## MISSOURI'S METHOD OF JOB EVALUATION

## REX M. WHITTON, Engineer of Maintenance, Missouri State Highway Department SYNOPSIS

Salaries and wages paid to employees by the Missouri State Highway Department are based on a system of job evaluation developed by a committee of Highway Department employees after a half-year period of study of industrial job evaluation systems and other available data on methods of evaluating jobs. This job evaluation system, which is a combination of the point system and the factor-comparison system, makes use of five job factors for units of measurement. These factors are basic training, effort, responsibility, job conditions, and on-job training. The Missouri job evaluation method has been giving satisfactory results for the past three years and has received the almost unanimous approval of the Highway Department employees.

Salaries and wages paid by the Missouri State Highway Department are based on a system of job evaluation that was worked out through a period of painstaking study covering many months. We believe that we have established a fair relationship between basic rates of pay for different jobs according to the knowledge and experience required to meet the difficulty and responsibility under working conditions required of each job.

In the past 15 to 25 years, as highway organizations have grown up into big business. the highway administrators have become acutely aware of the need for a scientific study of jobs and salaries or wages. Probably all state highway departments started with small personnel organizations. It is also likely that original salaries and wages were determined by the prevailing salaries and wages being paid in the community. In the early days of any highway department, when its jobs and employees were few in number, it was possible for the Chief Engineer to be personally acquainted with the type of work performed in each job and by each individual, and thus to be in a position to evaluate and establish the salary and wage rates of the limited number of jobs and individuals. Most highway departments grew beyond this stage many years ago, and have or should have developed some systematic plan of job evaluation and salary and wage administration.

That has been the experience of the Missouri Highway Department in the administration of its personnel. The first biennial report of the department, for the period ending December 1, 1918, listed 14 jobs and 32 employees. With the voting of bond issues and the establishing of gas taxes for road purposes, there was created a large highway construction and maintenance program in Missouri extending and expanding through the 1920's and the early 1930's, which necessitated the building of a large organization.

During this expansion period, the starting salary or wage paid in any job was usually determined by the prevailing salary or wage. A rapidly increasing personnel made many promotions possible during this period. Furthermore, it was the policy to grant periodical increases in compensation that were generally applicable to all types of jobs. These conditions resulted in a relatively contented personnel.

In the middle 1930's, the highway construction and maintenance program in Missouri became stabilized, and, as a result, there was a decrease in the rate of promotions and in the frequency of increases in salary and wages. It was probably in this period that it was first realized that some study and thought should be given to the relative salaries and wages being paid for the many and varied jobs in the department. In 1937, a classification of jobs was prepared and approved. Each job classification carried a definite salary range.

This salary classification system was in effect and use from 1937 through 1944, with salary revisions in job groups as found necessary. At no time, however, was sufficient thought given to the relative values of the various jobs in the department to result in any decided change in the relative values.

In 1944, with its accompanying shortages of personnel, especially in maintenance work, thought began to crystalize with regard to the

need for some fair method of establishing a relative evaluation of all jobs in the highway department. Since the beginning of the highway organization in Missouri it had been more or less the policy to grant general increases which affected all jobs and groups. This policy did not generally take into account the fact that some jobs had increased in importance through the years while other jobs remained at the same level of importance. As an example, let us take the job of highway maintenanceman, maintenance patrolman, or sectionman, as commonly referred to in most States. When the maintenanceman was first employed in Missouri, his job consisted mainly of driving a team hooked to a split log drag or a small pony patrol grader in order to smooth the ruts and other inequalities in the road surface. He was required to do hand work of cleaning ditches and culverts and some weed mowing by hand. With development of the highway system in the construction of concrete and bituminous roads and the development of motorized maintenance equipment, it became necessary for the maintenanceman to acquire a great amount of additional knowledge and skill in the proper handling of cement, asphalt, aggregates, and various types of motorized equipment, such as trucks, motor graders, bituminous distributors, power mowers, concrete mixers, power rollers, snow plows, etc. So a thorough analysis of the job of maintenanceman immediately revealed the fact that the content of this job had increased very materially in its requirements of skill and responsibility. Yet. with the more or less established policy of general increases which were uniformly effective in all job groups, there had been no increase in the salary for this job corresponding to the increase in job content. This is not only true for the job of maintenanceman but is also true for other jobs in the highway organization.

Investigation revealed that some organizations in private industry had been using systematic job evaluation methods for many years. These are commonly referred to as industrial job evaluation systems. Job evaluation consists mainly of an analysis and pricing of jobs, or, as one author defines it, "A measurement of the qualities and abilities necessary to carry the load under the assigned conditions of work." In industry, it was found that there are two distinct methods of doing the actual work of evaluating jobs, which are to either assign the job to a department or committee within the organization or to employ a competent outside concern for the specific purpose. There are arguments both for and against either of these methods.

After giving considerable thought to both methods of carrying on the work, the decision was made to appoint a personnel committee of department employees to make a study of the salary and wage problem, because it was thought that a small committee of employees with a thorough knowledge of the content of most of the jobs in the department, could acquire the technique of job evaluation quicker and get more satisfactory results than an outside individual skilled in job evaluation could acquire a knowledge of the content of the many and varied jobs in a highway organization. The Chief Engineer of the department, with the approval of the Commission, appointed the committee in March. 1945, composed of four bureau heads and one division engineer.

The personnel committee made a study of the various job-evaluation plans used by industrial organizations. It attended several meetings held by the War Manpower Commission where the advantages and procedures of job analysis were explained. It consulted with Industrial Engineering firms regarding the various methods of job evaluation. The committee read many magazine articles, pamphlets and books on job-evaluation methods. It was found that there are four basic systems of job evaluation, which are the ranking system, the classification system, which had been used in the department since 1937, the point system, and the factor-comparison system.

The ranking system and the classification system use non-quantitative methods of arranging jobs in order of difficulty or importance. Either of these methods is likely to perpetuate existing inequalities of salary. The ranking system consists of arranging positions in the order of their importance, grouping the list into various classes, and then establishing salary ranges for each class. The classification system consists of establishing a series of classifications with a salary range for each, and then arbitrarily placing the jobs in the predetermined classifications. Both systems involve the passing of blanket judgment on a job as a whole.

The point system and the factor comparison system are similar in that the job is broken down into basic factors and these factors measured and compared both qualitatively and quantitatively. The point and factor comparison systems provide for the use of specific units of measurement, the total of which definitely establishes the relative value of each job. This is the same procedure that is usually followed in estimating any highway project. An estimate of the cost of a highway project is more accurately determined by totaling the estimated value of the individual items than by evaluating the job as a whole.

After a thorough study of various methods of job evaluation, it was decided to use a combination of the point system and the factor comparison system.

Job evaluation under this method involved the use of a measuring stick composed of certain job characteristics or factors, with a definite range of numerical points assigned to each. It was found that the basic job characteristics or factors of most job-evaluation plans were the requirements for previous training, effort, responsibility, job conditions and on-job training. By ascribing varying point values to these factors, by determining the point value of each factor in each job, and by totaling the point values of all the factors, it is possible to obtain an accurate relative point value for each job.

In order to construct a measuring stick or an evaluating plan for jobs in the Missouri State Highway Department, it was necessary to make an extensive analysis and study of the characteristics of each job. Some industrial concerns use a different plan for the factory workers than is used for the office workers. The personnel committee decided that better results could be accomplished by using the same plan or yardstick for all employees of the department.

In making the job analysis, a questionnaire was sent direct to each employee of the department. The questionnaire was designed to obtain the employee's opinion of his job and to also develop his interest and support of the plan. He was asked what he did, why he did it, and how he did it. His opinion was requested on the minimum amount of educa-

tion, experience and responsibility that was required by his job. Accompanying the questionnaire form was a letter to the employee explaining its purpose and a sheet of instructions to aid in filling it out.

The completed job-analysis questionnaire forms were handed to the division engineers and bureau chiefs for study and comment. Each of the ten division engineers completed a questionnaire form for each job under his supervision, and the same procedure was followed by the bureau chiefs. All questionnaires were submitted to and studied by the personnel committee.

The job factors or units of measurement and the range of point values for each to be used as a measuring stick for job evaluation were determined from study of job analysis forms, from investigations of the job evaluation plans used by many industrial organizations, from consultations with industrial engineers and personnel administrators, and from the personal knowledge of each of the members of the committee which had been gained by long experience in the department.

The five job factors determined for use in the evaluating of jobs were: basic training, effort, responsibility, job conditions, and on-job training. The first four job factors were further subdivided in order to simplify the evaluating process and all five factors were defined and given a range of points.

Basic Training—The factor of basic-training is subdivided into education and experience.

Education is defined as the formal preparation required to perform the job. It need not be obtained in school, but school standards are assumed in the rating. For the minimum amount of education required by the job, one point is allowed for each year of general education, and two points for each year of vocational or technical education.

*Experience* is defined as the practical preparation in the same or related work, including essential experience in preceding jobs. For the minimum amount of experience required by the job, two points are allowed for each year.

*Effort*—The effort required by a job comprises both physical and mental effort.

*Physical Effort* is measured by the degree and continuity of physical exertion necessary

to perform the job acceptably. In this subdivision of effort, points are allowed as follows: One point for all jobs not modified by the definitions of higher demand that follow; two points for any job that requires a small amount of hard labor or has an unusually high fatigue factor; three points for any job that requires intermittent hard labor; four points for any job that regularly requires hard labor.

Mental Effort is measured by the degree and continuity of direct thought, mental alertness or mental planning that must be exercised in performing the job. For purposes of evaluation, mental effort is subdivided into versatility, concentration, complexity, and resourcefulness. Within these subdivisions, points are allocated as follows:

For any job requiring slight versatility, one point; for moderate versatility, two points; for extreme versatility, three points.

For any job requiring occasional concentration, one point; for frequent concentration, two points; for constant concentration, three points.

For any job that is not considered complex, no points; for slight complexity, one point; for moderate complexity, two points; for extreme complexity, three points.

For any job not requiring any degree of resourcefulness, no points; for a small amount of resourcefulness, one point; for average resourcefulness, two points; for great resourcefulness, three points.

Responsibility—Four kinds of responsibility are recognized as a basis for evaluation.

Responsibility for Equipment or Process relates to the amount of preventable probable loss to the department through damage to equipment or process. Probable loss on any one occasion is estimated as ten percent of possible loss. Points are assigned as follows: No point where no responsibility for equipment or process is involved; one point where probable loss is from \$1 to 10; two points for probable loss from \$10 to \$100; three points for probable loss from \$100 to \$1000; four points for probable loss above \$1000.

Responsibility for Material or Product relates to the amount of preventable probable loss to the department through damage to material or product. Points for evaluating this factor are allowed on the same basis as under responsibility for equipment or process.

Responsibility for Contacts refers to the personality and ability required to preserve good departmental public relations both inside and outside the department organization. One, two, three or four points are allotted for this factor in accordance with the degree of responsibility of contacts required by the job.

Responsibility for the Work of Others relates to direct supervision, involving the necessary planning and assisting, instructing and directing others in the performance of work. Points are allowed as follows: No points if there is no responsibility for the work of others; one point for any job requiring the supervision of one or two persons; two points for the supervision of three to six persons; three points for the supervision of seven to twelve persons; four points for the supervision of thirteen or more persons.

Job Conditions—Job conditions are evaluated under two sub-heads: working conditions and unavoidable hazards.

Working Conditions appraises the surroundings or physical conditions under which the job must be performed and over which the employee has no control, and the extent to which these conditions make the job disagreeable. Points are allowed as follows: One point for any job requiring regular hours in the office; two points for regular hours in the field in good weather, or in the shop or laboratory; three points for regular hours in the field in all weather, subject to considerable exposure. In addition, an extra point is allowed under any of the aforementioned conditions if the job consistently requires overtime.

Unavoidable Hazards appraises the possibility and degree of injury to which the person performing the job is exposed. Points are allowed as follows: No points to a job involving no hazard; one point to any job involving occasional exposure to minor accident, or occasional exposure to serious accident, or both; three points for constant exposure to serious accidents.

*On-Job Training*—On-job training is the estimated time required by the average employee to comprehend completely all aspects

of the job. Two points per year for each year required are allowed for this factor.

By totaling the values of the first four factors, the minimum point value of a job is obtained. Comparison of the evaluations of various construction and maintenance bureau jobs is shown in Table 1. By adding to the minimum point value, the point value of onjob training and such additional values as the job might develop in effort and responsibility, the maximum point value is obtained. Figure 1 shows a typical complete job-evaluation sheet for a project engineer in the construction bureau.

After the job factors with varying point values for each had been agreed upon by the committee, a meeting was called of all the purpose of comparing the point value of each factor for each job with the point value of each factor for all other jobs. A few changes in evaluation were made as a result of this comparison. In this way, the minimum and maximum value was obtained for each job in the department.

The next step was to make a survey of the salaries and wages being paid certain comparable key jobs in other departments of the State government, in the highway departments of adjacent states and in industrial organizations. The information obtained from this survey was valuable in determining the factor to be used for converting the minimum and maximum point value for each job to a salary range for each job.

TABLE 1									
COMPARISON	OF	<b>EVALUATION</b>							

	s	Skill		Effort				Responsibility				Conditions		Total
Job Title	Ed.ª	Exp.	Ph.	Vers.	Conc.	Comp.	Res.	Eq.	Mat.	Con.	Sup.	Hrs.	Haz.	Points
CONSTRUCTION Rodman EngrInspector Project Engineer Div. Const. Engr. Sr. Const. Engr. Asst. Const. Engr. Office Engr.	12 12 16 17 20 20 14	0 4 12 19 19 24 11	2 2 1 1 1 1 1	1 1 2 3 3 2	1 1 2 2 2 2 2 2	1 1 2 3 3 3 2	0 1 2 3 3 3 2	1 1 2 2 2 2 1	1 1 2 3 3 3 2	1 2 3 2 3 0	0 2 2 1 2 1	3 3 3 2 1 1	1 1 0 0 1 0	24 29 49 61 61 68 40
MAINTENANCE Maintenance Gang Foreman Dustrict Foreman Div. Supt. Div. Maint Engr. Sr. Maint. Engr. Asst. Maint. Engr.	8 8 12 15 17 20 20	2 8 10 14 19 19 24	3 2 1 1 1 1 1 1	1 1 2 2 3 3 3 3	1 2 2 2 2 2 2 2 2	1 1 3 3 3 3 3	1 2 2 3 3 3 3	2 2 2 2 2 2 2 2 2	1 2 3 3 3 3 3 3 3	1 1 3 2 3 2 3 3	0 3 2 2 1 2	4 3 3 3 2 1	2 2 1 0 0 0 1	27 37 46 51 61 61 68

<sup>a</sup> Abbreviations are described in the text.

bureau chiefs and division engineers for the purpose of explaining the tentative job evaluation method, and to instruct the bureau chiefs and division engineers to evaluate the jobs under their supervision using this method.

The job evaluations were made by the bureau chiefs and division engineers and submitted to the personnel committee. The committee studied and tabulated the evaluations so made, calculated averages, and finally arrived at its own evaluation of each job. A surprising uniformity was found to exist between the job evaluations made by the individual bureau chiefs and the division engineers and the final evaluation of each job as determined by the committee.

The personnel committee's evaluation of each factor and the minimum and maximum total value of each job were tabulated for the The factor selected and agreed upon was five. Thus by multiplying the minimum and maximum values of each job by five, the minimum and maximum salary of each job were determined.

The salary ranges thus established for each job in the department were approved by the Chief Engineer and were formally adopted by the Missouri State Highway Commission at a special meeting on September 10, 1945.

Along with any job evaluation plan which provides a range in salary for a job under the assumption that one employee may be worth more than another on the same job, there should be used some system of personnel rating for the purpose of properly pricing the services of the individual employee within the salary range of the job to which he is assigned.

Project Engine			nstructio	ction			
Job Title					Bureau		
I. SKILL A. Education Allow 1 point per ye of vocational or techn	ar of g tical edi	eneral e	ducation a required b	nd 2 points	per year cation.	16	
B. Experience Allow 2 points per ye required by job speci	ar for e fication.	ach year	of similar	or related e	xperience	12	28
II. EFFORT							
A. Physical I. All jobs not modi	fied by	definitio	ons of hig	her demand	that		
follow 2. Any job that requi unusually high fat	res a sn igue fac	nall amo tor	unt of har	d labor or ha	1 is an 2		
3. Any job that requi	ires inte	rmittent	hard labo	x		1	
B. Mental	ics regi		10001				
1. Versatility a. Slight b. Moderate c. Extreme		·	 	· · · · · · ·	. 1 . <u>2</u> . <u>3</u>	2	
2. Concentration					•		I
<i>i</i> . Occasional <i>b</i> . Frequent <i>c</i> . Constant	·	 				2	
3. Complexity a. None b. Slight c. Moderate d. Extreme	· 	······		······································	· . 0 · 1 2 3	2	
4. Resourcefulness a. None required b. Small amount. c. Average d. Great						2	,
III. RESPONSIBILITY	,						Γ
A. Fautoment	None 0	\$1-\$10 1	\$10-\$100 2	\$100-\$1,000 3	\$1,000 Up	2	
B. Material or Product.	0	1	2	3	4	2	
C. Contacts	0	1	2	3	4	2	
D. Work of Others	None	1-2	3-6 7	7-12	13 Up		
	18	•					⊢
A. Working Conditions 1. Regular hours in ( 2. Regular hours in ( tory	fice field in	good we	ather, or ther; subje	in shop or la ct to conside	1 bora- 2 rable	•	
4. Add for overtime					1	1	
B. Unavoidable Hazards 1. No exposure 2. Occasional exposure 3. Constant exposure serious accident	e to min to mine	nor accide	lent nt or occa	sional exposu			
4. Constant exposure	to serio	us accide	ent		3	2	5
V. ON-JOB TRAIL	VING	N T	finimum j raining tir faxunum j	ob evaluation ne (5 years ) ob cyaluation	n ≪ 2)	•	50

Figure 1. Job Evaluation Work Sheet

The Missouri State Highway Department has developed, used and abandoned at least three personnel rating plans and is not using any plan at the present time, except to try to evaluate the results of the individual employee's work as a whole for the purpose of establishing his salary in proper relation to other employees in the same job. Personnel rating systems, as compared to job evaluation plans, are very difficult to devise on a practical and usable basis, probably because some factors are additive while others should be used as multipliers. For example, the factor of "drive" by whatever name it is called, is average or normal salary for that job is \$275.00 per month, and the actual average of the salaries of all the employees of that job cannot exceed \$275.00 per month.

The development and adoption of a job evaluation method is not the end because the proper administration of salaries and wages in any organization is a continuing and growing problem, especially in these times of varying values. A job evaluation plan should be set up as a general plan or guide to be modified from time to time as experience is gained or as actual or scarcity values of certain types of jobs develop.



Figure 2. Salary Conversion Graph

difficult to analyze, but certainly does not simply add into the total of any individual's other characteristics. As a result of not being able to develop a suitable and satisfactory personnel rating system, the committee has adopted and is using the policy of establishing a salary normal or average for each job group where there are four or more employees in the group. It has been the usual practice to set the midpoint salary as the controlling average salary for the job. For example, if the range of salary for a particular job is \$250.00 to \$300.00 per month, the controlling The Personnel Committee with the approval of the Chief Engineer and the Commission has continued to administer all problems in connection with personnel. The Committee kept advised of salaries and wages being paid elsewhere and of the cost of living.

In about a year from the time of the adoption of the job evaluation plan and the establishment of the salary ranges in September, 1945, it was noted by the Committee that the cost of living as indicated by the Consumer's Price Index prepared by the U. S. Department of Labor had risen about fifteen percent. Due to this fact, the Committee recommended and received the approval of the Chief Engineer and the Commission for a flat increase of twenty dollars per month on all salary ranges under date of August 12, 1946.

This increase of twenty dollars on all salary ranges changed the numerical salary conversion factor from five to a varying factor and caused the Committee to change from a numerical factor to a graph for converting job points to salary. Job evaluation points were shown horizontally and salary dollars per month were shown vertically. Figure 2 shows the salary conversion graph.

Following the end of the war, it became increasingly evident that sufficient technical men would not be available to the department at the salary range then in effect. The personnel committee again made a salary survey to determine advisable salary ranges. It was also noted that the greatest shortage of technical employees occurred in the inspector and instrumentmen class or, in other words, in the lower grades of professional engineer. This was simply the working of the law of supply and demand. By setting the top salary for a few key technical jobs, the personnel committee established a salary conversion line for technical employees on the graph, which for the first time was not a straight line but had a hump in it through the lower grades of professional engineers. This salary conversion line for technical job groups was approved by the Chief Engineer and the Commission under date of April 7, 1947. No change was made in the salary conversion line for non-technical job groups.

As costs of living continued to rise, it became increasingly evident that another salary increase would be necessary for the non-technical job groups to off-set the increase in living costs. In September, 1947, the Consumer's Price Index showed about a seventeen percent increase over September, 1946. As a result, the personnel committee recommended a new salary conversion line, which was in reality a constant conversion factor of six. This recommendation was approved by the Chief Engineer and the Commission under date of September 9, 1947.

Cost of living continued to increase and the availability of technical personnel was on the decrease thru the latter part of 1947 and the first few months of 1948. The competition between various organizations for the services of graduating engineers became very keen. The monthly salary being offered in January and February, 1948 for engineers graduating at the end of the school year with no experience was ranging from \$275.00 to \$350.00 per month. Again the personnel committee concluded that another increase was necessary. The new salary conversion line was located by setting the salary of a college graduate, who started in the department on a job rated at thirty-one job-evaluation points, at \$275.00 per month and by setting the top salary of project engineer, which had a top job evaluation of fifty-nine points, at \$400.00 per month. The other control points on the new line was a top salary of \$495.00 per month at eightyfive points for division engineers and the legal limit of \$500.00 per month for bureau chiefs at 100 points.

At about the same time, the continuing rise in the cost of living justified a more or less blanket increase in non-technical job groups.

These last adjustments in salary ranges for both technical and non-technical groups were approved by the Chief Engineer and the Commission in April and June, respectively, of 1948, and are in effect at this time.

The job evaluation plan as described and its administration by a personnel committee has been in effect now for about three and a half years. There have been changes in the plan and there will be more changes. There has been criticism, but it is the most unanimous opinion of the employees from the bottom to the top and of the Commission that the plan and its administration by a personnel committee has been highly successful. It has been a morale builder since employees need and respond to the feeling and knowledge that someone has their interests at heart and is working for them. Someone has aptly said, "We get people to work by setting up the right incentives. The incentive that will produce the best results is the development of faith on the part of the employee that the department wants to, above all, develop its human resources and to reward people according to their merit, to reward them with all the good things-not money alone-that every man works for."

Such a system, however, is a framework to be changed and revised as becomes necessary. Conditions are not static and methods for meeting conditions must not be allowed to become static.