Improvement Priorities—The Factual Approach

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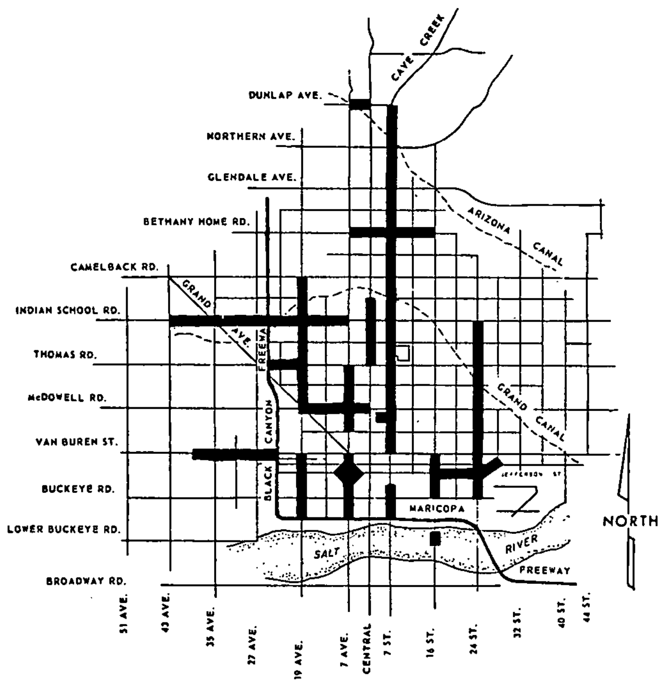
"Streets for the urban traveler" might well be the battle cry for the 1960's. Across the land one of the great unfulfilled needs of our urban areas is adequate street and freeway systems. Two important and timely contributions of this conference can be to emphasize the importance of efficient street utilization and the great need for additional funds to accomplish vital major street improvements.

The City of Phoenix has a strong and balanced street program. Since 1960 Phoenix has completed or has under construction over 35 miles of major street at a cost of



LEGEND:	Miles	Cost
CONSTRUCTED AND UNDER CONSTRUCTION	35.2	$ 18.2 Million

Figure 1. Major street progress, 1960-1967.

$18.2 million (Fig. 1). Although progress is good, it must be viewed in the perspective of the Street and Freeway Needs Studies of 1961 and 1965. Both of these studies clearly demonstrate that Phoenix is presently expending at about half the annual rate required to provide all the needed improvements of the major street system within a 20-yr period. The 1965 Deficiency and Needs Study factually showed that an annual investment of $8.2 million would be needed for 20 years to build major streets to serve present and future traffic. The current rate of investment is approximately $4 million per year.

This great urban street and freeway money problem was recently very clearly demonstrated by an excellent report published by the Arizona Highway Department. This report, "Arizona's Highway Needs—1965-1985," summarized the needs and revenues over a 20-yr period for State, county, and city levels of government. It concluded that there was a 20-yr deficit of nearly $900 million. Of this, over two-thirds (or more than $600 million) was allocated to city street systems.

The City of Phoenix has the major street plan, street classification system, workable street policies based on classification, the organization, and abundant facts. Our problem is money—or the lack of it. The funds that have been budgeted from 1960 to 1967 for major street construction, bottleneck elimination, and signalization are given in Table 1.

The funding problem leads to a three-pronged attack on street improvement:

1. Major street construction program—a city responsibility
2. Bottleneck elimination—a city responsibility
3. Local street improvement—property owners' responsibility

The balance of this paper will discuss two fronts—major street construction and bottleneck elimination. The projects that are included in these two programs must be selected to produce the maximum return in improved traffic flow and accident reduction from the funds that are available for street improvement. The factual approach to project selection and establishing priorities is essential.

MAJOR STREET CONSTRUCTION PROGRAM

The City of Phoenix' major street construction program is based on the adopted Major Street and Highway Plan shown in Figure 2. Street policies have been adopted in published form, which are geared to the adopted functional street classification map. A right-of-way standards map has also been adopted, which is based on the plan and functional street classification and tied to the street cross-section standards.

Each year the City publishes a new Six-Year Major Street Capital Improvement Program. The capital program is put together by a committee composed of the Public

TABLE 1

CITY FUNDS FOR MAJOR STREET IMPROVEMENTS 1960-1967—PHOENIX, ARIZONA

Year	Major Street Construction[a]	Bottleneck Elimination	Signals[b]	Total
1960-61	$ 1,582,000	$ 50,000	$ 85,000	$ 1,717,000
1961-62	1,892,000	78,000	59,000	2,029,000
1962-63	806,000	61,000	53,000	920,000
1963-64	969,000	80,000	22,000	1,071,000
1964-65	3,317,000	223,000	37,000	3,577,000
1965-66	5,454,000	133,000	67,000	5,654,000
1966-67	3,960,000	50,000	55,000	4,065,000
1967-68[c]	2,090,000	68,000	57,000	2,215,000
Totals	$20,070,000	$743,000	$435,000	$21,248,000

[a]Includes gasoline tax revenue bonds and city share of state gasoline tax; excludes Federal-aid secondary urban.
[b]New signals and modernization of old; excludes signals on major streets in the construction program.
[c]Tentative.

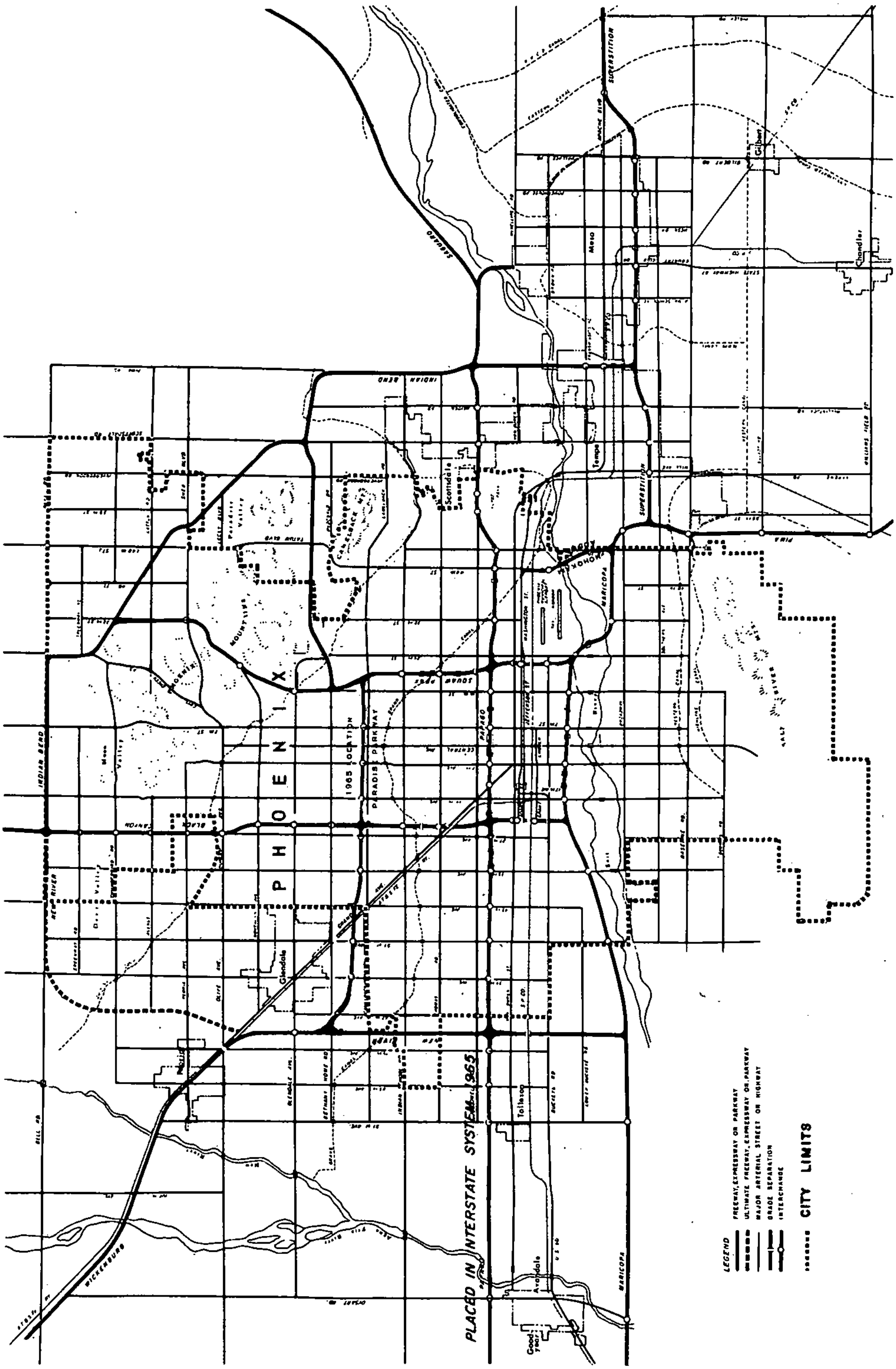


Figure 2. Major street and highway plan, Phoenix urban area.

Works Director, City Engineer, City Traffic Engineer, Planning Director, Real Estate Officer, Finance Director, Research and Budget Officer, and Street Improvement Administrator as chairman. The staff reviews and adjusts the program for any changing conditions or varying revenue forecasts.

The first three years of the 6-yr program are reasonably firm, as they are the design, right-of-way acquisition, and construction years. The second 3-yr portion of the program has flexibility for adjustment to meet changing growth patterns and new developments.

Traffic volume and travel time (delay) data and system development are major criteria for the development of the 6-yr program. The effort to develop long, continuous stretches of major street is shown in Figure 1.

Substantial work has been done toward the development of a major street priority formula. Most of this work is included in two earlier papers (7, 8). This research led to the development in October 1963 of a Priority Formula D, which follows:

MAJOR STREET IMPROVEMENT PRIORITY—FORMULA D

Element	Relative Weight (points)	
Delay rate per mile during peak hour		50
Collision index: 2 yr accidents/mile plus accident rate/mile		15
Structural condition		15
Surface and base	5	
Drainage	10	
Traffic: $\frac{\text{Present ADT}}{1{,}500} + \frac{\text{5-yr future forecast ADT}}{2\text{ (present ADT)}}$		20
Maximum possible points		100

Note: Projects to be listed in order of highest point value; program to be developed from list of projects and evaluation of budgetary and administrative considerations.

The delay rate and collision index point-rating scales are shown in Figure 3. Table 2 summarizes the test of Priority Formula D as applied to the projects in the adopted 1963 Six-Year Capital Improvement Program and an additional 25 test segments which had been selected to give a broad spectrum of street and traffic conditions.

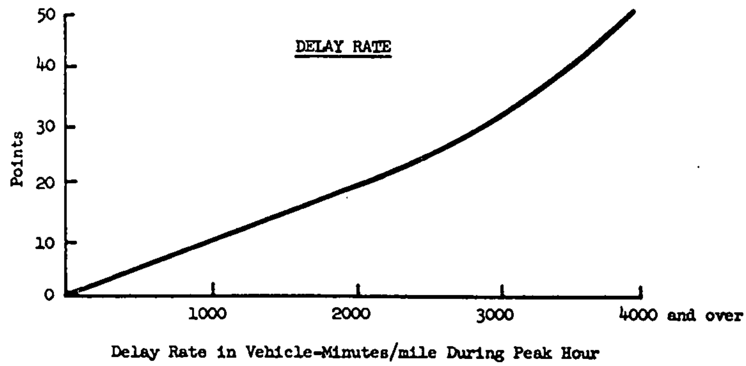
The conclusion was that a factual priority formula makes possible a listing of various projects in a relative priority list. It must be emphasized that at this point administrative, coordination, budgetary considerations, and judgment are most properly applied to develop the final capital program that will be the maximum benefit to the public. Further experience has indicated that facts may be applied to the development of a program without necessarily using the priority formula.

In addition to the more complex formula that has been previously described, a simple means of comparing several projects is to divide the measured average daily traffic by the number of traffic lanes. Although this is a rather crude yardstick, it has been found to be useful.

BOTTLENECK ELIMINATION PROGRAM

The bottleneck elimination program is an effective approach to easing high-accident or congested-location problems. It is a spot improvement program which allows Phoenix to take immediate action to solve specific problems. Generally, the best bottleneck project is a specific location that needs immediate action, but one where funds are not available for the construction of a long-term major improvement. It is important that the total street program properly balance the allocation of funds to these two efforts.

The bottleneck program is coordinated with the major street program. Quite often it is possible to use funds from the major street program to make a permanent



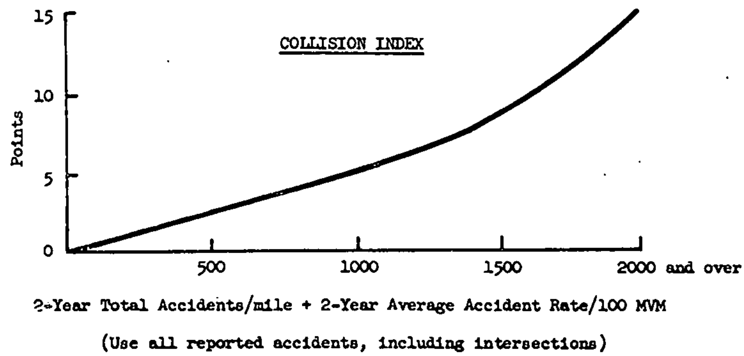


Figure 3. Major street improvement priority Formula C rating scales.

improvement which, at the same time, makes possible the elimination of a bottleneck. In every case, an effort is made to design a bottleneck project to fit into the future major improvements. Normally, a bottleneck project is not programmed unless the major street project is at least two years away.

Traffic Engineering makes full use of accident records, travel time studies, and traffic volume information in developing a priority list of these projects for consideration each budget year. The factual data are combined with a physical condition study to develop the plans for the actual project.

Traffic signals play an important part in the bottleneck elimination program. The signal priority list is developed annually, based on the traffic volume, pedestrian counts, accident records, the number of lanes, signal coordination, relation of school crossings, and special considerations. This factual priority list is reviewed and updated annually. A milestone was reached in the spring of 1967, when the signal priority list was submitted for budget review. This became a current program, with Phoenix having no intersections warranting signals that are not budgeted. New intersections will, of course, become warranted each year, as traffic continues to grow.

The important point is that the bottleneck program and the signal priority lists are carefully coordinated. In many instances widening or the elimination of a specific obstruction is necessary before a signal can be installed. In other words, the signal installation must be safe, and furthermore, the physical room to achieve the potential capacity of the signal must be provided.

TABLE 2

FORMULA D APPLIED TO ADOPTED 6-YEAR PROGRAM AND 25 TEST SEGMENTS

Major Arterial Street	Total Points (100 max.)	Year Scheduled (6-yr program)
Thomas Rd. Black Canyon to 19th Ave.	89.3	3
7th Ave. RR Structure/Jefferson to Grant-Lincoln	80.9	1
* McDowell Rd. 19th Ave. to 7th St. (as it was)	76.0	* *
Indian School Rd. 35th Ave. to Black Canyon	53.1	4-6
7th St. Maricopa Freeway to Grant-Lincoln	52.3	2
* Grand Ave. Thomas to Camelback (as it was)	47.0	* *
* 24th St. Buckeye to McDowell (as it was)	43.8	* *
19th Ave. Buckeye to Van Buren	43.8	2
16th St. Buckeye to Van Buren	43.8	3
* Van Buren 7th St. to 24th St.	43.2	
* Indian School Rd. 7th Ave. to 16th St.	41.7	
7th Ave. Osborn to Bethany Home	41.5	4-6
* 7th St. McDowell to Indian School (as it was)	37.7	* *
* 7th Ave. Van Buren to Thomas	35.0	* *
44th St. Thomas to Camelback	34.2	4-6
Van Buren 39th Ave. to Black Canyon	32.7	2
* 27th Ave. McDowell to Indian School	31.1	
24th St. Maricopa Freeway to Buckeye	31.0	4-6
Washington and Adams Tie-in	30.9	1
* 32nd St. Van Buren to Thomas	30.9	
7th St. Camelback to Glendale	30.8	2
* Camelback 16th St. to 32nd St.	29.3	
Dunlap 7th Ave. to Central	29.2	1
* 44th St. McDowell to Indian School	28.5	
* Van Buren 43rd Ave. to 27th Ave.	28.2	
24th St. Missouri to Lincoln Drive	28.0	4-6
Indian School 51st Ave. to 35th Ave.	26.5	4-6
* Central Ave. Camelback to Glendale	26.0	
16th St. Grand Canal to Camelback	26.0	
* 16th St. Camelback to Glendale	25.0	
16th St. Broadway to Buckeye	24.9	4-6
* Bethany Home 7th Ave. to 16th St.	24.2	3
7th St. Glendale to Dunlap	23.6	3
Thomas Rd. 43rd Ave. to 27th Ave.	23.4	4-6
* Broadway 7th Ave. to 16th St.	23.4	
* 19th Ave. Indian School to Bethany Home	23.4	
* Cave Creek 7th St. to 20th St.	23.1	* *
Papago Park Rd. Van Buren to McDowell	22.8	* *
44th St. Washington to McDowell	21.1	4-6
* 43rd Ave. Bethany Home to Northern	20.8	
* Thomas Rd. 51st Ave. to 35th Ave.	19.5	
* "Q" Ave. 43rd Ave. to Black Canyon	19.3	
* 59th Ave. Van Buren to Thomas	17.8	
* Van Buren 48th St. to 60th St.	15.6	
* Glendale Ave. 16th St. to 32nd St.	14.2	
* Baseline Rd. 16th St. to 32nd St.	8.9	

* Test segments.
** Construction completed.
Note: 75.3 miles of major arterial street rated.

During the past five years, 96 bottleneck projects have been completed. This is an average of nearly 20 a year. These projects ranged in cost from $500 to $45,000—the average was approximately $5,000. These costs include signals where necessary, the relocation of drainage structures, and widening and other improvements.

CONCLUSIONS

Factual data on traffic volume, travel time, and accidents provide the foundation for establishing priorities for major street construction programs and treating high-accident locations and eliminating congestion bottlenecks. These factual data should be applied to develop a balanced street program that will lead toward the construction of a total street system. One important aspect of the major street construction program is that it contributes significantly to the building of a city. This is particularly true in a new city such as Phoenix.

The end product of the continuing comprehensive cooperative urban transportation planning process must be provision of useful and attractive facilities to serve the public. The application of factual data to establish priorities is the key to securing the maximum benefit from the limited funds available for urban street improvement.

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