HIGH-QUALITY CITY-WIDE TRANSIT WITH BUSES

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The question examined was whether public transit could be made far more satisfactory and acceptable in middle-sized cities within a reasonable span of time. In that context the best answer was assumed to lie in greatly enhancing ordinary bus transit to make it a frequent, blanketing, day-and-night service. In the city, a frequency of 10 buses per hour from dawn till late evening is proposed. In the suburbs, commuter express buses would supplement the less ample regular-route service. The economics of enhanced bus transit were assayed by comparing the estimated expense of service, for a real city, with the expected revenue at several assumed patronage levels. The finding is that more appealing public transit is very likely to require subsidy, but the amount may be affordable. Because no technological breakthroughs would be required, buses might actually be in operation and providing superior service within a few years. Practical details on institutional and other aspects of such operations are discussed. Also demonstrated is the strong influence of existing streets and urban surroundings on the design of transit networks. To develop adequate public transit service within the new-style suburban environment will be difficult.

•THERE IS a belief that urban circulation and the urban environment might both be better if public transit had a far larger role. If that belief is valid it poses the challenge of providing greatly improved service that might attract many people—and doing so reasonably soon. This paper retraces work on that challenge relative to middle-sized cities, like those in upstate New York, that have retained an appreciable transit habit. Because the availability of advanced transit technology is not assured for major undertakings within the meaning of "soon", the basic challenge has been dealt with in terms of conventional equipment, chiefly buses.

The desired increase in the attractiveness of transit will surely depend on improvement in the quality of service offered. Because that might be expensive, the study was concerned with the economics of proposed improvements. The requisite improvement could doubtless be achieved by a generous supply of service, either on fixed routes or on a demand-responsive basis. The latter, innovative form of transit was deemed an inappropriate answer at this time for several reasons: Practical experience with demand-responsive transit operations is limited. Their applicability over the full extent of a middle-sized city has not been established. And there is lack of knowledge about the quality of service obtainable at any specific level of expense. By contrast, the relation between expense and quality seems more apparent for regular-route transit, and its total expense may be estimated readily. Conventional transit operations therefore form the basis for this study.

ASSUMPTIONS

The way to increase the appeal and use of transit seemed conceptually simple: The service should attempt to approach the characteristics of the private auto. In most respects buses do not duplicate autos and should not try to. But two qualities afforded by the auto do deserve emulation: availability (starting out whenever desired) and

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accessibility (getting from one place to any other). Those qualities might in principle be approximated by a blanketing, frequent, day-and-night, local bus service. Ideally, transit patrons then might gain some of the spontaneity and directness enjoyed by motorists.

To satisfy the criterion of adequate accessibility, it was assumed that buses would operate over an extensive route network patterned on a regular, orthogonal grid. (That pattern has the advantage of conceptual simplicity and seems well suited to serving scattered desire lines without forcing most travelers through downtown.) Routes might be spaced in a ½-mile-square mesh near the center; the grid might open to ½- by 1-mile spacing farther out, even covering some of the less dispersed suburbs. Few bus patrons using a network so fine-meshed should have to transfer more than once, and according to traditional standards the routes would be reasonably accessible.

A decent semblance of good availability could be obtained with 6-minute headways or a frequency of 10 buses per hour (so-called 10-bph service). If the headways are kept uniform, the buses need not be operated to a specified schedule. Patrons would then be freed from the inconveniences of traveling by timetable and clock. The 10-bph service would be operated in both directions over the entire bus-route grid through two straight shifts (nominally about 17 hours) on weekdays. Service at other periods, though not as frequent, would still offer comparatively good availability.

An economic assessment of this blanketing frequent-service concept was carried out using greater Rochester as the test site. Framed to the preceding standards of frequency and pattern, a hypothetical bus transit system (Fig. 1) was tested against the data base of the Rochester Metropolitan Transportation Study (RMTS). Rough economic calculations suggested that such a system might not be financially beyond reason. On the strength of that, further investigation was decided upon.

ROUTING ON EXISTING STREETS

The first task was to fit the idealized transit grid to the real streets of greater Rochester. It was soon evident that uniform route spacing must be compromised by the strongly radial street pattern within the city and by major barriers such as the river bisecting the city from north to south. Routing principles were therefore examined briefly in seeking alternatives to the desired orthogonal grid. A few ideas on transit routing resulted. For example, continuous routes are preferable to a chain of segments. Figure 2 shows that, at the price of some route indirectness, many patrons crossing the river would be spared multiple transferring.

In the suburban setting southeast of Rochester the attempt at network design met other adversities. Single-portal communities, traffic-impeding convolutions of subdivision streets, and the lack of urban continuity ("sprawl") all compounded the design problem. It is uncommon in that kind of setting to find essentially parallel highways spaced at intervals suitable for a transit route grid readily accessible by walking. Thus the proposed ½- by 1-mile suburban grid remains largely unattainable. Figure 3 shows the sparse route layout finally devised for the southeast section. It shows little resemblance to the tidy idealized grid superimposed on the corresponding section of Figure 1 (identified by corner tics).

The lessons taught by these efforts were twofold:

1. In cities lacking a regular street layout, the ideal of a uniform grid of transit routes may be quite infeasible; uneven spacing and irregular transit coverage must be accepted, along with wasteful double or triple frequency on certain route segments.
2. In most new suburban settings a comprehensive transit network catering primarily to pedestrian access is almost impossible to design and probably difficult to justify.

TRANSIT AND THE METROPOLITAN PATTERN

These experiences with transit routing lent support to a view of metropolitan development that is cognizant of transit. Not only is the performance of that mode in a given locale affected by the orientation of trips and the density of demand, but the street

Figure 1. Hypothetical transit grid.

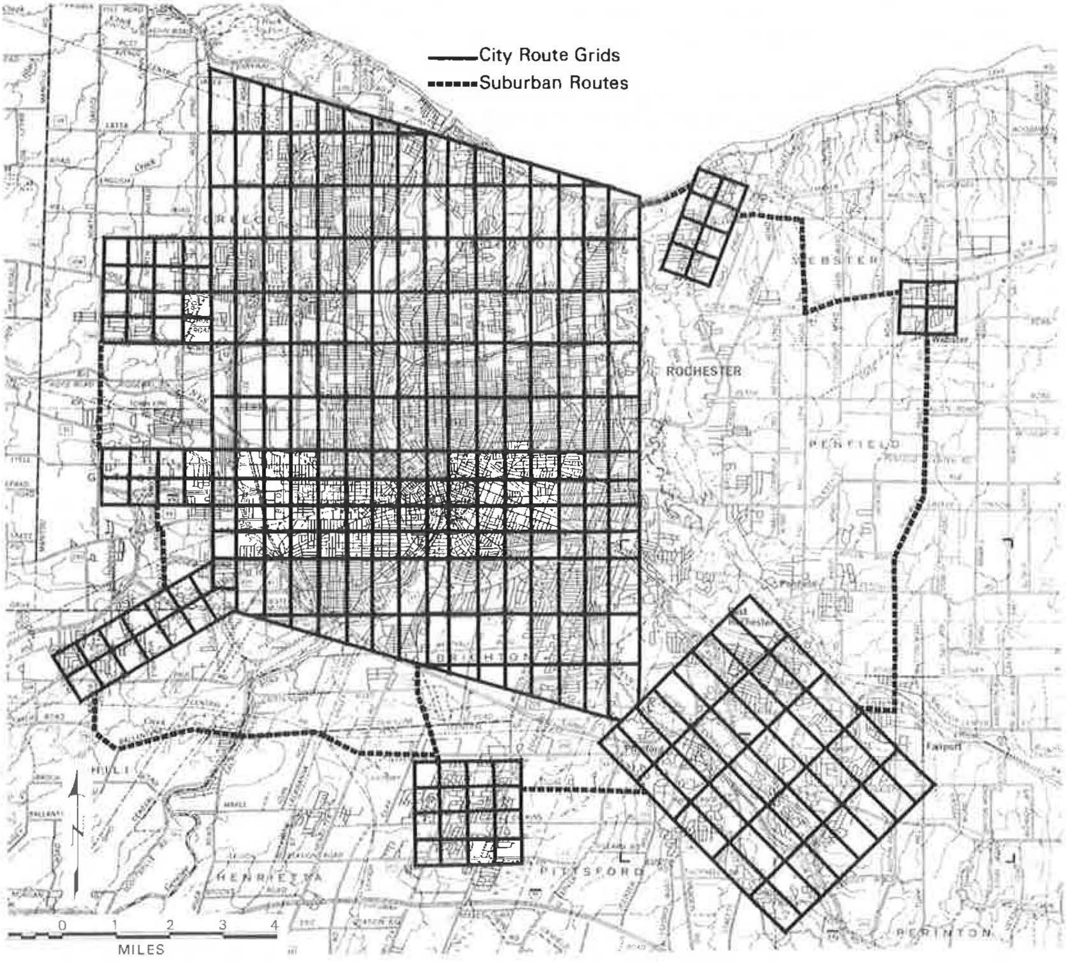
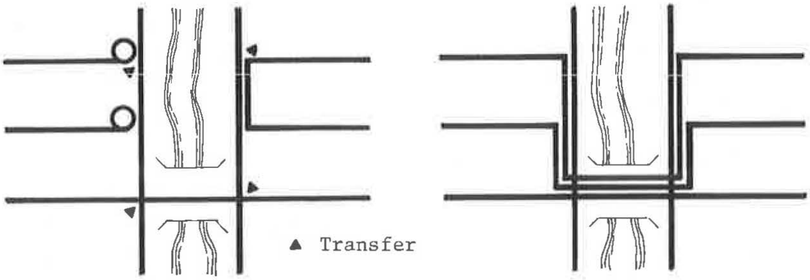


Figure 2. Indirect continuous routes save transferring.



pattern is also coming to be recognized as affecting service (1). The character of the streets and arterials can impinge on the movement of buses and on the ease of patrons in plying between buses and home. Figure 4 shows a middle-sized city and its environs. Conceptually, this metropolis comprises types of urban settings that are variously conducive or adverse to transit service: the central business district (CBD), the entire city, outlying older settlements, modern subdivisions—all of them set in a matrix of so-called sprawl. Disregarding municipal boundaries, the city may be regarded as the principal urban cluster that was built up by 1940, with a pattern and grain generally oriented to walking and public transit.

Such insights on metropolitan land used (and possible life-styles) gave an impetus for reappraising the notion of pervasive and frequent regional transit. In the city a high-quality service did still seem important as a modal alternative. Hopefully it would serve many persons for a variety of trip purposes. Hopefully, too, it would gain enough patronage to yield ample benefits to the public at large. Therefore the notion of frequent service blanketing the city still seemed relevant. A contrary appraisal was reached, though, for the suburbs. By the nature of their spatial patterns they are heavily automobile-dependent. Public transit has only ancillary roles in that environment, such as serving long-haul commuters and perhaps relieving parents of some of the chauffeuring of youngsters. (This is not to argue that there is hardly need for suburban transit. Much of that need, though, is apt to be denied fulfillment. The newer patterns of urban development often seem quite incompatible with forms of mobility that do not use personal motor vehicles.)

TOWARD A REALISTIC PROPOSAL

Evidently, then, any dramatic improvement in the quality of metropolitan transit should in a sense match the distinct kinds of settings to be served. A more practical proposal was accordingly put together, a group of services under the name "Tranef" (for transit network frequent). It is meant to serve the middle-sized city and its surroundings through this decade and the next. Four principal elements make up the Tranef proposal: enhanced city service, enhanced suburban service, commuter express service, and city flyer service.

The fundamental element, "enhanced" city transit, is shown in part by Figure 5. This service would be operated over a relatively fine-meshed grid that may be likened to the traditional radial transit routes supplemented by numerous crosstown routes. Enhanced suburban service, as shown in Figure 6, might traverse a few coarse grids linked by routes along major highways. Commuter express service, the third element, would be an operation during peak-hours mainly oriented to suburban commuting. In Figure 7 the solid lines trace some of the morning express trips in which buses typically might make a few residential stops and then run closed-door to a distant workplace or to the CBD. Figure 8 shows city flyer service: limited-stop operations along major city streets. City flyer buses would be scheduled in common with the enhanced suburban service, and indeed the two elements would function as extensions of each other.

Table 1 summarizes the availability by time period of the major elements of Tranef in the city and the suburbs. For any given element the frequency of service on workdays may differ from the frequency on other days and may also differ between the long daytime period and the late-night "owl" period. For anyone not familiar with public transit the frequencies specified in the table may have little real significance, but one may perhaps appreciate that the 10-bph specification means that a bus would go by in each direction every 6 minutes—or in about the time it takes to walk 3 blocks.

Tranef also has a fifth, and minor, element. It consists of the supplementary services that might be operated by the Tranef organization or by private carriers in coordination with the system. Examples include the following:

1. "Sectored" demand-responsive operations—Place- or time-restricted demand-jitney service for larger subdivisions might be patterned after the GO transit operation in suburban Toronto.

Figure 3. Suburban transit network.

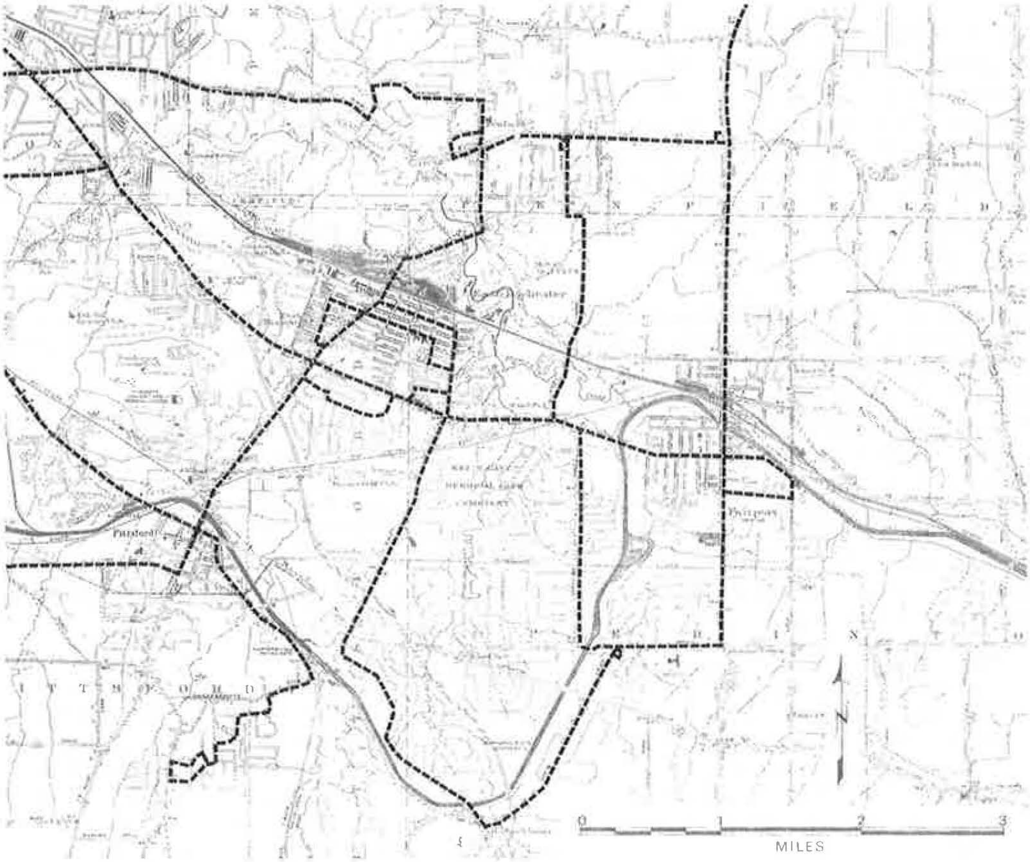
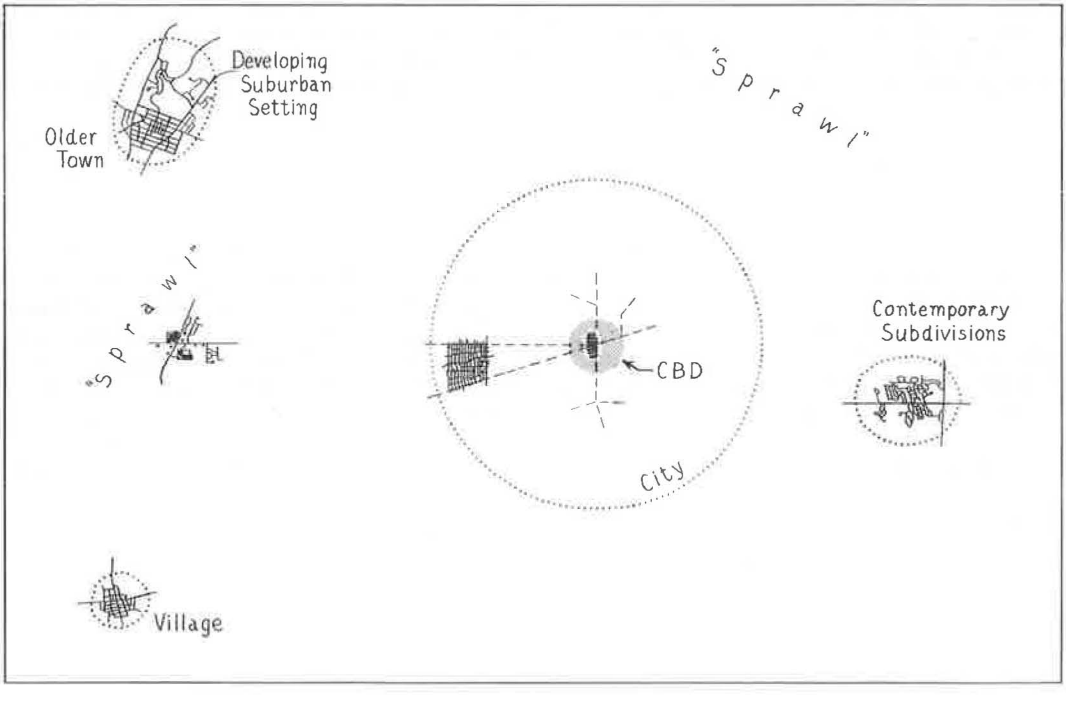


Figure 4. Middle-sized city and its surroundings (conceptual).



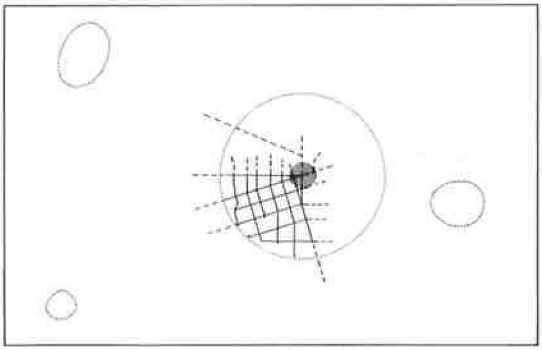


Figure 5. Enhanced city service (service frequency: weekdays, 10 buses per hour; Saturdays, Sundays, and holidays, 5; owl, 3).

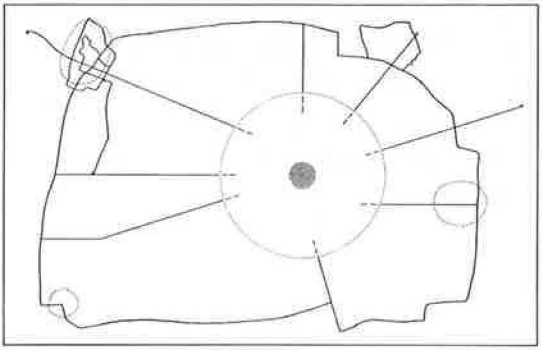


Figure 6. Enhanced suburban service (service frequency: weekdays, 4 buses per hour; Saturdays, Sundays, and holidays, 2; owl, 1).

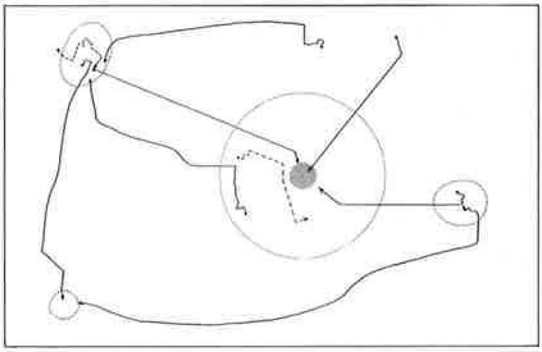


Figure 7. Commuter express service.

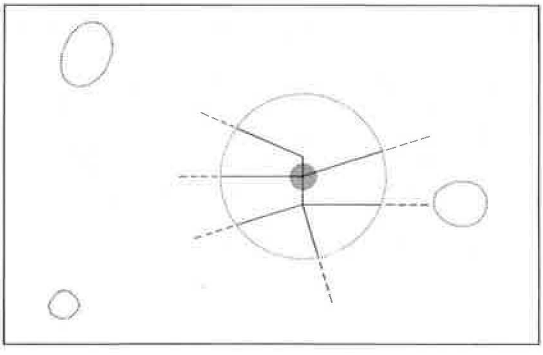


Figure 8. City flyer service (service frequency: weekdays, 4 buses per hour; Saturdays, Sundays, and holidays, 2).

2. Commuter trippers—Small buses might make twice-daily trips on special routes in the city, collecting employees from a residential locality and taking them to a common place of work. (This idea is illustrated by the longer dashed line in Figure 7.)
3. Subscription-jitney operations—In outlying communities, jitneys could transport commuters on a subscription basis between their homes and a commuter express terminal (as indicated in the northwest portion of Figure 7).
4. Commuter club arrangements—Using chartered buses, subscribers could operate a private service patterned on the successful Reston practices (2).

It may be instructive to examine a sample Tranef network (for enhanced city and suburban service) with respect to urban development and conventional transit routes. Such a network was laid out for metropolitan Rochester and is shown in Figure 9. In Figure 10 the contemporary public transit routes are superimposed, for comparison, over a faint copy of the Tranef network. Notwithstanding some similarities within the city, the Tranef network would function differently owing to both its additional crosstown routes and its unseen dimension of enhanced availability.

Viewing Tranef as a system, clearly it would supply good service where transit is most feasible: in the city. Enhanced service in the more developed suburbs may be regarded chiefly as an accommodation furnishing some mobility for youngsters and others without autos. By contrast, the commuter express operations (not mapped) cater to the most servable portion of the suburban market: long-haul commuters unwilling to fight traffic. Altogether, Tranef can be seen as a package of various transit elements that attempt to offer enough appeal to enough people in diverse groups to win the support necessary for a viable system.

Economics

Would Tranef be too expensive? Using greater Rochester as the test site, system economics were tentatively assessed by comparing assumed revenues with estimated expense. The specifications previously outlined, together with the network mapped in Figure 9, determine a fixed amount of service whose total annual expense may be estimated readily.

Input data for the economic assessment of city flyer and enhanced services are given in Tables 1 and 2. The assumed average speeds are believed to be reasonable. The data are reduced to the expense parameters of estimated fleet size, daily bus-hours, and daily bus-miles as follows:

$$\text{No. of buses} \quad B = F\left(\frac{L \cdot 2\text{ ways}}{S}\right)$$

$$\text{Bus-hours of travel } BHT = D \cdot B$$

$$\text{Bus-miles of travel } BMT = S \cdot (BHT)$$

where

F = service frequency in buses per hour (one way);
L = length of route in miles (one way);
S = average operating speed in miles per hour; and
D = duration of service at a specified frequency in hours.

Expense parameters for the enhanced and city flyer elements are calculated and aggregated to annual average daily (AAD) amounts in Table 3. Table 4 summarizes the calculated fleet size. Tranef commuter express operations were synthesized from an examination of RMTS home-to-work trip-making data. Half a dozen district pairs were identified as candidates for suburban commuter express service, which was assumed to offer 8 runs per peak period on 12-minute headways. To assure that the expense of commuter operations was not understated, bus-miles and other parameters were arbitrarily doubled. They were further expanded by 60 percent to cover supplementary commuter trippers and commuter-club operations.

Table 1. Tranef availability: buses per hour for major elements, times, and locations.

Service	Weekdays Daytime (17 hours)	Weekdays Peak	Weekdays Owl (7 hours)	Saturdays, Sundays, and Holidays Daytime (17 hours)	Saturdays, Sundays, and Holidays Owl (7 hours)
City					
Enhanced	10		3	5	3
City flyer	4			2	
Commuter express		Varies			
Suburban					
Enhanced	4		1	2	1
Commuter express		Varies			

Note: Service of 5 buses per hour frequency or less is operated to schedule.

Figure 9. Tranef network (enhanced services only).

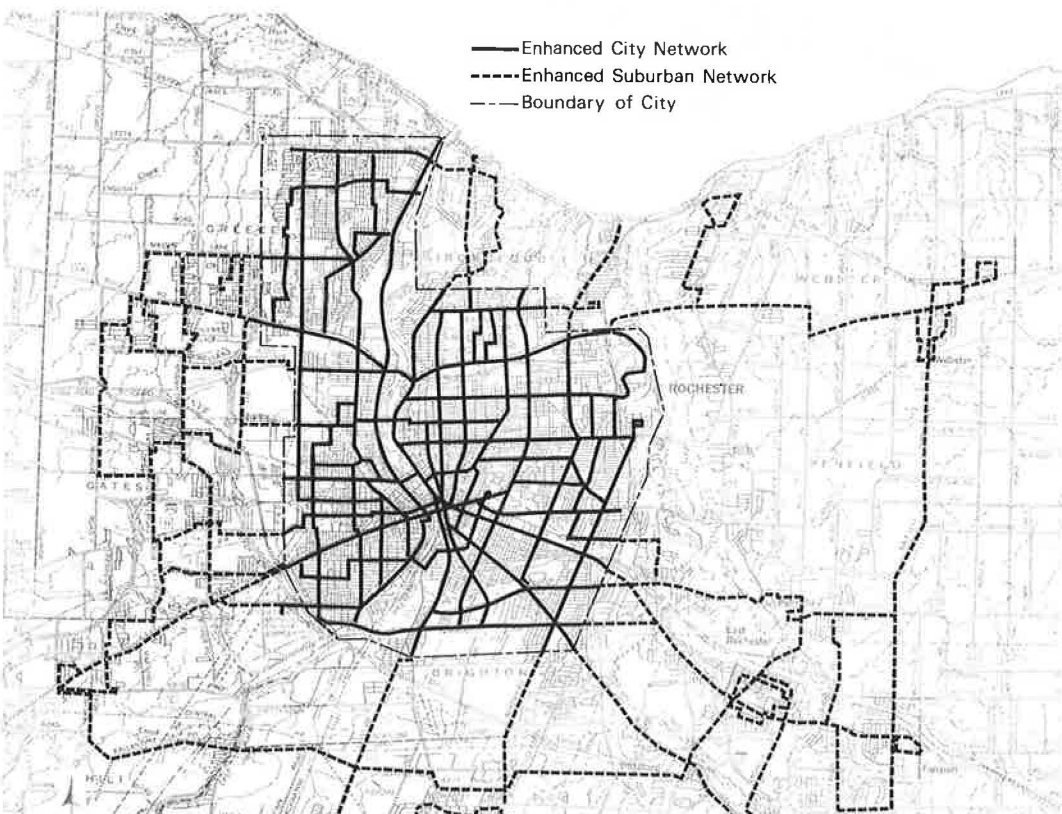


Figure 10. Contemporary public transit network.

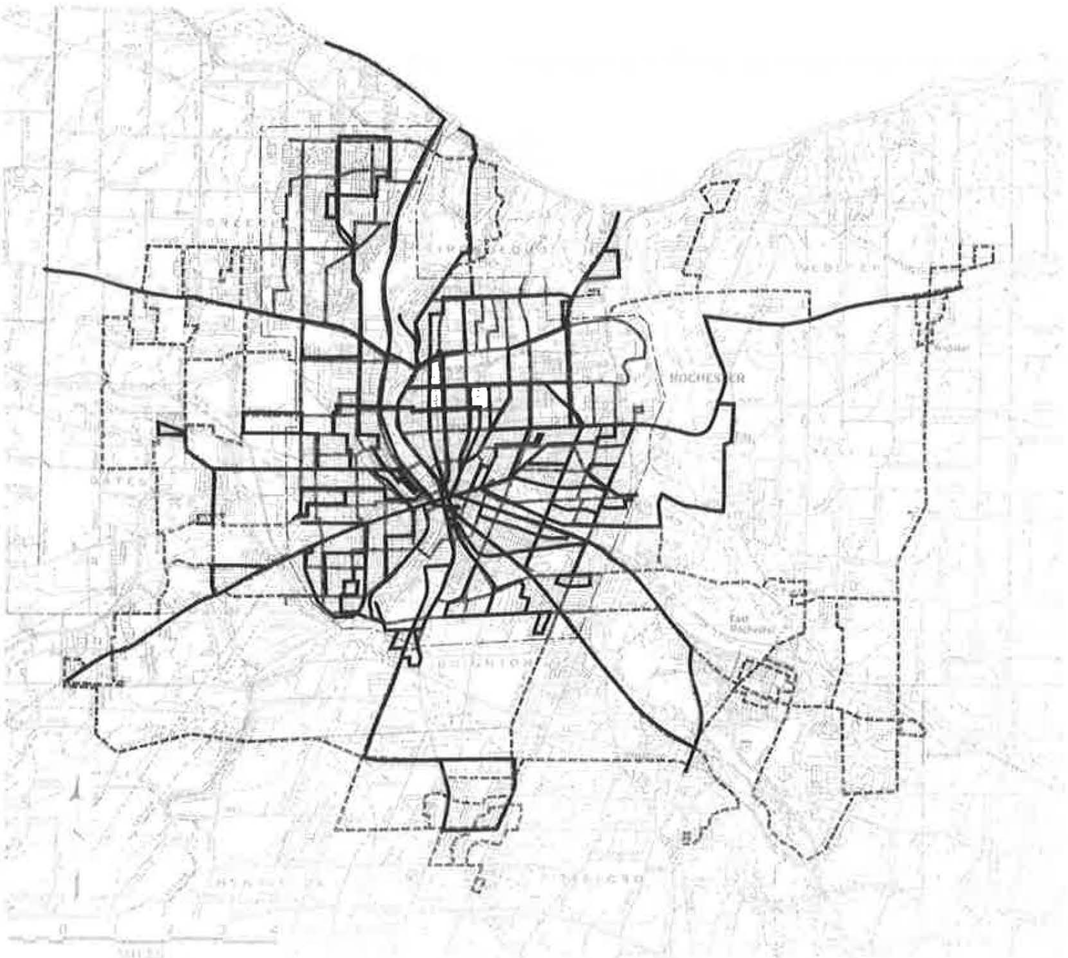


Table 2. Tranef route mileage and assumed speeds.

	Average Speed (miles per hour)			
Network	Weekday	Night	Sat., Sun., Holiday	Route Miles
City	12	16	—	168
City flyer	15	—	16	61
Suburban	16	20	—	150

Table 3. Calculation of annual bus-hours and bus-miles.

	City			Suburban					BHT		BMT	
Service	$F\left(\frac{L \times 2}{S}\right) = B$	B × D = BHT	BHT × S = BMT	$F\left(\frac{L \times 2}{S}\right) = B$	B × D = BHT	BHT × S = BMT	Days Per Year	AAD Factor	Σ	AAD	Σ	AAD
Weekdays												
Enhanced	$10\left(\frac{168 \times 2}{12}\right) = 280$	280 × 17 = 4,760	4,760 × 12 = 57,120	$4\left(\frac{150 \times 2}{16}\right) = 75$	75 × 17 = 1,275	1,275 × 16 = 20,400	250	0.685	6,035	4,134	77,520	53,100
City flyer	$4\left(\frac{61 \times 2}{15}\right) = 32.5$	32.5 × 17 = 550	550 × 15 = 8,300				250	0.685	550	377	8,300	5,690
Owl												
Enhanced	$3\left(\frac{168 \times 2}{16}\right) = 63$	63 × 7 = 440	440 × 16 = 7,060	$1\left(\frac{150 \times 2}{20}\right) = 15$	15 × 7 = 105	105 × 20 = 2,100	365	1.000	545	545	9,160	9,160
Saturdays, Sundays, and holidays												
Enhanced	$5\left(\frac{168 \times 2}{12}\right) = 140$	140 × 17 = 2,380	2,380 × 12 = 28,560	$2\left(\frac{150 \times 2}{16}\right) = 37.5$	37.5 × 17 = 640	640 × 16 = 10,200	115	0.315	3,020	951	38,760	12,210
City flyer	$2\left(\frac{61 \times 2}{16}\right) = 15.2$	15.2 × 17 = 260	260 × 16 = 4,150				115	0.315	260	82	4,150	1,310
AAD totals										6,089		81,470
Enhanced										5,630		74,470
City flyer										459		7,000

The total expense for the entire Tranef service hypothetically supplied in the test metropolis is given in Table 5. (Jitney operations are not considered.) The expense formula is based on economic analyses by Simpson and Curtin recast to a 1971 level and rounded to

$$\text{Expense} = 1.075\ [(\$7 \times \text{BHT}) + (20¢ \times \text{BMT}) + (\$20 \times \text{bus-day})]$$

(The first term has been increased to $7 per bus-hour to reflect influences possibly peculiar to Tranef conditions of employment.)

For the concluding phase of the economic assessment, hypothetical operating revenue was calculated from patronage equivalent to several assumed levels of use (share of total trips). In 1963, the Rochester Transit Company is estimated to have achieved a 12 percent transit usage in an effective service territory of 340,000 population. Balancing subsequent decline against the large service improvement conjectured for Tranef, its patronage was calculated at use levels ranging from 15 to 30 percent of total trips. Regular Tranef operations were estimated to serve a population of 400,000. An average of 2.3 weekday trips per capita was assumed for trip-making via all modes. Tranef revenue was annualized on an assumed basis of 320 equivalent weekdays per year.

Calculated average weekday trips (AWT) and annual patronage, at four levels of use, are given in Table 6. The related economic indicators are based, where appropriate, on an average fare of 35 cents. The figures are intended to reflect all expenses, including depreciation, as though system finances were entirely a local obligation. For reference a monthly "household tax" required to subsidize the deficit is tabulated; this subsidy and the break-even fare are shown in Figure 11 through the expected range of the Tranef market share.

Tentatively, two inferences may be drawn. First, Tranef finances are highly sensitive to the volume of patronage. Second, at prevailing patronage and fare levels, Tranef does not seem hopelessly uneconomic, although a need for subsidy is very likely. (Yet, if usage as high as 25 percent of all person trips could be sustained at a fare of 40 cents, unsubsidized operation might be possible.)

SIZE OF A DEMONSTRATION

Amid rising environmental concern, Tranef emerges as a relatively near-at-hand means to lessen urban traffic pollution. The concept of a package of useful transit services covering a broad territory—not merely traversing a single corridor or sector—may be innovative enough to warrant a demonstration. To gauge what that might entail, some rough calculations were made using the Rochester data as a basis. The additional commitments required for a full demonstration there are summarized in Table 7.

It is interesting to note that the $20 million investment equals the purchase price of some 7,000 to 8,000 new autos. That is about half the number of autos replaced in a single year within the Tranef service territory. In "regional" terms, then, a demonstration would not represent a heavy capital commitment, although an operating subsidy that seemed substantial might be needed.

A proper demonstration of Tranef would necessarily be large and costly and ought to be carefully structured. The temptation to tailor away uneconomic service—and with it, perhaps too much of the basic package—should be resisted. The demonstration should continue sufficiently long—say, half a decade—to allow people and institutions to begin adapting to the new services.

It is evident that a 5-year Tranef demonstration would cost over $50 million. What might it show? It would bring a new order of mobility to many persons in the sizable group that is currently hobbled by not having an auto for personal use. Another issue is the degree to which superior extensive bus transit in a middle-sized city could affect the environmentally baneful dependence on private autos. In this regard, the demonstration might reveal (a) whether metropolitan traffic pollution could be abated significantly by Tranef; (b) whether traffic congestion and parking competition would be noticeably eased anywhere; (c) what steady-state transit patronage might be attained; and (d)

Table 4. Calculated fleet size.

Service	Peak	Spares	Total
Enhanced, city	280	30	385
Enhanced, suburban	75		
City flyer	33	2	35
Commuter express	56	4	60
Totals	444	36	480

Table 5. Annual expense of Tranef service.

Service	Expense Calculation	AAD Expense (dollars)	Annual Expense (millions of dollars)
Enhanced	1.075 [(7 × 5,630) + (0.2 × 74,470) + (29 × 385)] =	66,654	24.33
City flyer	1.075 [(7 × 459 + (0.2 × 7,000) + (20 × 35)] =	5,711	2.08
Commuter express	1.075 [(7 × 288) + (0.2 × 6,160) + (20 × 60)] =	4,782	1.74
Total annual expense of service			28.15

Table 6. Economic characteristics of Tranef at selected levels of use.

Item	Weekday Level of Use (percent) 15	20	25	30
Average weekday trips (thousand trips per day)	138	184	230	276
Patronage (million trips per year)	44.1	58.9	73.6	88.4
Revenue at 35 cents (million dollars per year)	15.4	20.6	25.8	30.9
Deficit (million dollars per year) (on $28.2 million expense)	12.8	7.6	2.4	(+2.7)
Break-even fare (cents)	64	48	38	32
"Household tax" (dollars per month) for 3.1 persons per household	8.30	4.90	1.55	—

Figure 11. Break-even fare, or subsidy required, relative to use.

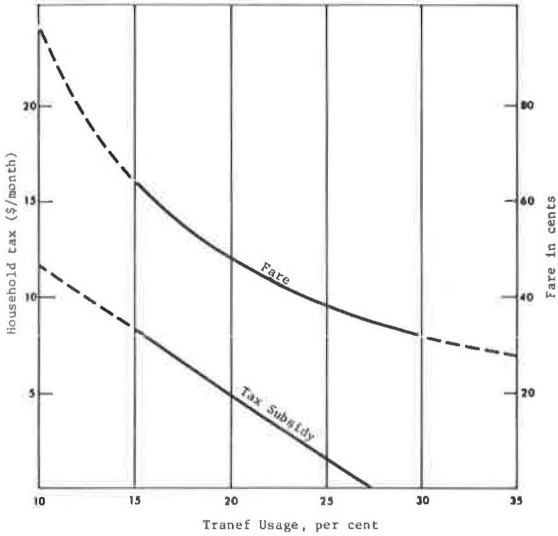


Table 7. Added commitments needed for Tranef service (RMTS demonstration).

Investment		
New buses, 220 at $45,000		$10 million
Equipment and garage, at $20,000 per bus		4 million
Start-up: promotion, training, etc.		6 million
Total investment	Approximately	$20 million
Labor		
New employees: approximately 1,000 (Current transit employment would be trebled.)		
Subsidy		
Uncertain, but might range between $6 million and $12 million annually.		

whether this kind of public expenditure could effectively be substituted for capital investment in transport facilities. In light of current controversy about building urban freeways and financing rail transit, the possible substitution of a moderate ongoing expense for a heavy fixed investment has major significance.

PRACTICAL CONSIDERATIONS

Tranef could be put into effect almost without recourse to new construction and new technology. Still, to do that would entail considerable effort beyond acquiring the additional financing, labor, and equipment. As evidence, there follows a sampling of the many considerations to be resolved in getting Tranef service under way.

Labor Relations

However vexing the problem of preventing any break in Tranef service may be, it must be faced. Tranef would expand transit employment markedly—in part at public expense—while making the community more dependent on the service. Thus the public is entitled to the security of uninterrupted service. Means of promoting three-way cooperation among Tranef management, labor, and the using-subsidizing public must have a high priority in any serious venture into the new concept.

Crossing Protection

Trying to cross a 4-lane suburban highway coursed by a large volume of fast-moving traffic can be an unpleasant and even deadly hazard for transit patrons, especially in winter dusk. A satisfactory remedy is not known. One possibility would be to restrict Tranef suburban stops to signalized intersections, at least during morning and evening peak traffic. (A demand-jitney service linking bus stops and homes could make that restriction more acceptable to patrons.) A more radical remedy would be to grant the transit buses, while stopped on busy highways, the same traffic-halting authority by which school buses are now protected.

Exclusive Bus Lanes

Exclusive transit lanes on arterial streets might significantly aid the speed and dependability of Tranef buses during the peak-traffic periods. Given the competition for street space during those periods, the designating of a lane for a single 10-bph route might be difficult politically, whereas a lane shared by two duplicating routes could much more easily be deemed warranted.

To keep transit lanes clear may require relentless enforcement. A sound legal base should be established for the necessary prohibitions, tow-away activities, and prosecution; penalties and court jurisdiction must also be clear. One approach to enforcement would depend on the local police to patrol and tow away under contract with the transit agency. An alternative approach would cede the exclusive lanes (by statute) for specific daily periods to the transit authority, whose own deputies, possibly off-duty police officers, would be responsible for removing and impounding any vehicle blocking a lane.

Prompt towing away of parked and "stopping" vehicles may be expensive, relative to the cost of a bus lane. For example, to create 10 lane-miles at an estimated $5,000 per mile would cost some $50,000. If enforcement activities used one officer at $5 per hour for 4 hours daily on 250 days per year, the expense would be $5,000 annually—or 10 percent of the capital investment.

Route Plowing and Sanding

All transit routes and bus stops ought to have high priority for snow and ice control. The usual practice of plowing street snow up onto the space between curb and sidewalk creates impediments for pedestrians. This plowed-up snow should be removed from bus stops so that patrons can get out to buses and back to the sidewalk conveniently and safely and with less delay. Legality and finances permitting, the sidewalks all along transit lines should also be kept passable—a task for which specialized equipment is now available. Indeed, the importance of walking as the primary access to transit suggests that the winter serviceability of sidewalks extending for several blocks from transit lines should be given attention.

Relations With Taxi Industry

The publicly assisted Tranef buses might, on first impression, appear detrimental to the taxi business. That could prove to be so. Yet the two modes are so inherently different that they would not, or should not, be in competition. Such an assertion gains support from a court decision in Michigan in the case of demand-jitney operations inaugurated by the Ann Arbor Transportation Authority.

Doorstep service is recognized as a feature that should, if feasible, be added to fixed-route transit both in the suburbs and in many localities at night. Incorporation of demand-jitney operations into the Tranef system has been mentioned previously, and such arrangements might be worked out cooperatively between Tranef and taxi interests.

Headway Regulation

The Tranef concept avoids the inconvenience of schedules by operating much of the service unscheduled but frequently. Uniform headways are then imperative, lest the benefit be dissipated by service gaps that inflict unexpected waiting on some patrons. A reason for instability of short-headway unscheduled service is evident: If one bus runs ahead, the following bus may become increasingly late in attempting to cope with a growing accumulation of patrons. (Instability can be serious on heavily patronized lines. One Canadian transit property is reported to have exacted the penalty of a day's pay for running early by even 1 minute.) Conventional scheduled service also becomes undependable and inconvenient when buses are early or late, causing missed connections or extra waiting.

The need for an inexpensive, automatic means for monitoring and regulating buses in service has long been felt (3, 4). Scattered reports on the development and demonstration of such equipment exist in the literature, but no complete system is known to be commercially available at present. Headway regulation is an example of a seemingly secondary matter that nonetheless deserves careful attention in the implementation of Tranef service.

CONCLUSION

In both regular-route and specialized express service, buses can provide relatively good coverage and frequency throughout the city while also meeting the needs of suburban commuters. Thus labor-intensive bus transit can distribute the benefits of improved service rather than concentrating them in a single sector, as often happens with capital-intensive transit improvements.

The economic results obtained in this study are preliminary and pertain to a particular city and therefore may not be applicable elsewhere. Nonetheless this paper is a useful reminder of the merits of buses in the planning of better transit for middle-sized cities.

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