

STUDY OF EVALUATING AND RANKING TECHNIQUES
FOR THE SELECTION OF A PRIORITY SCHEDULING
METHOD IN CAPITAL IMPROVEMENT PROGRAMMING:
MANHATTAN, KANSAS

by

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CHAPTER I

INTRODUCTION

A major concern of a municipality's capital improvement program is that of the scheduling for future capital improvement projects. This process of scheduling is referred to as the priority scheduling process.

The relative importance of projects should be based upon some systematic method of evaluation that should include some defensible and measurable criteria for establishing priorities for capital improvements.¹

Capital improvement programming along with the scheduling of municipal projects, have been used for more than a century.² What capital improvement projects should be chosen first? Which should be chosen second, third, etc.? Before delving into the actual scheduling process and the methods used to determine scheduling, first it must be determined just what is a capital improvement program, and it is,

A plan for capital expenditures to be incurred each year over a fixed period of years to meet capital needs arising from the long-term work program or otherwise. It sets forth each project or other

¹Walter Alan Steiss, Local Government Finance (Lexington, Massachusetts: D.C. Heath and Company, 1975), p.36.

²Lennox L. Moak and Albert M. Hillhouse, Concepts and Practices In Local Government Finance (Chicago: Municipal Finance Officers Association of the United States and Canada, 1975), p.95.

contemplated expenditure in which the local government is to have a part and specifies the full resources estimated to be available to finance the projected expenditures.³

Special effort should be made in choosing the appropriate method in the selection of project priorities. The extent to which a defensible priority system is developed and consistently applied will bear heavily on the success of a jurisdiction's capital improvement program. Manhattan, Kansas, like all other communities which just recently became involved in formal capital improvement programming, was faced with this dilemma.

During the past few years there has been increasing concern in local government for mismanagement and wastes of public revenues, overlapping developmental and administrative policies and an overall lack of coordination in capital improvement programming. The systematic scheduling of projects is the very hub of capital improvement programming. Without it, projects will be selected that are not comprehensive and will not cover the entire period of the CIP (capital improvement program). This period is usually six years in most municipalities.⁴ In the

³Lennox L. Moak and Albert M. Hillhouse, Concepts and Practices In Local Government Finance (Chicago: Municipal Finance Officers Association of the United States and Canada, 1975), p.95.

Eric C. Freund and William I. Goodman, ed., Principles and Practices of Urban Planning (Washington: International City Managers Association, 1968), p.389.

first year of the CIP projects are scheduled that are determined to be the most important and feasible for development/redevelopment in the city. The first year of the CIP is known as the capital budget. It is defined as:

A plan of proposed outlays and the means of financing them for the current fiscal period. It is usually a part of the current budget. If a capital program is in operation, it will be the first year thereof.⁵

In the subsequent five year period, projects are programmed in decreasing priority relative to their level of importance. Although, in some cases, the projects that receive top priority for every first year of the CIP can be determined on a yearly basis, lowering some projects and raising other projects in priority.

After completion of one year of the capital improvement program's six years, the next year (the second year of the original CIP) then becomes the first year and another sixth year is added on to the existing CIP. Projects now in year one (year two of the previous CIP), when determining priorities are most important, and the added sixth year is least important, that is, less important than years one through five.

⁵Lennox L. Moak and Albert M. Hillhouse, Concepts and Practices In Local Government Finance (Chicago: Municipal Finance Officers Association of the United States and Canada, 1975), p.95.

CHAPTER II

SELECTING A PRIORITY SCHEDULING METHOD IN CAPITAL IMPROVEMENT PROGRAMMING

Although capital improvement programming is not a new management tool municipal officials still find it a difficult task to implement, especially in the development of a priority scheduling method. It is at this stage of the capital improvement programming process when many governmental departments spend many hours devising a method to determine project priorities.

The main dilemma in capital improvement programming lies in the selection of a method for priority scheduling.¹ Cities have grown and become more sophisticated. Community needs are now more complex. Manhattan, like other communities, large or small, was faced with this dilemma. Among other things, communities must: (1) determine its capital improvement needs, (2) choose and allocate funding techniques and procedures, (3) involve all levels of local government (to a major extent), state and federal governments (to a more limiting capacity,

¹Alan Walter Steiss, Local Government Finance (Lexington, Massachusetts: D.C. Heath and Company, 1975), p.36.

mainly in the financing aspects), (4) comply with the comprehensive plan (if there happens to be one), (5) solicit citizen participation, (6) consider every section of the community, (7) determine the priorities of the community, and (8) have community support. Although all of these facets are important in the capital improvement programming process, number seven--the determination of priorities is perhaps the most important and essential.

Determining the community's needs does not seem to be a major problem for the various localities across the nation. A street is in need of repair, the zoo needs new cages, sewer problems will develop, etc. Some of the needs are more apparent and are more discernable even by the ordinary citizen. More in-depth analysis will supposedly detect the more significant problems and hopefully the funding sources will be determined for the implementation of the projects.

Priority scheduling in capital improvement programming deals with the development timing and sequencing of the community's major physical projects. The proposed projects are considered for all areas of the community. An inventory of projects is catalogued from which comparisons may be made according to the number, types and costs of projects required to meet the changes in growth and decline throughout the community.

Some cities delegate to the city planning department the task of development and arrangement of the CIP. In

these cases it is assumed that the planners have a thorough knowledge and more objective view of what occurs or should occur in the community, which makes the process of priority scheduling somewhat more reliable and credible.² The planning department does receive input from other operating departments within the municipal government, which is augmented by citizen input. The planning department is also in charge of putting together the community's comprehensive plan and many argue that the CIP should follow it (the comprehensive plan).³ So with the variety of data sources, the planning department has a more fundamental knowledge of community needs to determine priorities.

In the smaller communities, particularly those without planners or a planning staff, the financial officer is in sole charge of determining priorities.⁴

Another method of priority scheduling advocated is the one that favors the development and allocation of capital improvement projects solely on the basis of falling short of national, state and community standards and

²Eric C. Freund and William I. Goodman, ed., Principles and Practices of Urban Planning (Washington: International City Managers Association, 1968), p.391.

³Ibid.

⁴The American Society of Planning Officials, Capital Improvement Programming (Chicago: The American Society of Planning Officials, 1961), p.6.

goals.⁵ These projects can range from the maintenance of thoroughfares and streets to the development of a city-wide park. The CIP, along with other means of compliance, is used as a tool to rectify some unfeasible projects in the development of the community. In the larger cities (even smaller cities to some extent), there is the constant effort to comply with various governmental standards and regulations.

Many project priorities are set up to follow federal guidelines and are determined by the amount of federal and state subsidies to a community. This can result in a municipality's commitment to more essential projects. Over-extension of tax base and deficit spending are likely to occur where federal or state guidelines call for matching funds that are frequently required from localities in order for these communities to receive funding. Projects should be based on need first and then what the municipality can afford. This is saying that financing community improvement projects should not be used as one of the primary factors or criterion for assessing a community's capital improvement projects. Indeed, financial constraints are important, but they should not dictate the selection and scheduling of projects.

⁵The American Society of Planning Officials Capital Improvement Programming (Chicago: The American Society of Planning Officials, 1961). p.23.

After pondering the utilization of several methods for priority scheduling, many communities revert to a method that has been advocated by most capital improvement authorities for many years. This method is based on degrees of priority ranking which are defined with subjective community goals. It takes on a number of forms with many variations. One may call this the "traditional method of priority scheduling", because it seems to be most common in capital improvement programming. One form of this method is shown below:

Essential
(highest priority)

Projects which are required to complete or make fully usable a major public improvement; projects which would remedy a condition for a critically needed community program.

Desirable
(2nd priority)

Projects which would benefit the community; projects which are considered proper for a large progressive community in competition with other cities; projects whose validity of planning and timing have been established.

Acceptable
(3rd priority)

Projects which are adequately planned, but not absolutely required by the community if budget reductions are necessary.

Deferrable
(lowest priority)

The projects which are definitely recommended for postponement or elimination from the capital budget or capital program since they pose serious questions of community need, adequate planning or

proper timing.⁶

Presented below is another variation representing the same basic idea but expanding on the categorical criteria involved:

1. Urgent

Projects that cannot be reasonably postponed; projects that would remedy a condition dangerous to public health, welfare, or safety; projects required to maintain a critically needed departmental program; projects needed to meet an emergency situation.

2. Essential

Projects required to complete or make fully usable a major public improvement; projects required to maintain a minimum standard as part of a continuing departmental program; desirable projects that are self-liquidating; projects for which outside funds for over 65% of the costs are available for only a limited period.

3. Necessary

Projects that should be carried out within a few years to meet clearly demonstrated anticipated needs; projects designated for replacement of unsatisfactory or obsolete facilities; projects designated for remodeling for continued use.

4. Desirable

Adequately planned projects needed for the expansion of

⁶The American Society of Planning Officials, Capital Improvement Programming (Chicago: The American Society of Planning Officials, 1961), p.25.

current departmental programs; projects designed to initiate new programs that are considered proper in a progressive community in competition with other communities; projects for the conversion of existing facilities to other uses.

5. Acceptable

Adequately planned projects that could be used for ideal operations, but that can be postponed without detriment to present operations if budget reductions are necessary.

6. Deferrable

Projects that are definitely recommended for postponement or elimination from immediate consideration in the current capital program since they are questionable in terms of overall needs, adequate planning, or proper timing.⁷

The Kansas League of Municipalities advocates virtually the same method, but limits the number of categories to three:

Incremental (sometimes referred to as urgent or mandatory) needs are those capital outlays that must be made to match population increases or outward physical expansion. They are calculated on a more or less mathematical basis; as so many additional people or "customers" are added. Such projects also result from federal or state mandates for action (e.g., acquisition of landfill site).

Alternative (sometimes referred to as necessary) needs are those which, though absolutely essential, can vary greatly in nature and extent according to public policy. These might typically include streets and airport.

Optional (sometimes referred to as deferrable) expenditures include those which at any particular time or

⁷Alan Walter Steiss, Local Government Finance (Lexington, Massachusetts: D.C. Heath and Company, 1975), p.38.

any particular period do not have to be made at all, although they may be regarded as highly desirable. These might include auditoriums, parks, and urban renewal.⁸

⁸League of Kansas Municipalities, A Guide For Capital Improvements Programming and Budgeting (Topeka: League of Kansas Municipalities, 1975), p.11.

CHAPTER III
THE CAPITAL IMPROVEMENT PROGRAMMING
PROCESS IN MANHATTAN, KANSAS
PART 1

The priority selection and scheduling method chosen by the city of Manhattan, Kansas, appears to be adaptable for CIPs in most municipalities, at least in those of its size, with some adjustments. These adjustments are mainly in the form of the number of projects required by the particular municipality. In the larger communities, many projects are required. In smaller communities, very few projects are demanded, relative to those demanded by larger communities. The method was developed originally by the Illinois city of Galesburg, for capital improvement programming in the central business district.¹ This method is designed possibly to be used for many years.

The priority scheduling process begins after it is determined that there is to be a capital improvement program, which is a very important decision to municipalities.

The CIP usually starts to shape up during the month of January each year, with projects being proposed by many

¹The American Society of Planning Officials, Downtown Improvement Manual (Chicago: The American Society of Planning Officials, 1973), Chapter 37.

sources, mostly from departments within the municipal government. These projects cannot all be scheduled for the first year, due mainly to financial constraints, thus precipitating the need for priority scheduling.

After project proposals are submitted, the priority scheduling process begins, and is concluded when the projects have been ranked in some logical sequence according to their need, feasibility and the financial capability of the city.

In Manhattan the Planning Division of the Department of Community Development has the primary responsibility of coordinating the CIP. A summary description of projects and their budgets are submitted to the Chief Planner by each municipal department. Subsequently an executive committee composed of six (6) department heads, the Chief Planner and Assistant City Manager begin the realizing process which goes through several rounds of decision. Finally, the CIP is coordinated by the Chief Planner with the assistance of the Assistant City Manager.

The executive committee on Capital Improvement Programming in Manhattan, Kansas, is composed of municipal department heads and division heads directly involved with the formulation of the CIP. There are seven members on the committee in Manhattan. They are: City Manager, Director of City Services, Director of Community Development, Director of Finance, City Engineer, along with the

Chief Planner and Assistant City Manager.

Members of this committee conduct the public hearings, answer questions at the hearings, and justify project proposals. In addition, they perform the central review functions, along with the respective staffs. These functions include: mapping all project locations, estimation of the impact of the capital improvement projects, and ultimately priority scheduling, among other things.

The composition of this committee is varied as the cities and towns which conduct capital improvement programming.

For many years Manhattan had capital improvement projects, but the CIP was not formalized and was considerably more subjective than it is at present. The first organized capital improvement programming for the city of Manhattan was attempted in 1978. By organized it is meant that policy-makers and department heads first put together a CIP that year and the CIP document was produced.

By demonstrating that when the municipal government and community developed consensus through cooperative effort, the quality and practicality of the CIP is enhanced. Of course, there were some imperfections in this first attempt. The main handicap was the need for a method for determining the priority of capital improvement projects. The method developed and implemented

by the planning and administrative (executive) committee of Manhattan understandably manifested some shortcomings due mostly to the unfamiliarity and inexperience with this more objective and analytical process of decision, ranking and selection. Obviously, the executive committee from this experience and the improvements in their comprehension of the process and decision-making in designing a more practical and logically time-pleased set of projects were significantly demonstrated in the development of the second CIP, the subject of this report.

With the priority system recommended here, the number of projects being proposed for evaluation and ranking is unsequential. Only six projects are considered which are evaluated by three members of an executive committee simply to demonstrate how the method is implemented and perhaps how it can be adapted for cities with modest capital improvement programs. The priority scheduling process for those cities with more ambitious CIPs, like Manhattan, has proven to be very cumbersome.

A matrix will be used in the ranking and evaluation of the projects and will be detailed and described in the following chapter. It (the matrix) can be set up for fewer or more projects with more than one person evaluating and ranking the projects. In the case of Manhattan

there were over 80 projects and seven members of the executive committee evaluating and ranking the projects. And in larger cities there are more projects than there are scheduled for Manhattan. Also in Manhattan's system, the projects are broked down into eight categories. They are: Airport Development, Fire Protection, Park Resources and Recreation, Public Facilities (a new category added to the 1980-1985 CIP, it was not included in the 1979-1984 CIP), Sanitary Sewers, Storm Drainage, Streets and Traffic Control, and Water Projects.

The categories receiving the highest percentage of projects in Manhattan were streets and Traffic Control and Park Resources and Recreation.

Many of the 80 projects were those of the previous year's CIP and some had been reconsidered from earlier years. At the least all were seen as vital to the growth and management of the city of Manhattan. Millions of dollars are now committed and assured of being spent in some logical, equitable and sensible manner. For this reason one must say that the CIP is community financial decision-making and management planning at its finest. Many hours of work, meetings and discussion went into the development of the CIP and its priority scheduling method, in particular. The groundwork was laid for future capital improvement programs which will necessarily lead to a more confident and experienced city staff and executive committee.

The service category with the most projects in the 1980-1985 CIP is Park Resources and Recreation, with about 32% (27) of all projects, spread evenly over the six years of the program. Streets and Traffic Control accounted for about 25% (21) of the CIP. Again the projects were distributed almost evenly over the duration of the CIP. Table 1 lists the number of projects in the Manhattan CIP for 1980-1985, plus their percentages of the total number of projects.

In the previous year's CIP, Park Resources and Recreation and Streets and Traffic Control again dominated the projects submitted with about 25% and 20%, respectively, of more than 60 total projects. Many of the 1979-1984 projects appeared on the 1980-1985 CIP. Table 2 lists the number of projects in the Manhattan CIP for 1979-1984, plus their percentages of the total number of projects.

A new category was added to the CIP for 1980-1985. It is Public Facilities. It accounts for eight projects spread fairly evenly for the duration of the CIP.

Fairly important in the formation of the CIP is the part pertaining to capital improvement equipment requests for each category. Equipment needs which were not considered in this study at all, will now be mentioned briefly. Some capital improvement equipment

need, as well as capital improvement projects, are provided for out of the city's general operating budget instead of the capital budget. Included in equipment requests are vehicles, machinery and large expenditure, long duration items need by the city departments to perform maintenance, upkeep, etc. Park Resources and Recreation and Streets and Traffic Control received the most capital improvement equipment requests for the 1980-1985 CIP.

There was no ceiling on capital improvement project or equipment requests.

Tables 3 and 4 show the spread of Manhattan's capital improvement projects covering the CIP for 1979-1984 and the CIP for 1980-1985.

Table 1
The Manhattan CIP Service Categories
(1980-1985)

CATEGORY	NUMBER OF PROJECTS	PERCENTAGE OF TOTAL PROJECTS
Airport Development	4	4.76
Fire Protection	5	5.95
Park Resources and Recreation	27	32.14
*Public Facilities	8	9.53
Sanitary Sewer	7	8.33
Storm Drainage	4	4.76
Streets and Traffic Control	21	25.00
Water Projects	8	9.53
Total	84	100.00%

Table 2
The Manhattan CIP Service Categories
(1979-1984)

CATEGORIES	NUMBER OF PROJECTS	PERCENTAGE OF TOTAL PROJECTS
Airport Development	10	15.39
Fire Protection	8	12.31
Park Resources and Recreation	16	24.61
Sanitary Sewer	6	9.23
Storm Drainage	4	6.15
Streets and Traffic Control	13	20.00
Water Projects	8	12.31
Total	65	100.00%

TABLE 3
Manhattan Capital Improvement Project Spread
(1979-1984)

CATEGORY	1979	1980	1981	1982	1983	1984	TOTAL
Airport Development	3	2	5	0	0	0	10
Fire Protection	4	1	1	0	2	0	8
Park Resources & Recreation	5	3	2	1	3	2	16
Sanitary Sewer	3	3	0	0	0	0	6
Storm Drainage	2	1	1	0	0	0	4
Streets & Traffic Control	5	4	1	2	1	0	13
Water Projects	2	2	1	2	1	0	8
TOTAL	24	16	11	5	7	2	65

TABLE 4
Manhattan Capital Improvement Project Spread
(1980-1985)

CATEGORY	1980	1981	1982	1983	1984	1985	TOTAL
Airport Development	0	3	0	1	0	0	4
Fire Protection	2	1	0	0	2	0	5
Park Resources & Recreation	4	4	4	5	5	5	27
Public Facilities	2	1	1	1	2	1	8
Sanitary Sewer	5	1	0	0	1	0	7
Storm Drainage	1	1	0	2	0	0	4
Streets & Traffic Control	6	4	4	5	0	2	21
Water Projects	4	1	1	1	1	0	8
TOTAL	24	16	10	15	11	8	84

CHAPTER IV
THE CAPITAL IMPROVEMENT PROGRAMMING
PROCESS IN MANHATTAN, KANSAS
PART 2

The executive committee, responsible for the evaluation and ranking of projects, received a variety of requests and proposals to be considered for the 1980-1985 CIP from each municipal department. To demonstrate the simplicity and objectivity of this method of priority scheduling and the design and utility of its matrix system, this descriptive analysis is limited to six (6) projects. The projects are those that have been determined to benefit the total community and ranged from "large" to "small" capital investments.

The projects included in this study are: (1) A new pavement for a downtown street, (2) A swimming pool for the city park, (3) A monkey cage for the zoo, (4) Traffic signals at a busy intersection, (5) The renovation of the fire station, and (6) The renovation of the airport's runway. Further, the selected projects, or similar ones, appear to be somewhat common to and frequently considered by capital improvement committees and staffs in most cities, at least those the size of Manhattan and above. These

projects will be ranked later for establishing a priority schedule of development in the CIP.

At this point, the executive committee is directed to develop and define some specific criteria of qualitative and quantitative benefits to be derived from CIP projects. These criteria are based primarily on whether a project is responsive to the needs of and is affordable by the community. After, the specification of needs/services for each submitted project proposal, has been determined, the projects are rated according to their ability or potential to meet the benefits.

TABLE 5

General Criteria For Benefits
To Evaluate CIP Projects

- 1.Necessary to preserve public safety/public health.
- 2.Projects legally required or committed.
- 3.Necessary to implement growth objectives/allow for expansion.
- 4.Improve effieient use of land and/or public resources.
- 5.Replacement of present worn out services or structures.
- 6.Improve efficiency of city operation.
- 7.Add to value of area/increase the tax base.
- 8.Funds available for project.
- 9.Encourage economic development/create jobs.
- 10.Protect environmental quality.
- 11.Necessary to development of other projects.
- 12.Improve convenience to the public.

TABLE 6
Revised Criteria For Benefits
To Evaluate CIP Projects

1. Necessary to preserve public safety/public health.
2. Projects legally required or committed.
3. Necessary to implement growth objectives/allow for expansion.
4. Improve efficient use of land and/or public resources.
5. Replacement of present worn out services or structures.
6. Improve efficiency of city operations.
7. Add to value of the area/increase the tax base.
8. Encourage economic development/create jobs.
9. Protect environmental quality.
10. Necessary to development of other projects.

TABLE 7
Final Criteria For Benefits
To Evaluate CIP Projects

1. Necessary to preserve public safety/public health.
2. Replacement of present worn out service or structures.
3. Improve efficient use of land and/or public resources.
4. Projects legally required or committed.
5. Necessary to implement growth objectives/allow for expansion.
6. Encourage economic development/increase property value.

The original twelve benefits were reduced before they were seen by the ten evaluators (seven members of the executive committee mentioned earlier, plus three Manhattan City Commissioners). Before the actual ranking of the projects began, the ten evaluators were to rank the benefits, shown in the three (3) Tables above, as to their relative importance.

The first revised list of unranked benefits was accomplished by the City's Chief Planner and Assistant City Manager, the co-coordinators of the CIP. The decision, at this juncture, was to delete item twelve(12)-Improve convenience to the public, in Table 5, page 24. The item eight(8)-Funds available for projects, was deleted because the consideration of financial constraints at this point was inappropriate in the initial selection of the benefit's criteria. The revised list of (10) benefits, as shown in Table 6, page 25, was presented to the full executive committee of ten members for consideration of additions and deletions. The list of benefits in Table 6, page 25, was evaluated and ranked as to their relative importance by each member of the committee.

The benefits were chosen originally to help determine how to evaluate each project, and to determine how the projects would stack up when they were judged against each other, for final scheduling. The content of the

benefit list, which was cut down and combined from twelve (12) to finally six (6), was shown previously in Tables 5-7. Table 6 shows how the benefit list looked to the ten evaluators, after slicing off two benefits. Table 7 shows the final benefit list after further reductions (by the executive committee) took place. This final list of benefits is the one which was used to evaluate and rank the projects.

As mentioned previously, before the projects were rated against each other for final priority ratings, and before projects were rated against the six benefits, the benefits had to be ranked according to their relative importance to each other. These rankings were in the form of relative importance, and given importance factors, from most important benefit to least important benefit, with one being assigned to the benefit seen as most important and ten being least important, at the onset. The list of benefits is shown again in Table 8. (Note, the list of benefits presented in Table 8 is the same as that shown previously in Table 6). Although ten benefits are ranked to their level of importance by the ten evaluators, only six benefits (the final list shown in Table 7) were used to evaluate and rank the capital improvement projects and give these projects their priority.

The ten evaluators were given the list in Table 8 of unranked benefits and asked to rank them as to their

TABLE 8
Revised Criteria For Benefits
To Evaluate CIP Projects

- ___ 1. Necessary to preserve public safety/public health.
- ___ 2. Projects legally required or committed.
- ___ 3. Necessary to implement growth objectives/allow for expansion.
- ___ 4. Improve efficient use of land and/or public resources.
- ___ 5. Replacement of present worn out service or structure.
- ___ 6. Improve efficiency of city operation.
- ___ 7. Add to value of the area/increase the tax base.
- ___ 8. Encourage economic development/creat jobs.
- ___ 9. Protect environmental quality.
- ___ 10. Necessary to development of other projects.

relative importance to themselves (evaluators). Each evaluator, of course, had his own preferences of the importance of each benefit. Then, after the evaluations and rankings of the ten benefits were completed by the ten evaluators, the benefit list was narrowed to six. Some of the benefits were cut outright and some were combined with others.

With the ten evaluators displaying a wide difference of opinion as to what they perceived as important and not important, it was not an easy task determining the benefit rankings. As was seen in the actual determination of benefit importance, a benefit that was seen as most important by one of the evaluators, was seen as least important by another. A consensus had to be reached. This consensus process of an overall importance ranking of the benefits generated from the capital improvement projects will now be discussed.

The benefits derived from capital improvement projects are many. On some can be placed a revenue generation tag, on other benefits it cannot. Some projects are beneficial to every segment of the community, while some conform only to sectional interests and needs. Efforts were made to allow both sectional and total community benefits to be included in the benefits chosen, to allow benefits that imply revenue generation, as well as those

that are not. To each individual evaluator lies subjective differences of opinion. So it was not easy finding a way to please each evaluator. Also, those benefits to be used in the evaluation of the CIP projects should not be taken to be a conclusive list of benefits. Although they are and seem fine for the city of Manhattan, Kansas, there probably are some adjustments to be made, as deemed necessary in other communities.

A matrix was established to compare how each evaluator ranked the benefits where those ranked benefits varied and differed among the evaluators (this matrix is not to be confused with the priority scheduling matrix that will be discussed later). This was simply a chart with each of the ten evaluators' ranked benefits lined up against one another, to simply see how they matched and contrasted. With some, a benefit, or some benefits, were highly important, while with others the same benefit, or benefits were least important.

Also each evaluator was asked his opinion of the process so far, how he thought it was going, whether he, as an evaluator, thought there should be amendments, additions, or subtractions, of the revised, derived benefits. This was the point where the benefits to eventually evaluate the projects were finally reduced from ten benefits to six benefits. All ten evaluators agreed now that there were still too many benefits, that after some reflection,

some were not very important, or pertinent, and that some could be combined with other benefits.

From the final amended version the consensus among the executive committee was formed (the three City Commissioners are now out of the scheduling process). They (Commissioners) were originally added to the process only for more opinions for which to base the importance of the benefits. The benefit that received the most important ranking most often was calculated to be the most important benefit. Also from the final list of benefits, the benefit that was seen as least important most often received the lowest ranking. The remaining benefits were ranked accordingly.

Again Table 2 is used to illustrate the final benefit list, along with the respective relative importance assigned to each benefit.

Weights will now be assigned to the benefits that are derived from the capital improvement projects. Each benefit is assigned a weight, in this case, a number. The weight assigned to the benefit previously determined most important is the number 21. The remaining benefits decrease in importance and also decrease in the weights being assigned to them. They are as follows: 19, 17, 17, 14, and 12. When combined these weights total 100.

One more thing should be mentioned about these benefits

and their respective weights before leaving to continue with the priority scheduling process. The weights (numbers) are arbitrarily assigned to each benefit to signify the importance of each benefit. Any numbers could have been chosen so long as the most important benefit received the the highest number (weight). The total of 100 was conceived because of the relative ease for divisional purposes that will become evident when the matrix (priority scheduling matrix) is discussed in the following chapter.

CHAPTER V

THE PRIORITY SCHEDULING MATRIX

The priority scheduling matrix distributed to the seven members of the executive committee is shown in Figure 1. The benefits for evaluating the CIP projects (discussed in the previous section) are listed across the top of the matrix in columns 2 through 7. The benefits are arranged so to display their level of importance as determined by the ten evaluators (also in the previous section). In the figure, the level of benefit importance decreases from left to right. The numbers assigned to each benefit are 21, 19, 17, 17, 14, and 12, when combined, equal 100. The number 21 is assigned to the benefit that is most important, while 12 is given to the least important benefit. Each benefit is assigned a particular number, indicating its level of importance, or weight.

Figures 1 through 7 are forms of the priority scheduling matrix in advancing stages. Developing from these matrices are the priority scheduling stages leading to the final priority of the projects. When the projects first enter the matrix, they enter unevaluated and unranked. When all steps of the matrix have been completed, the projects will be in their logical, sequential-

ly determined order, thus setting up the priorities. Only six projects are benign ranked, and there are six years in the CIP.

On the left side of the matrix, is the column for proposed projects, column number 1. The matrix is set up to accommodate an unlimited number of projects. But to demonstrate the simplicity of this priority scheduling method, only six projects will be discussed. They are, as mentioned before: (1) street pavement, (2) swimming pool, (3) monkey cages, (4) traffic signals, (5) fire station renovation, and (6) airport runway renovation.

In Figure 2, the projects are listed appropriately as they were given to the three persons (hypothetical) rating the projects (in Manhattan, after benefits were ranked according to their level of importance by the ten evaluators, the seven members of the executive committee were given the form in Figure 2, but there was a listing of numerous projects instead of the six presented here, in the following categories: Airport Development, Fire Protection, Park Resources and Recreation, Public Facilities, Sanitary Sewers, Storm Drainage, Streets and Traffic Control, and Water Projects). All six projects in this report are listed in just one category which will be called "General Improvements", because there is not one category used by Manhattan in which the six projects in this study will all fit.

To the right of the benefit columns are the columns

Figure 1

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6
Proposed projects	Necessary to preserve public safety/public health (21)	Replacement of present worn out service or structure (19)	Improve efficient use of land and/or public resources (17)	Projects legally required or committed (17)	Necessary to implement growth objectives/allow for expansion (14)

Ratings under each of the six benefit columns are based as follows:
50, profound importance; 40, very significant; 30, significant;
20, noticeable.

Column 7	Column 8	Column 9	Column 10	Column 11
Encourage economic development/increase property values (12)	Composite weighted average	Individual indicated priority	Overall weighted average	Overall priority

Figure 2

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6
Proposed projects	Necessary to preserve public safety/public health	Replacement of present worn out service or structure	Improve efficient use of land and/or public resources	Projects legally required or committed	Necessary to implement growth objectives/allow for expansion
	(21)	(19)	(17)	(17)	(14)
Street pavement					
Swimming pool					
Monkey cage					
Traffic signals					
Fire station renovation					
Airport runway renovation					

Ratings under each of the six benefit columns are based as follows:
50, profound importance; 40, very significant; 30, significant;
20, noticeable.

Figure 2 continued

Column 7	Column 8	Column 9	Column 10	Column 11
Encourage economic development/increase property values (12)	Composite weighted average	Individual indicated priority	Overall weighted average	Overall priority

Figure 3
rater #1

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6
Proposed projects	Necessary to preserve public safety/public health	Replacement of present worn out service or structure	Improve efficient use of land and/or public resources	Projects legally required or committed	Necessary to implement growth objectives/allow for expansion
	(21)	(19)	(17)	(17)	(14)
Street pavement	40	50	50	20	30
Swimming pool	50	40	30	30	20
Monkey cage	30	30	30	40	30
Traffic signals	40	30	20	50	20
Fire station renovation	20	20	30	20	20
Airport runway renovation	20	20	50	40	30

Ratings under each of the six benefit columns are based as follows:
50, profound importance; 40, very significant; 30, significant;
20, noticeable.

Figure 3 continued

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Column 7	Column 8	Column 9	Column 10	Column 11
Encourage economic development/increase property values	Composite weighted average	Individual indicated priority	Overall weighted average	Overall priority
(12)				
40	38.80	1		
40	35.90	2		
20	30.50	5		
20	31.20	4		
20	22.10	6		
40	32.30	3		

Figure 4
rater #2

Column 1 Proposed projects	Column 2 Necessary to preserve public safety/ public health (21)	Column 3 Replacement of present worn out service or structure (19)	Column 4 Improve effec- ient use of land and/or public resour- ces (17)	Column 5 Projects lega- lly required or committed (17)	Column 6 Necessary to implement growth object- ives/allow for expansion (14)
Street pavement	50	20	20	40	30
Swimming pool	40	30	40	40	40
Monkey cage	30	20	40	20	50
Traffic signals	40	40	40	50	20
Fire station renovation	20	40	30	40	30
Airport runway renovation	30	40	50	40	30

Ratings under each of the six benefit columns are based as follows:
50, profound importance; 40, very significant; 30, significant;
20, noticeable.

Figure 4 continued

Column 7 Encourage economic development/increase property values	Column 8 Composite weighted average	Column 9 Individual indicated priority	Column 10 Overall weighted average	Column 11 Overall priority
(12)				
20	31.10	6		
20	35.70	3		
40	32.20	5		
20	36.50	1		
40	32.70	4		
20	35.80	2		

Figure 5
rater #3

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6
Proposed projects	Necessary to preserve public safety/public health (21)	Replacement of present worn out service or structure (19)	Improve efficient use of land and/or public resources (17)	Projects legally required or committed (17)	Necessary to implement growth objectives/allow for expansion (14)
Street pavement	40	40	40	30	40
Swimming pool	50	30	50	20	20
Monkey cage	20	40	40	30	20
Traffic signals	50	40	20	50	40
Fire station renovation	20	40	50	20	20
Airport runway renovation	20	40	50	30	50

Ratings under each of the six benefit columns are based as follows:
50, profound importance; 40, very significant; 30, significant;
20, noticeable.

Figure 5 continued

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Column 7	Column 8	Column 9	Column 10	Column 11
Encourage economic development/increase property values	Composite weighted average	Individual indicated priority	Overall weighted average	Overall priority
(12)				
40	38.30	2		
30	34.50	4		
20	28.90	6		
40	40.40	1		
30	30.10	5		
30	36.00	3		

Column 7	Column 8			Column 9			Column 10	Column 11
Encourage economic development/increase property values (12)	Composite weighted average			Individual indicated priority			Overall weighted average	Overall priority
40 20 40	38.80	31.10	38.30	1	6	2	36.07	1
40 20 30	35.90	35.70	34.50	2	3	4	35.37	3
20 40 20	30.50	32.20	28.90	5	5	6	30.53	5
20 20 40	31.20	36.50	40.40	4	1	1	36.03	2
20 40 30	22.10	32.70	30.10	6	4	5	28.30	6
40 20 30	32.30	35.80	36.00	3	2	3	34.70	4

Figures 6 and 7
Individual and overall priorities

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6
Proposed projects	Necessary to preserve public safety/public health (21)	Replacement of present worn out service or structure (19)	Improve efficient use of land and/or public resources (17)	Projects legally required or committed (17)	Necessary to implement growth objectives/allow for expansion (14)
Street pavement	$\frac{1}{40} \frac{2}{50} \frac{3}{40}$	$\frac{1}{50} \frac{2}{20} \frac{3}{40}$	$\frac{1}{50} \frac{2}{20} \frac{3}{40}$	$\frac{1}{20} \frac{2}{40} \frac{3}{30}$	$\frac{1}{30} \frac{2}{30} \frac{3}{40}$
Swimming pool	50 40 50	40 30 30	30 40 50	30 40 20	20 40 20
Monkey cage	30 30 20	30 20 40	30 40 40	40 20 30	30 50 20
Traffic signals	40 40 50	30 40 40	20 40 20	50 50 50	20 20 40
Fire station renovation	20 20 20	20 40 40	30 30 50	20 40 20	20 30 20
Airport runway renovation	20 30 20	20 40 40	50 50 50	40 40 30	30 30 50

Ratings under each of the six benefit columns are based as follows:
50, profound importance; 40, significant; 30, significant;
20, noticeable.

containing individual composite averages (column 8), individual evaluator priorities (column 9), the overall project average (column 10), and overall priority (column 11). These four columns are the ones that specifically determine the scheduling of the projects.

At the bottom of the priority scheduling matrix are the ratings given to the projects when each project is rated against each of the benefits. This method differs drastically from the "traditional method" mentioned earlier, in that, now instead of just one criterion in which to judge the scheduling of projects, there are now more. They are: (1) the benefits are first evaluated and then ranked according to their level of importance, (2) the projects are now rated against each individual benefit, and (3) the importance of each project is determined when evaluated against each benefit.

If, when rated against a benefit, a project is given a 50, it indicates that the evaluator believed that the particular project was of profound importance when stacked up against that particular benefit. If a 40 was registered, it meant very significant, 30, significant, and 20, noticable. Each project was given just one of these four ratings according to each of the benefits at the top of the figure.

After the projects have been given their respective ratings, the number in the column is multiplied by the

number in parenthesis (the number (weight) given to each benefit, according to its level of importance), and the total divided by 100 gives the composite weighted average of that project, column 8. For example, in Figure 3, evaluator number 1's scores for project number one (the number one labeling the project is arbitrary, and is used strictly for identification purposes only): $(40 \times 21) + (50 \times 19) + (50 \times 17) + (20 \times 17) + (30 \times 14) + (40 \times 12) = 3880$, and divided by 100 = 38.80. The number 3880 is the same weighted average in Figure 3 for project number one. Each project is handled in the same manner by all three evaluators.

The individual indicated priority is calculated in column 9. The highest number in column 8 is given the highest individual priority, meaning, to the individual evaluator, the project that corresponds to that number was chosen as his selection that would be number one (since there six projects, the assumption is, that with a CIP of six years, there will be one project started each year of the CIP). So, to evaluator number one, project number one received the highest priority, with the highest composite weighted average. This project is the one indicating street pavement.

In continuing with evaluator number one, his priority schedule of projects lined up like this: (1) street pavement, (2) swimming pool, (3) airport runway renovation, (4) traffic signals, (5) monkey cages, and (6) fire station

renovation. The projects' respective composite weighted averages can be seen in Figure 3. Note, these are evaluator number one's individual selections and in no way are they the total, overall priorities, from all evaluators combined. They are his individual priority selections.

To arrive at the overall priorities, ratings from all three evaluators must be considered. This process is easy when three evaluators are rating and ranking just six projects. It was much more difficult when seven evaluators rated over 80 projects from eight categories, as was the case in Manhattan. But the method remains the same in both cases, nevertheless. For each project the total composite weighted averages were combined and divided by three in order to find the mean, or average. From the mean of the composite weighted averages the overall priority schedule can be determined easily. Following are the years comprising this CIP and their corresponding projects. The CIP is a six year program and covers years 1980-1985.

- Year 1--1980--Street pavement
- Year 2--1981--Traffic signals
- Year 3--1982--Swimming pool
- Year 4--1983--Airport runway renovation
- Year 5--1984--Monkey cage
- Year 6--1985--Fire station renovation.

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STUDY OF EVALUATING AND RANKING TECHNIQUES
FOR THE SELECTION OF A PRIORITY SCHEDULING
METHOD IN CAPITAL IMPROVEMENT PROGRAMMING:
MANHATTAN, KANSAS

by

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AN ABSTRACT OF A MASTER'S REPORT

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A problematic area in capital improvement programming lies in the selection of a method used for the scheduling of projects. Referred to as priority scheduling, this method is the very hub of a municipality's capital improvement program, and should be selected on the basis of the community's capacity (financial constraints, abilities, etc.) and performance in this vital area. Without a valid and testable method for priority scheduling, a CIP can go down the drain, never to be properly resurrected, leaving administrators wondering what went wrong.

Along with the capacity and performance arise problems concerning growth management, community needs, administrative policies, and others, which must be thoroughly addressed and examined in the selection of a priority scheduling method. The capital improvement program is a fairly long term agenda (six years maximum in most communities) which must address every segment and area of the community, and is not static, in that it must be evaluated each year to be implemented.

While working as a HUD Work-Study intern in Manhattan, Kansas, in the Community Development Department's Planning Division, I was given a project to research and study priority scheduling methods advocated by textbooks, communities, and other sources. From this I found a method successfully used by the city of Galesburg, Illinois, for capital improvement programming in the central business

district, and expanded it for our own program. Although somewhat amended from it's original usage, this priority scheduling method proved adaptable to fit our program objectives.

The method chosen utilizes a matrix as a form to illustrate the determination of how projects are evaluated and eventually given overall priority. Quantitative criteria are used in developing project rank. Projects are rated against some chosen benefits (six in all) derived from capital improvement programming projects in general, and simultaneously are given points (ratings) according to their importance in reference to these benefits. The six benefits are each assigned weighting factors, which are used to indicate the relative importance of each benefit.

After repeating the same procedure with each project, the one with the highest overall rank is the project that is seen as most important, or beneficial, and therefore, number one priority. In ranking one particular project over others, it shows the intrinsic and extrinsic value of that project over the others.