and including 10 years	38.51	32.86	-5.65
More than 10 and including 15 years	55.18	45.34	-9.84
More than 15 and including 20 years	70.78	64.77	-6.01
More than 20 years	115.34	105.40	-9.94
Life sentence	193.28	200.87	7.59
Death sentence	112.00	109.74	-2.26

Source: JLARC analysis of DOC documents

Admissions Component

The admissions component was altered using the recommendations from this report. The changes affect the admissions variable, the factors used to forecast admissions, and the final equations used for forecasting.

Admissions Variable. New commitments and parole violators represent actual admissions to State institutions and are a logical element to be included in admissions. Two adjustments, however, are made to admissions to account for inconsistencies between the admission and release components and policy changes affecting admissions. A third adjustment was made to attempt to include the felons residing on local jails who were available for transfer into the State system.

To better measure admissions, technical parole violators are subtracted from admissions. The reason for this is twofold. First, unemployment and the crime-prone population affect new felony commitments. Technical parole violators are not new felony commitments; rather, they have had their parole revoked for violating the provisions of their release. Second, the data used in the release component of the model adjusts the serving time of technical parole violators such that it appears continuous. Therefore,

including technical parole violators would both overstate admissions and double count their impact on the inmate population.

To account for actual CDI bed space savings (based on those who would have been incarcerated in a State institution had no CDI program existed) CDI diversions were added into admissions for FYs 1982-84. This allowed the measurement of admissions to be consistent before and after the CDI program began. (To meet the statistical assumptions of linear regression, the admissions measurement must be consistent throughout the time period.) Then, divertees expected in the forecast period are subtracted from the admissions forecast prior to putting those figures into the release component.

Since the early 70s some felons who would have been transferred into the State system have been housed temporarily in local jails. At times the number of felons in this situation has been substantial. In this forecast, the difference from one year to the next between the number of State felons housed in local jails who have greater than six months to serve on their sentences is added into the admissions for that year. A new methodology for accounting for this backlog will be developed in conjunction with JLARC's study dealing with the population and capacity of local jails.

Factors Affecting Admissions. Separate equations are being used to forecast white male admissions, non-white male admissions, and female admissions; therefore, crime-prone populations that most highly correlate with the admissions specified can be used in each forecast . The crime-prone populations used are 25-39 for the white males, 18-39 for the non-white males, 25-34 for females. The different crime-prone population factors were chosen due to their statistical significance.

Admissions Equations. The admissions forecast methodology incorporates three separate equations to represent the admissions system. The coefficient and statistical tests are listed in Table 30. T-statistics can be found below each factor in parenthesis.

With the exception of the female admissions equation, all of the models yield acceptable statistical properties. Furthermore, each equation is able to explain better than 90 percent of the variation in admissions (as exhibited by the R^2 statistic). The equation for females, however, displayed a tendency to consistently over- or under-predict (serial correlation).

Release Component

The release component has been altered from the original DOC forecast model in three ways. First, the average length of stay calculations are based on two more recent years of release data (FY 1983-84) instead of just one (FY 1982). Shorter lengths of stay are found in the current and expanded data base as has been shown in

Table 30

ADMISSIONS FORECAST COEFFICIENTS

Variable	White Males	Non-white Males	Females
White males 25 to 39	.001801		
(t-statistic)	(2.865)		
Non-white males 18 to 39		.005454	
(t-statistic)		(3.335)	
Females 25 to 34			.000254
(t-statistic)			(1.965)
Unemployment	80.98	52.61	
	(2.361)	(1.741)	
Lagged admissions	.6147	.6038	.907
(t-statistic)	(5.082)	(4.697)	(7.026)
Constant	-592.75	-495.07	-65.64
Adjusted R^2	.927	.948	.922
F-statistic	140.2	200.0	184.4
Standard error of model	144.8	131.0	26.2

Source: DOC's revised forecast.

Table 29. Second, the proportion of inmates in each sentence group has been set equal to the three-year average by weighting the FY 1984 admissions data. Third, the release component has been altered to adjust for the recidivist legislation enacted in FY 1979, which affects parole eligibility dates.

The recidivist adjustment accounts for the increased length of stay before parole eligibility for felons who have been previously incarcerated in the Virginia correctional system. The current length of stay calculations are based on releases for FY 1983-84; however, only those releases admitted after FY 1979 fall under the recidivist legislation. Therefore, separate methods were used to account for recidivists admitted before and after FY 1979.

For the first seven sentence groups, those with less than eight-year sentences, most of the releases in FY 1983 and 1984 were admitted after FY 1979. Therefore, the impact of the recidivist legislation is reflected in their lengths of stay. Sentence groups

12 and 13, (life imprisonment and death), are not eligible for parole, and no adjustment is necessary. Moreover, the inmates admitted prior to 1979 in sentence groups 8-11 require no adjustment.

For recidivists admitted after 1979 in sentence groups 8-11, an adjustment must be made to the lengths of stay to account for those who fall under the recidivist legislation guidelines. The adjustment is included in the release component of the model. The original length of stay for each recidivist is altered based on the number of previous felonies the individual has incurred. The effect is to increase the average length of stay for all recidivists admitted after FY 1979.

Manual Adjustments

The initial population forecast used FY 1982 data as the basis for projections. This data did not fully account for all of the effects of statutory and administrative changes that occurred in the late 1970s and early 1980s. Therefore, five manual adjustments were applied to the original forecast results to incorporate an estimate of the effect of these changes on the inmate forecast.

The alternative forecast is now performed with FY 1983 and FY 1984 data. The new data incorporates the impacts of some of the changes. Therefore, the method used to estimate the changes must be altered.

The recidivist parole eligibility changes have been incorporated as adjustments to the release component. The impact of CDI programs is also included by changes in the admissions and release components. Both of the adjustments were described earlier.

For the Gun Law, a manual adjustment is no longer required. The implementation of the law began to affect sentencing patterns in FY 1983. Any increases in sentences (the expected impact of this law) should be accounted for in the more current data used for the release component.

The Parole Board policy changes are partially included in the data. The implementation of the changes began in FY 1983 and were not fully implemented until FY 1985. Therefore, a manual adjustment may still be necessary to account for the effects that are not reflected in the data.

With data provided by the Parole Board, JLARC estimated the actual bed savings realized during FY 1983 and FY 1984. The approach of the estimate was twofold. First, the bed savings that were possible had the policy changes been fully implemented were identified. The potential bed savings for both FY 1983 and FY 1984 were 2126. Secondly, the savings that actually occurred -- according to the schedule with which the Parole Board implemented these

policies -- were estimated. The estimate of actual savings was 628, indicating that 29.5 percent of the potential was realized.

However, because the data are not available to test the extent to which the potential savings may actually be achieved (data will be available at the close of FY 1985 for this purpose), the DOC revised forecast has not been adjusted for more Parole Board savings. The extent of savings will be estimated with the new data, and any necessary adjustments will be recommended at that time.

COMPARISONS OF CAPACITY AND POPULATION FORECASTS

The forecast presented in the previous section can be combined with some alternative configurations of the system's capacity to yield several possible scenarios for the next five years. Three possible scenarios are discussed below, and each is illustrated graphically in an adjacent figure. These scenarios are illustrative of the possible future direction for the system; they do not exhaust the range of alternatives.

Scenario 1

The first scenario uses DOC's measure of capacity, called "operational capacity". Operational capacity is defined as the level of occupancy at which DOC officials believe the facilities can be safely operated. The measure generally includes one inmate per cell, some number of special purpose (medical, isolation, segregation, etc.) beds, and multiple beds in dorms. While some inconsistencies exist in the way the capacity is calculated in different facilities (see Chapter Two for detail), the measure reflects DOC's judgement of a desirable operating level.

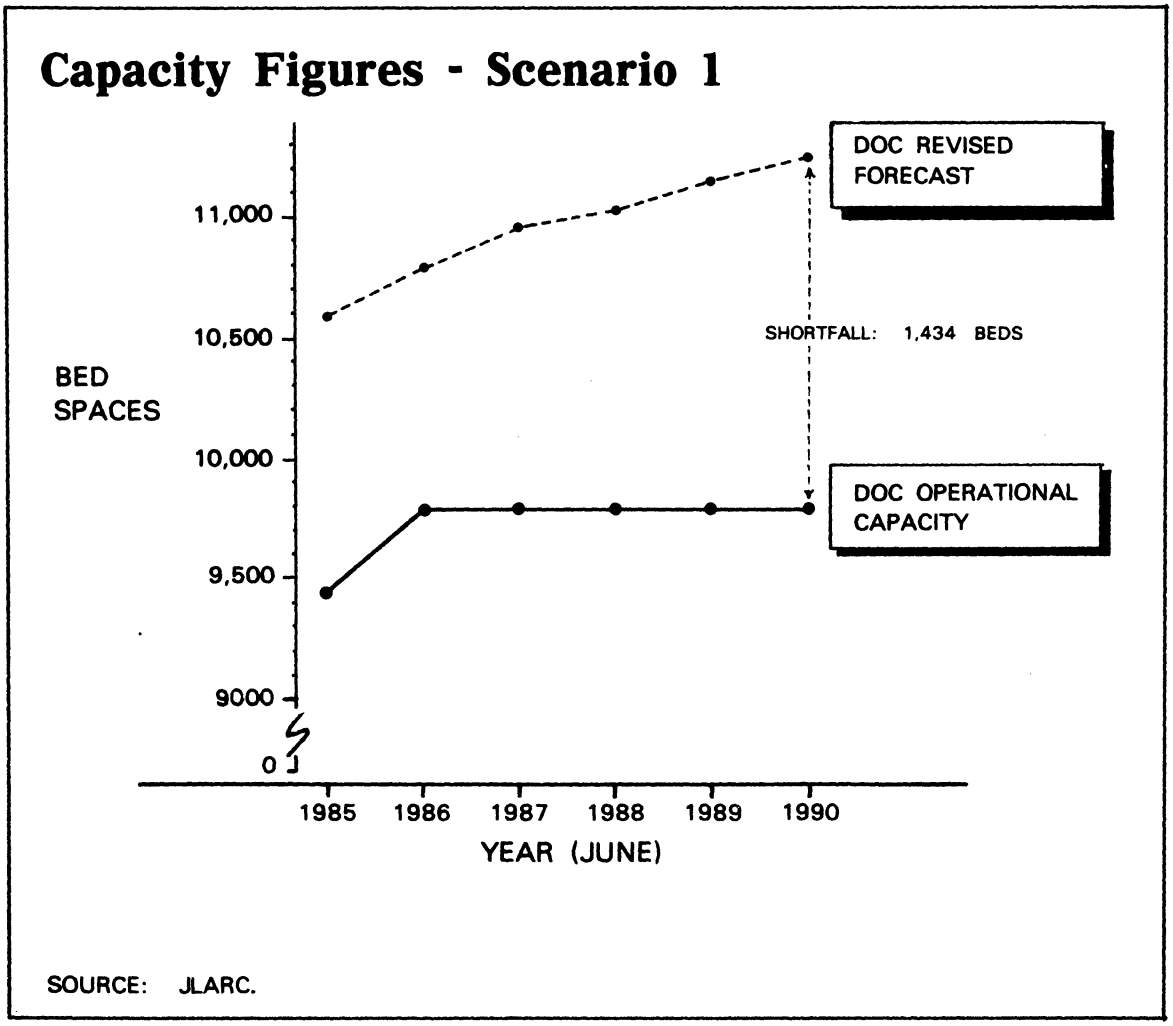
Operational capacity is plotted in Figure 12. The graph shows an increase in the capacity for FY 1986 due to the opening of the new facility at Augusta. All four of the recently constructed medium-security institutions (MSIs) are included, at 500 beds each. The operational capacity also reflects DOC's plan to close only the "A" building of the Penitentiary by 1990.

The comparison of operational capacity and projected inmate population indicates that 1,434 additional bed spaces will be needed by 1990. The capacity at that time will be 9,791 beds, while the population will be 11,225. The largest shortage occurs in 1990, because the population is gradually increasing while capacity remains level after FY 1986.

Scenario 2

DOC's definition of operational capacity does not include double-bunking at the MSIs, and contains an inconsistent amount of

Figure 12

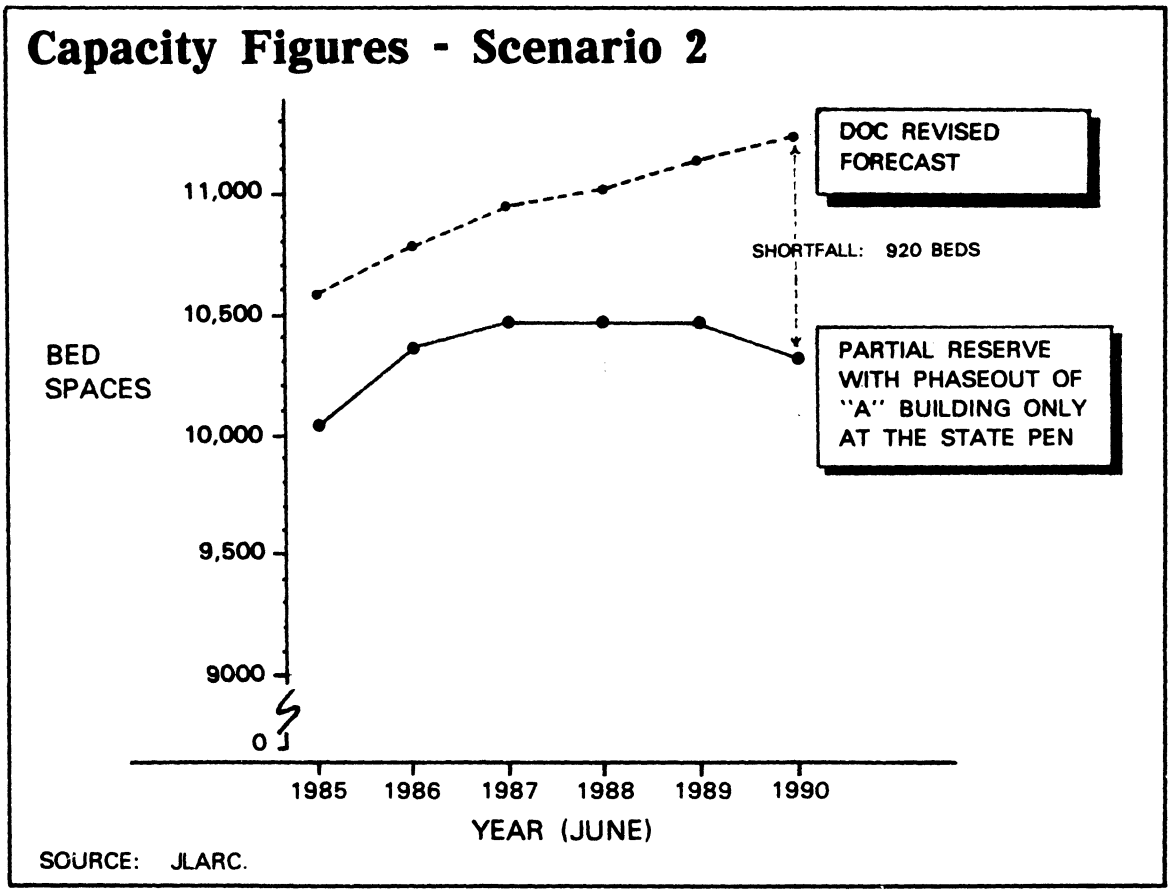


space for each inmate in dormitory areas, especially in field units. JLARC therefore developed another capacity term, "reserve capacity." Reserve capacity involves the use of a level of double-bunking that has been achieved in the MSIs in the past and the use of a square-foot maximum in dormitory areas.

Maximum use of the reserve capacity would involve the addition of over 1,300 beds to operational capacity. However, this level of use is not considered feasible for planning purposes. The maximum reserve capacity allows a short-term solution for unforeseen circumstances and probably could never be fully utilized.

A moderate reserve capacity, however, could be used for planning purposes, especially when the inmate population and the capacity are reasonably close. JLARC used these assumptions to develop a second scenario, employing the same population projection as in the first. Figure 13 shows the bed space requirements if some of the reserve capacity were included. The capacity shown in FY 1990 could be realized by double-bunking the MSIs for a total capacity of 615, and by using a guideline of 55 square feet per inmate maximum in the field units, and 70 square feet per inmate maximum in major institutions. These changes would add 514 beds to the operational capacity and reduce the bed space shortage indicated in Scenario 1.

Figure 13

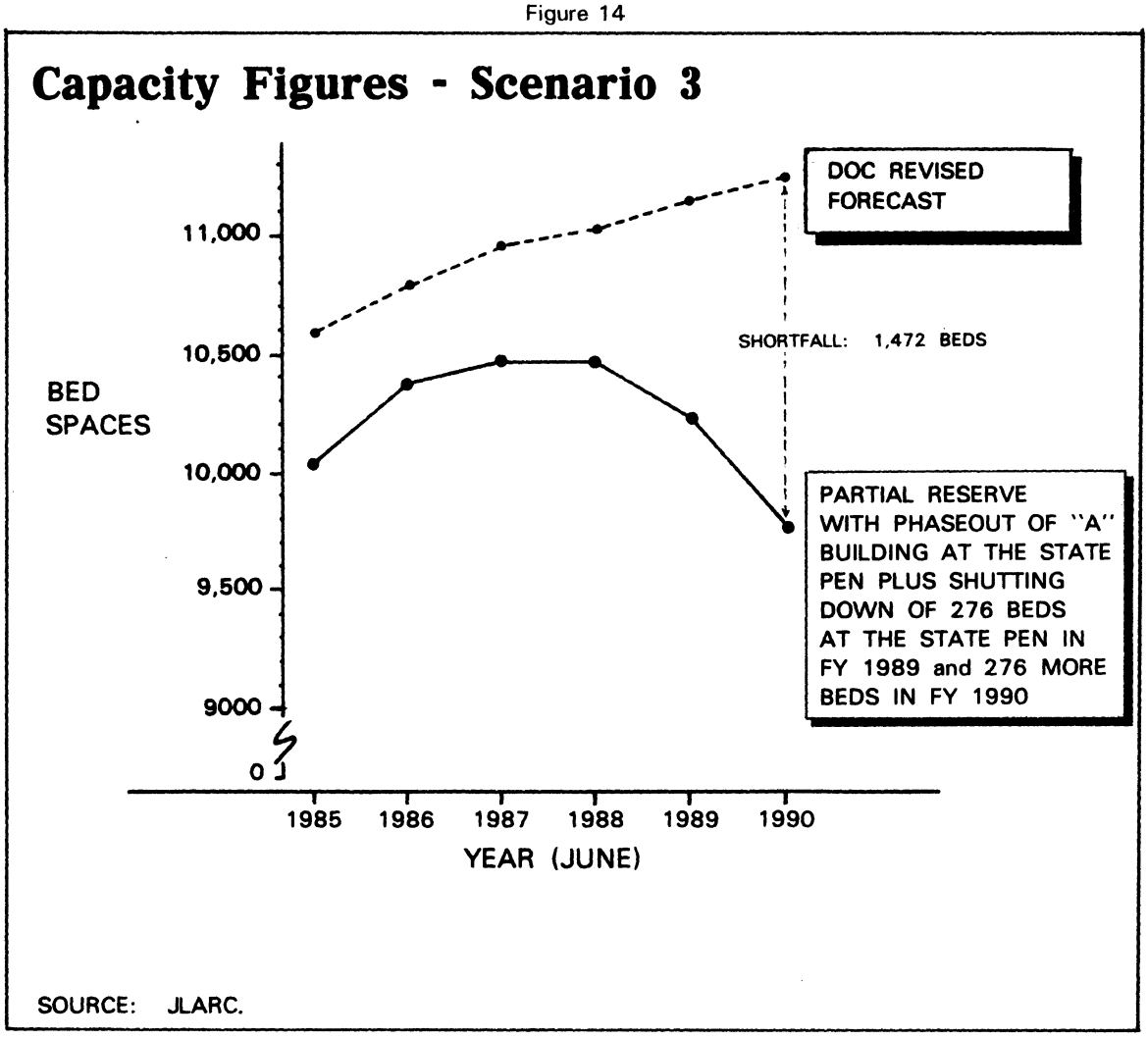


Scenario 3

Scenario 3 includes another change to the capacity figures. The "A" building at the Penitentiary is currently scheduled to close by June 1985. The loss of 316 beds in this section is reflected in operational capacity. The Appropriations Act indicates that "B" and "C" buildings should be planned for closure by FY 1990. The third scenario therefore uses the partial reserve capacity, but removes part of the Penitentiary beds beginning in FY 1989 and completes the closure in FY 1990.

The result of making this change is shown in Figure 14. The bed spaces would fall by 552 due to the closure of the Penitentiary, while the expected population would increase. Thus, 1,472 bedspaces would be required. While this deficit is substantial, it should be kept in mind that the closure of the Penitentiary is a policy option included with seven others in the next section.

Figure 14



OPTIONS FOR THE CORRECTIONAL SYSTEM

Several alternatives are available for creating the additional bedspaces required by the scenarios. They begin with the more traditional, facility-growth responses available to the Commonwealth and close with alternatives that reduce the number of inmates. Combinations and variations of the alternatives are possible. The list and the discussion are not final; rather, they represent several choices that must be analyzed in terms of their costs and benefits.

Utilization of the Penitentiary

The Penitentiary has been scheduled for partial closing by DOC over the next two years. There is strong evidence of legislative intent to fully close the facility by 1990. The perceived threat to public safety from its location in the center of Richmond, the operating costs for the old physical plant, and the value of alternative use of the land support the closure. However, the closure will mean the loss of approximately 552 additional beds (DOC operational capacity plans already include the closing of the "A" building) that may be needed.

Re-establishment of Deep Meadow

The trailer facility at Deep Meadow has been completely closed during the last year. The State retained ownership of the land. A new facility, either temporary or permanent, could be established on the site. Because the land is available already, this site could be viewed as a contingency option, if inmate population levels begin to strain the available bed space.

Expansion of Existing Facilities

Several institutions may have the space to expand the number of living units. The newly constructed medium security institutions may offer potential sites for "in-filling" with additional dormitory area. The impact of expansion on water, sewerage, food service, program space, and staffing would have to be evaluated. Cost and construction feasibility would also have to be studied.

New Facility Construction

Virginia will have constructed four similar medium-security institutions by 1986. The capital cost has been approximately $30 million each. Options for other designs, perhaps with larger capacity and lower operating costs, could be examined. If inmate population declines in the future, these facilities could enable the

closure of older facilities that have higher operating costs. Site selection would be a key difficulty with this alternative.

Contract Corrections

Many states and the federal government have begun to experiment with private sector initiatives for housing inmates. These options appear to offer advantages to states, if they are well controlled through contract specifications and monitored by DOC. The disadvantages can be high, especially if the implementation is inadequate. This alternative would require detailed research into the experience of the other governmental units that have contracted with the private sector for corrections.

Sentencing Guidelines

Sentencing guidelines options run the gamut from determinant sentencing to informing judges on a regular basis of the length of sentences being handed out across the State. Guidelines could be used to give a greater certainty of time to be served, but lessen the actual time spent in prison. Theoretically, the certainty of sentence could reduce the propensity to commit crime. If the serving time were actually reduced, the size of the population and the need for bed space could be reduced.

Community Corrections

Virginia has recently begun to offer a community corrections program at the option of the localities. An evaluation of the Community Diversion Incentive program by JLARC is currently being finalized. Typically, this type of program diverts nonviolent offenders from institutionalization and offers some rehabilitative programs and the opportunity to make restitution to the victim or the community. Expanded use of such a program would reduce the anticipated bed shortage, but the JLARC evaluation of the current program should be used to determine the feasibility of expansion.

Caps on Inmate Population

At least two states have set ceilings on the number of inmates that they will house at a given time. Iowa and Michigan parole inmates when their corrections system begins to reach capacity. The early parole is granted after the inmate's record is evaluated and an empirical evaluation of the likelihood of a repeat offense has been made. The results seem to have been tolerable in those states when compared to the alternatives.

CONCLUSION

By 1990 a shortage of bed space is anticipated in the State's correctional system. The size of the shortage can be minimized if a portion of the system's reserve capacity is utilized. However, if the Penitentiary is closed, approximately 1,500 bedspaces may be needed. Alternative methods of handling the shortage should be evaluated.

APPENDIX: AGENCY RESPONSES

As part of an extensive data validation process, each State agency involved in JLARC's review and evaluation effort is given the opportunity to comment on an exposure draft of the report.

This Appendix contains the responses of the Department of Corrections. Appropriate technical corrections resulting from the written comments have been made in the final report. Page references in the agency response relate to the exposure draft and may not correspond to page numbers in the final report.

COMMONWEALTH of VIRGINIA

Department of Corrections

ALLYN R. SIELAFF
DIRECTOR

P. O. BOX 26963
RICHMOND, VIRGINIA 23261
(804) 257-1900

December 6, 1984

MEMORANDUM

TO: Ray Pethtel

FROM: Allyn R. Sielaff AS

SUBJECT: JLARC Report on Capacity and Inmate Population Forecasting

Attached is the Department of Corrections' response to your staff report "Virginia's Correctional System: Population Forecasting and Capacity." The Department has already submitted to your staff comments regarding in-fact errors and errors of omission contained in the exposure draft; these comments should be included in your final report if the errors have not been corrected.

I would like to commend you and your staff for a fine effort of examining the Department's forecast methodology and producing an alternative inmate population forecast. I am assured by my staff that only a few details concerning the methodology to be used need to be finalized. It is my hope that an updated inmate population forecast can be produced for use during the 1985 session of the General Assembly.

Please feel free to call me concerning our response if you need to do so.

/sh

DEPARTMENT OF CORRECTIONS'
RESPONSE TO "VIRGINIA'S CORRECTIONAL SYSTEM:
POPULATION FORECASTING AND CAPACITY"

I. Comments Regarding Chapter II: Capacity of the State Correctional System.

The Department of Corrections generally is in agreement with the findings presented in this chapter. In particular, the Department is in agreement with the statement on pages 27-28 regarding the practice of double-bunking: ...."The rejection of capital outlay needs based on plans to permanently double-bunk these facilites is not recommended."

With regard to recommendation numbers one and two on page 44:

The Department agrees with both recommendations and is in the process of developing guidelines regarding capacity. However, the term "reserve capacity" suggests that such capacity is always available. In times of inmate unrest, staff shortages and other unforeseeable events, it may not be practical to house more inmates than the number given as "operational capacity." The Department, then, would prefer to use the term "emergency capacity", instead of "reserve capacity." "Emergency capacity" carries with it the connotation of short-term usage, while "reserve capacity" does not.

II. Comments Regarding Chapter III: Model Structure

See memo regarding errors of fact and omission.

III. Comments Regarding Chapter IV: Evaluation of the Admissions Forecasting Component

The Department has provided JLARC staff with data and explanations regarding the "unexplained constant" and "unknown method for calculating admissions 1973 to 1975." Additionally, the staff of JLARC and the Department have agreed to investigate an alternative method for determining jail backlog.

The JLARC staff tested the alternative admissions forecast using Durbin-Watson's D statistic. This statistical test is inappropriate when using a lagged dependent variable. The appropriate test would have been the Durbin-Watson H test.

Recommendation #3: JLARC contends that the estimation of technical parole violators for these years is inexact, and in addition, that the serving times for technical parole violators may be overestimated. JLARC staff, however, have not quantified the degree of overestimation, if indeed, any exists. The Department will continue to include technical parole violators in the forecast as they are presently treated for the near future. As a long term strategy, the Department will attempt to disaggregate the release component to eliminate any possibility of serving time overestimation.

Recommendation #4: The Department agrees with this recommendation to the degree that it is possible.

Recommendation #5 and #6: JLARC staff and departmental staff have agreed to investigate an alternative method of estimating jail backlog. Staff agree that jail backlog should be included in the forecast.

Recommendation #7: The Department agrees with this recommendation, and will include female admissions as a separate equation.

Recommendation #8: The Department contends that while the state unemployment rate has a relatively high correlation with admissions, the prediction of unemployment from the Virginia large-scale econometric model has been highly variable and somewhat unreliable. It must be stated that the large-scale model was built to predict state revenues and unemployment is produced as a residual statistic. In effect, the large-scale model does a good job of predicting revenues, and a less effective job of predicting unemployment. The Department will include the unemployment rate as a predictor variable if the General Assembly and Executive Branch agencies involved in the budgeting process realize that the variability of this predictor will require continual adjustments in the inmate population forecast.

Recommendation #9: See above. The Department has updated the forecast three times in calendar year 1984 to account for changes in the unemployment forecast. Admission estimates have changed significantly each time the unemployment forecast has been changed.

Recommendation #10 and #11: The Department agrees with these recommendations.

Recommendation #12: The Department has considered other variables that affect admissions in the past, and will continue to investigate additional variables in the future.

IV. Comments Regarding Chapter V: The Evaluation of the Release Component

Recommendation #13, 14, and 15: The Department agrees with these recommendations.

Recommendation #16: The Department intends to update the forecast as soon as possible. At this point it appears that the update will be complete during, not prior to, the 1985 legislative session.

Recommendation #17 and #18: The Department generally agrees with these recommendations. However, the Department will first attempt to make the SLAM II model more flexible.

Recommendation #19 and #20: The Department agrees with these recommendations.

V. Comments Regarding Chapter VI - Evaluation of the Manual Adjustments

Recommendation #21 and #22: The Department has included the recidivist adjustment as part of the release component. JLARC staff have this methodology, and should review and comment on this method.

Recommendation #23 through #32: Staff from JLARC and DOC have reviewed a new methodology presented by DOC at the Director's Conference on Inmate Population Forecasting, November 8, 1984. JLARC has agreed to reanalyze these issues, and finalize these adjustments prior to January 1, 1985.

Recommendation #33: JLARC staff are reanalyzing the Department's methodology as presented at the Director's Conference on Inmate Population Forecasting in November. The Department contends that comments contained in the "errors of fact" memorandum, regarding the JLARC method are still true. JLARC staff and DOC staff will finalize this adjustment by January 1, 1985.

Recommendation #34 and #35: The Department contends that the adjustment explained at the Director's Conference on Inmate Population Forecasting should be used as the CDI adjustment until a full analysis of JLARC's CDI report is completed.

Recommendation #36: This has already been accomplished.

Recommendation #37: The Department agrees with this recommendation.

VI. Comments Regarding Chapter VII: Performance and Maintenance of the Model

The Department agrees with Recommendations #38-41, and will continue its effort to update and monitor the inmate population forecast.

The Department has no disagreement with Recommendations #42 and #43, if the General Assembly wishes to comply with these.

FEB 26 1985

COMMONWEALTH of VIRGINIA

ALLYN R. SIELAFF
DIRECTOR

Department of Corrections

P. O. BOX 26963
RICHMOND, VIRGINIA 23261
(804) 257-1900

February 22, 1985

Mr. Ray D. Pethtel
Director
JLARC Staff
Suite 1100, 910 Capitol Street
Richmond, Virginia 23219

Dear Mr. Pethtel:

I read with interest your letter of February 8, 1985 regarding your need for DOC's forecast to complete your report.

As you know, both your staff and mine have worked closely together over the past several months to finalize a methodology to use in forecasting the adult inmate population.

I have stated publicly that we intend to incorporate most of the methodology changes suggested by your staff in the JLARC interim report of November, 1984. In fact, all of the short-term changes which we agreed to make are in place.

There are, however, still a few procedural issues which your staff and mine are continuing to discuss. These issues need to be resolved before another forecast is released.

As you know, budgetary decisions for the remainder of this biennium have already been made; the key time frame in which a new forecast would be needed for the 1986-1988 biennium is the fall of this year.

I am suggesting that your staff and mine continue to work together to fine tune the forecast methodology and get a better understanding of how the changes you have suggested are impacting the forecast. It is my hope that we can issue a joint forecast after the issues are resolved, possibly by mid-June, 1985. We should then update the data base to include FY 1985 data and issue a revised forecast by the end of September, 1985.

Please be assured that we will continue to cooperate with you and your staff in this critical area of planning. If you have any questions, please give me a call.

Sincerely,

Allyn R. Sielaff

Allyn R. Sielaff
Director

/sh

MAR 21 1985

COMMONWEALTH of VIRGINIA

Department of Corrections

ALLYN R. SIELAFF
DIRECTOR

P. O. BOX 26963
RICHMOND, VIRGINIA 23261
(804) 257-1900

March 20, 1985

Mr. Ray D. Pethtel, Director
Joint Legislative Audit and Review Commission Staff
Suite 1100, 910 Capitol Street
Richmond, Virginia 23219

Dear Mr. Pethtel:

As a follow-up to my letter of February 22, 1985, my staff have produced a population forecast which incorporates the short-term methodological changes which we agreed to make as a result of your interim report. The result of this forecast is a projection of total state responsibility in 1990 of approximately 11,500 prisoners. State responsibility, as defined by this Department, includes technical parole violators and felons held in local jails with greater than six months left to serve and who are available for transport to the Department.

As recommended in your interim report, the Department has begun to develop alternative programmatic and facility configurations to address the projected 1990 population. Recently, the Senate Finance Committee requested a briefing on a number of issues related to Corrections, including our planning activity and the status of the inmate population forecast. This briefing is scheduled for April 3, 1985. I realize that in your version of the model, your forecast is for inmates housed within state facilities. Even though our forecasts are not directly comparable, I would appreciate your comments regarding the acceptability of using the 11,500 forecast figure for 1990 planning. This, as previously mentioned, is our projection of state responsibility. The number of inmates that can be housed in local facilities is a policy option within the context of our planning activity.

Your response to this request by March 27 will be appreciated. If you have any questions, please give me a call.

Sincerely,

Allyn R. Sielaff

Allyn R. Sielaff
Director

/sh

COMMONWEALTH of VIRGINIA

ALLYN R. SIELAFF
DIRECTOR

Department of Corrections

P. O. BOX 269
RICHMOND, VIRGINIA 232
(804) 257-19

April 25, 1985

Mr. Ray D. Pethtel, Director
Joint Legislative Audit and Review Commission
910 Capitol Street, Suite 1100
Richmond, Virginia 23219

Dear ~~Mr. Peth~~Ray tel:

This is to confirm that the following state responsibility population figures resulted from the forecasting methodology agreed upon by our two agencies:

6-85	10,595
6-86	10,795
6-87	10,950
6-88	11,062
6-89	11,137
6-90	11,225

If we may be of further assistance in this matter, please do not hesitate to contact me.

Sincerely,

Allyn R. Sielaff

/sh

RECENT REPORTS ISSUED BY THE JOINT LEGISLATIVE AUDIT AND REVIEW COMMISSION

Inpatient Care in Virginia, January 1979
Outpatient Care in Virginia, March 1979
Management and Use of State-Owned Vehicles, July 1979
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Report to the General Assembly, August 1979
Virginia Polytechnic Institute and State University Extension Division, September 1979
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Management and Use of Consultants by State Agencies, May 1980
The General Relief Program in Virginia, September 1980
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