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NOTICE TO READERS

The Journal has been published regularly as a quarterly — four issues per calendar year — but for many years the issues have not been distributed within the quarter of the identifying date of the issue. This situation has caused some confusion, and corrective action is now being taken.

There will be no issue bearing the date of January 1975. Instead, Volume 62 will start with this issue dated April 1975. Thus, Volume 62, 1975-1976, will consist of the issues dated April, July and October 1975, and January 1976. There will be no change in publication period or frequency. Subscriptions and advertising contracts for the four issues of Volume 62 will still cover the four issues of Volume 62, etc.

We trust that this adjustment to bring us back on schedule will be beneficial to all.

JOURNAL OF THE
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Volume 62 **APRIL 1975** **Number 1**

REGIONAL GOVERNMENTAL DILEMMAS

Abel Wolman*
(The Thomas R. Camp Lecture, Boston, January 15, 1975)

Introduction

My remarks are not prefaced by a continuation of eulogies of Mr. Camp. Those who have preceded me in this lectureship have done well and accurately by him. If I were to continue this process, Mr. Camp would be the first to rise up in wrath and demand that we proceed with the business of the day. This risk does not bar me, however, from recording my profound appreciation of being chosen to deliver this lecture in a continuing honor to a distinguished engineer, a scholarly practitioner and a devoted public servant.

The topic I choose is almost a necessary offshoot of our times, when growth in general, and urban growth in particular, are current topics at all levels of our society. The rapid increase of urban populations since World War II is a global phenomenon, in developing as well as in so-called developed countries. The fact of urbanization is not new. The rate of change is only an accelerated one, because "spill over" from central cities began more than half a century ago.

Nomenclature for the phenomenon differs from country to country, e.g. the metropolitan areas of the United States, the conurbations of England, the agglomerations of India, or the popular, but fictitious, megalopolis of many countries. Similarly, the very nature of the populations living in these complex entities differ from country to country. The suburban well-to-do in the United States has little in common with the favellas in Brazil, the villas miserere in the Argentine, or the bustees of Calcutta. Their location, their economic status, their culture and ideology, are as wide apart as the poles.

The one characteristic in common is the reason for this paper — they all lack or need a managerial structure to provide and to operate all the facilities required for their existence in a healthy and safe environment. The vicissitudes accompanying the creation of such institutions and, in fact, pursuing them for the rest of their lives, are the concerns of engineers, economists, political scientists, politicians and citizens. Some of these concerns I share with you today, largely because they have not yet been resolved to the satisfaction of either the public or the theoretician.

*Professor Emeritus of Civil Engineering, The Johns Hopkins University

"Regional government", as used herein, is an autonomous unit, representative of local political units, having the functions of planning, implementing and operating facilities. It should be distinguished from an agency designed largely to couple federal-local relationships and to capture central government funds for local units (the popular indoor sport of the last five to ten years).

The Past Record

The problem of regional governance, either in limited functions or across the board of meeting society's needs, is not new. As a matter of fact, in this very region in which I speak, some of the earliest devices for regional management were created by imaginative officials and citizens. In some ways, those were happier days for such steps, because "vox populi" or public confrontation was not yet the assumed salvation of the people. Constituency support was sought, but not in grand circuses of thousands of conscientious, militant adversaries, all motivated for the "common good" but too frequently resistant to change.

Because the route was somewhat easier for the creation of single or multiple purpose regional governments, such units were developed in the growing metropolitan areas of the United States. They are still viable, for example, in the areas surrounding New York City, Boston, Pittsburgh, St. Louis, Chicago, Baltimore, Los Angeles, Detroit, Cleveland, Cincinnati, Minneapolis-St. Paul, Seattle, Denver, New Orleans, and many other smaller entities. These continuing struggles toward intelligent and logical management date back, in some cases, to well over a century. The devices often used were annexations and consolidations now frowned upon by those who might be annexed. As problems grew, more elaborate regional institutions were conjured up — always moving power of action further and further away from the electorate.

The creation of special metropolitan authorities needs particular mention because they proliferated in relatively large numbers in the first quarter of the twentieth century. They were dominated largely by the expanding requirements for water and sewerage facilities of burgeoning populations outside of central cities. Simultaneously, problems of transit forced the creation of such forms as the Port of New York Authority in 1921. The structure and powers of these specialized authorities need not be elaborated here, except to re-emphasize the fact that local political units were necessarily increasingly stripped of their autonomy and responsibility, always with the tacit hypothesis that this transfer was wise, logical and for the greater good.

A rising public suspicion of regional government is clear. That it should be so obvious in 1975, was predicted in 1930, in a remarkable volume*

*The Government of Metropolitan Areas in the United States. National Municipal League, New York. 1930.

published by a Committee on Metropolitan Government of the National Municipal League. The words, from that document, were prophetic:

"Generally speaking, the special metropolitan authorities have not been effective in the important function of consolidating the public opinion of a metropolitan area . . ., the term 'district' as expressing a political entity has failed to stir public imagination or the sense of loyalty as the words 'city', 'state' or even 'county' do. In a word, the 'district' does not express the average citizen's idea of a community. Whatever the explanation, the significant fact about these organizations is that in most cases the public opinion of the territory under their jurisdiction consists of as many separate political cubicles as before they were established." p. 338. And furthermore: "in the last analysis, the government of metropolitan areas constitutes a sturdy challenge to American political ingenuity." p. 390.

Has the Challenge Been Met in 1975?

Has American political ingenuity come up with a form of government for regions satisfactory to the people? The answer to this question is definitely "NO", in spite of the library of volumes by official and private groups who have confronted themselves with the issue for the last half century. In general, all students of the problem have concluded that regional government should be the "wave of the future." The books gather dust, however, when implementation waits upon a recalcitrant public.

A glaring example of this resistance is in the great metro area surrounding the capitol of the United States and encompassing millions of people. For some decades, attempts to consolidate and coordinate regional functions via a single structure have been characterized by failure. The fierce local pride in the states of Maryland and Virginia, and their multiple subdivisions, coupled with the anomalous political status of the District of Columbia, have so far prevented the simplistic solution so attractive to the academic planner.

Even in this complex region, services have been continuously provided, albeit perhaps with less theoretical efficiency or least cost. This situation points up the other answer to the central question posed, namely, that regional governments, such as they are, have a long record of service even though their popularity has been on the wane for years.

An assessment of the life and times of a few regional structures, with which I have been identified for some years, is helpful. They are, in general, characteristic of many others in this country. They date from 1913 to the 1970's, and are, as follows:

- The Washington Suburban Sanitary District
- The Baltimore County Metropolitan District
- The Miami Conservancy District
- The Six County Metropolitan Area (Detroit Complex) of Southeastern Michigan
- The Middlesex County Sewerage District
- The Ocean County Sewerage District

Their creation was not without major travail, often without popular support, and sometimes with violent opposition. The Conservancy Law of Ohio, for example, of which the Miami Conservancy District is an offspring, was denounced in the newspapers some sixty years ago, in familiar present day terms, as follows:

> "the most infamous in the history of the world, contains hidden wonders, more despotic and drastic than all the edicts of the czars that ever lived, subverts most rights of citizens and provides for power dams and reservoirs to destroy the peace of mind of the people of the valley, most damnable piece of legislation ever conceived, makes Troy mourn."

All the entities I have listed have performed yeoman public service, several for more than half a century. And yet, most have been under serious public attack within the last ten years. Some are being threatened with actual dismemberment and reversion to the local morass of multiple political units, from which they were designed to escape many years ago. The underlying criticism, where it is vocal, is that the regional units are "undemocratic" — in many ways a reflection of the climate of today, but strangely enough a resurgence of attitude of many years ago.

In all fairness, and viewed objectively, it is unfortunately true that hierarchies of government, increasingly remote from the man on the street, take on the garment of omniscience, cloaked too often with arrogance. These are correctible vices of management, too often recognized after the damage to public relations has been done. The democratization of authorities, by whatever name, is possible. It is usually slow, often an afterthought, and, invariably introduces more and more political maneuvering in an institution theoretically above such earthy intrusions.

The successful operation of a regional management presupposes *total* participation of all local political units. In recent experiences, some important local units "want out". Their ostensible reasons are the preservation of local autonomy, the inequities in the allocation of capital and operation costs, and differences as to technologic solutions to manifold urban problems.

Unfortunately, practitioners in this field have not come up with alternative governance mechanisms which would transcend the objections to existing machinery. The gap between the theoretical ideal and the realities of management is virtually as wide as it always was. Because of this misfortune, I search for some inkling as to why this should be so. Why is human behavior so tied to the City Hall or to the county seat?

The State of Maryland has twenty-three counties and the City of Baltimore. As chairman of the State Planning Commission in the late 1930's, I had an awareness that some counties were far too small to provide effective management and service. We employed the late Professor V. O. Key, then at the Hopkins and subsequently at Harvard, to study and report upon the government of the counties. As an astute political scientist, he recommended consolidation of counties into a smaller viable number. His report went to the Legislative Assembly with strong approval by the Commission.

It was received in an ambient temperature of below zero, was never allowed on the floor, and was placed on the proverbial shelf where it has rested for some forty years — unlikely to be disturbed for some time to come. Love for each county seat was dramatic and supreme. I confess, as time goes on, I am increasingly respectful of this public concern, even if not fully understanding of its subtle origins.

Those of you who are devotees of Mark Twain may find a clue to this behavior in the doings of Huckleberry Finn and Tom Sawyer — and to our own exposure to the mysteries of geography in elementary school. In a delightful essay* on "Maps in Literature", the Muehrckes, scholars in geography and in free lance writing, point out that "The disparity between the 'map world' and the 'real world' can be crucial in a problem-solving context: to substitute a map for reality can have serious consequences." They go on to illustrate this by referring to Mark Twain's recognition of this map-reading error in "Tom Sawyer Abroad". When Tom and Huck take a trip in a baloon, Huck doubts that they have passed Illinois, although he thinks they should have. Tom asks Huck how he knows this.

"I know by the color. We're right over Illinois yet. And you can see for yourself that Indiana ain't in sight."

"I wonder what's the matter with you, Huck. You know by the *color*?"

"Yes, of course I do."

"What's the color got to do with it?"

"It's got everything to do with it. Illinois is green, Indiana is pink. You show me any pink down here, if you can. No, sir; it's green."

"Indiana *pink*? Why, what a lie!"

"It ain't no lie; I've seen it on the map, and it's pink."

You never see a person so aggravated and disgusted. He says:

"Well, if I was such a numskull as you, Huck Finn, I would jump over. Seen it on the map! Huck Finn, did you reckon the States was the same color out of doors as they are on the map?"

"Tom Sawyer, what's a map for? Ain't it to learn you facts?"

"Of course."

"Well, then, how's it going to do that if it tells lies? That's what I want to know."

"Shucks, you muggins! It don't tell lies."

"It don't, don't it?"

"No, it don't."

"All right, then; if it don't, there ain't no two States the same color. You git around *that*, if you can, Tom Sawyer."

"He see I had him, and Jim see it too; and I tell you, I felt pretty good, for Tom Sawyer was always a hard person to git ahead of."

Can it be, as the psychologists tell us, that we are fixed in our beliefs in

*Maps in Literature. Phillip C. Muehrcke and Juliana O. Muehrcke. The Geographical Review, Vol. LXIV, No. 3, July, 1974, pp. 317-338. New York, N.Y.

the first grade of school? Is the County Court House, as a symbol on a map, our lamp of light forever? It is inviolate, it should not be tampered with and it certainly should not be "coordinated or consolidated" with its neighbors!

What Do Other Countries Do?

Some observers of the situation in the United States blithely suggest that all "we need is to change the whole system" or "we must change every social and economic institution in the country." In saying this so heroically, they cast an envious eye at some approaches in Canada and Great Britain. American reformers have long looked admiringly at the Toronto metropolitan government, created in 1953 with a wide spectrum of public functions. What is not underscored by these envious admirers is that it was created over the objections of most of the local governments concerned, by the Provincial Government on recommendation of the Ontario Municipal Board, a quasi-judicial body. The possibility of a referendum was never seriously discussed. Can you imagine such a procedure in the United States, where a single village of less than a thousand people might well have prevented such an overlying institution, notwithstanding its apparent successful operation in Toronto.

A more startling governmental reorganization took place in England and Wales in 1974. This step was described by an Englishman as the greatest change ever to take place in history in a government over a thousand years old. The substitution of ten new regional authorities, with multiple functions, for 29 river authorities, 160 water supply undertakings and 1200 sewerage and sewage disposal authorities, staggers the imagination. It followed some years of parliamentary inquiry, public discussion, and professional society intervention. Only the future can disclose how well the structural simplification will work. Can one imagine a similar reorganization in our own country, particularly if it were specifically spelled out as it was in England?

Even more attractive to some are the central government controls, particularly in water resources development, as exemplified in Israel and in Ceylon. Both countries are small and compact. In the first case, water is truly in short supply and, in the second, abundant. Both lend themselves, however, to manageable functions, superimposed upon local units of government and upon each individual. They both illustrate the decision to choose efficiency of management above local freedom of choice and perhaps of hazardous chaos. Again, it is doubtful that such complete centralization of power would be acceptable in our complex society of some 250 million individualists.

Political ideology is not always a guarantee of smooth administration. In India, with strong socialist bent, many variants of regional structure are at hand, with equally variable performance. The history of the governance of the Calcutta metropolitan area is replete with the problems once described by Bertrand Russell as contests of freedom versus organization. In the case of Calcutta we have the largest metro complex in all of India, with a present population of 8.5 million. Of these, some 2.5 million are refugees and another million of squatters moving to urban centers for jobs, education, movies and relief from village boredom and subsistence living. By 1986, the region may have 12 million people. Let us trace the search for the best way to manage this congery of people, with an urban heritage of more than a century and needing all the functional services for survival.

In 1959, a World Health Organization Mission reviewed the situation on the site. Calcutta was then the seat of cholera transmission throughout the Far East. The disease was then on one of its epidemic rampages. Since cholera is essentially water-borne and due to insanitary conditions in general, the WHO interest was clear. The Mission recommended the creation of a region-wide water and sewerage authority, which, after long debate, reached reality in 1966, on October 2, the birthday of Mahatma Gandhi.

During the period of 1967-1970, however, this agency was unable to function and no action was taken to implement the basic development plan. It was a period of political instability, decline in law and order, and economic recession. United Front Governments, essentially a series of communistic parties, elected in 1967 and 1969, were unable to govern for long and soon gave way to a period of "President's Rule". Finally, the Central Government intervened in 1972, with the creation of the Calcutta Metropolitan Development Authority. This agency has great "umbrella-like" powers to consolidate and coordinate a wide variety of public services, e.g. water supply, sewerage, drainage, traffic, transit, hospitals, schools, slum clearance, housing.

The evolution of this managerial entity over some 15 years, since the proposal by WHO, is recorded here primarily to emphasize the fact that people seem to behave the same way, regardless of political ideology. It is particularly interesting that the United Front Governments opposed the water and sewerage authority because it was undemocratic!

This rehearsal of personal experiences leads to the inevitable question: do we have any viable alternatives to either regional management and structure or central government take-over? A variant of the latter is, of course, take-over by the States.

Are There Alternatives to Regional Government?

In the present climate of the United States, there is an increased resistance to another layer of government and a growing suspicion of political leaders. An amazing devotion to familiar political boundaries, accompanies a wariness of remote control and decision making, and with it all, massive, adversary public participation in all issues. Under these militant circumstances, can we offer a system of regional operations calculated to provide reasonably effective services?

Actually, we have been driven over the years to use, pragmatically, other devices. Regional planning and coordinating units have been set up, without implementation powers. Their composition has been varied. Where the membership has been predominantly elected officials the results have been good.

Contractual relationships between political units have served sound purposes, but have the disability of continuing adjustments as local conditions are rarely static. Flexibility has been the keynote to success in changing allocation of costs, benefits, and rate structures. Negotiation became an annual exercise.

Annexation of adjacent political units is rare. Decades ago it was frequent. The practice has many disabilities on both sides of the hypothetical fence.

Tax-base sharing has recently emerged as another deviant from regional management. The proposal is that compensation, in taxes, would be granted to localities (often the central city) which were bypassed by commercial and industrial expansion. Other areas also would be thus compensated, which have preserved open spaces and natural environmental assets by foregoing industrialization. These attempts stem from the desire to mitigate the effects of present inequitable and regressive local tax structures.

Similar purposes have been achieved by the tax on commuters. This device, frequently suggested, has not been widely applied, because of the strong objections of those living outside the city, but working within it.

The State, ever alert to expanding its functions, would undertake to manage many lagging local and regional services. Maryland is one of the leaders in this effort in its legislative sanction of a few years ago.

All of these alternatives to regional political units represent a continuation of the ancient desire to preserve local autonomy against increasing centralization of power, of maintaining freedom in a world requiring organized management, and of minimizing the inroads on democratic processes for the "common good". In our fragmented governmental system, it is probable that the search for substitutes for intermediate levels of government will continue. During these processes of trial and error, much would be gained, in both existing and proposed regional entities, by deliberate democratizing of these authorities. Their governing bodies should be chosen by the electorate, their proceedings should be publicly visible, citizen participation, troublesome as it is, should be available on major policy issues, and sensitive public relations should be a continuing responsibility. Perhaps, it can be demonstrated, if there is a will, that a bureaucracy can be both efficient and responsive to "grass roots" public desire, can be impersonal and objective, while alert to the hopes and aspirations of its citizens. Do we ask for a utopia? Or is it around the corner in the technological revolution in management? Will systems analysis and the computer rescue us from the mysteries of man's political behavior? The answers wait upon my successors' diligence and mounting expertise!

"Between the idea
And the reality
Between the motion
And the act
Falls the shadow."*

*The Hollow Men, T. S. Eliot, A Little Treasury of Modern Poetry: Publ. Charles Scribner's Sons. New York. 1946. p. 295.

A COMPARISON OF METHODS FOR ESTIMATING FLOOD PEAKS ON STREAMS IN MASSACHUSETTS

by
Gary D. Tasker[1]

Abstract

Modifications of the Potter method (Potter, 1957) and the Small Basin Study (SBS) method (Johnson and Tasker, 1974) for estimating flood peaks from basin characteristics are used to predict the 50- and 10-year peak discharges at 77 continuous and partial-record gaging stations in Massachusetts. The predicted peaks made by each method are compared with the peak discharge estimated from station frequency curves for each station. Results indicate that, while the random error for both methods is about the same, the modified Potter method systematically predicts peaks which are substantially higher (150 percent) than those estimated from station frequency curves.

Introduction

One of the tasks of engineers concerned with the design of bridge or culvert openings, roadbed elevations, flood-protection works, or flood plain zoning is to estimate the probability of recurrence of floods of various magnitudes. In 1944 Kinnison and Colby (1944) published their important paper that related frequencies of floods to drainage basin characteristics. Since then Potter (1957), Benson (1962), Green (1964), Knox and Johnson (1965), Tice (1968), and Johnson and Tasker (1974) have made contributions to statistical analysis of flood peaks on a regional basis for Massachusetts streams. Table 1 summarizes the basic differences in these methods. Note that only two of these methods apply to streams with drainage areas of less than 5 square miles (mi^2) or 13 square kilometres (km^2), the Potter method and the SBS (Johnson and Tasker) method.

The Potter method is perhaps most widely used in Massachusetts in modified form by assuming a storage index of less than 4.5 for streams with drainage areas of less than 5 mi^2 (13 km^2) and by extrapolating the estimating curves for use below 1.0 mi^2 (2.6 km^2). This results in estimates of the 50- and 10-year peak discharges on many small streams in Massachusetts which are greater than the estimates made by the unmodified method.

In 1962 the U. S. Geological Survey in cooperation with the Massachusetts Department of Public Works and the Federal Highway Administration established a network of continuous and partial-record gaging stations to collect data on annual peak discharge on small rural streams in Massachusetts. The SBS method resulted from an analysis of data collected through the 1973 water year from this network in addition to the data collected at the regular network of U. S. Geological Survey gaging stations.

[1]Hydrologist, U.S. Geological Survey, Boston, Massachusetts.

Table 1. — Summary of seven methods for estimating flood peaks in Massachusetts.

	KINNISON AND COLBY (1944)	POTTER (1957)	BENSON (1962)
Data base	27 gaging stations in and adjacent to Massachusetts.	24 gaging stations in and adjacent to Massachusetts.	164 gaging stations in New England; 33 of which are in Massachusetts.
Method used to determine discharge-frequency relation at gaging stations.	Discharge frequencies were determined from precipitation frequencies, a rain-fall-runoff relation, and unit hydrographs.	The array of observed annual peaks were plotted on extreme-value probability paper. The upper end of the frequency curve was determined by a least-squares fit of those peaks having an indicated recurrence interval of 5 or more years.	A discharge-frequency curve was drawn by eye through each set of points determined from the record of annual peaks to average the trend of plotted points.
Method used to develop estimating relationships.	Graphical multiple regression.	Graphical multiple regression.	Step-backward multiple regression using 14 independent variables.
Significant independent variables.	Drainage area, storage factor, slope factor, and lag-time factor.	Drainage area, rainfall index, and storage index.	Drainage area, basin slope, storage factor, temperature factor, and orographic factor.
Form of estimating relations.	Equations.	Coaxial graph.	Equations.
Minimum size of basin to which applicable.	Smallest basin used in developing equations — 12.3 mi^2.	1.0m^2	15 mi^2

GREEN (1964) (does not apply to Hoosic River basin)	KNOX AND JOHNSON (1965)	TICE (1968) (applies only to Hoosic River basin in Massachusetts)	SMALL BASINS STUDY (SBS) (Johnson and Tasker, 1974)
146 gaging stations in New England; 30 of which are in Massachusetts.	43 gaging stations in and adjacent to Massachusetts.	487 gaging stations from New York to Virginia; 3 of which are in Massachusetts.	92 gaging stations in and adjacent to Massachusetts.
Same as Benson.	Same as Benson.	Same as Benson.	The array of observed annual peaks were fitted to a log-Pearson Type III frequency distribution.
Graphical.	Step-backward multiple regression using 6 independent variables.	Graphical.	Step-forward multiple regression using 12 independent variables.
Drainage area and hydrologic areas.	Drainage area, basin slope, and orographic factor.	Drainage area and hydrologic areas.	Drainage area, basin slope, and precipitation index.
Several graphs.	Equations.	Several graphs.	Nomographs.
15 mi^2	10 mi^2	5 mi^2	0.25 mi^2

In this report the 50- and 10-year peak discharges estimated by the modified Potter method and the SBS method are compared with the peak discharges determined from station frequency curves at 52 stations with drainage areas of less than 5 mi^2 (13 km^2) and 25 long-term gaging stations with larger drainage areas. The 52 stations have drainage areas ranging from 0.25 mi^2 (0.64 km^2) to 4.96 mi^2 (12.8 km^2) and the twenty-five long-term stations have drainage areas ranging from 12.3 mi^2 (31.9 km^2) to 497 mi^2 (1290 km^2).

Station Frequency Curve

In general, the station frequency curves were determined by fitting the observed array of annual peak discharges to a log-Pearson Type III frequency distribution, which is the base method recommended by the Hydrology Committee, Water Resources Council (1967) as a uniform technique for Federal agencies. For the twenty-five long-term stations having periods of record ranging from 33 to 63 years and averaging 49 years, the skew coefficient computed from the logarithms of the observed annual peak discharges was used in fitting the frequency distribution. Where historical information was available, it was used to modify the upper end of the long-term frequency curve. For the fifty-two small drainage area stations having an average period of record of 11 years, the generalized skew coefficients given by Hardison (1974) were used.

Comparison of Estimated and Predicted Flood Peaks

Any difference between observed and predicted data is referred to as error, which may be divided logically into two sources: random error and systematic error (bias). Random error may be measured by the standard deviation about the mean of the residuals (difference between logarithms of predicted and observed values). These values (table 2) are represented graphically in figures 1 through 4 as one-half the distance between the two dashed lines. Systematic error may be measured by the mean of the residuals (table 2), which are represented graphically by the solid lines in figures 1 through 4.

The stations used to make this comparison were among those used to develop the SBS method. Therefore, conclusions drawn from the results of this comparison are valid only to the degree that the sample of stations used represents all of the streams in Massachusetts. In addition, because the station frequency curves were developed from a finite sample of annual peaks, they do not necessarily represent the true frequency of peaks at the station. Nevertheless, it may be possible to draw two guarded conclusions from the data.

First, it is apparent from table 2 that the random error for both methods is about the same. The standard deviations of residuals based on all 77 sta-

Table 2. — Mean and standard deviation of residuals. Percentages indicate relative amount estimated values differ from observed values and sign indicates whether above (+) or below (−).

Sample	Recurrence interval of estimated peak, in years	Mean of Residuals (Systematic error)				Standard Deviation of Residuals (Random error)			
		Modified Potter method		SBS method		Modified Potter method		SBS method	
		LOG UNITS	%	LOG UNITS	%	LOG UNITS	%	LOG UNITS	%
25 long-term stations.	50	+0.2890	+ 95	−0.0541	−12	0.2760	68	0.2217	53
	10	+0.3036	+101	−0.0312	− 7	0.2714	67	0.1843	44
52 small drainage area stations.	50	+0.4567	+186	−0.0598	−13	0.2316	56	0.2456	60
	10	+0.4333	+171	−0.0160	− 4	0.1959	47	0.2086	50
All 77 stations.	50	+0.4023	+153	−0.0580	−12	0.2575	65	0.2367	57
	10	+0.3912	+146	−0.0209	− 5	0.2297	55	0.2000	48

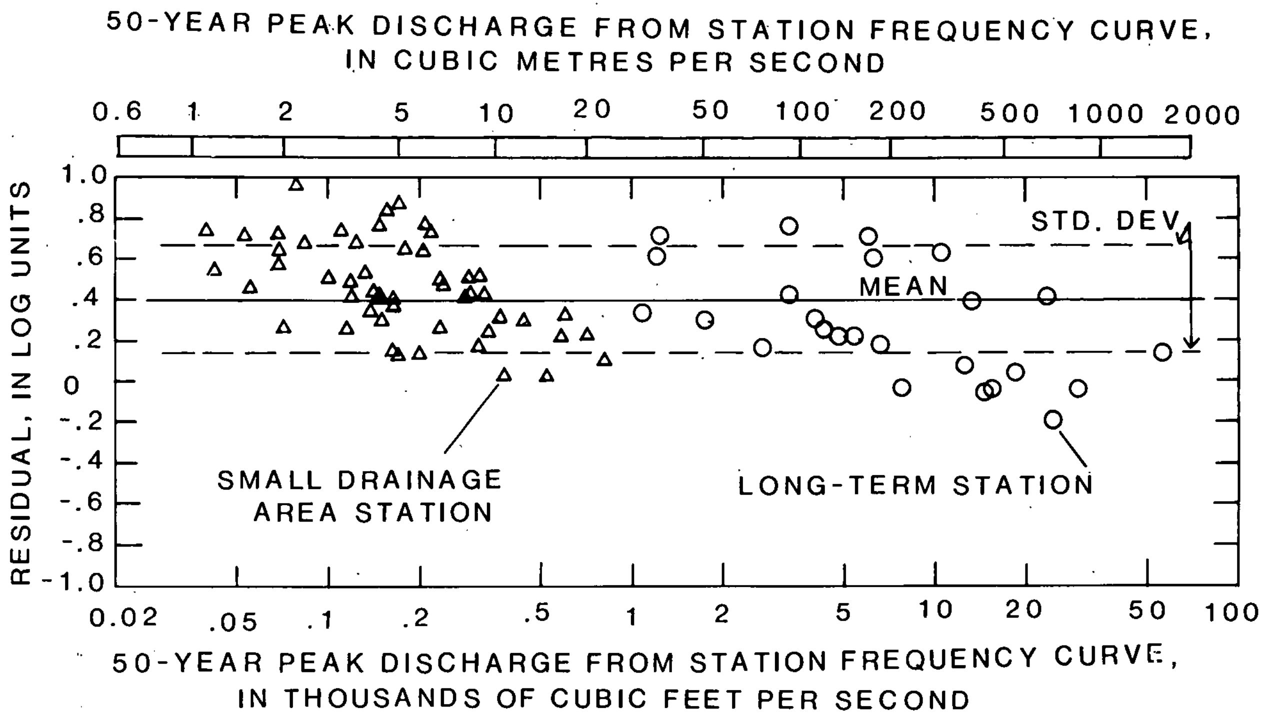

Figure 1. — Relation of residuals from modified Potter method for 50-year peak discharge to the 50-year peak discharge from station frequency curve.

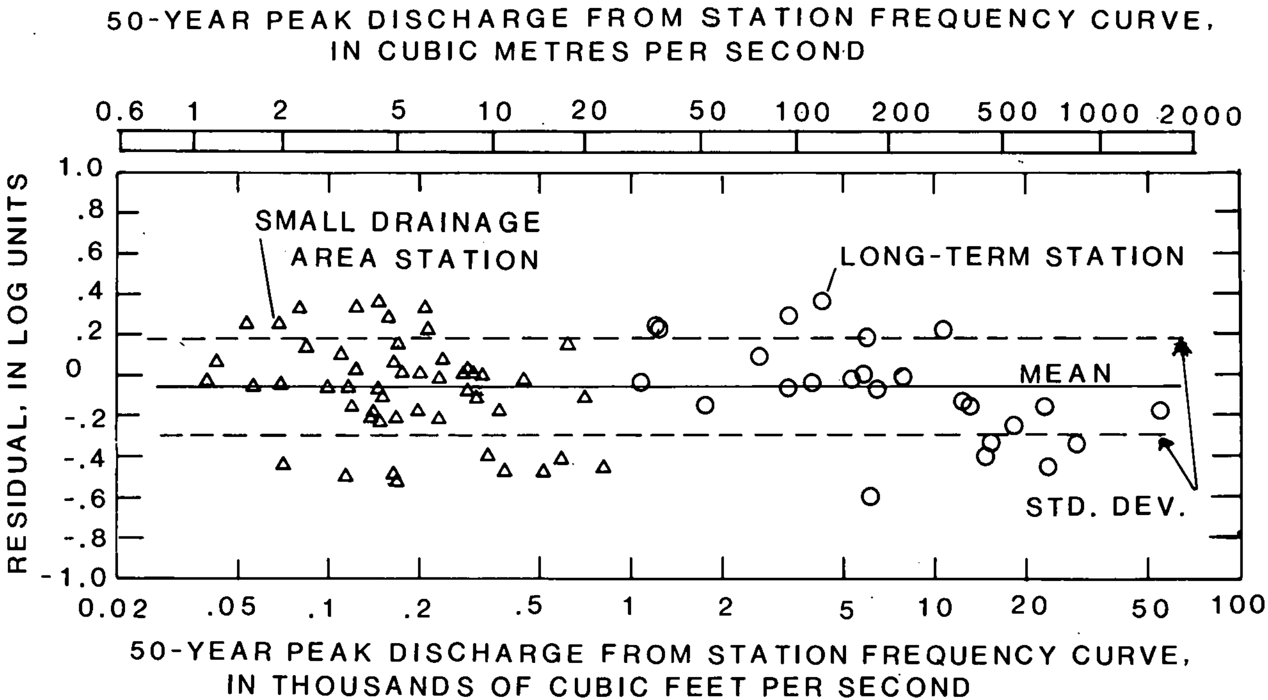

Figure 2. — Relation of residuals from SBS method for 50-year peak discharge to the 50-year peak discharge from station frequency curve.

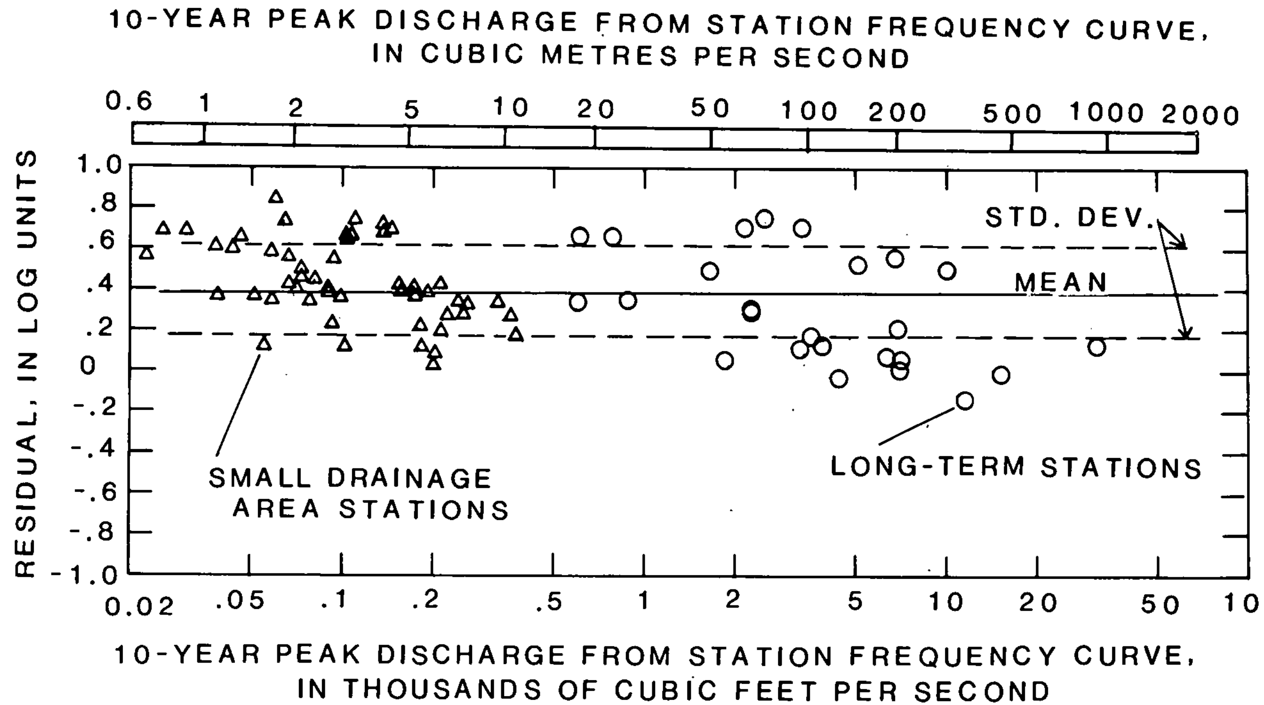

Figure 3. — Relation of residuals from modified Potter method for 10-year peak discharge to the 10-year peak discharge from station frequency curve.

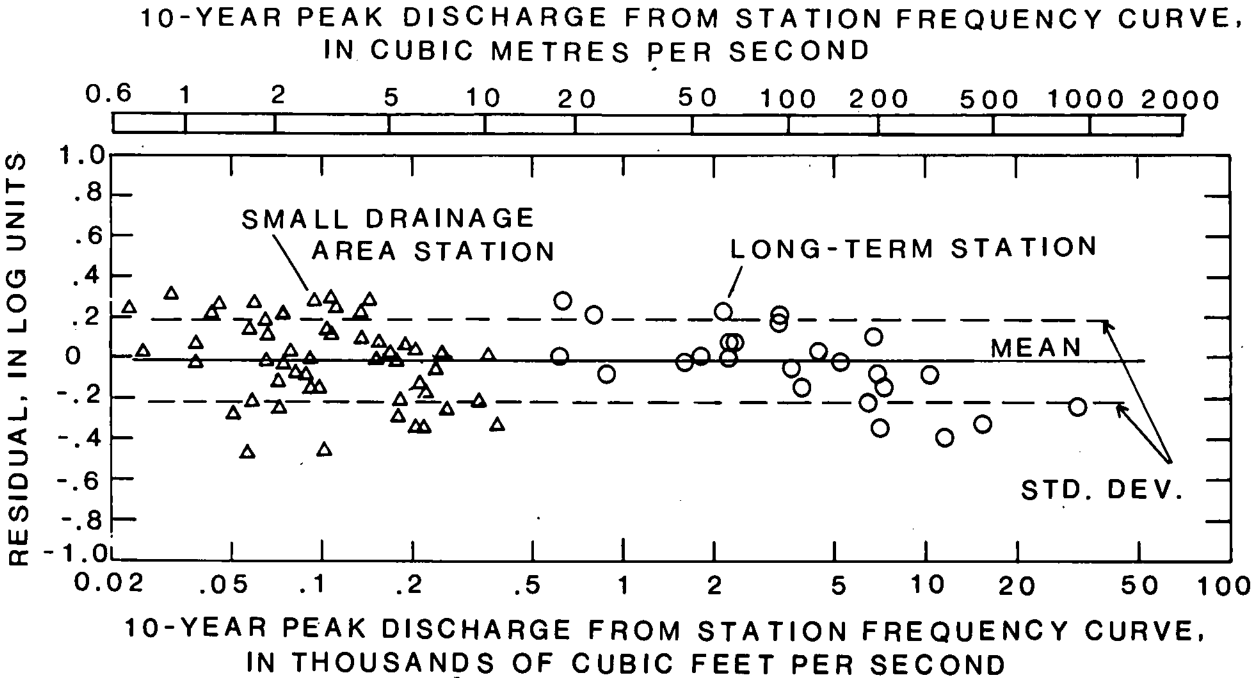

Figure 4. — Relation of residuals from SBS method for 10-year peak discharge to the 10-year peak discharge from station frequency curve.

tions for the 50- and 10-year peaks are for the modified Potter method 65 and 55 percent and for the SBS method 57 and 48 percent, respectively. Second, the modified Potter method systematically predicts values of peak discharge which are substantially higher than those estimated from station frequency curves at the U. S. Geological Survey network of gaging and partial-record stations in Massachusetts. Based on the 77 stations, the modified Potter method predicted values of the 50- and 10-year peaks averaging about 150 percent higher than those of the station frequency curves.

Discussion of the SBS Method

The SBS method used longer periods of streamflow records for the larger streams and a number of observations (although short term) on many small streams which were not available to Potter. A plot of the algebraic sign of the residuals for the 50-year peak on a map does not indicate a geographical bias in the method; however, the method predicts values of the 50-year peak discharge which average 12 percent lower (table 2) than the values estimated from the station frequency curves and used as a basis for comparison. This is due largely to the manner in which the skew coefficients for each station were determined.

In the SBS method, Johnson and Tasker computed station frequency curves based on skew coefficients determined from logarithms of the observed annual peaks (station skew). The average station skew for the 52 small drainage area stations was −0.1. In this report the generalized skew coefficients (map skew) given by Hardison (1974) were used. The values of map skew in Massachusetts vary from +0.4 to +0.6 and result in estimates of the 50-year peak discharge at gaging stations which, on the average, are higher than those used by Johnson and Tasker. Hardison (1974, p. 752) states that the use of these map skew coefficients results in more accurate estimates of the 50- and 100-year peak discharges at short-record sites. If the map skew of Hardison rather than the skew values computed from flood records actually allows more reliable estimates of long-term flood-frequency relations, the estimates of 50- or 100-year peak flows at ungaged sites by the SBS method may average about 12 percent low.

Acknowledgment

This report was prepared as part of a cooperative study supported by the Massachusetts Department of Public Works and the Federal Highway Administration. The opinions, findings, and conclusions expressed are those of the author and not necessarily those of the cooperating agencies.

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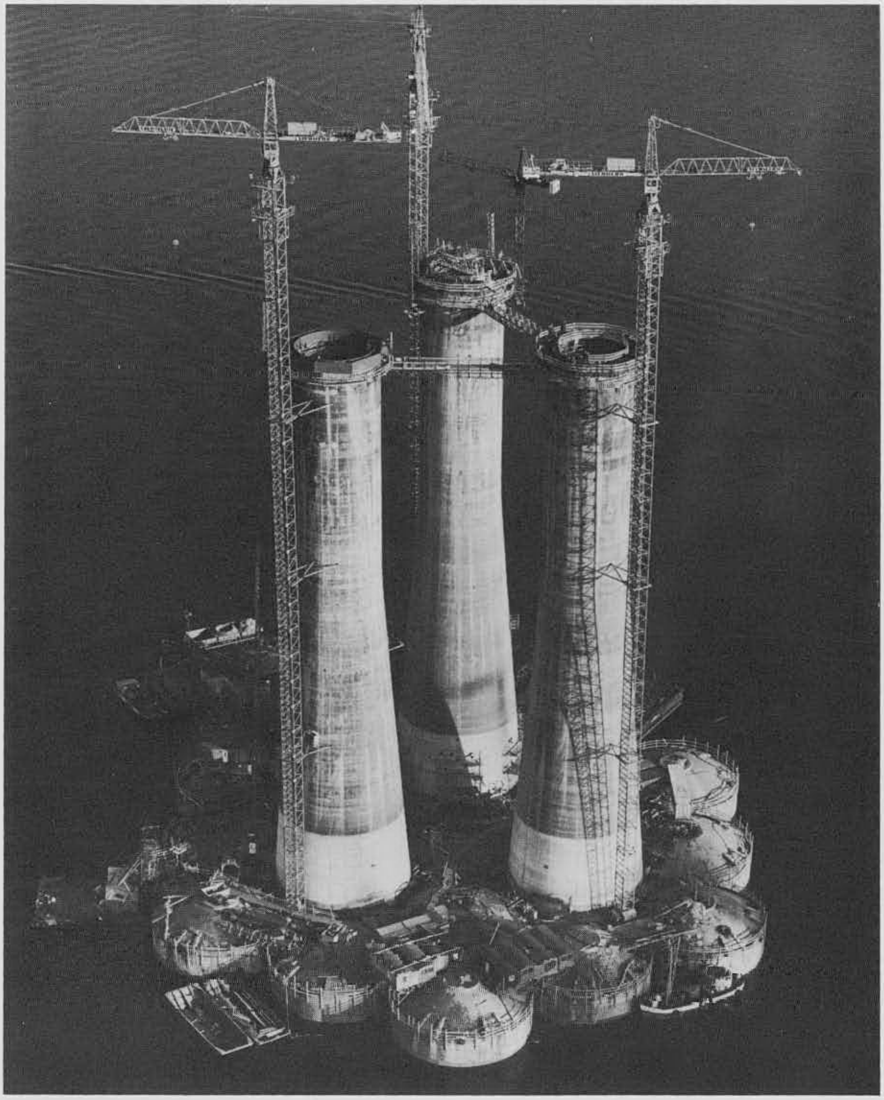

DESIGN AND CONSTRUCTION OF CONCRETE STRUCTURES IN THE NORTH SEA

by Ben C. Gerwick, Jr.*

(The Mathis Memorial Lecture, M.I.T., February 24, 1975)

For the development of a number of major oil fields in the North Sea, prestressed concrete caissons have been selected. These huge structures have bases up to 100 meters square and stand 200 meters from sea floor to deck level. A typical structure will contain 100,000 cubic meters of prestressed concrete and provide storage for 1,000,000 barrels of oil. These are among the most complex and sophisticated structures ever undertaken, and require the integration of many engineering disciplines for their accomplishment.

These structures pass through many design stages during construction and service: fabrication in a dewatered basin, launching, completion afloat, submergence to mount the steel deck structure, towing to the site, submergence to the sea floor, and founding, followed by alternate filling with hot oil and displacement by cold water. Most important of all, they must safely weather the repeated severe storms of the North Sea.

The new oil discoveries in the North Sea lie almost exactly half-way between Scotland and Norway, in water depths of 70 to 160 meters, and are exposed to some of the worst sea and wind conditions in the World. The proper development of these fields has required consideration of many factors. The trend is to the construction of very large integrated platforms, capable of supporting drilling and production operations, processing of gas for transmission, reinjection of gas or water, and interim storage of oil. Such a platform may support a large number of deviated wells drilled from it in addition to adjacent sea-floor completion satellite wells. The newest platforms must support almost 40,000 tons of equipment on top.

The development of these concrete sea structures has been very radical and very sudden. The first such caisson, Ekofisk, was commenced in 1971 and is now in place and in service, showing excellent performance in full accord with predicted values, during the storms of the last two winters. The successful installation of Ekofisk unleashed an intensive effort in design of concrete caissons for deeper water and more severe conditions. Twelve such structures are now under construction, with valuations ranging from 100 to 350 million dollars each.

It is important to recognize the contributions of various organizations in responding to this challenge: the enterprise of Norwegian, French, and British constructors, the critical roles played by U. S. engineers in providing technical expertise, the work of Det Norske Veritas in providing certifica-

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tion capability and of Lloyds in providing insurance. A particularly important need was filled by FIP, the International Federation of Prestressing, in the timely holding of International Symposia on Concrete Sea Structures and in promulgating Recommended Practices for Design and Construction.

The over-riding determinant in the design of these structures is the wave force. Typically, the 100-year design wave may be 30 meters with a 16.5 second period, exerting a lateral force of 40,000 tons. Attention is also paid to the energy distribution in the wave spectra to ensure that maximum design forces are accurately calculated for the various portions of the structure. Dynamic amplification of the structure-soil system is added.

Uplift forces, as the wave passes, will frequently equal or exceed the lateral forces, but fortunately are out of phase with them.

These wave forces are almost entirely inertial in character, heavily influenced by the mass of the enlarged base. They tend to cause sliding of the structure, aggravated by their cyclic nature and rocking and overload of the soil in bearing.

Obviously the foundations for such structures are critical. Soil sampling and investigation is extremely difficult and there are usually far less good data developed than desired. Fortunately, North Sea soils are quite strong, being of glacial origin, and hence can usually provide adequate bearing. Thus potential shear or sliding failure under cyclic loading may determine the size of the base. To improve this aspect and also to prevent scour, steel or concrete skirts are provided which penetrate 3 to 6 meters or so into the sea floor. Permanent drainage is provided for sand strata to prevent pore pressure build-up under storm waves, with risk of liquefaction.

To resist the dynamic loads of the waves without fatigue, the towers or columns of such structures must be prestressed. The hugh hollow base is used to provide flotation during construction, tow, and installation, and oil storage thereafter. Compartments of this base are subjected to very heavy external hydrostatic forces during construction and installation: of the order of 100 to 150 tons per square meter (20,000 to 30,000 psf). When the structure is landed on the seafloor, local hard spots may produce concentrated loads on the base which are two to three times as great. Thus shell design (cylinders, domes, haunches, etc.) is employed, and detailed studies must be made of moments and especially of shears. Existing programs and codes have proven inadequate and recourse must be made to fundamental theory, especially in determining ultimate shear capacity of the sections in question.

The construction of such structures is carried out in a sequence: the base is constructed in a basin to a height of 10 meters or so, then floated out to deep water and completed afloat. Various construction techniques are employed and combined, including slipforming, panel forms, precast concrete segments, etc.

Very high strength concrete is employed, and strict quality control is exercised throughout. Frequently 600 or more skilled workmen will be employed to carry out the many aspects of work required.

While the concrete structure is being constructed, the steel deck, about 7000 tons to box girder construction is being fabricated. The concrete structure is now ballasted down in protected but deep water, until only a few meters of the column tops protrude above the surface. The deck is now floated in over the top, on barges, and the structure de-ballasted to transfer the deck to the columns. This is generally the most critical stage in the structure's life; due to the extreme hydrostatic pressures on the base.

One of the advantages of the caisson concept is that all the oil and ballast piping, controls, and much of the equipment can be installed and tested while the structure is still afloat in the fjord. Then, during the best weather season (June-July and perhaps August), the structure is towed out to sea. The largest tugs in the world are used, 12,000 to 20,000 shp, and up to 5 are used in parallel to move the huge mass which draws about 60 meters and displaces 500,000 tons. Once arrived at the site, perhaps 7 days after leaving, the tugs fan out to hold the structure in position while it is ballasted down to the sea floor: a process that usually takes 12 hours or so. By over-loading (ballasting) the structure, the skirts on the lower part of the base are forced into the soil. Uniform bearing is then achieved by under-base grouting, using special mixes.

Control and supervision of such a large and complex undertaking requires highly qualified engineers at all levels. Management of the operation requires detailed schedule control, especial attention to advance procurement, and meticulous planning.

The detailed design of these structures has to date been carried out simultaneously with construction, necessitating special contractual arrangements by which responsibilities and risks are clearly defined.

As could be expected with such accelerated schedules for unprecedented structures, problems have developed and there have been many anxious moments. Fortunately, as of now, all of these have been met and the next group of offshore concrete structures is on schedule, with tow out scheduled for the summer of 1975.

For example, the Ekofisk structure encountered problems with thermal cracking due to high heat of hydration. These cracks were filled with epoxy. Shears where found to be excessive for founding on the seafloor, where local "hard spots" might produce concentrated loads of 200 tons/square meter. A second heavily-reinforced concrete slab, one meter thick, was placed above the original slab and tied to it by thousands of drilled-in dowels.

On another structure now under construction, during one stage, differential ballasting was employed. Due to misunderstanding between the constructor and designer, certain empty cells were subjected to very high hydrostatic heads in the wrong direction, with consequent severe cracking. These cracks were successfully repaired in a major program of epoxy injection, grouted pre-placed aggregate, and structural modifications.

The three-dimensional analysis of the complex shell configurations for two current structures has proven extremely difficult, with the result that shears and moments at the juncture of domes and cylinders were under-estimated. Fortunately this was caught in time. Structural strengthening is now being carried out and internal air pressurization will be employed.

The successful identification and meeting of these critical developments is a tribute to the engineering and construction profession. While the majority of these problems are the result of pushing ahead so rapidly into new uncharted areas, they would never have been even recognized as potential problems if some enterprising individuals and groups had not had the courage to move ahead boldly and with confidence. Our knowledge in all the fields involved is increasing by leaps and bounds due to the dedication of those involved to ensure that the structures will have a high degree of safety for all conditions.

Additional design criteria and structural analyses are now being developed: collision from service vessels, cyclic thermal changes in the storage tanks, the impact of equipment or supplies dropped overboard during handling, and even possible sabotage. Such criteria are very real, but have not previously been widely applied to offshore structures. Risk analyses and failure-mode effect analyses are being carried out on a far more thorough basis.

These offshore structures represent a significant advance in engineering and construction and set a whole new pattern for offshore facilities of many types: offshore terminals, floating nuclear power plants, ocean energy facilities, and facilities for increased production of petroleum from the continental shelf and eventually from the continental slope. Perhaps of greatest long-range import, they have forced the integration of the diverse disciplines of structural engineering, foundation engineering, materials technology, mechanical engineering, naval architecture, hydrodynamics, construction engineering and management, all within a framework that requires full consideration of economic, political, and environmental factors.

PROCEEDINGS OF THE SECTION

Minutes of Meetings

BOSTON SOCIETY OF CIVIL ENGINEERS SECTION-ASCE

Minutes of the Section meetings are included as part of group meetings as follows:

November 20, 1974 — Computer
December 11, 1974 — Structural
January 8, 1975 — Construction
February 19, 1975 — Transportation
April 2, 1975 — Environmental

COMPUTER GROUP

November 20, 1974 — The regular Computer Group meeting was held at the Ralph M. Parsons Laboratory for Water Resources and Hydrodynamics, M.I.T. Professor Charles L. Miller of M.I.T. discussed the various expectations of the early sixties for computer applications in engineering and how well they have been fulfilled to date. It was noted that the least realized of all the prognostications called for substantial changes in the structure of engineering organizations. Other expectations that have not been realized, focused on the mode of computer use and software development. However, it was pointed out that computer usage is widespread today and growing. It would appear that the expectations of the early sixties are going to take a little longer to achieve. There were approximately twenty-five members and guests in attendance.

Lewis H. Holzman, Clerk

January 22, 1975 — The Computer Group met at the Ralph M. Parsons Laboratory for Water Resources and Hydrodynamics at MIT in Cambridge. Thirty-two people attended the meeting which was called to order at 7:15 p.m. by James N. Jackson of the Computer Group's Executive Committee.

The meeting consisted of a panel discussion on the topic "Computers — An Unfulfilled Promise for the Small Firm?" The panel consisted of Professor Dan Roos of the Department of Civil Engineering, MIT; Mr. Russell Barnes of Barnes & Jarnis, Inc., Boston; and Mr. Samuel Francis of Francis & Jackson, Associates, Marion. Mr. Francis discussed the deliberations entered into by APEC in their attempt to expand their computer usage for the small engineering firms. Mr. Barnes discussed and documented the deliberations which his firm had undergone in their consideration of computers and various types of programable calculators. Professor Roos discussed the general problem of computers in engineering firms and the particular pressures that face the small consultant.

An extended discussion period followed the presentation of the panel and the meeting was adjourned at 9:00 p.m.

March 19, 1975 — The combined Computer Group and Transportation Group meeting was held at the Playboy Club in Boston. Mr. Kay Krekorian, Deputy Chief Engineer of the Massachusetts Department of Public Works and Mr. Alfred Howard, Transportation Planning Director of the Boston Redevelopment Authority discussed their experiences with computerized systems for determining traffic patterns and controlling them. The dissimilarities of equipment and objectives of the City and State systems were forcefully presented. Mr. Stanley Siegel, Director of Transportation of the Town of Brookline was moderator.

An election was held for offices of the Computer Group for the coming year. Outgoing Chairman, John T. Christian presented the following slate for the executive committee:

Chairman — Jekabs P. Vittands
Vice Chairman — Lewis H. Holzman
Clerk — James N. Jackson
Member — Sal Mazzotta

Member — Robert A. Wells, Jr.
Member — John T. Christian

As there were no other nominations the slate was elected unanimously. Approximately 80 members and guests attended the Joint Meeting.

Lewis H. Holzman, Clerk

CONSTRUCTION GROUP

October 30, 1974 — The October meeting of the Construction Group was held at the Red Coach Grill, 43 Stanhope Street, Boston. Luncheon was served at 12:30 P.M. At 1:00 P.M. the meeting was called to order. After brief announcements by Samuel E. Rice, III, Chairman, he introduced the main speaker, Mr. Philip Whitton of San-Vel Corporation. The talk was on "The Growing Use of Precast — Prestressed Concrete Building Units". A film of construction of the "57 Building" on Stuart Street, Boston was shown. Mr. Whitton explained the various aspects of this unique construction.

The meeting, attended by 18 persons was adjourned at 2:00 P.M.

Laimonis Rieksts
Vice-Chairman

December 18, 1974 — The regular Construction Group luncheon meeting was held at the Red Coach Grill, 43 Stanhope Street. Luncheon was served at 12:30 P.M. At 1:10 P.M. after brief announcements, Chairman Rice introduced Mr. Charles Appley of MBTA and Mr. David Thompson of Haley & Aldrich. A film presentation and talk was about the recent MBTA extension North of Boston. Mr. Appley talked about the details of construction and the difficulties encountered. Mr. Thompson talked about the soil conditions and pre-loading of the soil.

A total of 24 members and guests were in attendance. The meeting adjourned at 2:10 P.M.

Laimonis Rieksts
Vice-Chairman

January 8, 1975 — The Construction Group luncheon meeting was held at the Playboy Club, Park Square, Boston.

This was also the monthly Business Meeting of BSCES-ASCE.

After social hour and dinner, the meeting was called to order at 7:30 p.m.

After brief introduction by Chairman Samuel Rice III, floor was given to President Thomas Liu.

He made a motion to vote on the proposed by-law changes as approved by the Board of Government of their November 4, 1974 meeting. Articles 6 and 8 of the by-laws are affected.

The motion was seconded and the vote was unanimous in favor of the change.

The guest speaker for the evening, Mr. Ken Parker of Gilbane Building Company talked about "CONSTRUCTION MANAGEMENT, AN EVOLVING CONCEPT".

It was a very timely and interesting subject which stimulated a lot of questions and discussion.

Total of 29 members and guests attended.

Meeting adjourned at 9:00 p.m.

Laimonis V. Rieksts
Vice Chairman for
Renwick Chapman, Clerk

February 12, 1975 — See Geotechnical Group.

ENVIRONMENTAL GROUP

November 6, 1975 — On Wednesday, November 6, 49 members of the Society met at the Playboy Club for dinner and a discussion of Wastewater Plant Startup and Operation. The discussion was initiated by Mr. Joseph Hanlon of Camp, Dresser & McKee who delivered a paper which lasted approximately 40 minutes. Mr. Hanlon was introduced by Messrs. William H. Parker, II, Chairman, Environmental Group and Clifford W. Bowers, Sub-Chairman. Following Mr. Hanlon, Mr. Hibbard Armour of the Environmental Protection Agency, Mr. Ross Crane of Metcalf & Eddy, Inc., Mr. John Hartley of the City of Marlborough and Mr. Brian Jeans of the Massachusetts Water Resources Commission each made a few comments and the floor was then opened to questions. The meeting adjourned at about 9:00.

Respectfully submitted,
Clifford W. Bowers
Sub-Chairman

January 15, 1975 — See Hydraulic Group

February 26, 1975 — The Environmental Group met at the Playboy Club of Boston for a dinner meeting.
The subject of this meeting was ozone disinfection of secondary effluents and the invited speaker was Carl Nebel of Welsbach Ozone Systems Corp. Mr. Nebel explained the state of the art on equipment for ozone production and its use in disinfection of wastewater treatment plan effluents.

April 2, 1975 — The Environmental Group met at the Playboy Club of Boston for a dinner meeting.

The lecturer for the evening was Steve Lathrop of the Environmental Protection Agency, who spoke on the Safe Drinking Water Act of 1974.

Officers for the Environmental Group were elected at this meeting, and are as follows:

Chairman,	Leo Peters
Vice Chairman,	Paul Taurasi
Clerk	Fred Blanc
Members,	Clifford Bowers
	Warren Ringer
	Peter Knowlton

GEOTECHNICAL GROUP

December 10, 1974 — The forum meeting was held at MIT using the Potpourri format in which each speaker was allocated 10 minutes for presentation and 5 minutes for question — answer — discussion. The subjects of the seven speakers ranged throughout the Geotechnical Engineering field. The program began at 6:30 p.m. with the first speaker. A break for coffee and donuts was made at 7:45 with resumption of the program at 8:20 and adjournment at 9:30. Many favorable comments were received from the approximately 103 prsons who attended.

The speakers and their subjects were as follows:

a. Jim Weaver and Dick Stulgis (Haley and Aldrich)
"Settlement Behavior of Oil Storage Tank During Hydro-Test".
A description of the settlement measuring equipment, the discovery of an area of high differential settlement, the evaluation of the observations and corrective action taken.

b. Dave Campbell (Stone & Webster)
"Computer Approach for the Analysis of Rock Anchoring Systems".
A brief description of a computer program used to analysis rock bolt patterns in terms of geology (joints, faults, etc.) and discussion of a specific application to a powerhouse excavation.

c. Steve Alsup (Goldberg — Zoino)
"Engineering Geophysics is not Seismic Refraction".
Discussion of two methods out of a listing of more than 30. Provided data on depth of survey using nuclear radiation type equipment and indicated range of reliability of data.

d. John Roma (Golder — Gass & MIT)
"Caisson Dewatering at Harvard Business School".
A description of caisson — dewatering problems in a portion of the Harvard Business School apartment building complex. This job used large diameter deep wells rather than a wellpoint system. Observation of adjacent structures showed no settlement.

e. Jean Audibert (Stone & Webster)
"Comparison of Teraprobe & Vibro — Flotation".
Comparison of effectiveness and costs of densifying sands at two sites using the above methods.

f. Tom Turcotte (Weston Geophysical)
"Weston Geophysical seismic station".
Description of the new seismic monitoring station in Westboro. Also discussed proposal for northeastern United States grid to provide regional coordination of observations on a monthly basis.

g. Ken Briggs (Stone & Webster)
"Zero Blow Count in Clays underlying a Nuclear Power Plant Site".
The detective work involved in finding a rational explanation for observed low blow counts at depth under a nuclear power plant site. Resolved that sensitivity of the clay was the cause.

Respectfully submitted,
Alton P. Davis Jr.,
Chairman Geot. Sect.
Forum Comm.

February 12, 1975 — A joint meeting of the Geotechnical and Construction Groups was held on February 12, 1975, at Harkness Commons, Harvard University. The program was a panel discussion on the subject of "Design and Construction of Tunnels", moderated by Stiles Stevens of C. E. Maguire. Members of the panel were:

Research: Dr. Steve Majtenyi, U.S. Dept. of Transportation, Federal Highway Administration, Washington, D.C.
Design Professionals and Consultants: Mr. Robert Jenny, Consulting Engineer, New Jersey
Contractor: Mr. George Fox, Chief Engineer Grow Tunneling Corp., New York
Project Management: Mr. Ed Plotkin, McLean-Grove Construction Co., New York

In addition, limited presentations were provided by C. John Dunnicliff, Chief Engineer, Soil & Rock Instrumentation, Inc. on "Soft Ground Tunnels", and Professor Herbert Einstein, MIT, on "Hard Rock Tunnels".

Chairman for the evening and program organizer was William S. Zoino. Attendance at the meeting was curtailed because of a raging blizzard during the afternoon and early evening.

HYDRAULIC GROUP

December 4, 1974 — A meeting of the Hydraulic Group of the Boston Society of Civil Engineers Section was held on Wednesday, 4 December 1974 at the Ralph M. Parsons Water Resources Laboratory at the Massachusetts Institute of Technology in Cambridge. Attendance at the meeting was 21.

The meeting was called to order by Group Chairman, Saul Cooper, at 7:10 p.m. The Chairman gave an outline of the three remaining Hydraulics Group's meetings which include the Second Annual Thomas R. Camp Lecture to be held on January 15, 1975. Chairman Cooper appointed Frank Perkins, chairman of the nominating committee, with instructions to report on a slate of new officers at the March 1975 meeting.

Mr. Cooper introduced the speaker for the evening, Professor Bernard Berger, Director of the University of Massachusetts Water Resources Research Center. The speaker outlined the background, purposes and funding for the Research Center which was established in 1965 on enactment of the Water Resources Research Act of 1964. Professor Berger gave a synopsis of three on-going projects which included:

(1) Design of a Rational Sampling Network for a river

(2) Effects of Lakeshed Developments on Water Quality

(3) Impact of Nonpoint Urban Runoff on Water Quality of Receiving Streams.

A question and answer period followed the presentation. The meeting adjourned at 8:30 p.m.

Oscar L. Donati
Clerk

January 15, 1975 — A combined meeting of the Hydraulics and Environmental Groups of the Boston Society of Civil Engineers was held on Wednesday, 15 January 1975 at the Massachusetts Institute of Technology Faculty Club in Cambridge. This dinner meeting was the third annual Thomas R. Camp Lecture with 70 people in attendance for the lecture. A brief meeting of the Group's Executive Committee was held prior to the scheduled dinner meeting.

The meeting was called to order at 7:45 p.m. by Hydraulics Group Chairman Saul Cooper who gave a brief background of the Camp Lecture series and introduced Mr. William Parker, Chairman of the Environmental Group and Mr. Charles A. Parthum, Vice President of the BSCES. Also introduced were Mr. Joseph Lawler, President and Mr. Joseph Heney, Vice President of Camp Dreser & McKee Inc., engineering firm.

Chairman Cooper introduced the featured speaker of the evening, Dr. Abel Wolman, Professor Emeritus of Sanitary Engineering at the John Hopkins University. The subject of the Camp Lecture was "Regional Governmental Dilemmas". Dr. Wolman's talk dealt with the many problems associated with establishment of regional governments for the management water resource needs not only in this country but also in other parts of the world. He indicated that remoteness from governing bodies is one of the major problems of many people in the world and said that we must learn how to improve communications with the man on the street.

A question and answer period followed the presentation. The meeting adjourned at 9:30 p.m.

Oscar L. Donati
Hydraulics Group
Clerk

March 5, 1975 — A meeting of the Hydraulics Group of the Boston Society of Civil Engineers section was held on Wednesday, 5 March 1975 at the offices of C.E. Maguire, Inc. in Waltham, Massachusetts, with an attendance of 32 people.

The meeting was called to order by Group Chairman, Saul Cooper at 7:15 p.m. Chairman Cooper announced that at the next Hydraulics Group meeting in April a new slate of officers will be presented and an election will be held. Mention was also made of the upcoming annual meeting of the Society to be held at the Museum of Science on 30 April 1975.

Chairman Cooper introduced the guests speakers, Mr. Martin Weiss of the Metropolitan District Commission and Mr. David Kenyon of the Corps of Engineers. The subject of the presentation was, "Boston Harbor — Eastern Massachusetts Metropolitan Area Wastewater Management Study". The speakers discussed the various alternative plans and issues considered in arriving at the selected plan. Additionally, they outlined the remaining tasks to be completed. The study has progressed to the point where an alternative plan has been selected following a series of public meetings. Final adoption of the plan is scheduled for the latter part of September 1975.

A question and answer session followed the presentation. The meeting adjourned at 8:30 p.m.

Oscar L. Donati
Clerk

April 8, 1975 — A meeting of the Hydraulics Group of the Boston Society of Civil Engineers Section was held on Tuesday, 8 April 1975 at the Ralph M. Parsons Water Resources Laboratory at the Massachusetts Institute of Technology in Cambridge. Attendance at the meeting was 27.

The meeting was called to order by Vice Chairman Thomas Baron in the absence of Chairman Saul Cooper at 7:10 p.m. Mr. Baron introduced Mr. Frank Perkins, Chairman of the Nominating Committee who presented the following slate of officers for the 1975-1976 year:

Thomas S. Baron — Chairman
Oscar L. Donati — Vice-Chairman
Lee Wolman — Clerk
Edward Dunn — Executive Committee
William P. Darby — Executive Committee
Saul Cooper — Executive Committee

The above slate was elected unanimously by voice vote.

Tom Baron assuoedALYSIS, Inc. The subject of the presentation was "Urban Storm and Wastewater Modeling." Mr. Harley gave a brief outline of the various parameters that are generally used in the modeling of urban watersheds. He explained the various simulation techniques used in modeling and gave a brief summary of 10 existing runoff models currently in use.

A question and answer session followed the presentation. The meeting adjourned at 8:30 p.m.

Oscar L. Donati
Clerk

STRUCTURAL GROUP

December 11, 1974 — The meeting of the Structural Group was called to order by Chairman Dr. Kenneth Leet at 7:00. Dr. Leet turned the meeting over to Dr. Thomas Liu, President of the Society.

Dr. Liu briefly discussed the Society's present status and its plans for the future.Dr. Leet then announced that the BSCE-ASCE Seismic Committee had finished preparing the specifications on earthquake design for the new State Building Code. These were submitted to the Code Commission and will be published in the near future. Dr. Leet further stated that at the next section meeting a panel comprising members of the Seismic Committee would discuss the new Code provisions.The meeting was then turned over to Mr. Hans Hagen who moderated the program. A panel consisting of Mr. Kenneth Leach, Vice President of George B. H. Macomber Co.; Mr. Robert Catella, Project Manager of Harvard University; and Mr. Donald Reed of Wallace, Floyd, & Ellenzweig, Inc., who discussed the evening's topic, "Fast Track Design and Construction". The panel members discussed the pros and cons of fast track and their experience with this method of construction. An informative exchange of comments followed with the forty members present. The meeting was adjourned at 9:15.

Lawrence H. Ogden
Clerk, Structural Section

February 5, 1975 — The meeting of the Structural Group was called to order by Chairman Dr. Kenneth Leet at 7:00 PM.

The following members were nominated and elected to serve on the Executive Committee of the Structural Section for the 1975-1976 term.

Chairman: Mr. Hans William Hagen
Vice Chairman: Mr. Lawrence Ogden
Clerk: Dr. Frank Heger
Members: Mr. Frank Davis, Mr. Richard Foley, Prof. Kenneth Tsutsumi

Dr. Leet then introduced the speakers for the evenings panel discussion. The panel consisted of members of the ASCE/BSCE.

Seismic Committee: Dr. Howard Simpson, Dr. Othar Zaldastani, Professor Myle S. Holley Jr. and Professor Robert V. Whitman.

The committee was formed to develop seismic provisions for the new State Building Code. These provisions were recommended to the building code commission and incorporated with revisions in the new code. Dr. Simpson presented the history of the committee, its objectives and it's accomplishments. Dr. Simpson expressed the committees desire to continue to review and update its recommendations on a semi-annual basis. Dr. Zaldastani presented the history of other seismic code provisions. He explained the significant differences between these provisions and the New State Building Code. Dr. Zaldastani went on to discuss items that require further recommendations and implementations in the new code. Prof. Whitman discussed the implementation of the code provisions by the Design profession. The panel discussion was followed by a question and answer period with the 80 attending members of the society.

Dr. Thomas Liu, President of the BSCE Section was present in the audience. He expressed the Society's appreciation for the committee's year and one-half of work. He also announced that the board of Government had unanimously adopted provisions for the continual existance of the Seismic Committee.

Lawrence H. Ogden
Clerk Structural Section

April 8, 1975 — The meeting of the structural section was called to order by Chairman, Hans William Hagen at 7:15 pm.

Mr. Hagen announced the topics to be discussed in the Seismic Design Lecture series next fall. Final dates and location will be announced in September.

Lecture 1 Introduction, Fundamentals, Description of Code provisions
Lecture 2 Dynamic Analysis
Lecture 3 Cast-in-place Concrete
Lecture 4 Soils and Foundations
Lecture 5 Structural Steel
Lecture 6 Masonry
Lecture 7 Pre-fabricated Construction systems

The next order of business was the introduction of the Evenings speaker, Dr. Mark Fintel, Director of Engineering Services, Portland Cement Association.

Dr. Fintel spoke on Earthquake design of High Rise Concrete Structures. He compared the performance of shear wall structures and frame structures that he had studied in recent earthquakes. Dr. Fintel stressed that it is as important for the Buildings components to survive the earthquake as it is for the structure. He briefly presented the current theories of design and research programs being sponsored by the P.C.A.

The hundred guests participated in a

question and answer period which followed the presentation.

The meeting was held at M.I.T.'s center for Advanced Engineering Study.

Lawrence H. Ogden
Clerk Structural Section

TRANSPORTATION GROUP

February 19, 1975 — The meeting was held at Nick's Restaurant at 5:30 pm with approximately 92 members in attendance. The guest speaker was Mr. Frederick P. Salvucci, Secretary, Commonwealth of Massachusetts Executive Office of Transportation and Construction whose subject was "Future Transportation Policies of Massachusetts".

Chairman Rodney Plourde called the annual meeting to order and introduced the headtable. He then turned the meeting over to Mr. Bertram Berger to conduct general BSCES/ASCE business. Mr. Berger stated that at the November 4, 1974, meeting, the Board of Government voted to submit the Bylaw amendments to the members to be voted on at the regular Section meetings on January 8, 1975 and February 19, 1975. In accordance with Article 15, Amendments of the Bylaws and the ASCE procedures, the amendments will become effective if two-thirds of the members present and voting at each of the meetings vote in favor of the amendments, and the amendments are approved by the National Committee on Sections and District Councils.

The vote was unanimous. And, whereas the vote was unanimous at the January 8th meeting, the amendments became effective.

Mr. Plourde presented the slate for the 1975-76 officers of the Transportation Section:

Maurice Freedman — Chairman
Marvin W. Miller — Vice Chairman
Robert F. McDonagh — Clerk
Russell Barnes — Member
Leo DeMarsh — Member
Donald Graham — Member
Rodney Plourde — Member

Nominations were then opened to the floor. There were none; a vote was taken; and it was unanimous. Mr. Plourde then introduced the guest speaker for the evening, Mr. Frederick P. Salvucci, Secretary of the Executive Office of Transportation and Construction. Mr. Salvucci reviewed where the Commonwealth is headed in transportation and cited the problems of growth, economy, highway, and air.

One of the main problems his office will be dealing with is mobility of citizens. He stated that the Department of Public Works currently has a program planned for car-pooling. Another consideration is mobility for the handicapped. A major problem currently facing his office is rail access, and he went into great detail on this subject. Mr. Salvucci reiterated that there would be no major highway construction within the 128 parameter, unless perhaps depressing the Central Artery or a third harbor crossing.

The meeting was then opened to questions and answers.

Marvin W. Miller
Vice Chairman

March 19, 1975 — See Computer Group

BOSTON SOCIETY OF CIVIL ENGINEERS SECTION, ASCE

Committee Chairmen 1974-1975

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ANNUAL MEETING COMMITTEE	David D. Leahy
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