WABCO

PITTSBURGH'S

pat-metro

A COMPLETE MODERN RAPID TRANSIT SYSTEM

Beginning with immediate improvements to South Hills rail service, trackage, and vehicle, WABCO proposes a program culminating five years hence in a 28-mile PAT-METRO rapid transit system. This system of regional quality and scope, having new automated trains running on modern, quiet, grade separated rail rights-of-way, can be accomplished while maintaining and improving existing revenue service for an expenditure of $114 million.

In this proposal, WABCO describes the steps by which PAT can build this 28-mile PAT-METRO system, equivalent to almost half of the 60-mile system covered in the PBQD study of 1967, for less than one eighth of its cost. These steps are fully capable of further extension to the entire PAT service area and beyond.

PITTSBURGH'S pat-metro

A COMPLETE MODERN RAPID TRANSIT SYSTEM

PROPOSED BY

WABCO

FORWORD

This proposal presents the results of approximately six months of work by the WABCO MASS TRANSIT CENTER and several consulting experts. This work by WABCO and its consultants covered fields on modern US & European rail vehicle costs, design and performance, subsoil conditions encountered in recent excavations along proposed subway routes, unit costs for tunneling, cut and cover, and other major construction techniques applicable to the several portions of the 28-mile route proposed. It also included studies on modern welded rail, tie, and ballast costs and installation techniques, sub-stations, rectifiers, and power feeder costs and requirements as well as the braking, communications, signaling, and automated train operation areas with which WABCO has long been identified. WABCO gratefully acknowledges the co-operation and useful information for this proposal received from PAT's operating staff and from the Pennsylvania Department of Highways.

WABCO was encouraged to undertake this effort at no cost to PAT on December 12, 1968. At that time, Mr. F. J. Close expressed interest in Mr. L. E. Walkley's verbal description of the promising results of 1963 WABCO studies which showed that substantial improvement in trolley service between South Hills and Downtown could be obtained merely by improving the signaling and automating the switches, interlockings, and vehicles. The overwhelmingly important implication of that early study was that truly spectacular results could be obtained with minimum cost and delay by similar modernization of the remaining portion of the existing rail system. But this implication was unfortunately lost in controversial debate over the subordinate question of whether it was feasible to install new automatic train operation (ATO) equipment on the deteriorated and obsolescent fleet of PCC cars *or* to modify them for multiple unit or two directional operation.

In this present proposal, WABCO puts these questions in perspective to permit comparison and clear cut choices among the several options presented to the county commissioners and PAT directors by various groups such as the PBQD proposal study of 1967, the several Transit Expressway Revenue Line proposals, the PATWAY Proposals, Sawmill Expressway Proposals, and others. The major distinction between all of these proposals and this WABCO proposal is that the others all require a cessation of existing service for several years and propose to destroy the valuable existing right-of-way asset and start from scratch. The others also cost much more money and take much longer to complete, and all but the PBQD study serve a much smaller portion of the PAT service area. It is hard to imagine a more compelling set of reasons for carefully considering the action steps proposed herein.

It is WABCO's firm conclusion, based on many years of extensive study of local transit problems and solutions proposed here and found elsewhere, that the long term direction for transportation in the Pittsburgh region should incorporate:

- An extensive backbone rail network utilizing existing private rights-of-way to the fullest possible extent with full grade separation of type appropriate to the terrain and environs (fenced, open cut, elevated, or subway);

- Stations located at intervals of between ½ and 1½ miles;

- Rolling stock on these routes comparable to that in Chicago and Boston (50 foot cars, 3 mphps acceleration, maximum 4-car trains, maximum speed—65 mph);

- Full Automatic Train Operation and central supervision;

- Eventual addition on certain of these routes of express commuter service with larger faster cars (70 foot, 85 mph), serving stations separated by 1½ to 4 miles and with termini as far away as Washington, Ligonier, and Butler but having limited stops within Pittsburgh city limits;

- Numerous automated secondary distribution systems operating wholly within urban activity centers with fixed guideway. These could be elevated rubber-tired trains, small individual vehicles or small rail vehicles in single units or trains;

- Extensive feeder bus routes serving neighborhood and activity centers on city streets and freeways. Some reserved-lane bus service may be utilized until traffic volume requires installation of rails to provide higher capacity. Some "Uncoupled Transversals," as proposed by TRI, crossing two or more backbone branches may be feasible and desirable;

- Extensive freeway, arterial, and secondary street network.

Such a coordinated collection of systems and modes would truly exemplify regional "balanced transportation" at its best in that most service area residents would have more than one choice of travel mode, and ghettos as well as affluent neighborhoods would be served. Taking the first major step to achieve such a system by embarking on the program proposed herein would truly earn Pittsburgh an enviable reputation as a center of urban transit progress and capability which would be ample reward to WABCO for the proposal effort involved. It represents by far the best, most certain, and perhaps the only hope of accomplishing the results for Allegheny County which Commissioner Staisey, in his speech of March 12, 1969 at the Fourth International Conference on Urban Transportation, promised before the end of his present term of office.

INTRODUCTION

WABCO proposes a three phase action program to place the 28-mile PAT-METRO System in operation by 1974. Phase 1 is designed to produce immediate visible improvement on the three present rail services, fixed facilities, and rolling stock and to prepare for the major construction and new-car fleet acquisition scheduled in Phase 2. Phase 3 adds a fourth METRO service from Downtown east to Wilkinsburg and may be scheduled more or less independently from Phases 1 and 2.

Although the three phases may be carried out serially if funding availability or other considerations so dictate, they many also be scheduled in parallel to meet the 1974 completion date. In either event, stable, viable revenue service is maintained throughout the program.

An important scheduling constraint occurs in Phase 2 when it is expected that construction of the proposed Sawmill Run Expressway will obliterate a portion of the present trolley right-of-way located on the eastern slope of Sawmill Run Valley and now used by the services to Library and Drake via Castle Shannon. It has been suggested that the Pennsylvania Department of Highways prepare a subsitute right-of-way on the western slope of the valley and a new structure at Palm Gardens before obliterating the present right-of-way. The required coordination is described in more detail under Phase 2 of the detailed discussion following.

In the detailed phase discussions which follow, the "fixed facilities" elements are shown separately from the "rolling stock" options to indicate, first, that such options exist and, secondly, that the fixed facilities portions which include trackage, wayside signaling passenger stations, power supply and sub-stations, shops, and parking lots, required by far the larger capital investments. They account, in fact, for 70 to 80% of the total, whereas the vehicle fleet accounts for only about 10% of the total investment.

The characteristics of the running trackage portion of the fixed facilities as regards minimum curvature, maximum grade, average station spacing and platform height have a profound effect, not only on the cost of the fixed facilities themselves, but also on the size, performance, and features of the vehicle best adapted to such trackage characteristics. The characteristics of the fixed facilities and the rolling stock, taken together, determine how well the resulting service suits the needs of the riders in the service area.

It is likewise true that the needs of the service area do not develop uniformly and simultaneously over the whole system. The "built-up," congested, downtown sections (such as Mount Lebanon & Downtown Pittsburgh) characteristically develop a need for rapid transit subways before outlying areas such as Castle Shannon, Library and Drake, which can be adequately served for considerable time by trolleys on private rights-of-way.

During this in-between stage, which may persist for a decade or more, the European concept of "Limited Trams" or "Semi-Metro" shows great promise. These articulated multiple unit trams are capable of full automatic, double-ended operation and can accommodate passengers equally from raised platforms downtown or from railhead level boarding stops in the suburbs. As loads grow in the suburbs, they can easily be superseded by higher performance "Chicago size" equipment which will be adequate for Pittsburgh's needs at least into the '90's and probably beyond.

Thus PAT decision makers may be well advised to ponder the initial choice of limited trams to

be later superseded by Metro (Chicago) type cars and high platforms throughout the system. Although the limited tram is a European concept, U.S. car builders can supply such equipment.

A further comment has to do with the larger (70 foot), higher speed (75 mph) cars for which the 1967 Parsons Brickerhoff Quade & Douglas 60-mile system was laid out. It is unlikley that such equipment will be needed in the next decade except for commuter type service which may be feasible on some routes to points now outside the PAT service area. But to lay out the entire basic initial network with the long radius curves (500 foot), low profile (4% max. grade) and long platforms (600 foot) required by these cars would provide system capacities which would be drastically under-utilized for many years to come even if population growth far exceeds present expectations. Needless to say, this would further burden the Port Authority with an impossible funding problem. WABCO suggests, therefore, that serious consideration of such large cars be deferred until either long range commuter service or much higher line capacities are obviously desirable and feasible. The program steps proposed herein fully preserve this future option.

The final introductory comment relates to automation. The highest level of automation thus far proposed was first demonstrated on the "Expo Express" by WABCO. The next major demonstration will occure on BARTD where Westinghouse Electric will supply the equipment. Both of these systems are steel wheel on steel rail. The automation of a steel wheel-steel rail system is somewhat more certain, simpler, and less costly than for a system where no running rail exists since the rail has long been used as a communication and detection channel in addition to its other purposes. However, in unconventional systems, an auxiliary communication channel must be added whose safety characteristics remain to be demonstrated.

On either steel or rubber, the choice between "attended" versus "unattended" operation is entirely a matter of public and managerial policy since the technological capability has long been proven for both systems. The principal area of doubt for the operating executive concerns the level of liability courts and juries would assess against an operating agency in the event of a major catastrophe with an attendant on board versus the same situation without an attendant, regardless of the attendant's ability or inability to prevent or, in any way, to modify the catastrophe or its consequences.

WABCO's proposal is based on fully automated operation with an attendant on board. The system may be operated unattended for no additional equipment cost if PAT so desires.

PITTSBURGH'S pat-metro

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PROGRAM SUMMARY

	Phase 1 (000)	Phase 2 (000)	Phase 3 (000)
Fixed Facilities	$ 9,760	$80,000	$10,500
Route Miles	21	21	7
Time Required	2 Years	4 Years	1 Year
Vehicle Options			
Repair & Refurbish	80) $ 240	—	—
Semi Metro*		56) $ 8,400	20) $ 3,000
Metro		75) $ 9,750	26) $ 3,380
Phase Totals	$10,000	$88,400 $89,750	$13,500 $13,880

Cumulative Totals	Phase 1 (000)	Phase 1 & 2 (000)	Phase 1, 2, & 3 (000)
Phase 1	$10,000		
Route Miles	21		
Time Required	2 Years		
Phase 1 & 2			
With Semi Metro*		$98,400	
With Metro		$99,750	
Route Miles		21	
Time Required		4 Years	
Phase 1, 2, & 3			
With Semi Metro*			76) $111,900
With Metro			101) $113,600
Route Miles			28
Time Required			4 to 5 Years

*2 Car Units

PHASE I

In Phase 1, the following results are obtained within 2 years for $10 million:

- **20% improvement in schedule** providing a typical time saving of 9 minutes between downtown and Library. This results from simplified downtown routing, grade crossing elimination, and improved signaling;
- **Much smoother ride** provided by 15 miles of new permanent roadbed and 6 miles of repaired roadbed subject to major construction or later abandonment in Phase 2 and repair and refurbishing of 80 cars;
- **Reduced power consumption** and substation operation costs due to addition of one new substation and replacement of old rotary equipment in three existing ones with new automated, static equipment;
- **More convenient passenger interchange** with buses and autos due to new passenger stations and improved parking facilities;
- **Less interference** from other surface traffic due to grade crossing eliminations;
- **Better appearance** and more reliable operation due to repair and refurbishing of cars and shelters;
- **Faster, more efficient maintenance** and repair of fleet due to new and more convenient shop equipment.

Description of Phase 1 work items:

Ways & Structures

Construction of 15 miles of new double track using heavier rail, welded joints, treated ties and new ballast. Replacement of approximately 30% of existing 30-foot poles with new 35-foot poles. New ground anchors, guy wires, crossarms and braces, eyebolts and insulator pins. Replacement of cross spans, strain insulators, suspensions, caps and cones. Replacement of approximately 25% of the existing 2/o trolley wire including new ears and armors. Present power feeder cable and signal wires to be transferred to the new crossarms. The trackage involved is principally that from Drake and Library to Washington Junction and Castle Shannon and from Castle Shannon to Clearview Loop and approximately Overbrook.

Repair 6 miles of existing track by replacing broken joints, bad ties and rail sections, correcting poor drainage, realigning, and resurfacing rails where required. The trackage involved is primarily that which will be obliterated by the Sawmill Expressway, the Phase 2 grade separation in Mt. Lebanon-Dormont-Beechview, the Mt. Washington tunnel and the Downtown surface routes to be later abandoned.

Downtown Reroute

When entering downtown Pittsburgh, the "Valley Routes" (#35, 36, 37) presently turn right on Fort Pitt Boulevard at the Pittsburgh end of the Smithfield Bridge, turn left and proceed north on Grant Street, then left on Liberty, left on Wood, left on Fort Pitt Blvd., and right again on Smithfield Bridge. The Beechview-Mt. Lebanon line (42/38) proceeds straight down Smithfield from the end of the bridge, turns right on 7th Avenue, right on Grant and proceeds south, turns right on Fort Pitt Blvd., then left onto the Smithfield Bridge.

It is recommended that all lines use the Beechview-Mt. Lebanon routing downtown and that the Liberty Ave., Wood St., and Fort Pitt Blvd. trackage west of Smithfield be abandoned. The short loop trackage via Fourth Ave. should be retained and scheduled as expedient.

If funding or other delays prevent early implementation of Phase 2, addition of a second track between the existing Smithfield trackage and the curbline, with scissors crossover at approximately 7th Avenue, should be considered. This modification, together with automatic signal pre-emption at cross streets, would render the procurement of a fleet of Limited Trams attractive as an interim measure since they are capable of the double end operation necessary for the use of the crossovers. Grant Street trackage could then be abandoned and dedication of Smithfield Street to exclusive PAT use for buses and trains considered. Costs for such an interim program would be modest but have not been included in this proposal.

Signaling

Install a new traffic circuit from Boggs to Oak utilizing existing signals modified to eliminate directional indicators. This system will show a normally red aspect at the entrance signal to the single track sections which precludes the possibility of simultaneous entry of cars on both sides of the section. A preferential circuit gives precedence to inbound cars but is limited in such a way as to permit alternate entry from either end during unusually heavy demand to prevent abnormal delays or "queueing" of outbound cars. This work is recommended because of its modest cost and operational effectiveness even though the trackage involved will be obliterated by Sawmill Expressway.

Substations

Construct one new unit substation and install new static equipment in three existing substations.

Some present power substations are subject to excessive line losses because of their great distance from the trolley line segment which they serve. Many of them have old motor-generator sets or rotary converters which should be replaced with modern, automatically operated, transformer/static rectifier units. New equipment of this type can be easily installed in existing substation buildings where the location with respect to the served load is satisfactory.

Where a new location is desired, a small outdoor metal clad unit on a concrete pad requiring no building is recommended.

Passenger Stations

Construct two new passenger stations designed to facilitate bus-rail and auto-rail passenger interchange. Repair, refurbish, or rebuild existing passenger shelters and approaches. The new stations are to be modern enclosed structures of functional design and modest cost, providing shelter and convenience for a considerable volume of interchange passengers. Existing shelters are to be repaired, painted, and provided with approach walks where feasible.

Parking Lots

Clean, grade, surface and mark existing free parking lots to improve their appearance, capacity, smoothness and access.

Crossing Eliminations

Eliminate eight existing grade crossings on the 15 miles of permanent trackage which now impose significant hazards or delays. Additional grade crossings not now of significance will become so in Phase 2 and are scheduled for elimination therein.

Shop Equipment

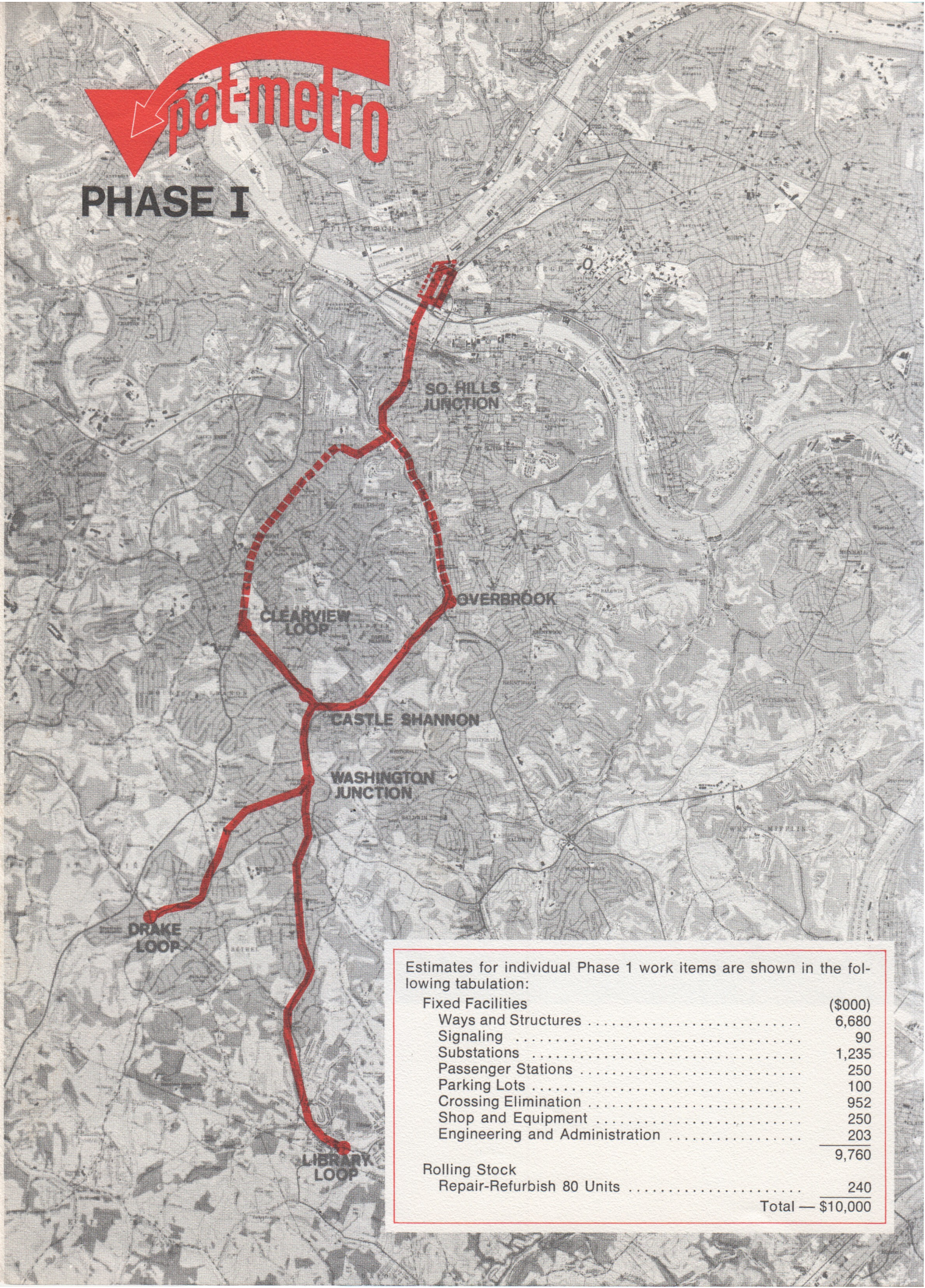
Relocate shop equipment from Homewood and set up in South Hills Junction shop. Since no rail connection now exists to Homewood, major items requiring repair must be trucked to the Homewood shop involving delay and expense which can be avoided by activating a suitable facility for maintenance at South Hills Junction.

Engineering and Administration

Provide necessary in-house engineering and administrative services by additions to PAT present staff.

Vehicles

Repair-refurbish 80 vehicles. Refurbishing includes minor body repair, interior painting, re-upholstering, re-glazing, etc. Repair covers mechanical and electrical propulsion, battery m-g sets, braking, and running gear items other than body items.



Estimates for individual Phase 1 work items are shown in the following tabulation:

Fixed Facilities	($000)
Ways and Structures	6,680
Signaling	90
Substations	1,235
Passenger Stations	250
Parking Lots	100
Crossing Elimination	952
Shop and Equipment	250
Engineering and Administration	203
	9,760
Rolling Stock	
Repair-Refurbish 80 Units	240
Total —	$10,000

SUBWAY (TYPICAL)

PHASE II

In Phase 2, the following results are obtained within 4 years for $80 million for fixed facilities plus $8.4 million or $9.8 million for rolling stock depending on type selected:

Three modern rapid transit services operating on 21-mile automated system in subway downtown, subway/elevated in Beechview, Mount Lebanon, and in fully separated right-of-way to Library and Drake via Castle Shannon. This results from the major new construction, additional crossing elimination or protection, new rolling stock, and automated central office described below.

22% further improvement in schedule, cutting another 8 minutes from a typical run between Library and Downtown Pittsburgh, which results from full grade separation and new automated rolling stock.

Modern attractive passenger interchange points resulting from the construction of eleven new underground, elevated and surface stations and five new parking lots.

Improved operating efficiency and further cost reduction resulting from further power system modernization and completely new maintenance and repair facility.

Phase II individual work item estimates:

Fixed Facilities	($000)
Ways and Structures	58,850
Signaling	4,845
Substations	1,685
Passenger Stations	5,400
Parking Lots	1,000
Crossing Eliminations	835
Shop and Equipment	5,000
Engineering and Administration	2,385
	$80,000

Rolling Stock	
Semi-Metro — 56, 2-car units	8,400
Metro — 75 units	9,750
Total	$88,400
	or 89,750

Phase II work item description:

Ways and Structures:

• Install new double track welded rail, ties, and ballast, electrification and signaling on new private right-of-way sub-grade. New Palm Garden structure provided by Pennsylvania Department of Highways from approximately South Hills Junction to Overbook and from new Palm Gardens structure to Fallowfield.

• Construct subway/elevated/surface private right-of-way for approximately 2.6 miles on Broadway and Washington Road from Fallowfield to present Clearview Loop and install double track, electrification and signaling.

• Construct new tunnel from South Hills Junction to a portal near the Panhandle bridge, an overpass to the bridge, and a new single track tunnel parallel to existing single track tunnel from approximately Forbes Street to Penn Central Railroad station.

• Install approximately 1.6 miles of new double track-electrification and signaling from South Hills Junction to Penn Central Railroad station via Panhandle Bridge and old and single track tunnels.

Signaling

The entire 21-mile system will be automated. Attended trains will be under automatic control for all normal mainline operations. Subsystems included are train detection, train separation, route selection, route protection, wayside/train communications, and the train carried control package. These subsystems provide for train protection, automatic train operation, central line supervision, and manual control functions.

The train protection subsystem insures that safe operation is provided in all modes of control by improving safe speed limits and protecting against collision and mis-aligned or conflicting routes. Fail-safe circuity is used in all subsystems which govern the safety of trains.

The Automatic Train Operation (ATO) subsystem regulates speed, programs stopping and starting processes and confirms that the train is stopped within prescribed station limits after which it permits the train attendant to open the passenger door. He may also elect to skip a station stop without nullifying or preempting automatic control.

Line supervision subsystem provides automatic routing by identifying each train and aligning the proper route as it approaches an interlocking. The central dispatcher manages the system by exception, intervening only in the event of an unusual traffic pattern or a special route requirement.

Full manual controls are provided as back-up, both in the central office and on each train. Two way voice communication between central and trains is also provided. These systems operate independently of the automated train control system and insure quick restoration of normal operation if malfunction occurs.

Substations

Modernize two more existing substations, add two new substations, and dismantle two old substations using equipment as described in Phase 1. This now completes

PHASE II

the modernization of the power supply for the entire 21-mile system.

Passenger Stations

The eleven new stations (5 underground and 6 surface or elevated) together with the elimination of some very closely spaced stations now provides an average station interval of approximately ½ mile. Again the construction re-commended is functional, attractive, and inexpensive. The most expensive station is that on the new downtown subway estimated at $1 million.

Parking Lots

Approximately 10,000 new parking spaces are provided by up to five new parking lots. Parking garages may be preferable in place of one or more of the parking lots in which case they should probably be funded and operated by the parking authority and charged a fee which would include a round trip transit ticket. Free parking lots in busy locations would be subject to considerable abuse by car-pool riders and others whose free use of the facility would displace the paying transit rider. An equitable fee which would include a transit ticket should be charged all users of all parking garages and parking lots in busy locations.

Crossing Eliminations

Approximately 17 grade crossings remain to be considered after completion of Phase 1. Of these, approximately 10 will require overpass or underpass structure. The remaining 7 include some streets which may be closed or rerouted by highway construction and others on which automatic crossing gates may be satisfactory for a decade or more due to light traffic. Sufficient contingency is allowed in the overall system estimate to permit elimination of all crossings remaining from Phase 1 by suitable structures if desired.

Shop and Equipment

Construct and equip new modern shop, central office, and marshalling and repair yard in the vicinity of Killarney.

Engineering and Administration

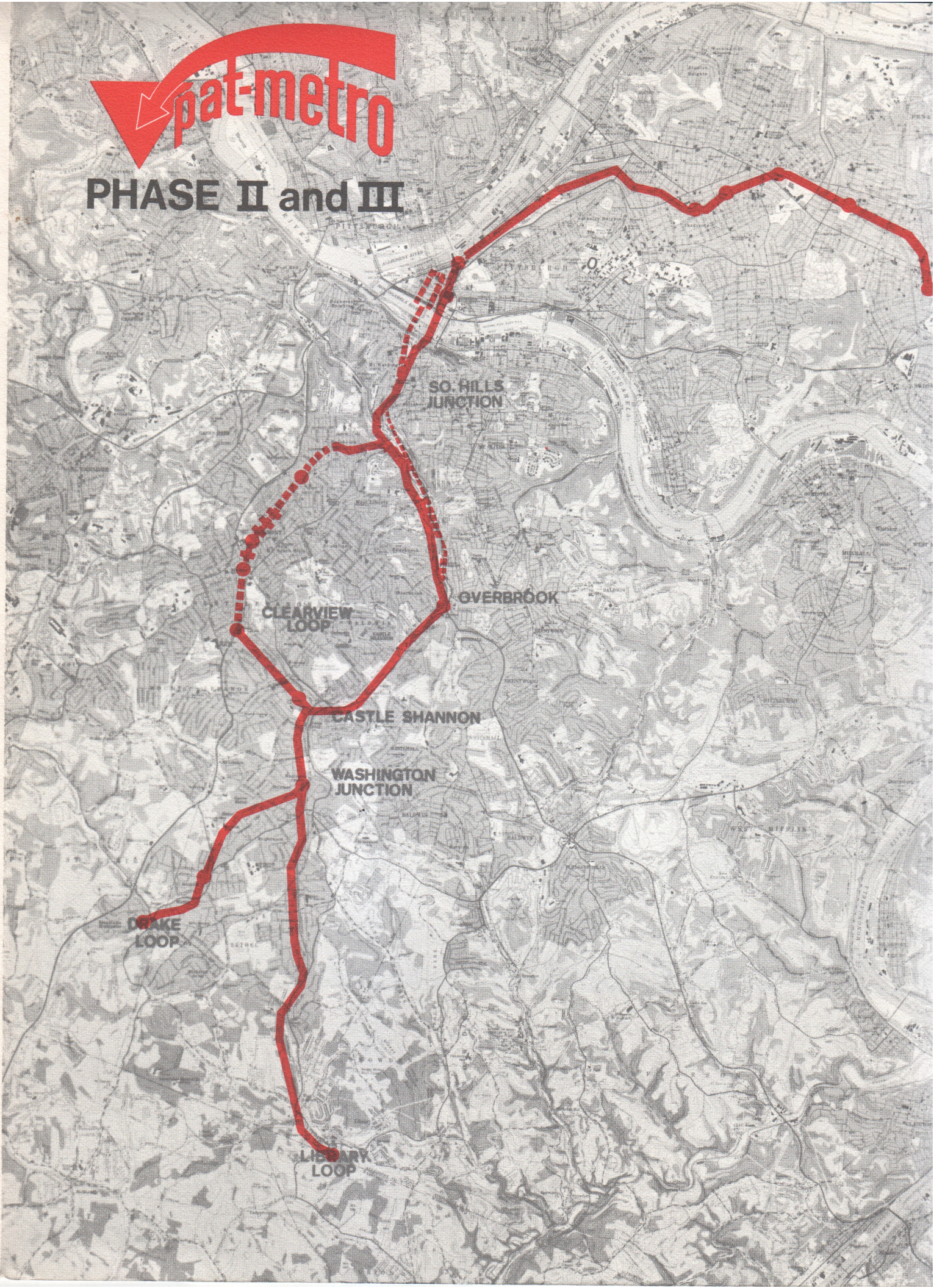
Provide necessary in-house engineering and administrative services for Phase 2 by further additions to the PAT staff assembled for projects in Phase 1.

PHASE III

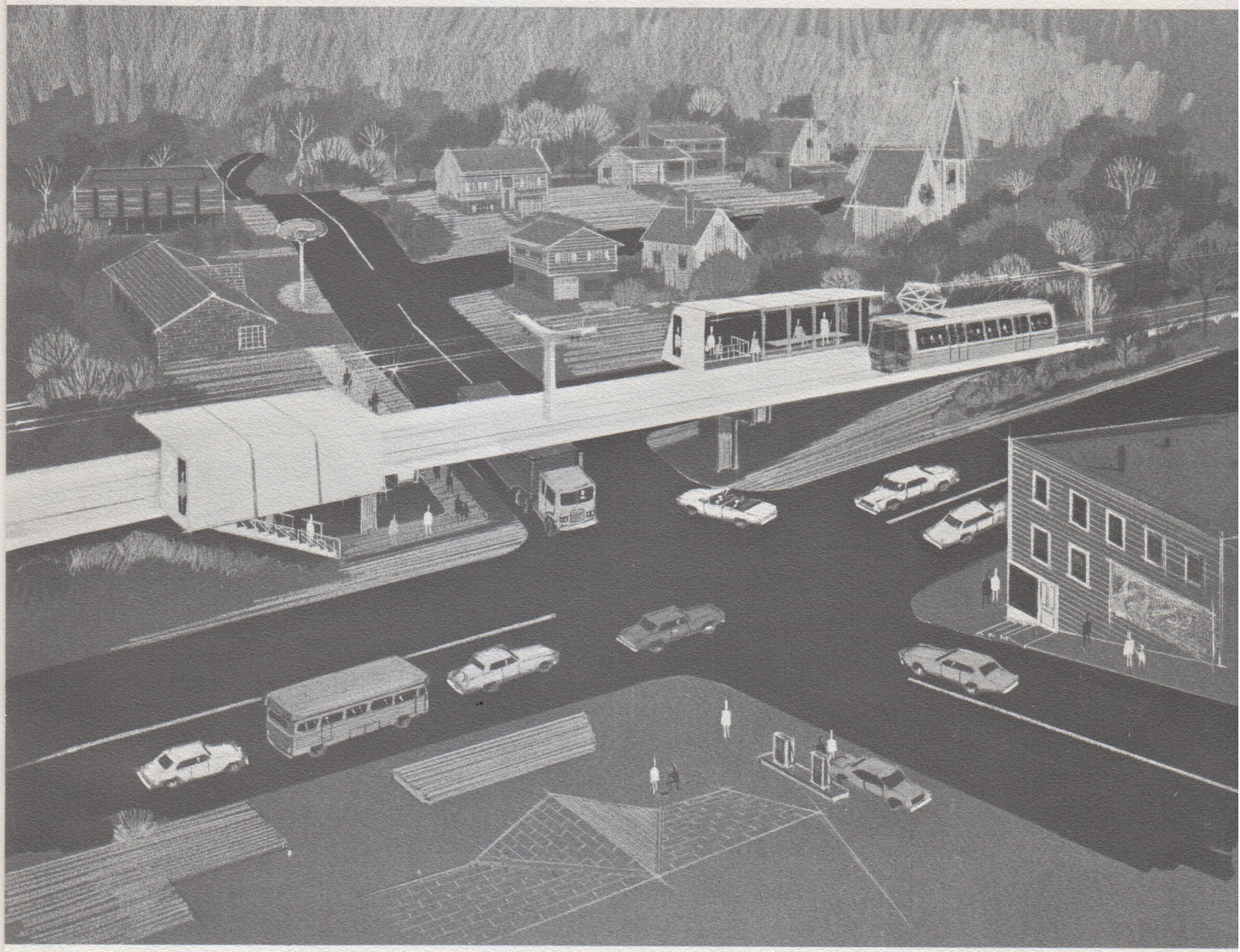
Phase 3 is estimated to cost $10.5 million for fixed facilities plus $3 million for Semi Metro or $3.4 million for Metro Vehicle fleet as desired. This phase can be completed in 1 year and increases the PAT-METRO system to 28 route miles by installing approximately 6.8 miles of double track, electrification, and signaling on Penn Central private right-of-way from PCRR Pittsburgh Station east to Wilkinsburg. The existing right-of-way is fully grade separated. Two additional power substations and necessary feeder cable are included. Island stations are to be constructed on the site of existing PCRR stations at Roup, Shadyside, East Liberty, Homewood and Wilkinsburg with necessary passenger access and lighting revised and refurbished to acceptable modern standards. Parking facilities convenient to two of these stations are provided. No additional shop facilities are required. Engineering and Administrative services by PAT staff are provided.

The system resulting from Phase 3 has excellent revenue potential and extends good service to ghetto areas. It also provides an excellent foundation or nucleus for further extension to other parts of the Pittsburgh region.

Fixed Facilities	$10,500
Rolling Stock	
Semi Metro 20 — 2 car units	$ 3,000
Metro — 26 units	$ 3,380
	$13,500
	$13,880


pat-metro
PHASE II and III
SO. HILLS JUNCTION
OVERBROOK
CLEARVIEW LOOP
CASTLE SHANNON
WASHINGTON JUNCTION
DRAKE LOOP
LIBRARY LOOP

BETHEL PARK (TYPICAL)



VEHICLE OPTIONS

Cities having medium density population like Pittsburgh generally require a rapid transit system having a peak-hour line capacity of 10,000 to 20,000 passengers per hour with — station dwell time of 15 to 25 seconds and station intervals averaging about ½ mile. However, because Pittsburgh's rivers and hilly terrain tend to concentrate our population on the relatively scarce land area suitable for dwelling construction, we have a less uniform distribution of population than other cities. Thus, a transit line in Pittsburgh travels through densely populated areas requiring station spacing averaging about ½ mile yet also traverses intervening areas where stations should be spaced no closer than 1 to 2 miles apart.

Pittsburgh, therefore, requires a vehicle having the good acceleration needed for closely spaced stopping as well as the 50 to 60 mph top speed which can be reached between stations spaced further apart.

Vehicle size, however, is dictated by the number of passengers to be accommodated during rush hour and the average amount of car space to be allocated to each. The cost per unit passenger space tends to decrease with car size which favors the choice of the largest car that can be operated without providing either an excessive number of empty seats or using excessively long intervals between trains during off peak operation.

The near optimum vehicle choice for Pittsburgh's present and probable future demand is the Metro car:

METRO

Length	48-50 feet
Width	9.3-10 feet
Height	11-12 feet
Weight Empty	45-50000 lbs.
Seats	45-50
Standees	75-100
Traction Motors	4 @ 100 hp
Acceleration Rate	3 mphps
Braking Rate	3 mphps
Maximum Speed	65 mph

This description fits very closely the Chicago CTA Lake Street cars, the Boston MBTA Forest Hills cars, New York's PATH cars, and the Frankford elevated cars in Philadelphia.

Notwithstanding the foregoing, however, there is good reason to consider the somewhat less expensive Semi Metro or limited tram vehicle which has more modest performance and somewhat lighter carrying capacity.

SEMI METRO

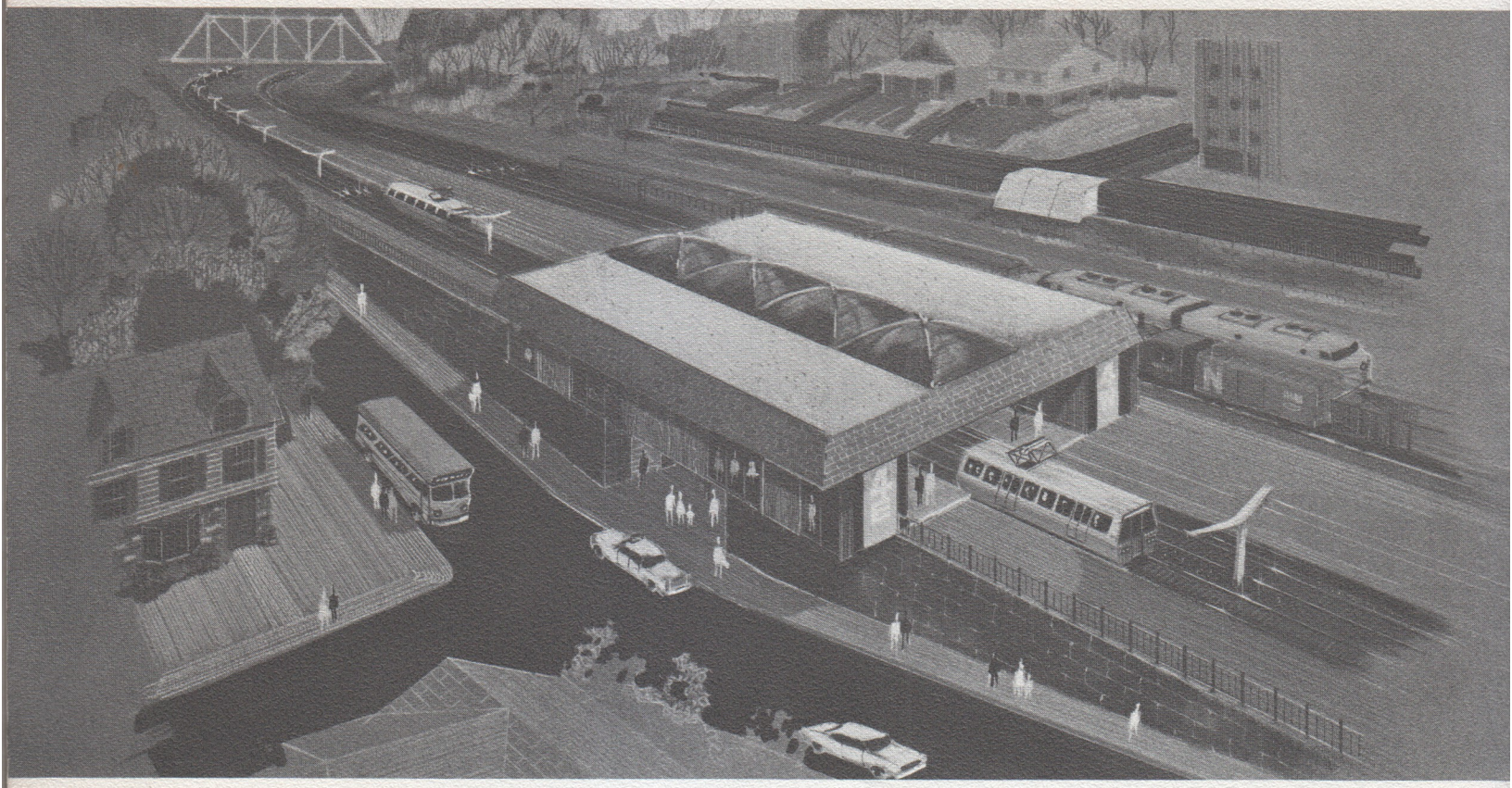
(2 car-Articulated unit)

Length	77 feet	Standees	100
Width	9 feet	Traction Motors	2 @ 150 hp
Height	12 feet	Acceleration	2 mphps
Weight	45000 lbs.	Braking	3 mphs
Seats	64	Maximum Speed	45 to 50 mph

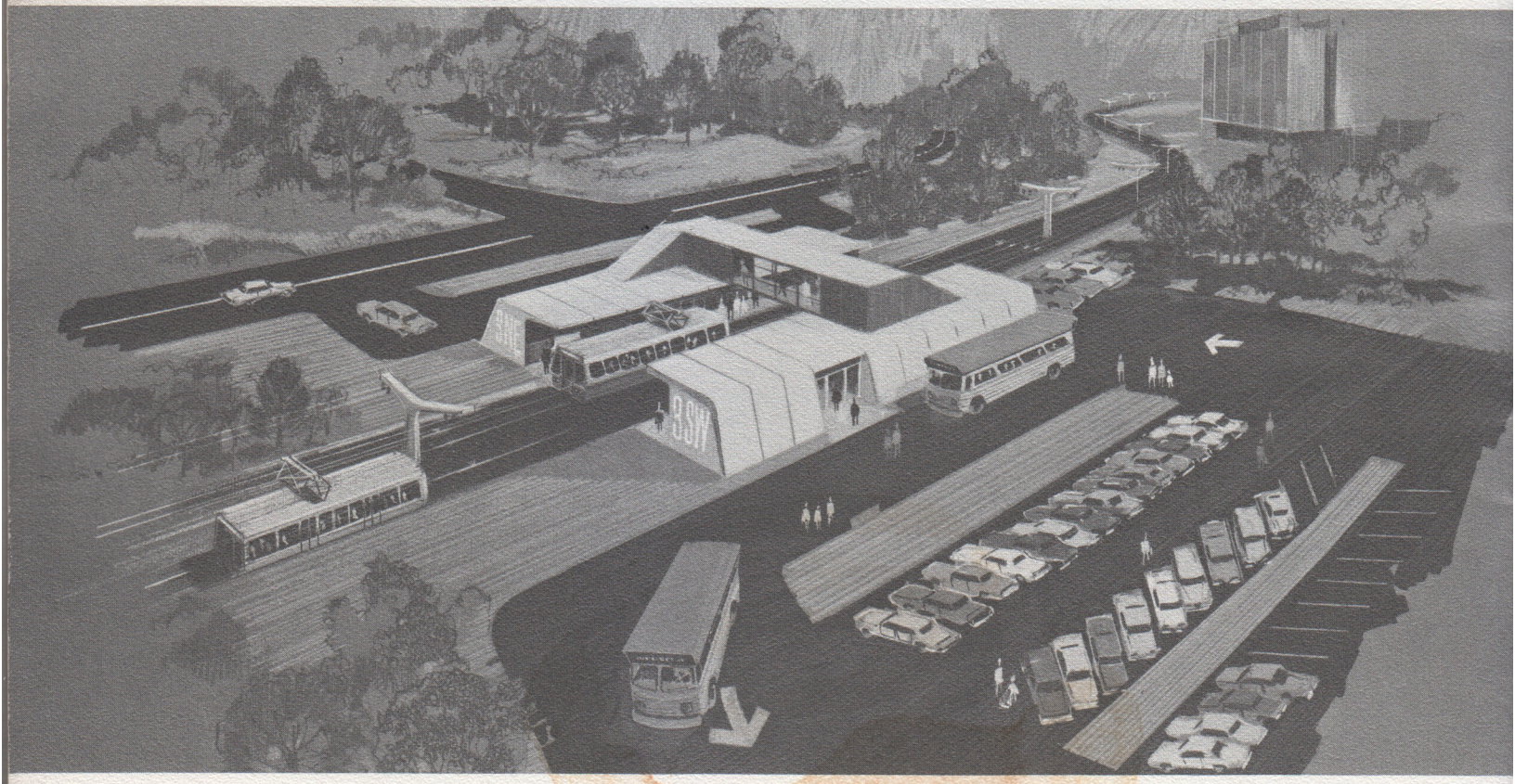
These units can accommodate passengers boarding from either car floor level platforms or from ground level. This permits expenditure for high level platforms in the suburbs to be deferred until passenger demand requires them. Their lower cost, modest but acceptable performance, and the savings they permit in station costs suggest they may be the best choice for PAT-METRO for the next 10 to 15 years.

PITTSBURGH'S pat-metro

WILKINSBURG (TYPICAL)



INTERCHANGE (TYPICAL)



PITTSBURGH'S pat-metro

- Can begin at once with certainty as to ultimate cost and ability to perform.
- Incorporates world's most advanced transit technology — already proven; no development required; no air or noise pollution.
- Provides wide area coverage — 28 route miles between Library and Wilkinsburg.
- Provides better service; goes where the passengers live, work, want to go; does not traverse empty inaccessible areas.
- Includes generous number of stop locations without sacrifice of fast service; access to line from served areas is superior; serves poverty pockets as well as affluent.
- Staging is very manageable; easy to coordinate with highway program because of fast completion, flexibility; no construction or operating uncertainties in any phase.

Requires — NO INTERRUPTION OF SERVICE DURING CONSTRUCTION.

Each phase of improvement or expans
easily continued until the next phase b
Capable of expansion to regional sy
promise of present economy.

- Lowest first cost.
- Lowest operating cost.
- Lowest incremental cost.
- Lowest fixed facility cost.
- Lowest vehicle fleet cost.
- Lowest total cost.
- Shortest construction time.

WABCO

WESTINGHOUSE AIR BRAKE COMPANY
PITTSBURGH, PENNSYLVANIA 15218

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