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"THE BUS OF THE FUTURE"

Summary of Comments and Suggestions on Bus Design,
as submitted to ATA Committee on Bus Design in
response to Committee's letter October 14, 1955

January 1956

American Transit Association
292 Madison Avenue
New York 17, N. Y.

THE BUS OF THE FUTURE

SUMMARY OF COMMENTS AND SUGGESTIONS ON BUS DESIGN SUBMITTED TO ATA COMMITTEE ON BUS DESIGN

Foreword

In making up this summary, the various headings follow closely the indexing of the "Urban Motor Coach Design Objectives," originally prepared by the Association in 1946.

After each heading and subheading there appears a figure showing the number of comments or suggestions ("references") received pertaining to that heading.

An asterisk (*) in front of any item indicates that there was a large number of references to that particular item.

An Index showing the arrangement of the section headings and the number of "references" received under each heading is provided for convenience and to indicate which features of bus design seem to need the most attention.

The following appendixes are included in this summary:

Appendix A - Comments on "The Bus of the Future" by Charles L.

Patterson, Chairman, New York City Transit Authority.

Appendix B - Letter to Chairman J. L. Haugh from Henderson Gilbert,

Harrisburg, Pa.

Appendix C - Letter to Chairman J. L. Haugh from A. M. Gordon,

Director of Sales, Grant Money-Meters Company.

Appendix D - Drawings and Sketches of Proposed New Designs.

THE BUS OF THE FUTURE

SUMMARY OF COMMENTS AND SUGGESTIONS ON BUS DESIGN SUBMITTED TO
ATA COMMITTEE ON BUS DESIGN

Index

	No. of References	
<u>GENERAL APPEARANCE</u>		5
<u>BODY</u>		1456
DIMENSIONS AND WEIGHTS	131	
Weight	14	
Floors	52	
Aisles	20	
Steps	41	
Turning Radius	2	
Body Width	2	
DESIGN OF FRONT END	300	
Special Facilities for Operators	6	
Improved Visibility	111	
Driver's Seat	8	
Operating Controls	11	
Gauges and Instruments	5	
Fare Collection Facilities	96	
Rear and Side View Mirrors	25	
Heating and Ventilation (Driver's position)	7	
Separation between Driver and Passenger	7	
Turn Signals	11	
Other Suggestions	13	
VENTILATION AND HEATING	78	
LIGHTING	83	
SEATS	131	
SASH	65	
DOORS AND STEP WELLS	270	
FLOORS	16	
STANCHIONS AND HANDRAILS	25	
ROUTE AND DESTINATION SIGNS	50	
OTHER MATTERS RELATING TO BODY	307	
Quieter and Rattleproof	11	
Body Design	59	
Interior and Exterior Decoration	59	
Safety Features	16	
Communication Facilities	75	
Other Details	87	
<u>POWER PLANT</u>		47
<u>CHASSIS</u>		101
STEERING	33	
SPRINGS	28	

WHEELS AND TIRES	11	
BRAKES	29	
<u>POWER TRANSMISSION</u>		7
<u>MISCELLANEOUS</u>		7
ADVERTISING	5	
GENERAL	2	
<u>MECHANICAL DESIGN</u>		27
Total "references"		1650

"THE BUS OF THE FUTURE"

SUMMARY OF COMMENTS AND SUGGESTIONS ON BUS DESIGN SUBMITTED TO ATA COMMITTEE ON BUS DESIGN

GENERAL APPEARANCE (5 references)

"Sweeping design to convey the impression of movement."

"Glamorous 'New Look' design - modern auto designs have been changing significantly approximately over five years. They may be expected to change at an even faster rate in the future. Accordingly, the transit industry must build future buses that will compete favorably with the best styling of the auto industry." (This company provided drawings and sketches suggesting such designs.)

"It is the opinion of the writer that eye appeal has no effect on the number of riders that use bus service in urban service. To a lesser degree, comfort plays no very important role when rides are relatively short. It should be borne in mind that only those ride to whom private automobile transportation is not available. The pickup of bus passengers on every corner by private automobiles confirms this. No one rides a bus because of any loyalty to the bus company. The only reason we have riders is because the passenger, for various reasons, cost - safety - or parking, perhaps, prefers it to a private car."

"That portion of the bus below the window should be made to appear as massive as possible to give the potential passenger a feeling of security. The portion above should be open, with considerable more window space for people sitting, and particularly to favor standees so that they do not have to stoop to read street signs or watch outside moving scene. This will make the coach appear lower to the ground and will also give the passenger a feeling of a more roomy, spacious vehicle. There should be a stainless steel influence on the lower half of the buses that would sparkle in the sunlight or night lights. This would reduce repainting costs."

"Headlights, tail lights, air vents and trim should show more originality with distinctive and streamline design to enhance beauty, and give appearance of speed to coach."

BODY (1456 references)

DIMENSIONS AND WEIGHTS (131 references)

Weight (14 references) - All of these references recommended lighter weight buses. One cited a figure of 150 pounds per seat as a desirable ratio. The use of alloy steel and other lightweight alloys was suggested, plus general re-design.

Floors (52 references) - All of these suggestions recommended lower floors. Most were from the standpoint of convenience and safety of passengers in boarding and alighting and some mentioned improved appearance of the vehicle. Specific points mentioned were:

Would have special appeal to older people and mothers with children.
Would prevent crowding on steps.
Would make for quicker and easier fare collection.
Would reduce passenger accidents.
Might require use of special small diameter tires.
Will permit lower and roomier entrance and exit facilities.
Desirable floor level would be maximum of 15" from ground; 12" height also mentioned.
Wheels might be located at extreme ends of bus, providing space for propulsion engine, air conditioning equipment and wheel housings outside of passenger compartment.
Use depressed center aisle.
Use individual drive for each wheel to eliminate axles.

Aisles (20 references) - All of these suggestions recommended wider aisles. One recommended a 30-in. minimum width. One referred to the possibility of gaining space between exterior skin of bus and the interior masonite lining below the window sills.

Steps (41 references)

* Steps should be lower and properly dimensioned.

Height should not be greater than nine inches.

Suggested use of Col. Sheppard's "Product of 72" for dimensions.

Turning Radius (2 references)

Turning radius should be reduced.

Would reduce cost of space required in loops.

Would facilitate turning corners and getting closer to curb.

Might be obtained by use of power steering.

Body Width (2 references)

Bus should be wider permitting wider aisles, wider seats and better interior appearance.

102" width mentioned specifically.

DESIGN OF FRONT END (300 references)

Special Facilities for Operator (6 references) - Provision should be made for:

Built-in dash facilities for holding change holder, forms, transfers, transfer cutter, punchers, loose change.

A flat level shelf to accommodate lunch box, thermos bottle and cup.

Cupboard or locker to hold operator's supply of transfers, zone checks, coins, tokens, maps, stationery, street directory, etc.

A trash can to hold rubbish, transfer stubs, etc.

Improved Visibility for the Driver (111 references) - Specific suggestions were:

- Redesign and relocation of window stripping and corner posts to minimize interference with vision.
- Height of windshield should be adequate for operator of above-average height.
- Current devices to reduce sun and headlight glare inadequate.
- *Use of wrap-around windshield.
- Use of more glass in front doors.
- Driver's position should be more forward.
- An elevated cockpit - "a move in right direction if driver can carry on all his duties."
- Driver's position should be at right side.
- Make front end of bus wider.
- Windows at side should extend lower to permit better observation of vehicles alongside bus.
- Provide better vision directly in front of bus so children and short people can be seen.
- Use transparent plastic between windshield and floor.
- Windshield wipers should operate horizontally crossing entire windshield.
- Provide better windshield wipers to cover a larger area more efficiently.
- More effective defrosters needed.
- Provide spray equipment for windshield to permit cleaning of glass.
- Provide proper sun visors.
- Provide tinted windshields.

Driver's Seat Should be Improved (8 references) - Specific suggestions were:

- Seats should be designed for greater and more rapid adjusting.
- Provide power operation of seat adjustment.
- Install at proper position relative to steering wheel and standard distance from dash and left side of bus.
- Better ventilation.
- Redesign back to give adequate support.
- Provide swivel seat.

Improve Operating Controls (11 references) - Specific suggestions:

- Standardize and simplify instrument panel, control panel, switches and door valves.
- Foot controls should be light to touch and require minimum travel.
- One-pedal control for acceleration, running and braking.
- Should include dead man control feature.
- Left foot pedals for door control, emergency brake.

Gauges and Instruments (5 references) - Specific suggestions:

- Design better device to indicate failing air pressure.
- Provide "definitely reliable" speed indicating device.

Include tachograph.

Include signal light or other warning device to indicate when hand brake is set and ignition on.

Improve Fare Collection Facilities (96 references) - Specific suggestions:

Should be more efficient and flexible.

Should be built as integral part of bus equipment.

Should require less maintenance.

Should "fit in" better with interior design.

- * Provide automatic, coin changing, transfer issuing fare box.
Provide better transfer and ticket dispensing equipment such as conveyor system to carry money to operator, leaving operator's hands free for other operations.
- Provide mechanical fare collection.
- * Use turnstiles at doors.
Collect amount according to distance carried. (Note: This suggestion mentioned use of turnstile and a punched card.)
Provide automatic passenger counting device.
Provide automatic money changer.
Provide automatic issuance of transfers.
Provide counting and timing device for passengers getting on and off.
Use a straight cash fare to conserve time of operator.
Use locked fare boxes instead of cash - return type to permit safer operation by driver and save time in auditing department.
Provide adequate fare box light; install small light inside fare box to eliminate shadows in corners.
Provide beam type light to assist passengers in locating proper change.
Place sign in conspicuous place requesting passengers to have correct fare ready.
Recess fare box into dash.
Include device to print mileage on operator's trip card at start and finish or selected intervals.
Provide two fare boxes or fare box with two coin slots.

Improve Rear and Side View Mirror Facilities (25 references) - Specific suggestions:

Develop better and more consistent method of placing rear view mirrors, so that operator will not have to crane his neck to get mirror in focus.

Consider the use of periscopic device in place of ordinary mirror.

Use prismatic or convex curved mirror.

Provide device such as periscope to give operator view of outside rear of bus when he is backing up.

Provide larger or long type outside mirrors on both left and right side of bus for exterior rear view.

Provide satisfactory mounting for outside rear view mirrors and arrange so they will pass through automatic washer without damage to washer or mirrors.

Right hand mirror arrangement should be improved.

Improved Facilities for Heating and Ventilation of Driver's Position
(7 references) - Specific suggestions:

- Provide separate heater for driver with separate regulation.
- Provide protection from cold blasts so operator can work properly without heavy clothing.
- One reply suggested use of "dutch door" type panel.
- Arrange heating and defrosting equipment so it will not be visible to improve appearance of front end, increase visibility and provide additional space for other equipment.

Provide Proper Separation between Driver and Passengers, to Provide Adequate Working Space and for Safety Reasons (7 references) - Specific suggestions:

- Provide partition with lower part metal and upper part glass.
- Design front end so that passengers cannot stand in a position so as to limit the vision of driver at railroads and intersections. (This presumably refers to use of device such as a crowd gate.)
- Use a vertical panel of plastic instead of a metal bar to provide a break-away effect if passenger is thrown against it.
- Provide some form of window deflector to avoid drafts for passengers behind driver.
- One reply stated "operator should be located where he can readily talk to his passengers."

Provide Adequate Turn Signals (5 references) - Specific suggestions:

- All buses should have turn signals.
- Should be set and released by foot operation and have easily observable indication to operator.
- Careful attention should be paid to location, size and brightness.
- Turn signals should be provided on sides of bus toward front to provide further warning to pedestrians and auto drivers who cannot observe front or rear signals.
- Provide tinkling bell or peanut whistle hooked in with turn signal.

Other Suggestions (13 references)

- Improve the general appearance of the instrument panel and dashboard.
- Provide horns with better and more distinctive sound, operating with a light touch.
- Provide a recessed space in the dash for fire extinguisher and first aid kit.
- Provide obstacle detector on right side (electric eye).

VENTILATION AND HEATING (78 references)

A number of the replies under this heading merely indicated that general improvement in both ventilation and heating of the bus is needed. Other replies included specific suggestions and comments as follows:

There should be adequate forced ventilation.

Windows should not cloud up or frost up.

Use ceiling suction fans or other method to remove hot air near ceiling.

Windows should be sealed tight.

Windows should be rigid at bottom, open at top with top sash sliding down.

Use Edwards sash as on ACF C-44 coach with sliding arrangement on lower sash.

Heating and ventilation system should be similar to that used on airplanes.

Provide air vents at each seat, either through the roof or side panel.

Provide insulation for body and roof.

Heating and ventilation system should be completely automatic.

Heating and ventilation system should be completely automatic, but not subject to control by operator.

Ventilating system should operate independent of heating requirements.

Reduce plumbing and number of heater motors to a minimum, free of complicated controls.

Provide temperature control at each seat.

Provide better ventilation for standee passengers.

* Provide year 'round "air conditioning."

Open up front end to improve ventilation in summer.

Provide push button window controls for passengers as in autos.

Equip air intake at front of vehicle with air-maze oil treated filter.

Experiment with radiant heating.

Provide base board type heaters around bus.

Place heater motor in rear engine compartment to eliminate draft and noise around driver's head.

Arrange ventilation for rear of bus to take away smoke and strong odors.

Heating and ventilating system should favor the front of the bus.

Use deodorant or fragrance to provide pleasantly scented bus.

LIGHTING (83 references)

Provide interior lighting which will eliminate all glare, without shadows and in sufficient amount so that passengers may read comfortably.

Use indirect or concealed lighting.

* Provide fluorescent lighting.

Use one set of tubular lights running the length of the bus.

Lights should be installed between windows instead of in ceiling.

Provide individual lighting for each seat as in airplanes, controlled by passengers but with driver having master switch.

Provide electric eye or other device to turn on interior, sign and running lights whenever it is dark enough to require them.

Provide ceiling lights over doors to better illuminate stepwells and over fare box for operator in handling fares.

* Install floodlights near right front marker to operate with opening and closing of front door to light street area near front door.

Provide back up lights (and buzzer).

Provide lighted sign on front of coach reading "brakes" to warn approaching vehicles when brakes on bus are being applied.

Provide lighted signal on rear of coach reading "Stop - Pedestrian," controlled by operator through push button to warn following vehicles when pedestrian or passenger is walking in front of bus.

Headlights should be improved to provide better visibility and to eliminate glare in fog or falling snow.

Two bright taillights should be placed on rear of coach, approximately ten inches from each side and not more than four feet from ground.

Interior lighting should not produce glare on windshield.

Provide indirect lighting along aisle near floor for use when other lights must be dimmed as during rain and fog.

Provide small red light high on front and rear center of each coach to signal relay coaches or need of supervisor.

Provide larger, brighter stop lights.

Provide oscillating light on rear of bus.

Provide illumination of outside spectacular advertising signs to make them more visible at night.

Provide distinctive marker light on roof.

Provide means of replacing marker lights from inside coach.

Consider use of germicidal lamps in bus interior.

SEATS (131 references)

Seats should be wider, more comfortable and better arranged and equipped. Specific suggestions:

Dispense with center aisle; place five-passenger transverse seats from end to end of passenger compartment, with doors on right-hand side of bus opposite each seat and operated by coin actuated locks or by driver control.

Use a longitudinal seat on door side of bus extending from front to rear exit door. This provides more space for standees, baskets or packages.

Eliminate longitudinal seats if made possible by redesign of floor height.

Take out a seat on each side to allow more space between remaining seats.

Provide more leg room between seats.

Provide greater knee room for seat behind rear exit door.

Provide center divider on each seat to give each passenger greater privacy and to prevent hogging of seat space.

* Provide individual seat control with respect to height, reclining, etc.

Upholster every seat a different color.

* Provide body contour foam rubber seat cushions and backs.

Provide contour or semi-bucket shaped seats to give passenger greater feeling of individuality.

Provide higher seat backs with head rests.

Provide plexiglass extension on seat backs to prevent passengers from bumping passengers seated in front of them.

Top of seat backs should be padded to minimize injury in event of sudden stops.

Provide more cushioning on all seat surfaces for better comfort.

Provide arm rests on aisle and wall side.

Provide built-in arm rests on longitudinal seats.

* Provide space for packages either under seat or over seat.

Provide pocket or container on seat back or side at each seat for take-one folders, maps, timetables and other promotional literature.

Use stainless steel backs on seats to resist vandalism.

- * Arrange aisle seat so that it folds back, slides back or swivels for easy access to window seat.

Provide built in safety belt on each seat.

Redesign rear seat to make it more comfortable and better insulated from engine heat.

Seats should be staggered on opposite sides of coach.

Upholstery material should be durable (impervious to sharp blades), should not show dirt, should be easily cleaned and not objectionable to passengers by being cold, slippery or sticky.

Provide mirrors at seats for convenience of women.

Provide ash trays at each seat when smoking is permitted; such trays might be connected to vacuum system to keep trays empty, and for circulation of air in the vehicle.

Provide individual foot rests with hot water circulated through them in cold weather.

Provide map of city bus routes "decaled" on back of seats.

Arrange seat mounting to facilitate cleaning; use single pedestal with outside edge of seat anchored to side of vehicle.

"Use a folding type seat that can be used only by inserting coin, having base fare for standees. This would keep deadheads from using seats. It would do away with the gripe about paying for a seat and having to stand."

SASH (65 references)

(Note: See also under "Ventilation and Heating" for additional comments and suggestions relating to sash.)

Visibility should be improved. Specific suggestions:

- * Enlarge windows and make sufficiently high to provide visibility for standees without stooping.

Remove horizontal strips from windows.

Use narrow supporting pillars between windows.

Use fixed sash.

- * Use tinted glass.

Use heat absorbing glass.

Use plastic instead of glass.

Use "one-way" glass.

Use draw-type shade or venetian blind.

Provide push-button-control windows.

Provide windows that can be operated freely with one hand.

Only upper portion of sash should be movable to prevent objectionable drafts and to prevent passengers from extending arm out of window. This arrangement also provides better ventilation and keeps noise out of vehicle.

Provide safety catches on windows that positively hold windows in position.

Provide improved visibility for standees.

Install glass or small windows in curved edge of roof to improve standee vision, general appearance of vehicle and, in case of windows, provide additional ventilation.

Sash spacing should correspond to seat spacing.
Provide for opening of rear window on each side to eliminate heat pockets in rear of bus.
Lower rear windows for better vision.
Arrange so that glass may be replaced in windows without removal of interior paneling.
Provide window guards.

DOORS AND STEPWELLS (270 references)

- * Doors should be wider, particularly exit doors. Two comments also mentioned that doors should be higher.
- * Provide doors that slide into side panel instead of folding doors.
- * Provide additional exit door at front.
- * Provide additional exit door at rear.
Provide improved arrangement for automatic operation of doors by passengers, with adequate safety devices.
Use treadles or electric eyes.
Provide additional exit door at center.
Provide entrance door at center and rear.
Provide double-width entrance and exit doors with separate control for each exit door with overriding control by operator.
Use transparent doors or provide more window space in doors for safety.
Exit doors should be located at extreme rear of bus to draw passengers to the rear.
Provide more positive means of holding entrance and exit doors in closed position to prevent rattle.
Provide better step lighting.
- * Provide automatic folding or retractable steps to expedite passenger movement and safety. Would permit lower risers and deeper treads.
Consider use of escalator system instead of steps "due to the fact that a big percentage of bus patrons are of the older age group."
Make uniform number of steps at entrances and exits.
- * Provide lights under both steps to show edge of bottom step at night and to illuminate ground area.
Provide light for each individual step.
Provide a grated step well or floor.
Provide heating equipment in stepwell or under steps to keep steps free from snow and ice.
Provide doors in front (not side) of bus.
Provide doors on left side of bus for use on one-way streets.
Provide doors that open overhead.
Provide continuous hand rail, reachable at ground level at entrance and exit doors.
- * Provide railing at front to separate boarding and alighting.
Place door controls under steps rather than overhead.

FLOORS (16 references)

Floor should be sloped as in a movie theater to provide more front visibility for passengers.
Provide a conveyor belt aisle floor.

Floors should be coved at sides and all corners.

The following suggestions were made with respect to floor material:

- Material should be of a "life time" nature, lasting ten to fifteen years.
- Should reduce slippery conditions.
- Should be warp-proof and buckle-proof.
- Should provide cushion in aisle for comfort of standing passengers.
- Should be of floral or other attractive design for eye appeal.

STANCHIONS AND HANDRAILS (25 references)

A number of the replies stressed the general need for more stanchions and handholds for safety and convenience of the passengers.

Other specific suggestions were:

- Place bar or stanchion in front of both front cross-seats for protection in event of emergency stop,
- Place handholds at each seat for standing passengers.
- Locate longitudinal stanchions closer to roof for greater safety and convenience of standees.
- Lower grab rail.
- Provide continuous grab rails.
- Provide safety retractable ceiling handholds for standees.
- Provide "nonskid" covering for handrails, grab handles and uprights.
- Use hard rubber, slightly flexible, for stanchions.
- Cover stanchions and handrails with fused protective covering.
- Use color on stanchions with different color at hand level from rest of stanchion.

ROUTE AND DESTINATION SIGNS (50 references)

*General comment - Destination signs should be improved with respect to legibility, makeup, method of operation, number and locations provided. Specific suggestions were:

- Height of opening should be increased to accommodate listing of two destinations.
- Use photographic projection instead of cloth roller, to make sign more compact, avoid waste of material and facilitate changing of signs.
- Provide power or electronically operated signs.
- Arrange so that all signs on vehicle may be operated from front end.
- Signs should be provided on front, side and rear of vehicle.
- Provide a 30% larger front destination sign and, above or below it, an additional sign one half its size for additional markings such as "Express," "Limited" and important way points.
- Include provision for run number in destination sign.
- Provide signs with different color combinations to indicate "Express," "Local," "Bus Full," "Not in Service," etc. in addition to sign legend.
- Large roller should be full width of coach at top and short roller for route signs should be on right front corner beneath windshield.

Provide more roller capacity to give greater flexibility.
Arrange signs so that they display same signs inside coach as on outside.
Install destination signs below windshield and rear windows.
Provide sign device built into top of coach and streamlined to roof contour, so that it can be viewed easily from both front and rear.

OTHER MATTERS RELATING TO BODY (307 references)

Provide a Quieter and Rattleproof Bus Through Use of Better Fastenings for Movable Parts, Insulation, etc. (11 references)

Body Design Should be Improved and Modernized. (59 references) - Specific suggestions:

Study English body design which is ahead of United States.
Use lightweight skin-stressed design.
Provide for interchangeable body bolted to frame, to provide changes in seating capacity and arrangement to suit changing conditions.
Use short, small vehicles capable of being coupled together into a train.
Each vehicle would have its own propulsion motor, but only leading one would contain controls. Trailers would be articulated with only two wheels. Adjust number of trailers to traffic requirements.
Use very narrow vehicles with side entry doors opposite each seat for operation down a narrow median strip in center of street reserved exclusively for transit use.
Provide larger loading area at front.
Provide less standing room at front of bus to force riders to rear.
Use tractor-trailer combinations.
Provide a double ended bus.
Use a plastic body.
Provide a double deck bus - with escalator to upper deck.
Give bus a more generally streamlined appearance.

(Two replies indicated present body design is satisfactory and should not be changed.)

Interior and Exterior Decoration Schemes Should be Changed and Improved. (59 references) - Specific suggestions:

Use permanently colored ceiling panels, grab rails, stanchions, seat backs and upholstery.
Floor covering should harmonize with interior color scheme.
Use simulated pile, plastic carpeting from wall to wall, two-tone seat covering, plastic fabric headliner and side wall covering.
Use stainless steel lower panels, colored plastic upper panels on ceiling, waterproof upholstery.
Use material not requiring paint and not easily damaged or marked.
Use stainless steel interior panels to resist vandalism.
Vary the color scheme and interior designs within the fleet.
Provide higher ceilings.
Provide functional interior lighting with flush mounting of fixtures and accessories.

Use bright colors for the seats and floors and interior. (One comment: Do not use "feminine" shades since there are as many men passengers to be considered.)
Use bright, distinctive paint on exterior.
Paneling between windows should be chrome-covered.
Color scheme should be changed periodically, including new streamlining effects as in modern cars.
Use a plastic or glass roof such as on the new trains.
Provide some form of general exterior lighting to increase visibility of bus.
Use body material with integral color to eliminate need for painting.
Provide a self-cleaning finish or electronic device to cause dust and grime to fall off.
Provide an improved paint which will adhere to wooden doors.
Consider covering the plywood panels with plastic or plastic-impregnated fibre-glass.
Use chrome covers on wheels.

SAFETY FEATURES (16 references)

All interior bus accessories should be rounded, curved, or padded to prevent injury to passengers in case of sudden stops or swerves.
Eliminate any sharp edges or corners particularly at the entrances and exits.
Incorporate reflective materials into exterior decoration.

COMMUNICATION FACILITIES (75 references)

- * Provide a public address system for use by operators in announcing streets, etc. A number of these replies mentioned use of the public address system for providing background music, news and advertising through tape recording.

Other suggestions were:

Provide a better signaling device for passengers.
Provide passenger signal button on back or arm rest of each seat.
Use chimes with different tones to indicate whether signal came from front or rear.
Change buzzer to a one-stroke chime.
Provide telephone communication between each seat and the driver.
Provide two-way radio-telephone communication with dispatcher for each individual bus for better control of service.
Provide public telephones.

OTHER DETAILS (87 references)

Provide a flashing light or other means of attracting passengers to the rear of the bus.
Provide a route map, as in subway cars, preferably illuminated from behind.
Provide package rack along one side, about 6'-9" above floor.
Provide parcel space for passengers, possibly in a compartment near the front door.
Provide sign indicating vacancies in bus.
Provide trash receptacles for passengers.
Provide movies, newsflashes, etc.
Provide television.
Provide FM radio or Muzak.

- Provide mirrors for passengers.
- Provide coin beverage dispenser with built-in receptacle for disposable cups.
- Provide pick-up service receptacle for photographic films and similar services.
- Provide clocks.
- Provide vending machines.
- Provide a dispenser for bus sickness pills.
- Provide means for announcing street names by signs, projection on a screen, tape recorded announcement, etc.
- Provide a folding tray for packages or writing with a lamp above.
- Provide radar feelers for foggy driving plus electronic eyes to warn when coach approaches a stop or comes too close to curb or any other stationary object.
- Standardize signs such as "no smoking," vehicle numbers, etc. so they appear in the most visible places on all coaches.
- Provide better locks on all engine and radiator doors.
- If rear seat must be removed for work on the engine, provide more positive sealing of opening between rear seat and engine compartment and locking arrangement to prevent unauthorized access to engine compartment.
- Passenger compartment should be well insulated from any noise, vibration and fumes from power plant.
- Undercoat bus to deaden noise (but not to interfere with unit replacement or understructure repair).
- Provide shock absorbing bumpers; bumpers wrapped around corners; improved bumper design and location.
- Body should be free from projection by having items such as marker lights, bumpers and rub rails built in.
- Provide larger, stronger chromium wrap-around bumpers to improve appearance and lessen coach damage. A hinged bumper at rear to protect radiator and transmission.
- Body panels should be easily removable for repair.
- Provide push-out body escape panels.
- Eliminate all corners and crevices in bus to permit easier cleaning.
- Provide covers (with strong locking devices) over wheels to provide more continuity and beauty in side appearance.
- Provide water sealed interiors and seat cushions with drainage to doors or other outlets for cleaning and flushing water.
- Provide wear-resistant inserts on covers for rapidly wearing parts such as brake pedals, starter buttons, dimmer switches, etc.
- Body units including side paneling should be of corrosion-resisting material to last the life of the bus; use insulation at the joints to prevent electrolytic action.
- Doors to engine and other compartments should have stronger and more positive securing devices.
- To prevent oil and sludge from accumulating on rear of body, provide two drain lines from air blow-off system to center of bus.

POWER PLANT (47 references)

Possible new methods of propulsion should be fully investigated and considered.

Specific suggestions:

Study possibilities of turbo-drive system of propulsion.

Use gas turbine.

Consider possibility of coach powered by atomic power.

Consider possibility of reviving use of steam engine. (This reply reviewed past history of experiments with steam power and its inherent advantages.)

Power plant should be lightweight, have long life and low maintenance and operating costs; must be adequate to equal or exceed the operating characteristics of the modern automobile.

Provide larger, more powerful motors.

Develop engine with no reciprocating parts having the torque characteristics of a steam engine.

Provide a lighter-weight diesel engine.

Engines should operate more quietly. Specific suggestions:

Provide insulation to cushion motor noises.

Develop a variable pitch fan for cooling system and eliminate all winter-front equipment.

Redesign exhaust system to eliminate excessive noise and maintain lower engine back pressure.

Provide an improved muffler.

Locate exhaust pipe near the roof.

Provide dual mufflers.

Redesign piston and combustion chamber to permit increased compression ratio and higher engine efficiency.

* Eliminate or reduce exhaust, smoke and odor. Specific suggestions:

Improve present injection system with respect to atomization and timing at various speeds.

Relocate exhaust pipe "perhaps in center of bus with tail pipe pointing horizontally towards rear."

Develop "exhaust exchanger" to mix clean air under pressure with exhaust gases before they are expelled from tail pipe.

Install exhaust pipe at top rear of bus.

Install blower on exhaust manifold to dissipate fumes.

CHASSIS (101 references)

STEERING (33 references)

Provide easier steering facilities for driver. Specific suggestions:

*Provide power steering

Provide automatic pilot steering.

Tilt steering wheel to approximately same angle as on a passenger car.

Provide deep dish safety steering wheel.

Provide steering on both front and rear wheel for easy entrance into and exit from bus stops.

Provide curb feelers.

SPRINGS (28 references)

- Air suspension should be generally adopted.
- Provide torsion-bar and "levelizer" suspension system to eliminate rock 'n roll air ride.
- Provide road stabilizing device to control skidding.
- Make front end heavier for better balance to eliminate shimmy and tire wear.
- Eliminate sway of bus on curves.

WHEELS AND TIRES (11 references)

- Use small wheels with soft donut-like tires.
- Use smaller wheels to permit lower floor and eliminate steps.
- Tire sizes on each bus should be the same on all six wheels.
- Provide safety tires for front wheels.
- Provide puncture-proof tires.
- Provide four hydraulic retractable wheels for moving coach on a direct right angle as into a loading zone.
- Provide tandem rear wheel assembly so that only two tires will be in service except when there is a standee load.
- Provide tandem wheels at rear.

BRAKES (29 references)

- Consideration should be given to disk-type brakes.
- Provide power brakes.
- Develop better location and operation of hand brake levers or use pedal-type emergency brake with push button release.
- Brakes should not lock wheels and cause a skid when clutch is disengaged.
- Brake life should be extended through some auxiliary braking systems.
- Include anti-roll-back device.
- Develop brake lining and brake shoe application to eliminate noise.
- Provide for automatic application of brakes when driver leaves his seat.
- Provide an adequate emergency brake.
- Radar-operated emergency brake.
- Include installation of sanding devices.
- Study modern developments in braking to provide more satisfactory system.

POWER TRANSMISSION (7 references)

- Provide faster acceleration for diesel buses through new improved and more efficient type of drive.
- Provide a transmission with push button shifting.
- Transmissions should be simplified to reduce road failures.
- Reduce transmission whining on diesel engine buses.
- Provide tandem rear axles for smoother riding.
- Provide self-locking differential or a power riding differential to prevent wheels from spinning on slippery street surfaces or with one driving wheel in the deep snow or soft earth.
- Differential drives should remain quiet for life of vehicle.

MISCELLANEOUS (7 references)

ADVERTISING (5 references)

Advertising, if desired, should be improved in appearance and kept in harmony with vehicle design. Specific comments:

Outside advertising should be eliminated; spoils outside appearance of bus.

Outside advertising display panels should be lighted to make it more salable.

Advertising racks (interior) should be designed for different sizes and heights of cards; should not be rectangular in shape, but should give appearance of flowing into ceiling of bus.

Consider use of shadow boxes with interior lighting.

GENERAL (2 references)

Develop an automatic vehicle, requiring no operator, following prescribed routes with a safe convenient method of passenger entry and exit.

Doll up drivers with more colorful uniforms.

MECHANICAL DESIGN (20 references)

The following items pertain to recommended changes in mechanical design or equipment intended to reduce maintenance labor and material costs or to provide protection against special hazards:

Brake shoes should be designed for cooler braking.

Substitute machined wheels for stamped wheels on front end of coach. This would assure easier steering and fewer front end repairs with better balance of front wheels and elimination of shimmy.

If the engine is to be water cooled, all parts coming into contact with water should be made of material less susceptible to corrosion.

The injector tubes are a weak spot in the head. If the head could be made of better metal or strengthened so as to prevent cracks between the bolt holes and the water outlet holes, considerable savings would result.

The generator cooling system could be improved by the installation of a fan on the drive end of armature, also instead of Hyatt bearing in drive end, use ball bearing of 406 size or larger. (Applies for generator GMC 1117568 or any generator where excessive amount of amperes are used.)

Auxiliary electrical indicators such as oil indicator and air switches on shift cylinder should be better quality and construction so they could be adjusted and repaired. This, rather than the cheap "one-shot" expendable items now used, the functioning of which can result in expensive major damage to the engine.

Water outlet holes in top of GMC 6-71 diesel block and inlet water holes in diesel head should come with replaceable brass sleeves to do away with corrosion.

Use an oil seal in the shifting governor to keep turbine oil out of governor and grease in. (Have oil seals facing down.)

Replace the cork oil seal GMC 2041113 in speedometer adaptor drive with a Neoprene oil seat.

- The circuit on electric speedometers should be controlled through a switch actuated by forward and reverse shift lever which would disconnect the speedometer from the circuit except when the bus is in forward motion. Considerable speedometer damage has been done when the "control-run" switch is on and the bus is not in motion. At such times the electric circuit on the speedometers is energized and if left in an "on" position for a great length of time the commutator in the sending unit is destroyed.
- The radiator, turbine cooler and shroud should be located behind a panel and hinged for easy access.
- Two separate battery compartments should be provided so that batteries could be stationary, utilizing some of the space under two adjacent seats. The structure around the compartments, top and bottom, should be integral part of the chassis. The batteries could have parallel connection, connected by series jumpers. It is believed that foot room under these two seats will still be adequate.
- Improve or replace present V-driver transmission. Turbine should be constructed of better material, especially the case(outside) and the blade assembly, such as reactor cover, rotor and impeller and bearings. The aluminum material does not stand road abuse. The case isn't strong enough to hold studs without pulling them out when torque wrench is used. If blade assembly were made of bronze or light steel, similar to the Spicer turbine and the case of cast iron, maintenance cost could be reduced. A low direct gear should be incorporated in the transmission for use on steep grades. This should be manually controlled by driver. A starter that does not run in oil at "drive end" would be better than one that runs in turbine fluid at "drive end."
- Inclusion of a simple method for checking cylinder compression. A 1/8-inch passage should be drilled from the front of the head to the compression chamber with a threaded plug at the outside end. A reamer might be necessary to clean out the carbon each time it is used. This would eliminate all of the present work of removing rocker arms and injector to install compression gauge fixture in injector tube, then replacing rocker arms and resetting valve lash before compression check can be taken, after which this whole procedure has to be reversed to put injectors back again.
- There should be a better arrangement with more room to repair or service the following items: Fan and oil filters, starter, brake valves, entire engine for steam cleaning, wiper control and regulator valves, door control valves.
- Electrical wiring panels should be located so that they are accessible from the outside of the bus. A swinging panel door could expose them for repair or checking.
- Neoprene covered wire should be provided in all greasy or dirty locations to eliminate "shorts" or fire, especially for battery cable.
- Provide a master switch to all circuits for disconnecting the battery as a protection against fire.
- The exhaust manifold should be relocated with more clearance from the engine to eliminate the collection of dirt and oil which causes fire hazard.
- Install an outrigging support to the emergency brake hinge pin that secures adjusting assembly on side of differential housing. Without this additional support the emergency brake may be out of order when and if air brakes fail or emergency stopping feature is required.
- Wiring should be more durable, weatherproof and adapted to bus requirements.

Wires on all types and sizes of buses should be uniformly coded for guidance of the electricians in making repairs.

Wiring should be placed in conduit above the engine to prevent deterioration from oil and dirt.

Shift to use of alternating current.

Improve air-operated equipment to eliminate contamination from outside sources, oil, possibility of freezing and carbon deposits.

Arrange power plant, transmission and all units for fast removal and accessibility.

Design rear seat to allow greater engine accessibility.

Appendix A

"THE BUS OF THE FUTURE"

CHARLES L. PATTERSON
CHAIRMAN
NEW YORK CITY TRANSIT AUTHORITY

In many respects the future of the transit bus appears to be dependent on the solution to the self-inflicted problem brought about by the ratio of automobiles to mass transit vehicles. Providing of speedier service will depend largely on City Planners rather than bus engineers since the present vehicle is incapable in most instances of operating up to its present peak performance because of interference by automobiles.

Coaches must be designed specifically for operation in densely populated areas and over heavily traveled streets at from eight to ten stops per mile and at an average scheduled speed of not less than twelve miles per hour, affording every feature essential for safe, fast, efficient and comfortable operation by the operator with the utmost in passenger safety, comfort and convenience.

The vehicle must be capable of at least matching, with the hope of surpassing the performance with respect to braking, acceleration and grade climbing ability of competitors traveling on the City streets, which implies adequate power, proper gearing, correct braking, rapid loading and unloading and light weight.

The attainment of these goals will depend on economics and practicability. It seems likely however, that:

Availability of better fuels with other engine changes may boost fuel economy by 25 or 30 per cent.

One hundred seated passengers in a bus operated by one operator will occur.

Ferrous and nonferrous metals will be replaced by plastics in body and associated parts.

Passenger comfort will be enhanced by such things as year-round air conditioning.

It appears very likely that the trend from spark ignition engines to diesel engines will be followed eventually by the gas turbine. Prior to the advent of the gas turbine however, the present passenger car and truck transition towards high output V-8 engine may come to this industry. It is possible that with fuels of 100 research octane number becoming commercially available and with compression ratios of ten to one along with other revisions such as increased combustion, volumetric and mechanical efficiency plus optimum carburetion and other technological advances in the reciprocating engine, there may even be a trend in the transit power plant from the diesel back to gasoline.

Simplification of power trains starting at the engine flywheel should be in the future since there are at present complex arrangements of fluid couplings, torque convertors, universal joints, propeller shafts, differential assemblies, angle gears

and so forth, which may possibly be replaced by simple fluid torque multipliers. Certainly power trains will be designed as integrated systems rather than combinations of independent units since it is the power at the wheel which counts.

One hundred passenger capacity buses or bus trailer combinations of several units with standees eliminated may be practicable. Side sliding door entrance from loading platforms with mechanical fare collectors combined with central public address systems and push button operation will enable one-man operation.

The transit engineers' thinking as mentioned above with reference to usability, performance and safety will require continuing pioneering including such things as monocoque stressed skin construction, lighter weight materials, simple power transmissions, power controls, improved lighting, air conditioning, new suspension systems, attractive fireproof foam rubber seating with attractive synthetic upholstery, noise insulation and so forth.

Schedules may be controlled by automatic headway recorders and transmitters electronically operated. In fact, the bus as we know it today may become an antique in the sense that it may be replaced by overhead monorail or helicopter service, but it seems reasonable to assume that the mobility of the bus combined with proper street planning will continue to provide the most flexible system for mass urban transportation.

Ref: 1507-HF-N
December 14, 1955

Appendix B

"The Bus of the Future"

214 Telegraph Building
Harrisburg, Pennsylvania
October 17, 1955

Mr. J. L. Haugh
Chairman, Committee on Bus Design
American Transit Association
c/o San Diego Transit System
San Diego 1, California

Dear Mr. Haugh:

I am the retired ex-president of Harrisburg Railways Company and although not connected with that company since it was sold last year, I maintain an active interest in its success and in the industry.

There is much to be said in redesigning our vehicles. Any too radical changes if adopted, however, would make obsolete the many thousands of vehicles we have purchased in the last few years and many of our companies would be unable to finance new fleets. Operating the new and the old buses, if there was a great difference between them, at the same time would bring about the same condition as on the steam roads; viz, not having enough streamlined cars always to complete a train, there is a mixture of old and new, which does not appeal to the rider forced to use the older vehicles.

I think the immediate need for change is to make it easier for the customer, especially the new customer, to know which bus, what schedules and routes he should take to get to his destination.

We have been changing our routes continually to conform with urban traffic changes. In order to cut out waste and losses, we have abandoned lines, cut back services, changed schedules, rerouted, made different schedules on certain days until our customers are confused. All these changes are necessary, but we have not or have not been able to keep the patron informed or make it easy for him to ride.

Ten years ago I tried to get some better destination signs from the manufacturers, without results. We now have split signs, different colors for odd routing, symbols (like the red stroke) for turnbacks, cards in the windshield, and various other notices which the average person cannot remember or fathom.

Try going to a strange city and see how hard it is to find the vehicle which will take you to your destination.

Should we have simplified and fewer signs on our buses?

Should we give more explicit up-to-date information on our bus stop signs?

How efficient are signs inside the bus or pasted on the windows mixed up with all the ads?

Do people carry our printed schedule cards? If we have to change routings or schedules continually, can the patron keep up to date?

What methods do the real efficient stores use to make shopping easy? We might get some hints to apply to transit; in fact, just as the airplane showed what could be done, has helped the railroads.

I think "plastering" our buses with signs "Ride the Bus," etc., detracts from the vehicles and continually hammering on that theme in the newspaper has been expensive and without commensurate results.

Referring to page 1 of your letter may I suggest the following:

- (1) More eye appeal - The new buses coming from our manufacturers are good looking. I think our customers have no criticism on that phase. Certainly outside advertisements detract. The appeal is a well painted, clean bus at all times.
- (2) I think the customer is not at all interested in "a lighter vehicle."
- (3) Certainly the steps into and out of buses are unsatisfactory and dangerous, most difficult for the older and crippled people who make up such a large proportion of our riders.
- (4) Fare Collections - Each city seems to have a different method, most of them complicated - one time we pay as we enter, next time as we leave; cash, tokens, transfers, etc. I wonder if we are not asking our patron to keep our books and accounts for us.
- (5) Certainly more comfortable seats and more room would be popular.
- (6) A quiet bus seems to make a more comfortable ride, just as is the case with your own automobile.
- (7) I think we have been overcoming bad engine fumes. We shall always be blamed for the smells which come from poorly maintained trucks, which travel our same routes.
- (8) Improved visibility for the driver - Here we are getting away from the customer and talking above ourselves.

We have missed one very important item - Ventilation. Buses are either too hot or too cold. In humid weather the windows are so steamed up one cannot see out. Heat in summer is unbearable. With full standing load, the air certainly is bad. So far the engineers have come up with theoretical systems, which look well on paper, but do not accomplish results or are too complicated, or rely too much on the human element of the driver. Air conditioning in trains and planes has brought a demand for better comfort in buses.

Page 2 of your letter

- (1) Certainly the staff, foremen, and bus drivers should be consulted and asked to make suggestions, but they do not always see the everyday rider's viewpoint and have an eye for more mechanical changes affecting costs, etc.
- (2) Get the customers' ideas. Possibly this could be done by asking for suggestions in answer to newspaper ads. To consult the patron is good publicity.
- (3) If this does not work, try a contest.

Always keep in mind that we are an old industry. Many of us live on precedent and see only from the viewpoint of operation and maintenance; in fact, many of our staff do not ride the buses. Let the customer tell us.

Please pardon this lengthy letter. I am thoroughly sold that the only way we can hold our business is service to the public and that of such quality that people will want to ride with us easily, comfortably, and speedily and not use transit simply because of weather conditions or lack of ownership of automobiles.

The present survey should not be from an engineering or manufacturing or operating standpoint. After the suggestions and requirements of riders and nonriders are received, it is then time to turn over this data to the engineers and operators to see what can be worked out.

Very sincerely yours,

/s/ Henderson Gilbert

Henderson Gilbert

Appendix C

"The Bus of the Future"

GRANT MONEY-METERS COMPANY

1117 Douglas Avenue
Providence 4, R.I.

October 31, 1955

Mr. Jesse L. Haugh
Metropolitan Coach Lines
610 South Main St.
Los Angeles 14, California

Dear Mr. Haugh:

This letter is written to you as Chairman of the A.T.A. Committee on Bus Design.

"We have a very definite suggestion and recommendation regarding an improvement in bus design that relates directly to zone fare collection.

"Briefly the recommendation is to - (1) Widen the front doors of the vehicle sufficiently so simultaneous exiting and entering of passengers is permitted with a guide bar in the centre. (2) Operators control should be so he can open either half of the door independently of the other or both halves simultaneously. (3) That is all.

"While this sounds absurdly simple the impact can be tremendous. Perhaps some background to this suggestion will clarify the reasoning."

Prior to the design and development of our present line of fare collection equipment we embarked on an extensive field research and study program as to just how we could benefit the industry.

This was not philanthropy but rather a cold business proposition.

We knew we could not hope to sell new fare collection equipment in any quantity unless the benefits far surpassed any first cost or investment consideration.

Our studies disclosed an appalling high direct cost of fare collection; in many cases exceeding 5 cents per vehicle mile. This represented up to 30% of reducible direct operating cost.

The second phase of our studies revealed that the industry needed and wanted a true zone fare system because of the increasing complex fare structures and necessary fare increases.

But they had no equipment available to collect this zone fare.

This gave us our goal. (1) Automation in the fare box to speed up collections, to save seconds at every stop and increase actual running time. (2) Extraordinary visibility to sharply reduce accidents, to detect and stop the rapidly increasing wave of short fares and relieve strain and fatigue from the driver. (3) Built in means for zone fare collection or measured riding.

When we finally produced our product, the acceptance exceeded even our highest hopes.

Hundreds of leading operating companies are now enjoying the extraordinary benefits from this equipment with reports coming in such as "accidents reduced by over 20%" -- "Your boxes increased our gross by over 2%" -- "Found your boxes bring in \$30.00 more per week per vehicle to me" -- "Has sharply reduced pilfering and fare mishandling so it is no longer a factor with us," etc., etc.

But not a word about zone collections.

We gave them the tool for it but physical limitations of the bus prevents from using it.

The saying in the industry became "You just can't collect zone fares with a muzzle loader."

You widen that muzzle just a bit Mr. Haugh and let us see what happens to that saying. As an example in a pay-leave system, all doors can be opened in the first zone providing three lanes for entering passengers. No identification checks issued. Debarking passengers in the first zone leave the vehicle by the fare box lane depositing the first zone or minimum fare.

After leaving the first zone, embarking passengers enter at the front in the nonfare box lane taking a zone identification check as they enter from a zone check dispenser. Debarking passengers in the second zone use the fare box lane in exiting depositing in the fare box the zone check with accompanying proper fare. Any passenger without a zone check drops in full amount from first zone. Simultaneously embarking passengers are entering through the nonfare box lane taking zone checks from the dispenser as they enter.

This operation is repeated in all subsequent zones. Variation can be introduced such as overlapping zones, etc.

Advantages are gained with a pay enter system also as by means of a criss cross bar. Passengers entering the nonfare box lane are guided past the fare box when entering the vehicle proper. This increases platform capacity permitting driver to close his doors sooner and be on his way while collecting balance of fares thereby saving valuable seconds at every stop.

While we really admit this is no panacea to all zone collection problems, we do believe it is a forward step in speeding collections of complex fares plus greatly reducing stopping time.

Sincerely yours,

/s/ A. M. Gordon, Dir. of Sales

Appendix D

"The Bus of the Future"

Drawing and Sketches of Proposed New Designs

This Appendix includes reproductions of sketches and drawings of proposed new bus and bus detail designs as submitted by the companies listed in the index below:

CHICAGO TRANSIT AUTHORITY

Plate 1 - Suggested Design for "Bus of Tomorrow."

Plates 2, 3, 4, 5 and 6 - Suggested Design for "Bus of Tomorrow."

Plate 7 - Suggested Turnstile Installation for Rear Exit Doors of Buses.

CLEVELAND TRANSIT SYSTEM

Plate 8 - "Transit Coach for the Future," showing artist's sketches of exterior, framing section and elevation drawing.

Plate 9 - "Transit Coach for the Future," showing three artist's sketches of proposed designs.

SAN ANTONIO TRANSIT COMPANY

Plate 10 - Proposed 200-Passenger Bus, showing elevation and section drawings (upper) and artist's sketch of exterior, modernized (lower).

Plate 11 - Proposed Seating Layout for Bus Using All Transverse Seats With Door for Each Seat.

SAN DIEGO TRANSIT SYSTEM

Plate 12 - Proposed Schematic Drawing of Coach Ventilating Circuit Designed Especially for Standee Comfort and Supplementing Air to Engine.

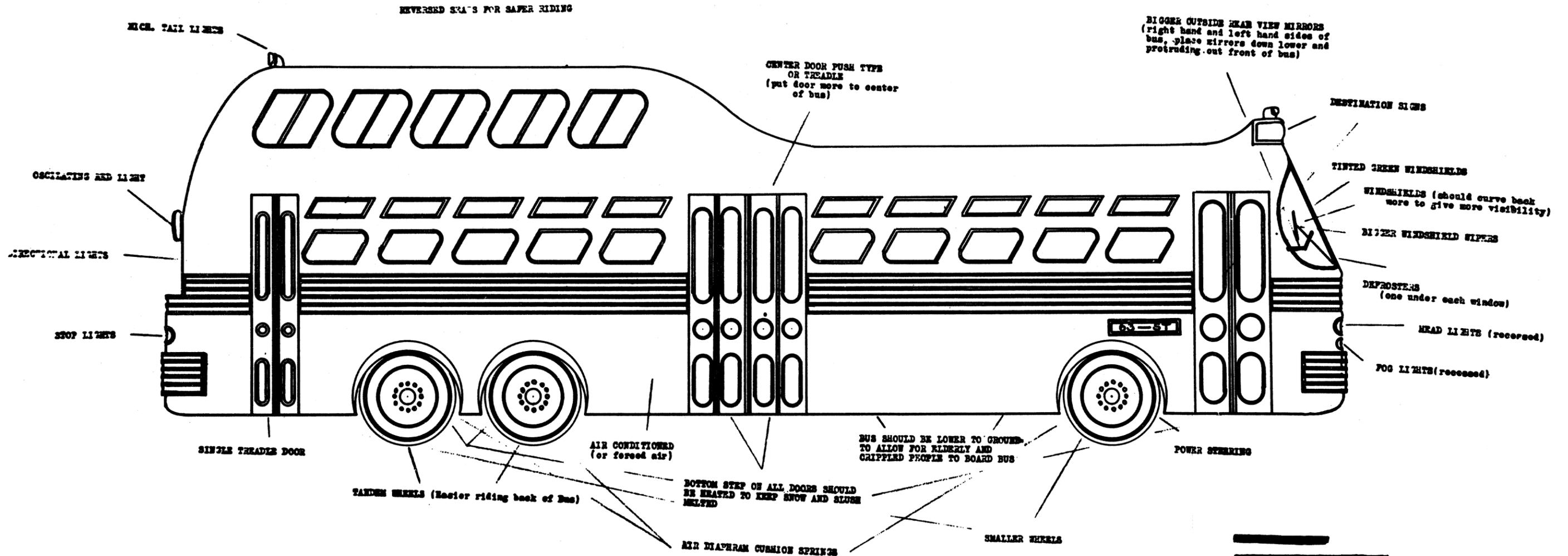
Plate 13 - Proposed Type of Coach Window Ideal for Passenger Comfort and Less Costly to Maintain.

TORONTO TRANSIT COMMISSION

Plate 14 - Letter giving description of "Proposed Design of City Coach."

Plate 15 - "Proposed Design of City Coach," parts index, for use with drawings on Plates 16 - 21.

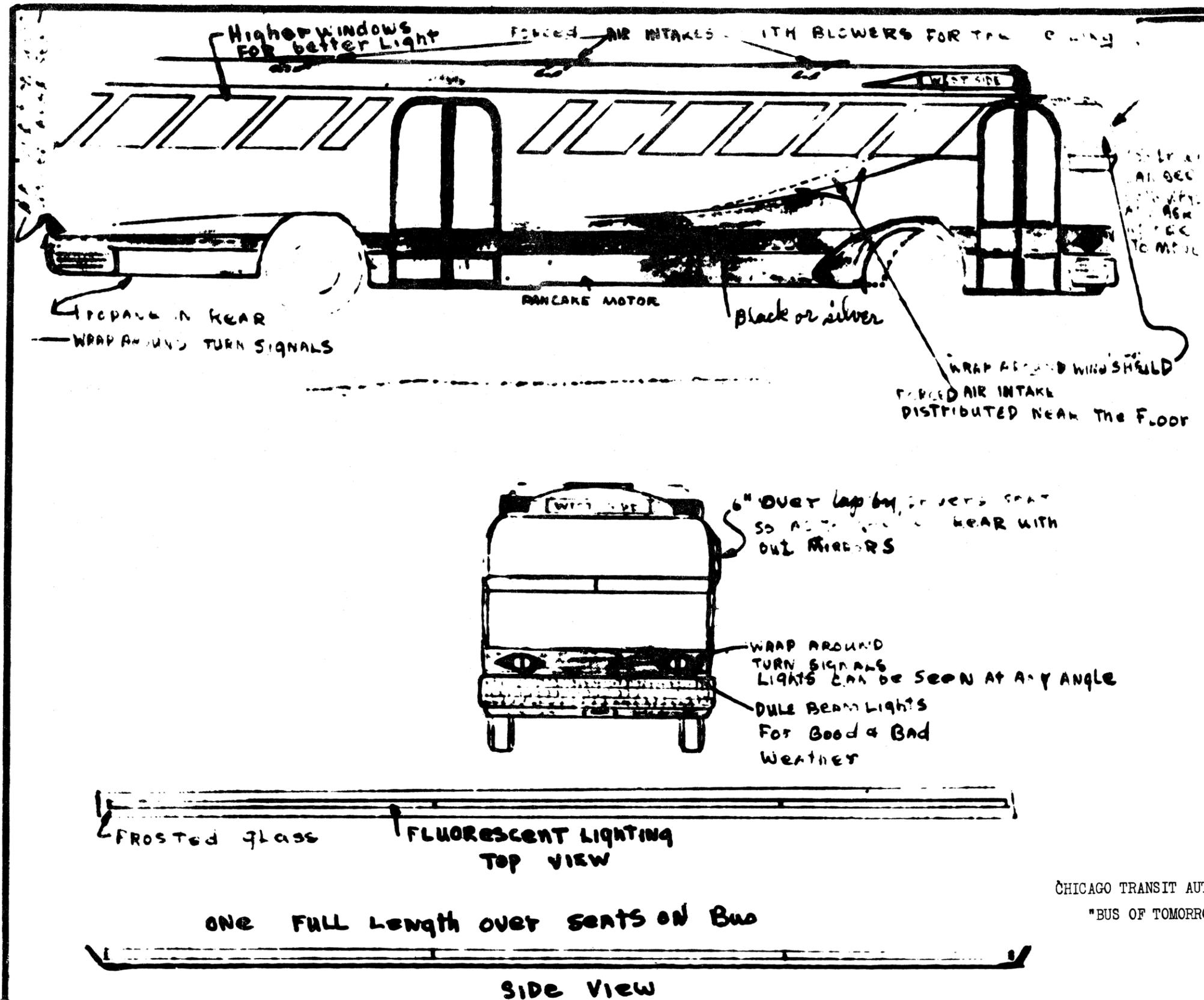
Plates 16 - 21 inclusive - "Proposed Design of City Coach," detailed drawings.



CHICAGO TRANSIT AUTHORITY

"BUS OF TOMORROW"

PLATE 1



CHICAGO TRANSIT AUTHORITY
 "BUS OF TOMORROW"

ONE FULL LENGTH OVER SEATS ON BUS

SIDE VIEW

CHICAGO TRANSIT AUTHORITY

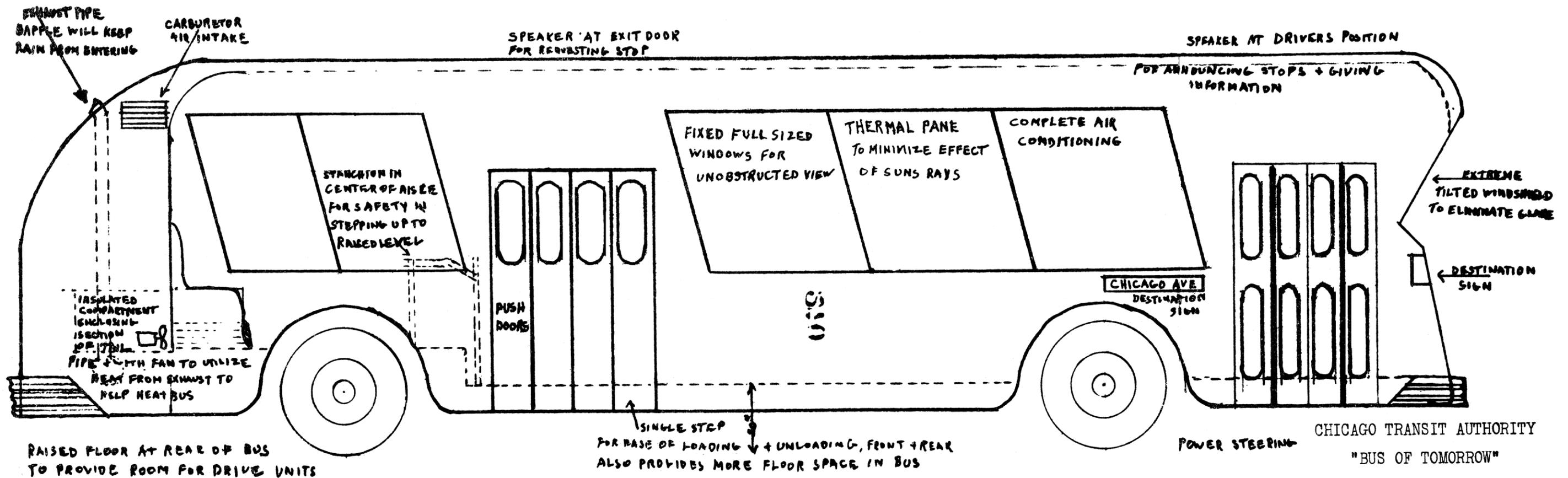
BUS OF TOMORROW

Suggestion No. 392

I SUGGEST THAT the following features be incorporated in the Bus of Tomorrow: (1) Power Steering, (2) E-Z eye glass with wrap-around windshield with 6-inch overlap on left side. (3) Wrap-around turning indicators. (4) Dual beam headlights. (5) Nonopening windows with pushout safety glass for emergency exit. Windows don't open because of air-conditioning.

(6) Bus weights are O.K. (7) A lower gear in motor for faster pick up, not speed. (8) The length and width is O.K., otherwise it would be harder to manoeuvre on streets. (9) Make bus 1 foot higher for tall people, (10) racks for small packages.

SUGGEST BODY BE SET ON HEAVY CHASSIS, WITH SPRINGS OR SOME TYPE SUSPENSION SO THE CHASSIS AND SPRINGS WILL ABORE ROAD SHOCK AND BODY WILL BE SEPARATE UNIT AND NOT SUBJECT TO ROAD SHOCKS. AT PRESENT TIME THE BODY IS AN INTEGRAL PART OF THE CHASSIS AND SUBJECT TO THE SAME ABUSE



CHICAGO TRANSIT AUTHORITY

BUS OF TOMORROW

December 5, 1955

Suggestion No. 270

I SUGGEST THAT for the "Bus of Tomorrow," that the windows be as large as the bus design will permit without sacrificing body strength, they should be in as large sections as possible without top and bottom divisions, they should be permanently fixed and should be double thermo-pane. The windows should be large so that standing passengers as well as seated passengers will have an unobstructed view to the outside. They can be permanently fixed because with air-conditioning there will be no reason to open them eliminating the need for window latches and sash. Thermo-pane would enable the windows to be large and keep out most of the sun's heat and yet leave in the light.

The above suggestions would add to the beauty of the vehicle, eliminate much window maintenance and be easier to keep clean as glass is easier to keep clean than paint.

I hope to see the bus equipped with the new turbo engine, now being developed, as I believe this engine will be easier to maintain not having pistons, cylinders, spark plugs, etc.

The engine will be located in the rear of the bus, allowing the floor level to be lower.

The exhaust pipe will extend through the roof of the bus which will dissipate the exhaust fumes quickly, keep fumes away from following vehicles and not contaminate the air at pedestrian level. The exhaust pipe shall be enclosed in an insulated chamber, the chamber to be equipped with a blower to direct the warm air from the exhaust pipe to heat the interior of the bus. There is sufficient heat given off by even the exhaust pipe of a propane engine, which is at the present time wasted, to heat an entire bus and will develop heat much quicker than the present hot water system. The exhaust temperatures from the turbine engine would be much higher and there would be heat to spare.

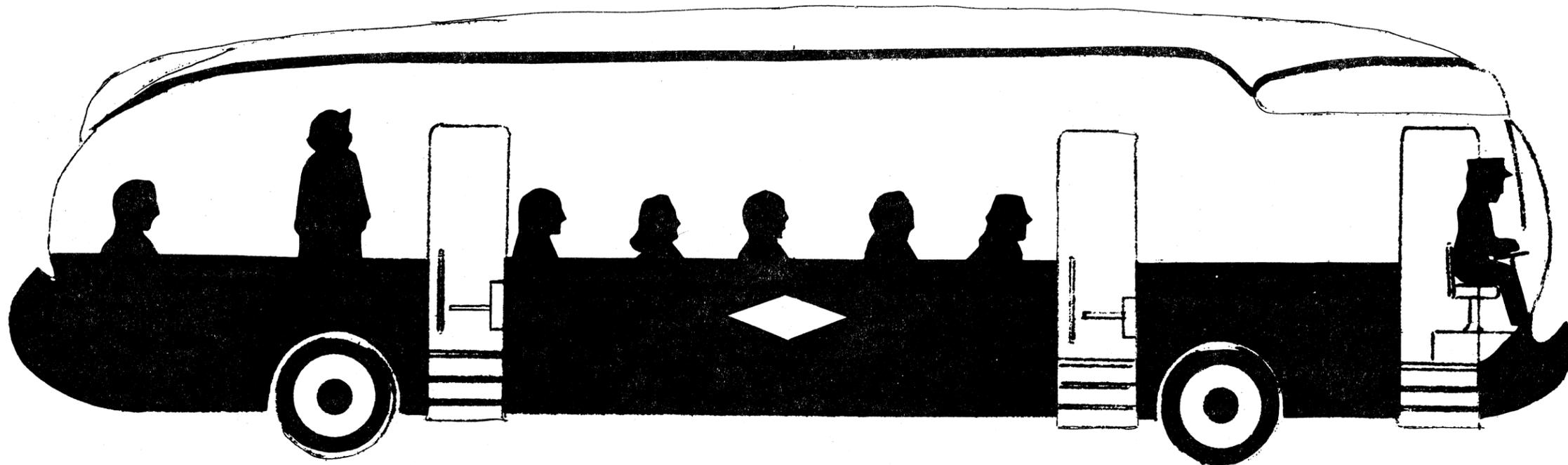
The chassis would be of a sturdy, heavy design, so that the body would not be called upon to carry any of the stresses and loads as I propose that the body be designed to ride on the chassis and not be an integral part of the chassis so as to give a smoother, softer ride. The body could be hung on the chassis or set on torsilastic, air or some other type of suspension, so that all the road shocks are absorbed by the chassis.

The air intake for the engine would be at the roof level where there is less dust and the intake could more easily be protected from direct wind.

PLATE 3

* DOORS - Three on each side.

* OPERATOR'S AREA - At front center.



* MIRRORS - Wrap around overhead and at sides.

CHICAGO TRANSIT AUTHORITY

"BUS OF TOMORROW"

* DESTINATION SIGNS - Electric, at front, sides and rear.

* VISIBILITY - Transparent sides from seat height to roof.

CHICAGO TRANSIT AUTHORITY

Suggestion No. 313

SUGGESTED FEATURES FOR THE BUS OF TOMORROW

STEERING - Automatic pilot for straight-ahead operation in exclusive transit bus lanes; manual override power steering for turns.

OPERATOR'S AREA - Located at front center to improve over-all visibility and allow stream of passengers on either side.

OPERATOR'S VISIBILITY - Operator's area enclosed on front and sides by transparent nonglare laminated structure. Bonding material between laminations in front sections to be good electrical conductor to allow passage of current to heat structure and prevent formation of ice.

MIRROR - One full rear view mirror forming arc over front of bus and extending downward to steering wheel height on each side. Wing sections adjustable from 90° swing to flush with bus body.

OPERATOR'S BARRIER - Curved barrier behind operator with one-way vision glass to minimize interference from passengers and afford him full view of bus interior while furnishing some privacy.

PASSENGER VISIBILITY - Transparent, nonglare, shatter-proof sections from top of seat back to roof. No opaque material at joints.

ILLUMINATIONS - Indirect, uniform lighting reflected from ceiling to illuminate standee areas as well as seat areas.

LOUDSPEAKERS - Provided so that passengers can hear operator call streets and make announcements above noise level.

DESTINATION SIGNS - Electric letters spelling out destination on front, rear and sides. Selected by operator from control keyboard.

DOORS - Duplicate sets of doors located on each side of bus to permit bus traffic to load and unload on both sides of one-way streets. Except at front, doors to be familiar single-panel, outward-swing, house-hold type; customer operated, operator locked and unlocked. Front door to be slide-to-rear type and controlled by operator. All panels to be completely transparent.

TURNSTILES AND FARE VENDING MACHINES - Two-way Perey Kompak type turnstiles at each door, free turning for exit and operated by coins or tokens for entrance. Device controlling turnstile also able to issue transfers, make change and issue tokens. Device at front door also to punch transfers after they are ready by operator.

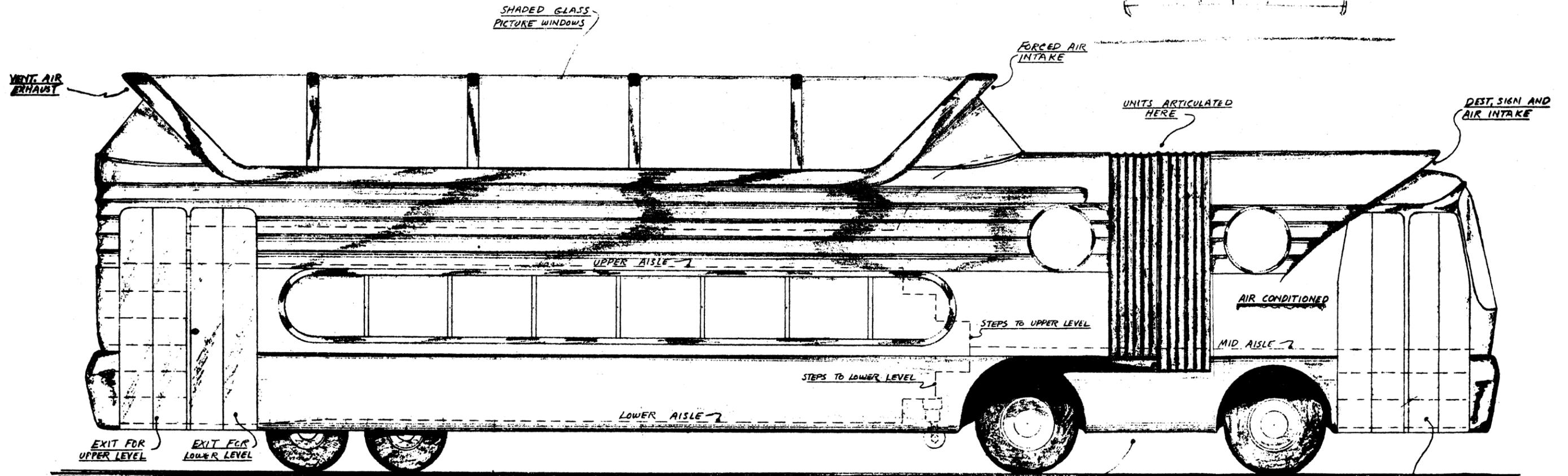
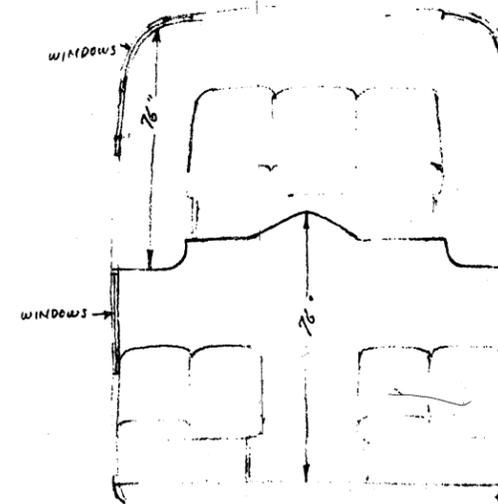
GRAB RAILS AND STANCHIONS - Horizontal stanchions approximately 3 feet from floor, beginning at each door, and, except for passage gaps, converging into one section running full length of bus.

SEATS - One row of individual pedestal-base seats along each wall; second row of individual seats on one side only with theatre-type inward folding cushions to allow persons to leave wall side seats without anyone pivoting and striking persons in aisle. Longitudinal seats over one front and one rear wheelhousing.

AIR-CONDITIONING - Electro-mechanical units of the freon-charged type.

HEATING - Uniform radiant heating from floor eliminating hot and cold spots.

BAGGAGE RACKS, VENDING MACHINES AND DISPOSAL UNITS - Space for baggage, vending machines (candy, newspapers, etc.) and waste paper disposal over one front and one rear wheelhousing.



VENT AIR EXHAUST

SHADED GLASS PICTURE WINDOWS

FORCED AIR INTAKE

UNITS ARTICULATED HERE

DEST. SIGN AND AIR INTAKE

UPPER AISLE

AIR CONDITIONED

MID AISLE

LOWER AISLE

STEPS TO UPPER LEVEL

STEPS TO LOWER LEVEL

EXIT FOR UPPER LEVEL

EXIT FOR LOWER LEVEL

SMALL WHEELS FOR LOW FLOOR

TRAILER SECTION CAN BE KEPT IN SERVICE
MAX. AMOUNT OF TIME WITH DIFFERENT
TRACTOR UNITS.

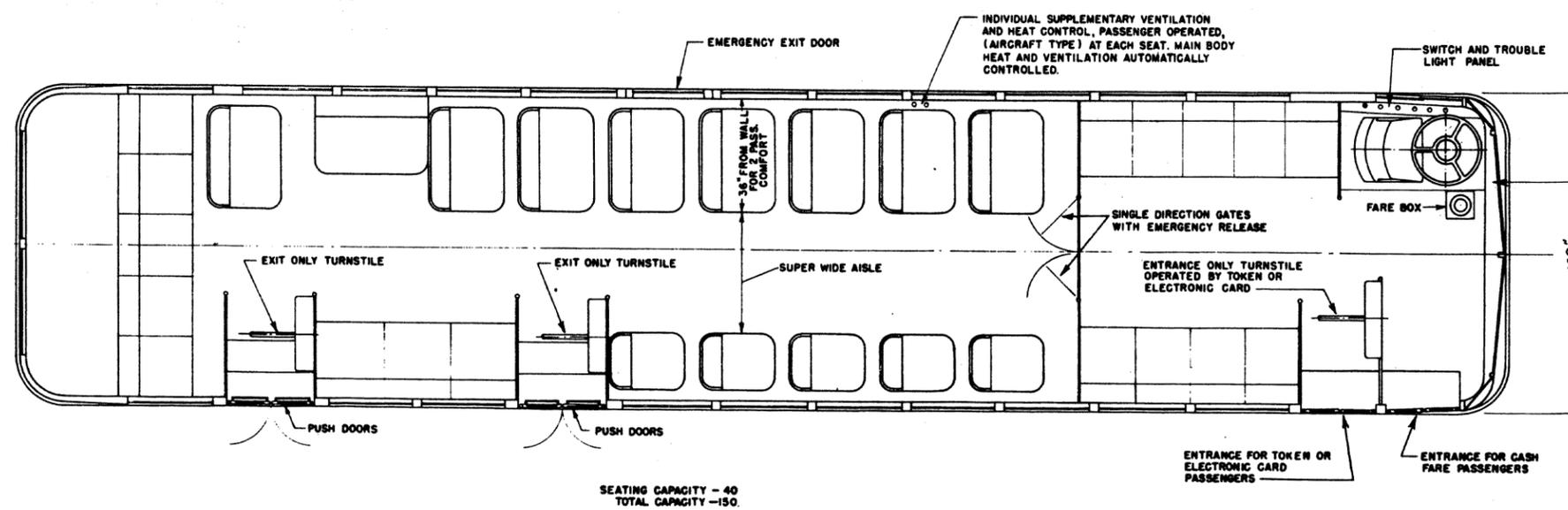
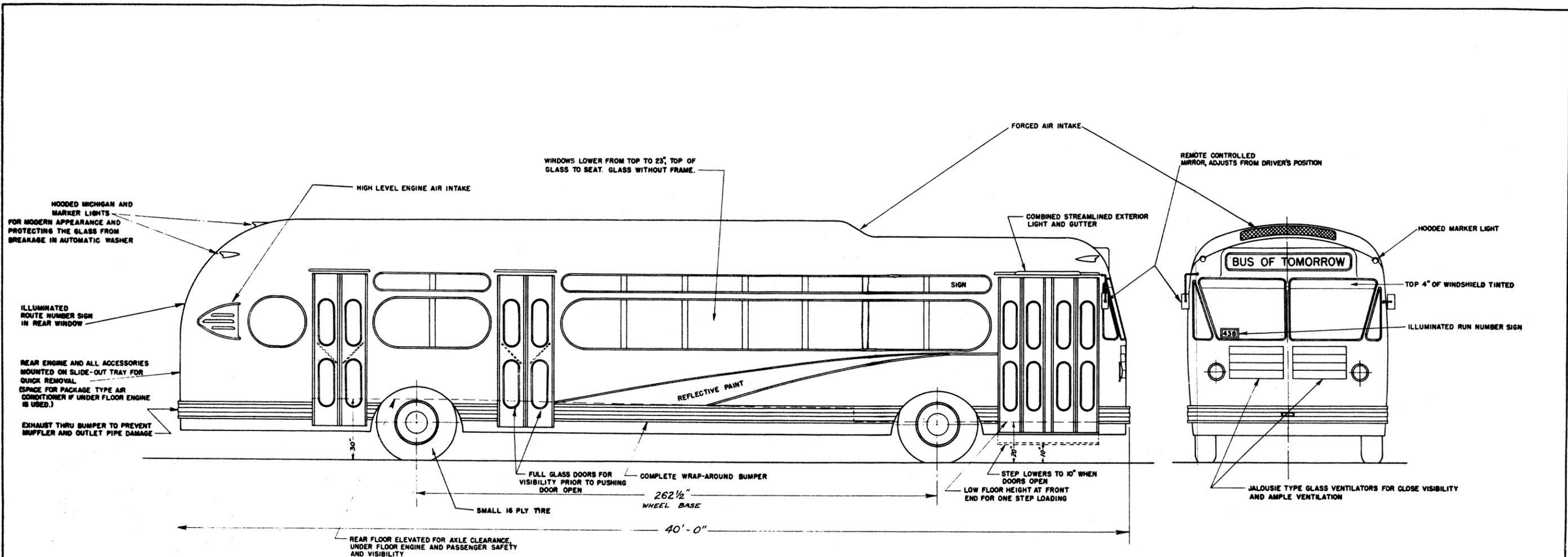
COMPLETE POWER UNIT INCLUDING
FRONT PASSENGER & DRIVER COMP. CAN
BE REMOVED QUICKLY FOR REPAIR OR
SERVICE

ALL GLASS DOORS
FOR BETTER VISION

CHICAGO TRANSIT AUTHORITY
"BUS OF TOMORROW"

CITY BUS OF TOMORROW

• PLATE 5



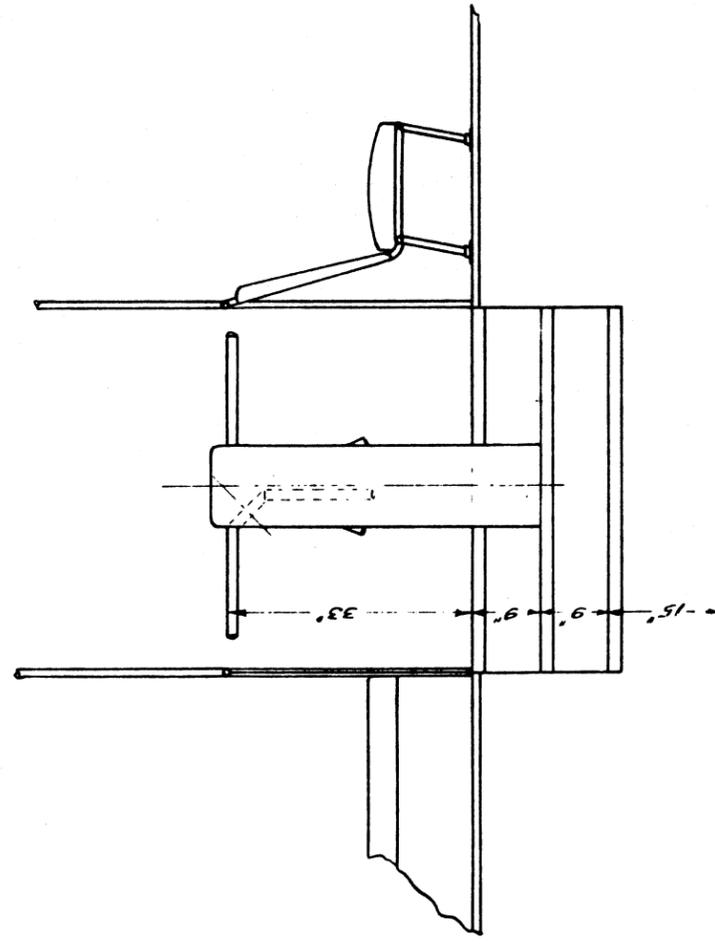
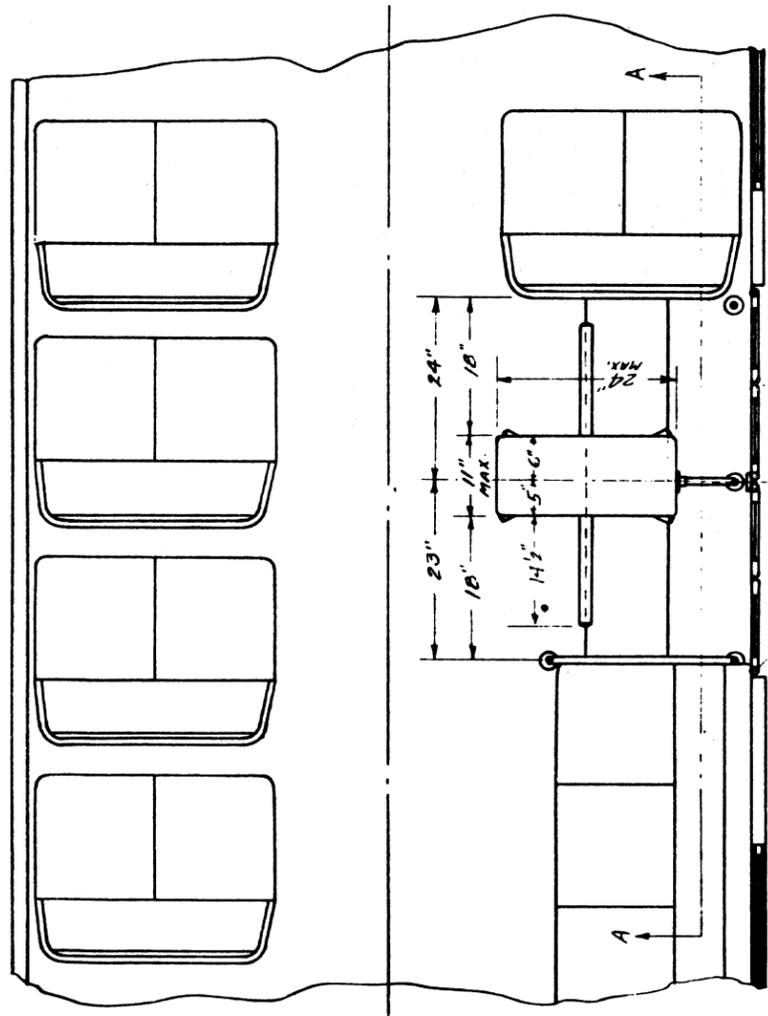
- FEATURES**
- ALL CONTROLS BY PUSH BUTTON EXCEPT BRAKE AND ACCELERATOR
 - ALL RUBBER SPRINGING OR AIR SPRINGS
 - ALL DOORS, GATES & TURNSTILES EQUIPPED WITH RELEASES FOR FAST EXIT IN EMERGENCY
 - SHORT WHEEL BASE, UNDER 40' TURNING RADIUS
 - LOCK TYPE REAR AXLE FOR STARTING ON SLIPPERY PAVEMENT
 - DOUBLE AXLE RATIO FOR RAPID ACCELERATION IN LOCAL SERVICE AND HIGHER SPEEDS IN EXPRESS OR CHARTER SERVICE
 - EXIT TURNSTILES TO PREVENT ILLEGAL ENTRANCE AT REAR DOORS - MAY BE RELEASED FOR STREET FARE COLLECTION
 - ENTRANCE TURNSTILE TO ASSIST FARE COLLECTION AND ENFORCE REAR EXIT
 - SUPER WIDE AISLE TO FACILITATE PASSENGER CIRCULATION
 - LOW ENTRANCE STEPS FOR EASY RAPID LOADING
 - MASTER TROUBLE LIGHT ELIMINATES NECESSITY OF CONSTANTLY WATCHING NUMEROUS INDICATORS
 - IMPROVED VISIBILITY FOR DRIVER
 - IMPROVED VENTILATION

CHICAGO TRANSIT AUTHORITY
"BUS OF TOMORROW"

**TRANSIT TYPE
BUS OF TOMORROW**

SCALE: 1/2" = 1'-0" DEC. 5, 1955

Word Searchable Version not a True Copy



NOTE: BUS DIMENSIONS ARE FOR
HARMON-HERRINGTON TROLLEY BUSES

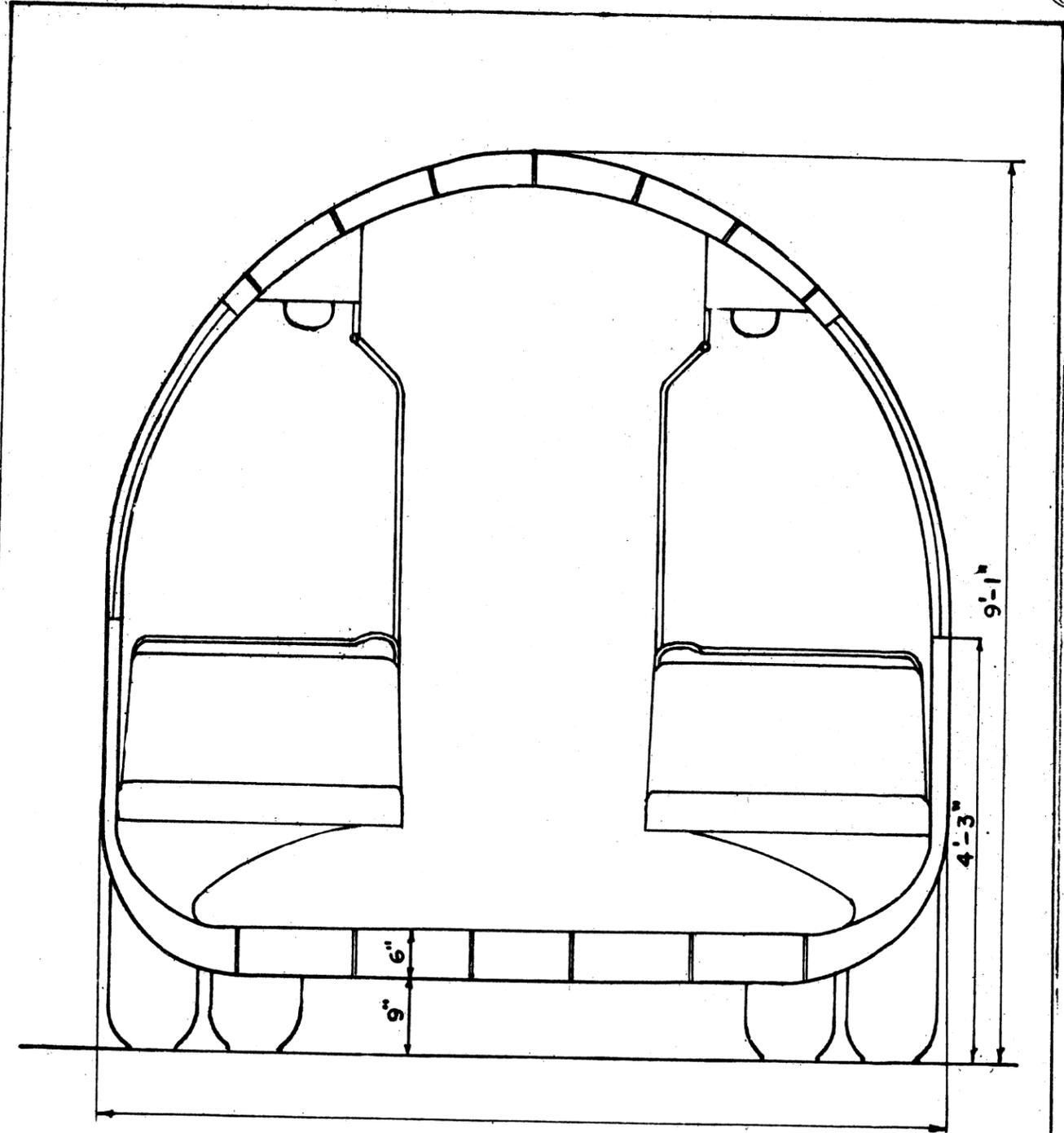
SUGGESTED TURNSTILE INSTALLATION
FOR REAR EXIT DOORS OF BUSES

C. T. A.

SCALE: 3/4" = 1'-0"
C. E. K.

JAN. 14, 1952.
SK-11452.

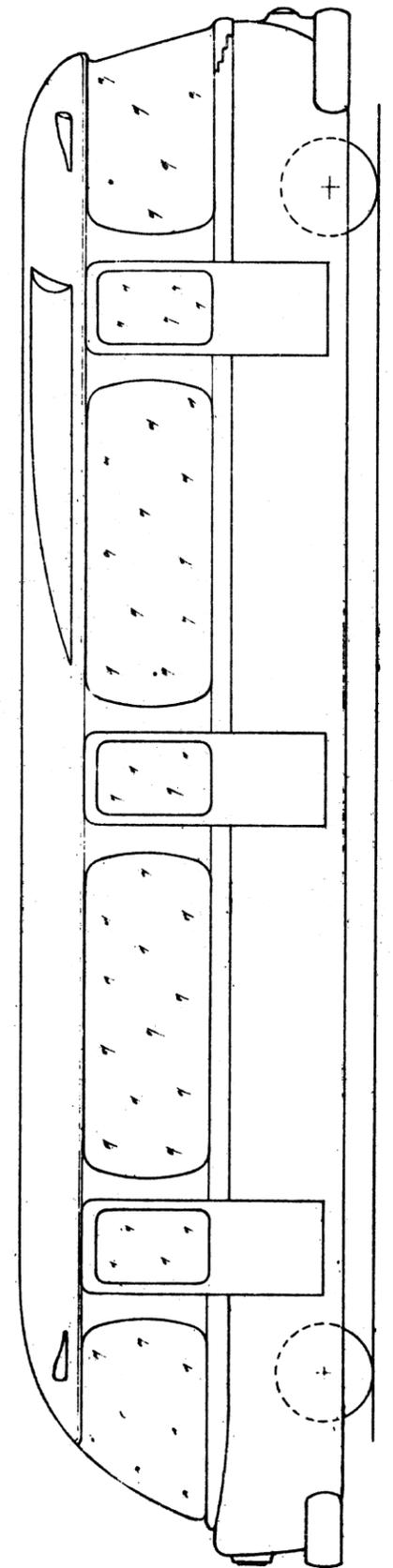
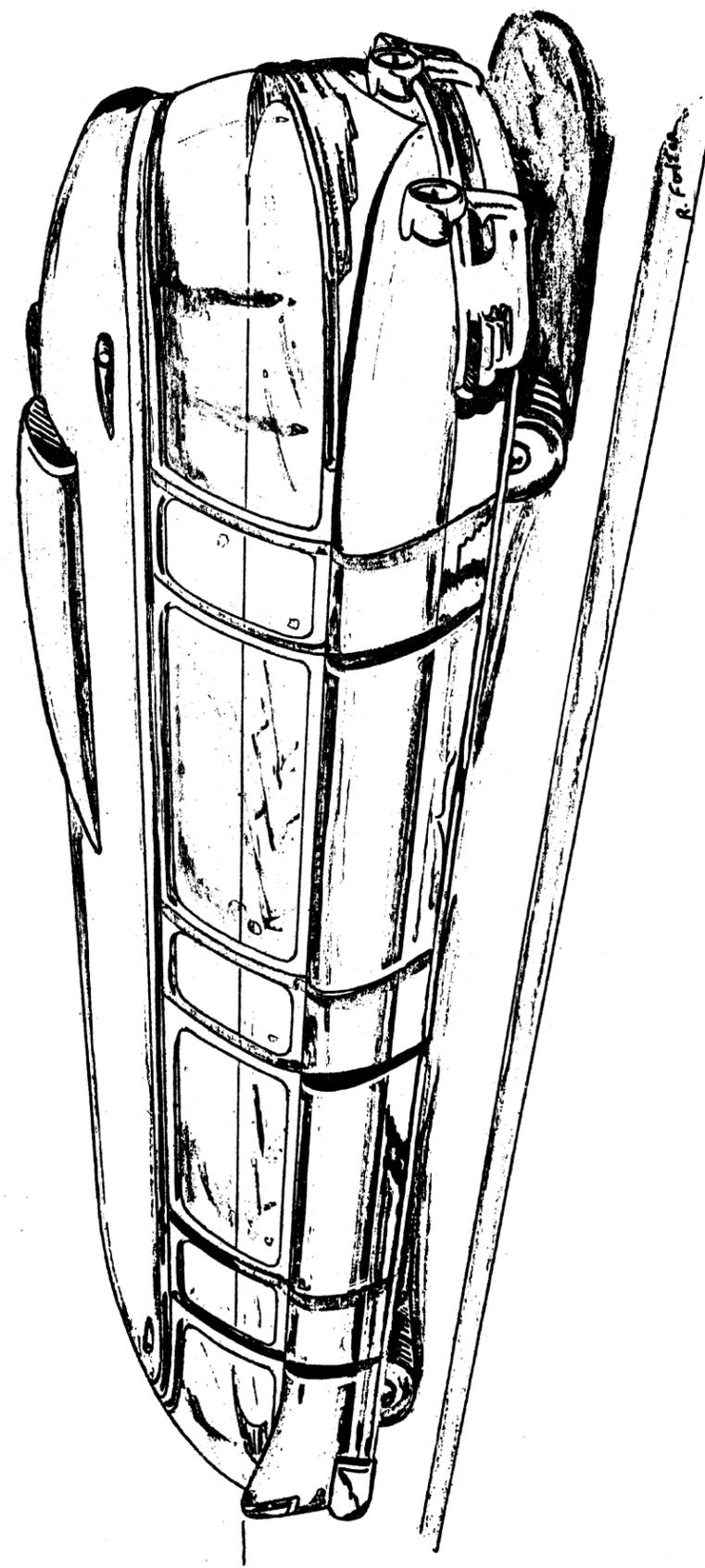
2



CLEVELAND TRANSIT SYSTEM
 EQUIPMENT DEPARTMENT
 ENGINEER'S SKETCH SHOWING
 FRAMING SECTION OF TRANSIT
 COACH FOR THE FUTURE

B

R05



THE CLEVELAND TRANSIT SYSTEM
 EQUIPMENT DEPARTMENT
 ELEVATION
 TRANSIT COACH FOR THE FUTURE

PLATE 8

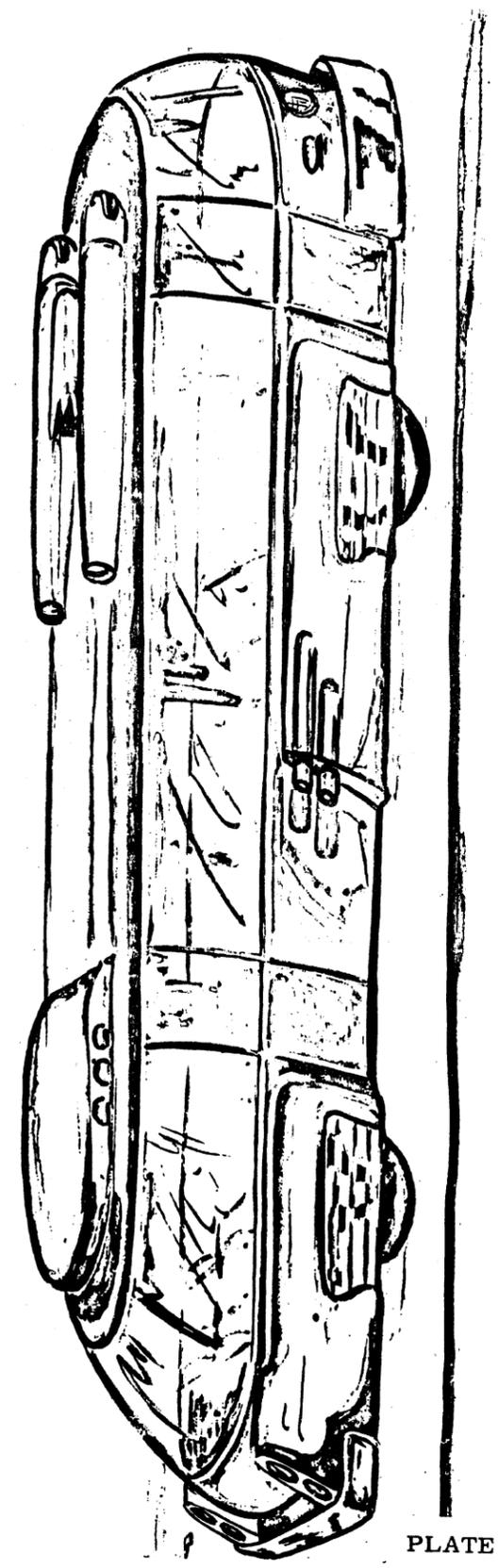
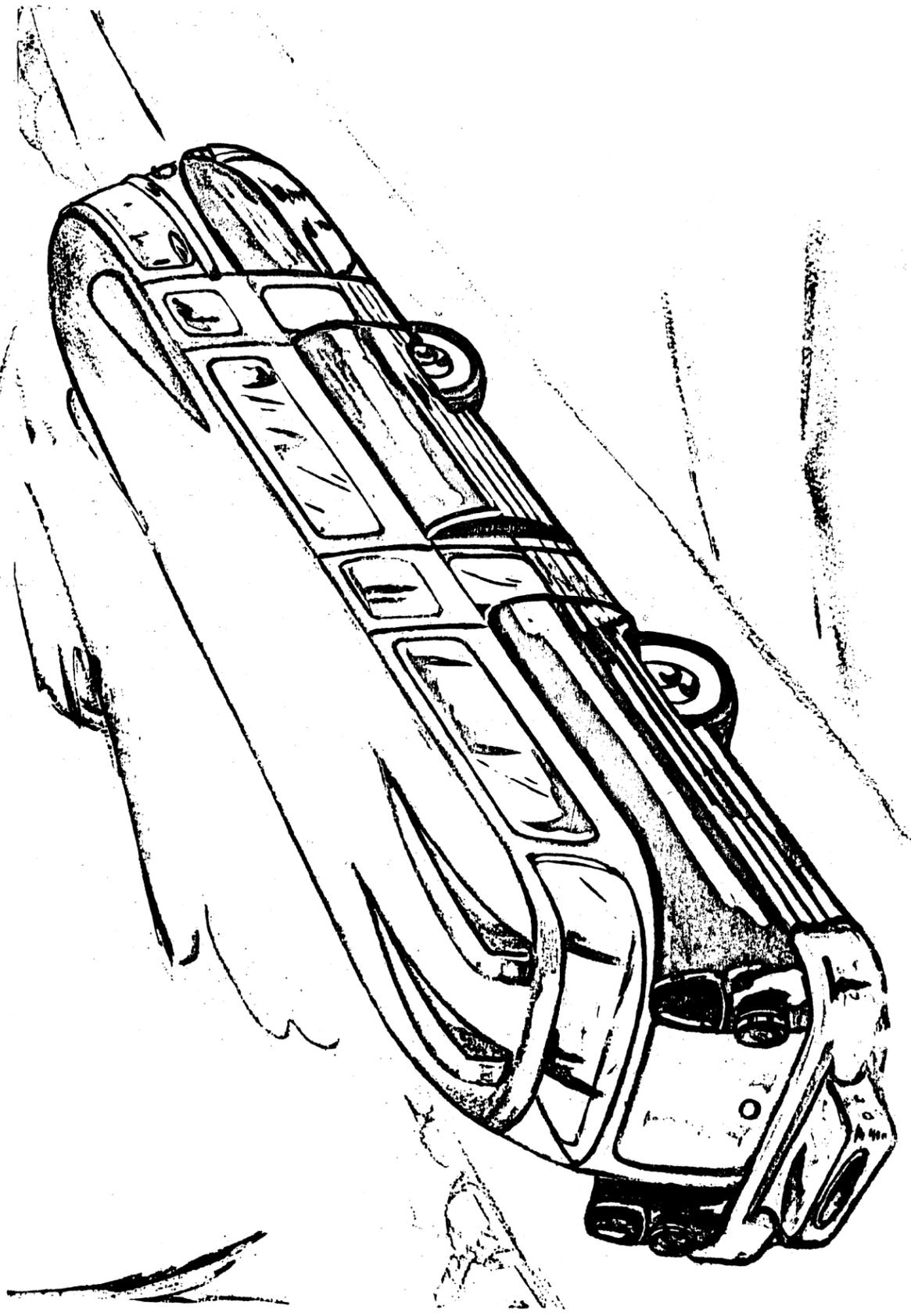
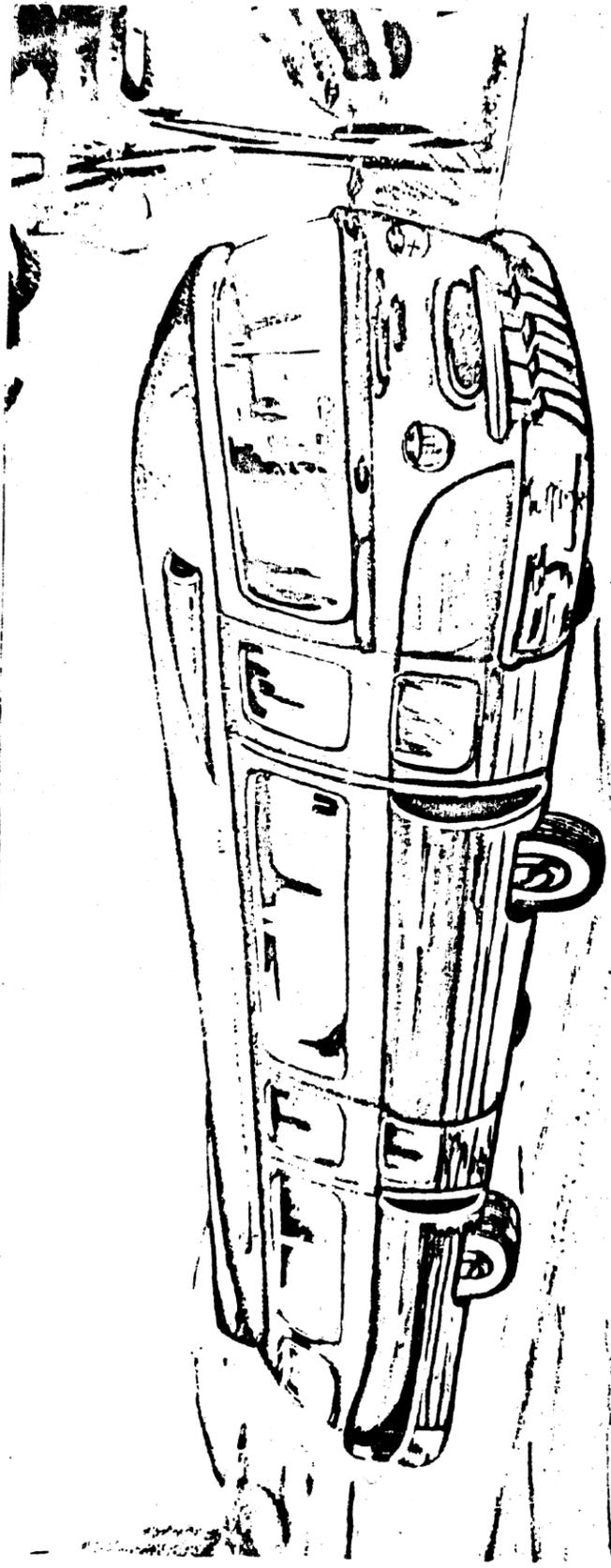
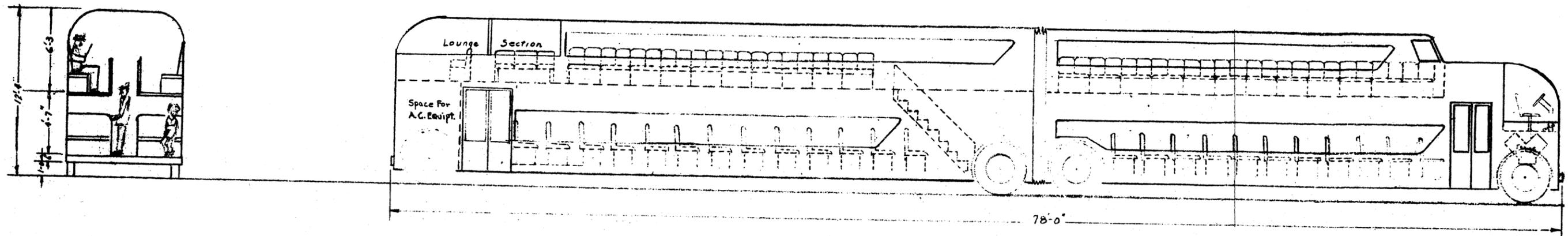
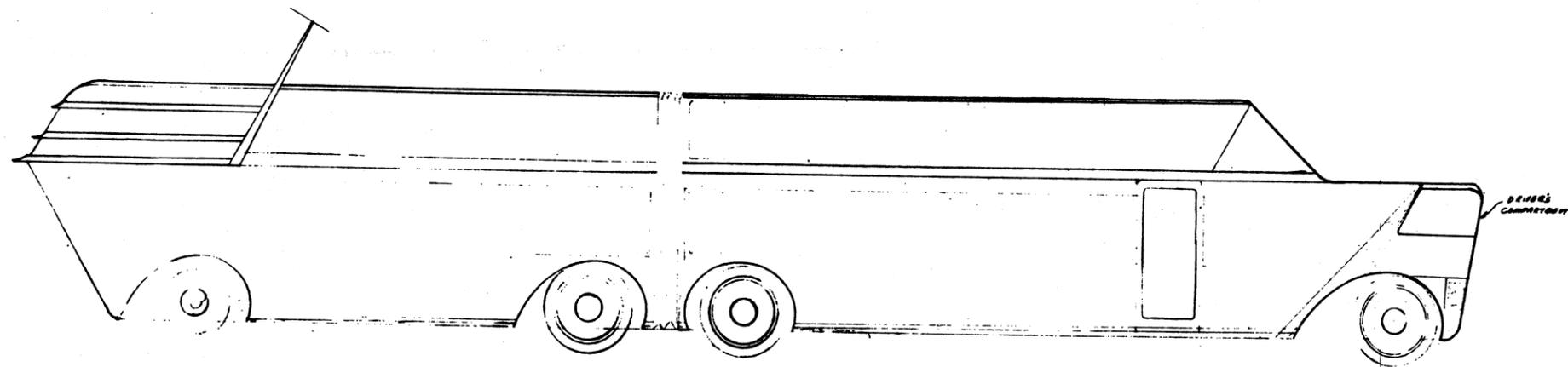


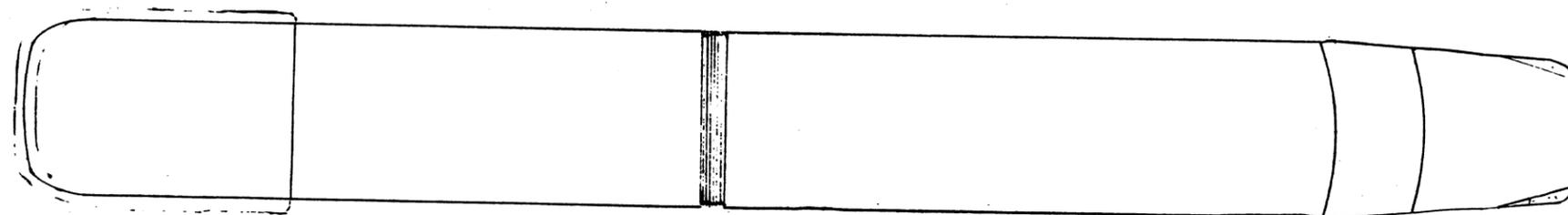
PLATE 9



PROPOSED 200 PASSENGER BUS
 Submitted by
 SAN ANTONIO TRANSIT CO.



MODERNIZED CONCEPTION



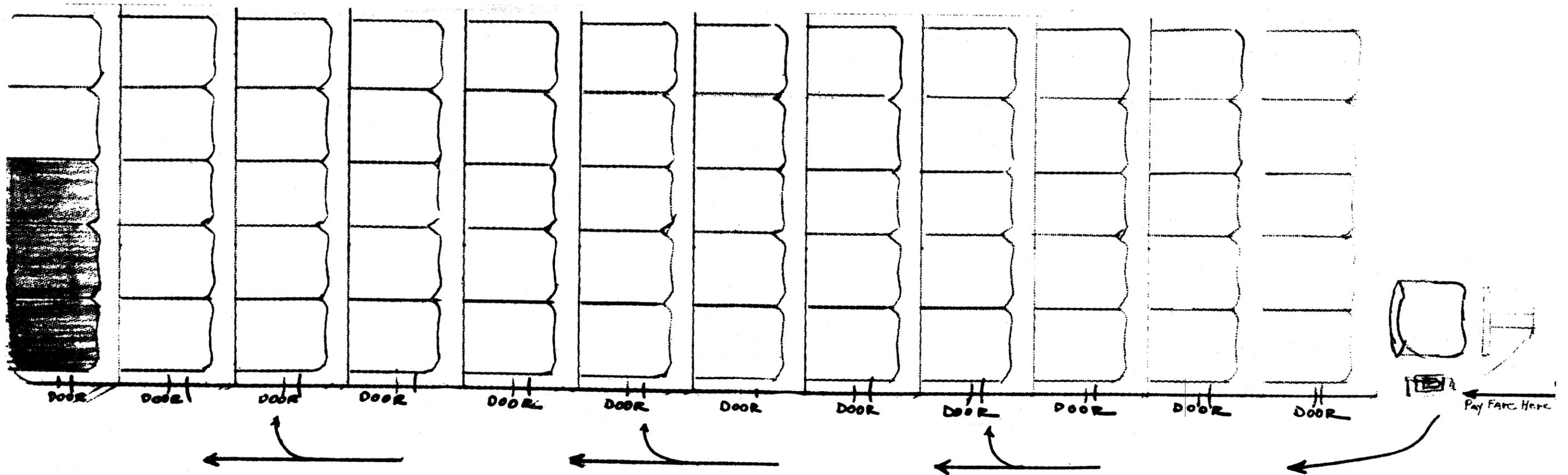


PLATE 11

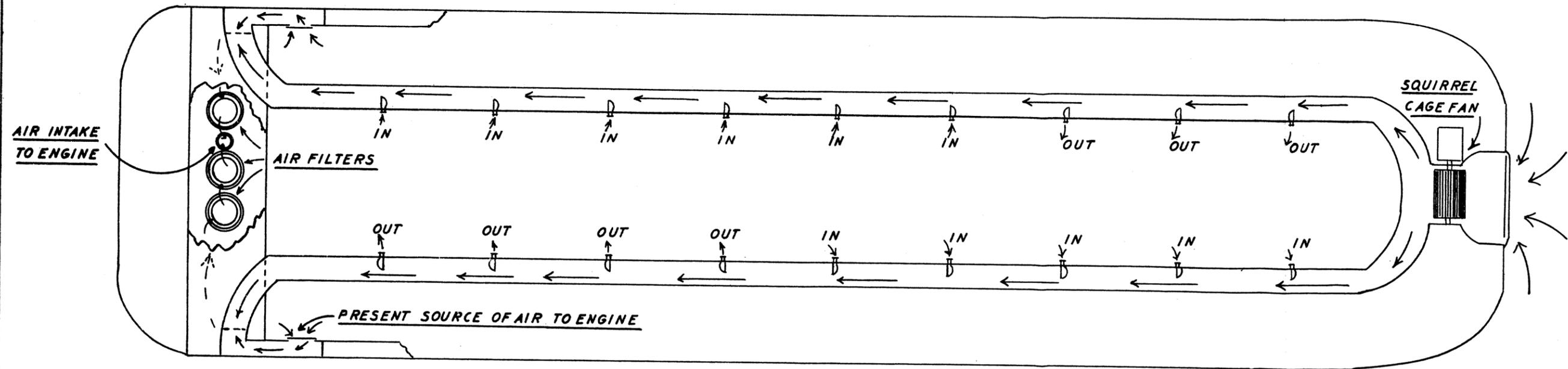
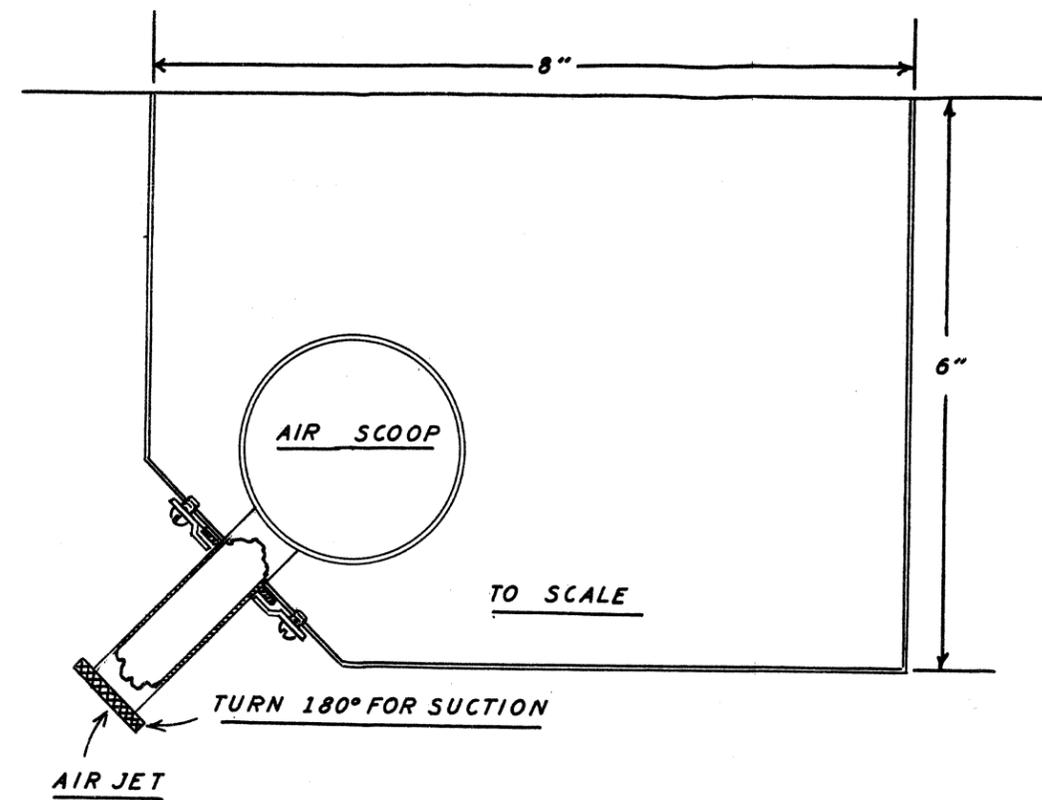
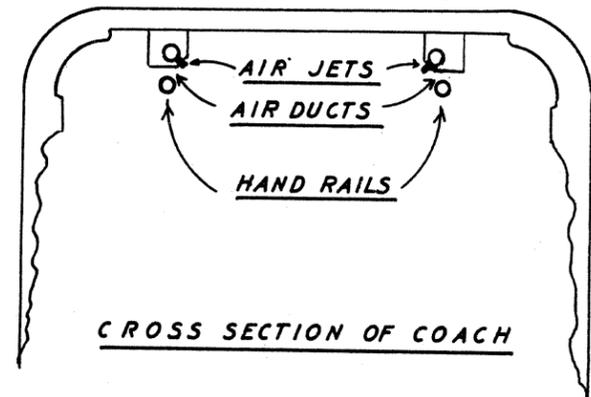


Exhibit B

SAN DIEGO TRANSIT SYSTEM
PROPOSED SCHEMATIC, COACH
VENTILATING CIRCUIT DESIGNED
ESPECIALLY FOR STANDEE COMFORT,
AND SUPPLEMENTING AIR TO ENGINE

DSGNY	DWG.	TR.	DATE	APPROVED
F.T.	F.T.	F.T.	12-55	PLATE 12

3/4" TO 1"

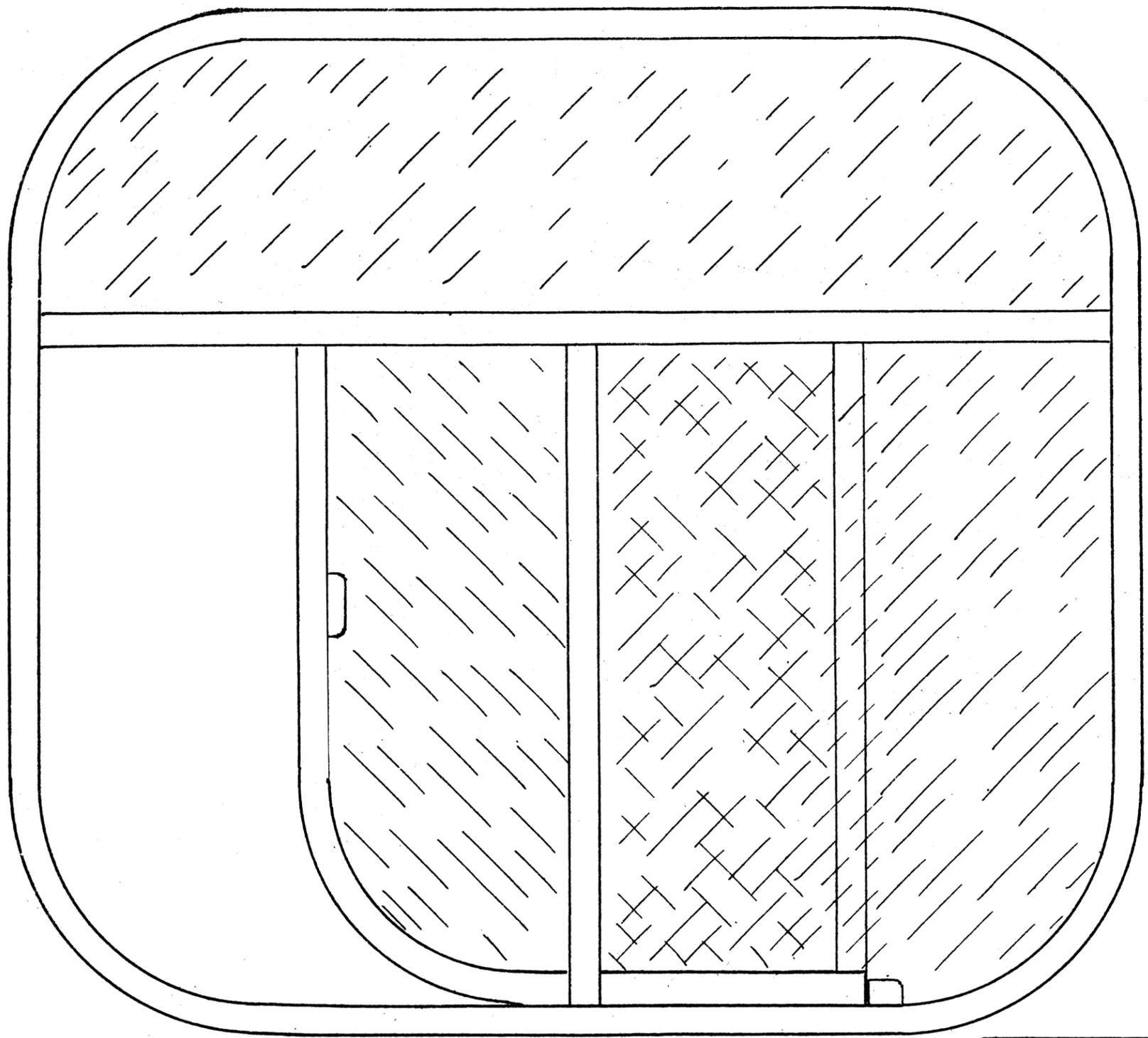


Exhibit A

SAN DIEGO TRANSIT SYSTEM
PROPOSED TYPE OF COACH WINDOW
IDEAL FOR PASSENGER COMFORT
LESS COSTLY TO MAINTAIN

DWG.	TR.	DATE	APPROVED BY
F.T.	F.T.	1255	PLATE 13

350 Sutherland Drive,
Toronto 17, Ontario,
November 30th, 1955.

Committee on Bus Design,
American Transit Association

Proposed Design of City Coach

Gentlemen:

Enclosed for your consideration is my design for a City Coach in which I have attempted to incorporate your eight points of prime importance, namely:

1. More eye appeal
2. A lighter vehicle
3. Easier and faster loading and unloading
4. Quicker and easier fare collection
5. More comfortable seats and passenger accommodation
6. A quieter bus
7. Less engine fumes
8. Improved visibility for the driver

It is a vehicle to have fast, smooth acceleration, safe, even stops, achieved through motor, pump, oil lines and turbine drive. (See Sheet 2, Parts Index Sheet 1.)

Contained within the turbine housing is a friction brake of 2'6" diameter, in both trucks in case of motor or pump failure.

Since brakes are not contained within the wheels, the wheel diameter is reduced to 2'6" outside diameter, lowering the floor line.

This vehicle does not use the conventional chassis framing, which further lowers the floor line and omits the entrance and exit steps, thereby permitting collection of fares turnstile method. (See floor plan, sheet 3, Parts Index Sheet 1)

Sheet 3 shows Floor Plan in three stages to convert today's method of fare collection to suggested method -

Stage 1 Operator collects transfer, makes change, gives routes, and drives coach

Stage 2 Operator makes change, drives coach

Stage 3 Operator drives coach

Turnstiles to accept coin through a funnel to speed deposit of same. Transfers to be of a sensitized paper acceptable to turnstile only.

Doors are each wide enough to permit entry and exit of two persons at a time. (See Sheets 3 and 4, Parts Index Sheet 1)

Enclosed drawings convey the general ideas, and I feel that with further study and engineering by those concerned, this design could be made practical.

Yours very truly,

/s/ D. J. Meikle

D. J. Meikle,
Engineering Department,
Toronto Transit Commission

PARTS INDEX

For Use With Drawings Sheets Two to Seven

(1)	MAGNESIUM STEEL HOUSING CONTAINING OIL TURBINE, RING GEAR FRICTION BRAKE AND STAY PIN.	(9)	NONSLIP FLOORING ON INSULATION.	(21)	OPERATOR - UNOBSTRUCTED VIEW OF TRAFFIC. CAN SEE OVER PASSENGERS' HEADS.	(32)	STAY PIN.
(2)	DUEL WHEELS FRONT AND BACK. 50" ROAD SURFACE PER TIRE. 2'-6" O.D. PERMITTING FASTER ACCELERATION. MORE FLEXIBLE TIRE REQUIRED. NO BRAKE WITHIN WHEEL.	(10)	STANDARD BUS SEAT WITH THE ADDITION OF A FOOT BRACE ON BACK OF EACH SEAT FOR QUICK STOPS. SIDE PROJECTION ON BACK OF SEAT AT WAIST TO PREVENT PASSENGER SLIDING INTO AISLE ON SHARP TURNS.	(22)	BUMPER - 4 SIDES TO PROTECT FRAMING.	(33)	HOLD-ON RODS. ALUMINUM. RODS SPACED 1'-6" CENTRE TO CENTRE ON A GRID LENGTHWISE AND CROSSWISE.
(3)	FRICTION BRAKE WITHIN HOUSING 2'-6" DIA. FOR EMERGENCY USE ONLY.	(11)	WHEEL WELL COVERING.	(23)	BODY COVERING - LIGHTWEIGHT COLORED BUILT-UP FABRIC AND PLASTIC SHEETS. NO JOINTS PATCHED READILY.	(34)	ADVERTISING.
(4)	AIR BELLOWS-RUBBERIZED FABRIC PRESSURE CONTROLLED BY OPERATOR TO SUIT LOAD. STAY PINS WITHIN.	(12)	DRIVERS SEAT, BUCKET TYPE, ADJUSTABLE.	(24)	GRILLE - FOR MOTOR AND HEATING.	(35)	EXHAUST OUTLET DISPERSED BY FIN OF ROOF.
(5)	OIL LINES, SUPPLY AND RETURN FROM PUMP TO TRUCKS.	(13)	OPERATOR'S CONTROLS.	(25)	ALTERNATE FUEL COMPARTMENT.	(36)	VERY LARGE SIZE EXHAUST MUFFLER.
(6)	PANCAKE MOTOR AND PUMP, DESIGNED AS ONE UNIT TO SUIT BUS REQUIREMENTS. MOUNTED ON SLIDES FOR QUICK REPLACEMENT AND SERVICING. FUEL PROPANE GAS.	(14)	TRANSFER DISPENSER.	(26)	MOTOR COMPARTMENT. PANCAKE MOTOR AND PUMP, ONE UNIT, DESIGNED TO SUIT BUS. MOUNTED ON SLIDING TRACK FOR MAINTENANCE AND QUICK MOTOR CHANGE.	(37)	POWER STEERING.
(7)	UNIVERSAL JOINT AND DRIVE (SIMILAR TO THOSE USED ON 4 WHEEL DRIVE TRUCKS) OPERATED HYDRAULICALLY TO TURN WHEELS FOR DIRECTION.	(15)	TURNSTILE TO ACCEPT COIN AND TRANSFER.	(27)	FUEL TANK COMPARTMENT. FUEL - PROPANE GAS.	(38)	EMERGENCY DOOR.
(8)	PARTITION HANDRAIL HEIGHT. NO POSTS AT EXITS - TO DISCOURAGE CROWDING.	(16)	ADVERTISING PANEL - ILLUMINATED.	(28)	SUGGESTED LIGHTWEIGHT BODY FRAMING TO REPLACE CONVENTIONAL CHASSIS. TO BE DESIGNED TO SUIT LOADING.		P.A. SYSTEM. INSULATE FOR SOUND AND VIBRATION.
		(17)	WINDOWS - POLARIZED SAFETY GLASS, ALUMINUM FRAME SET INTO BUS FRAME WITH RUBBER SO THAT IN CASE OF ACCIDENT COMPLETE FRAME CAN BE PUSHED OUT.	(29)	BRACE FRAMING TO SUPPORT BUS IN UPSIDE-DOWN POSITION IN CASE OF ACCIDENT.		
		(18)	SIGN-BUS DESTINATION - ILLUMINATED ROUTE MAP SHOWING STREETS TRAVELED BY BUS.	(30)	MOTOR SLIDES.		
		(19)	DOORS - ALUMINUM FRAME - POLARIZED SAFETY GLASS FASTER OPERATING.	(31)	SKYLIGHT WINDOW FOR EXTRA LIGHT ON EXITS AND ENTRANCE.		
		(20)	LIGHTS - DIRECTIONAL SIGNALS CAUTION, STOP AND GO LIGHTS. HEADLIGHTS RECESSED IN BUMPERS.				

SHEET 1
D. J. MEIKLE ENGINEERING DEPT. T.T.C.
Nov. 30, 1955

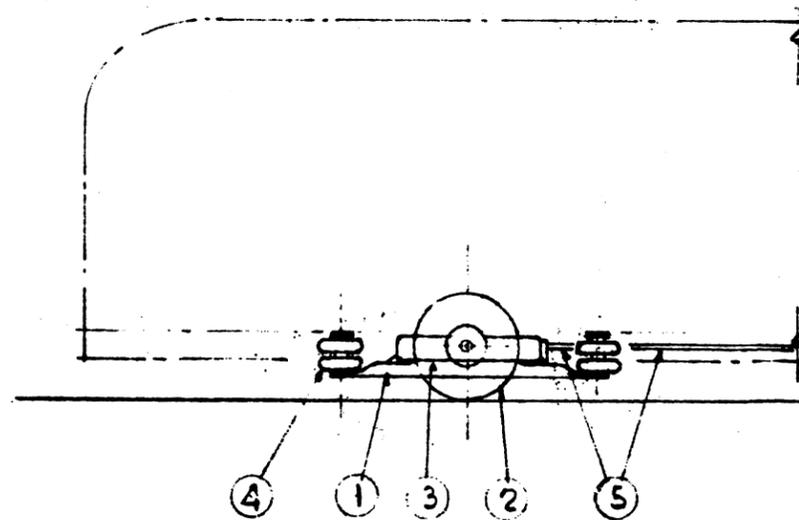
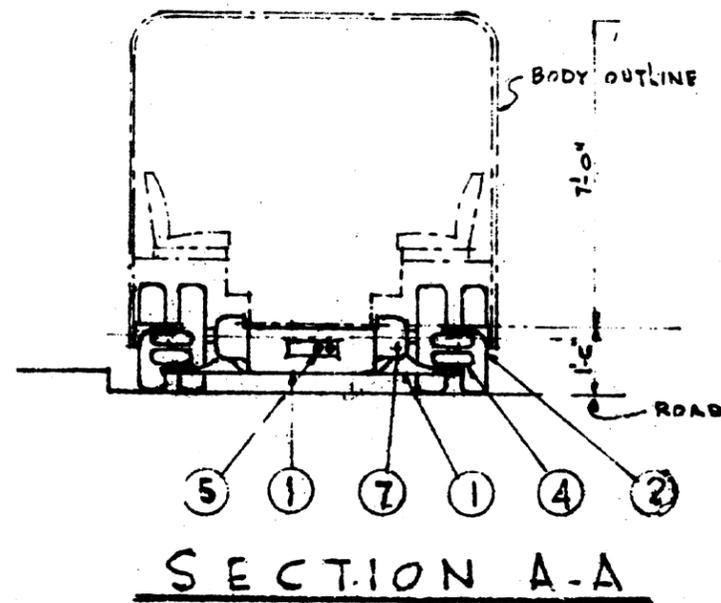
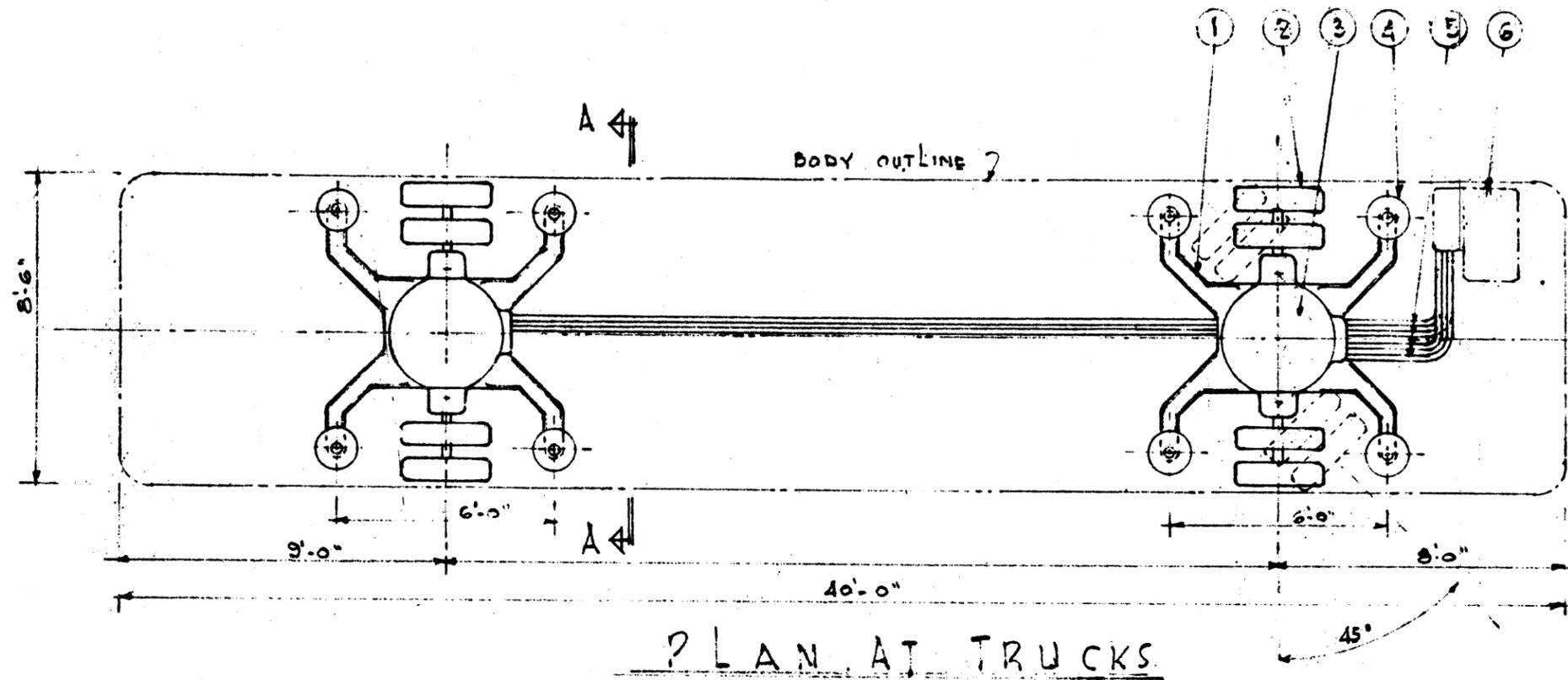
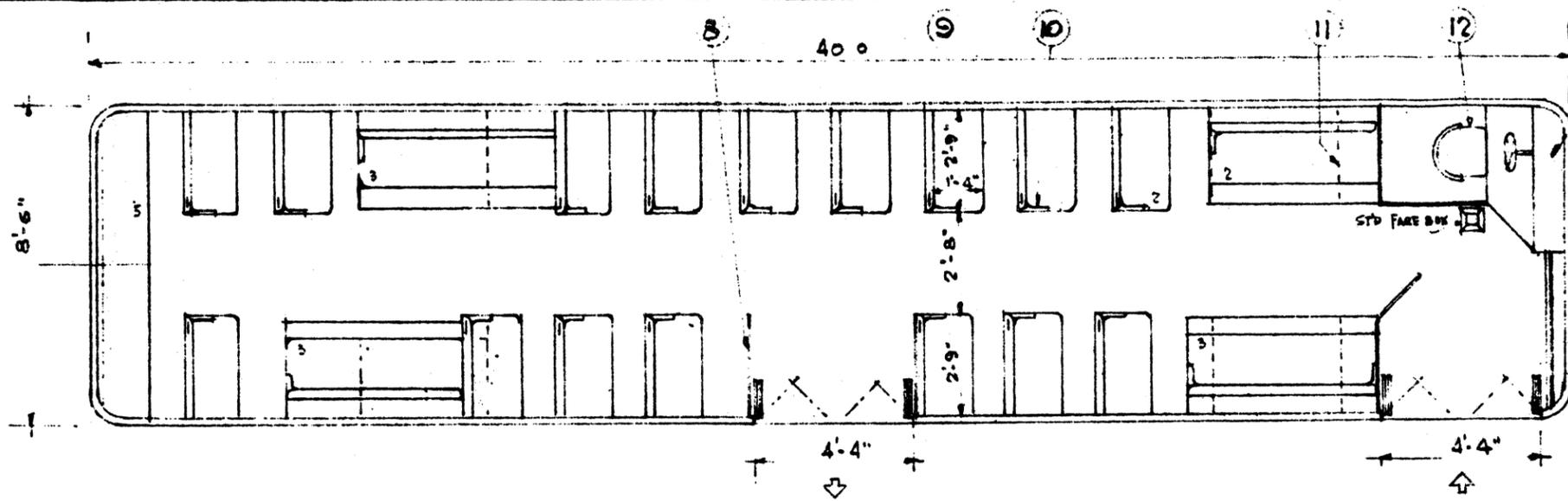


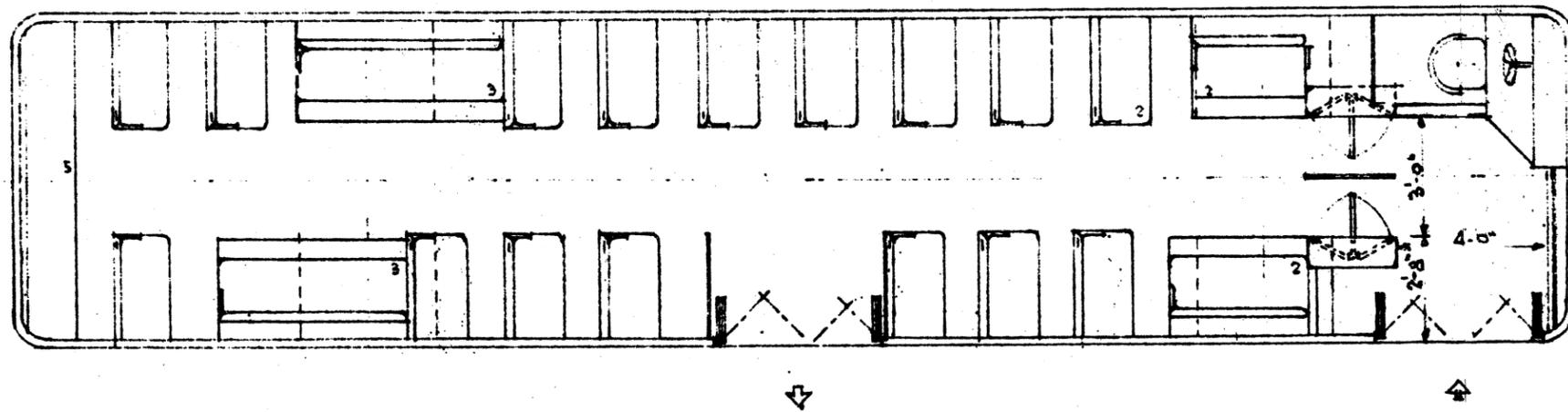
PLATE 16

SHEET 2

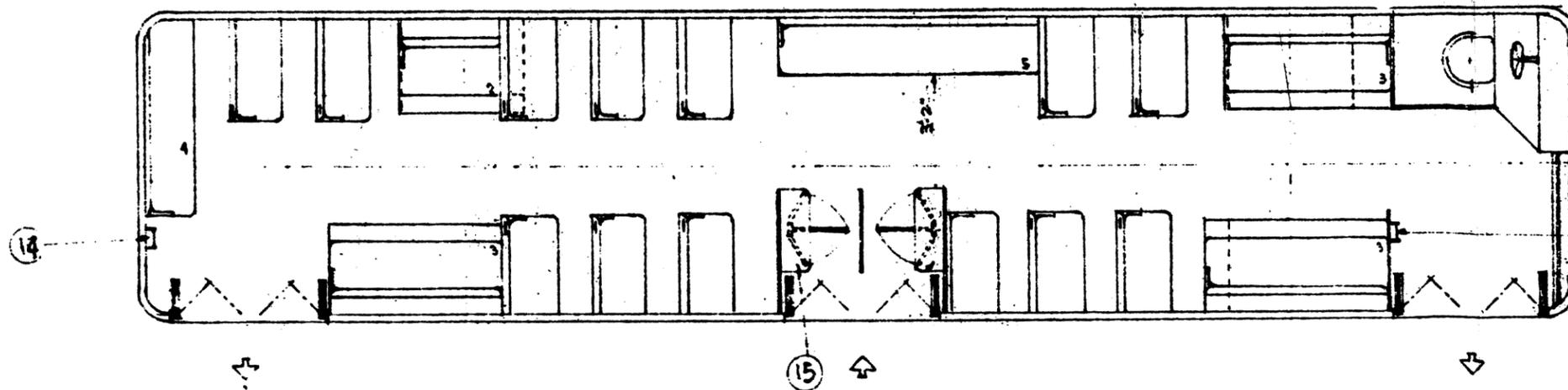
D. J. MEIKLE ENG. DEPT. T.T.C. NOV. 30, 1955



SEATING PLAN
STAGE 1
 SEATING 43



STAGE 2
 SEATING 47

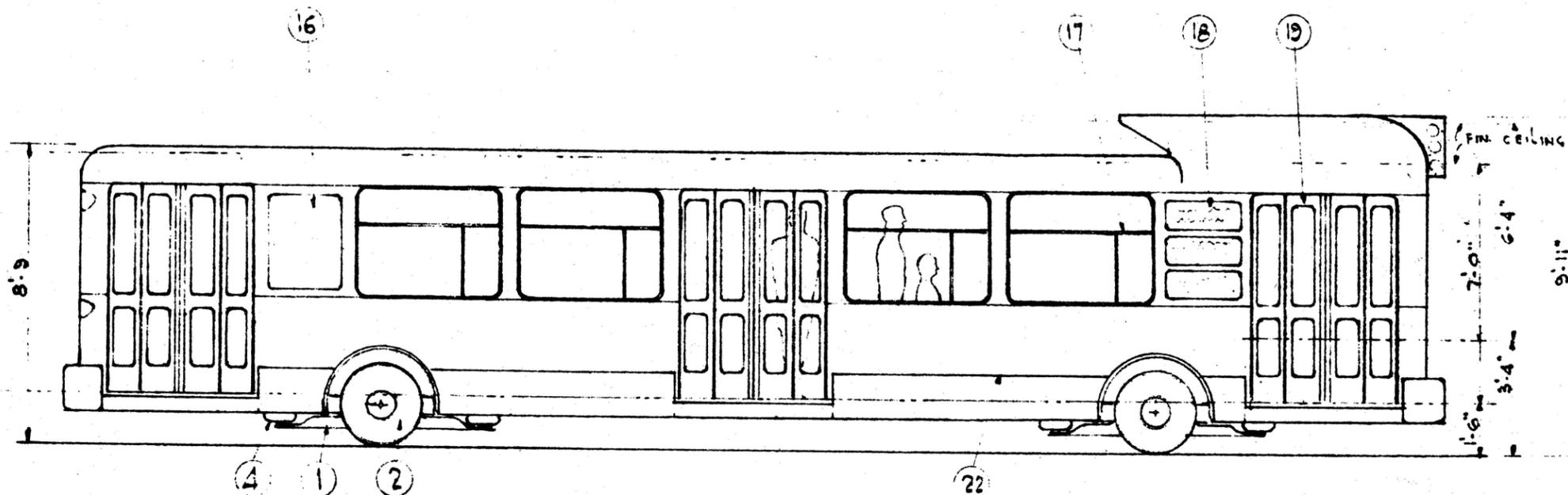


STAGE 3
 SEATING 46

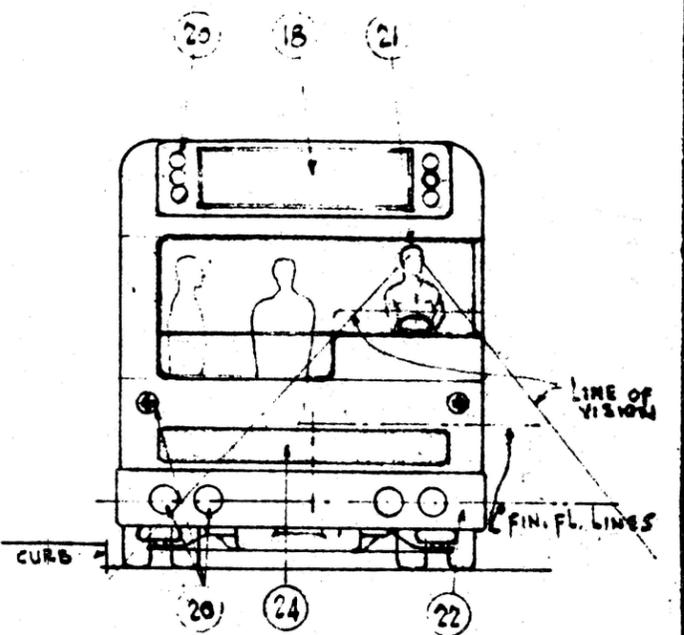
PLATE 17

SHEET 3

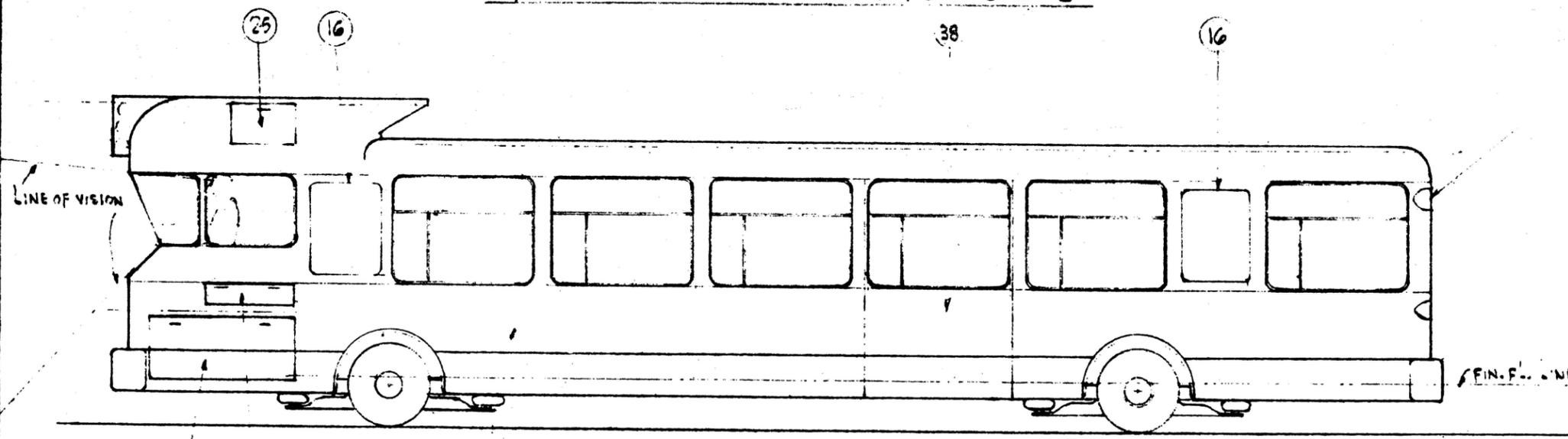
D. J. MEIKER, ENG. DEPT. T.T.C. NOV. 30 55



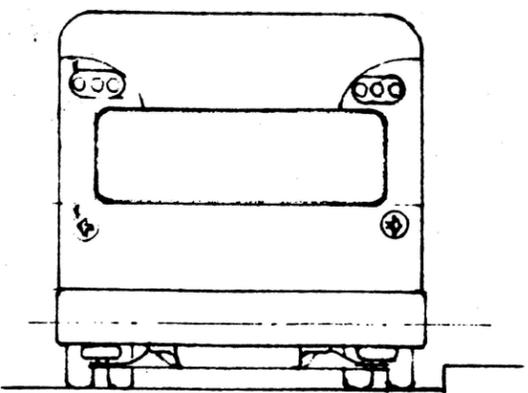
ELEVATION CURB SIDE



FRONT ELEVATION



ELEVATION ROAD SIDE

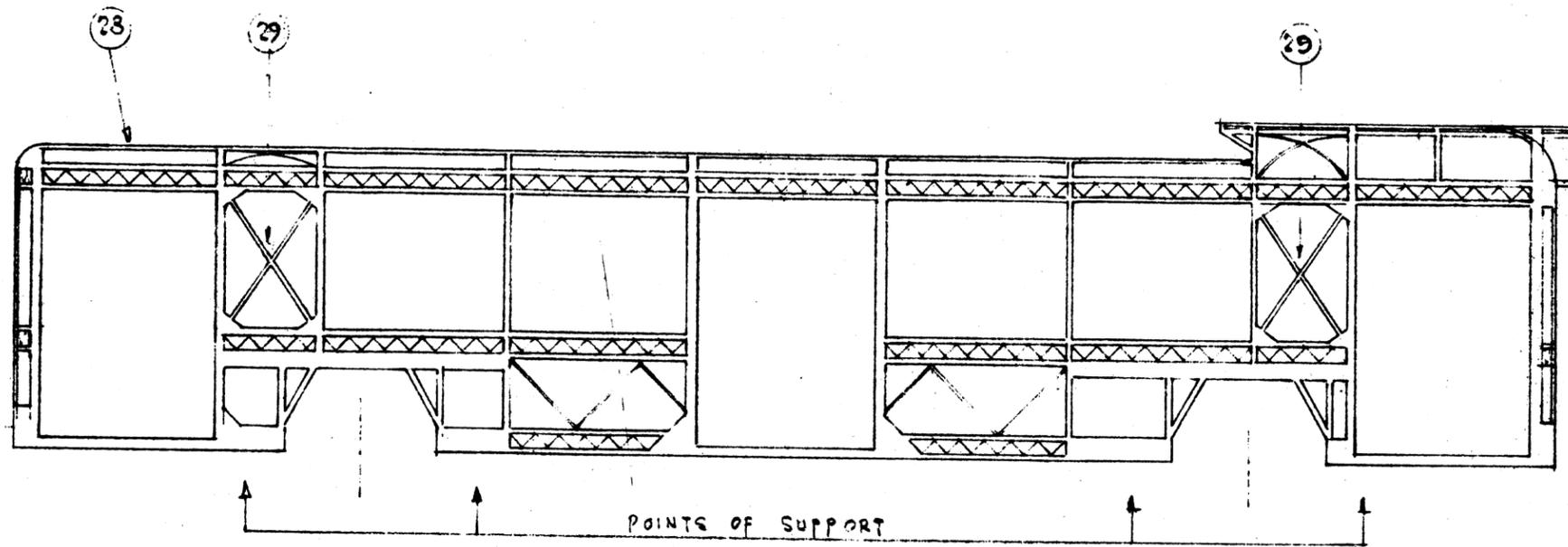


REAR ELEVATION

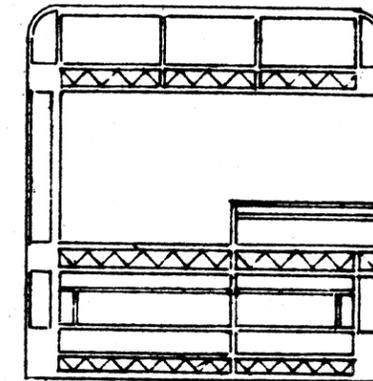
PLATE 18

SHEET 4

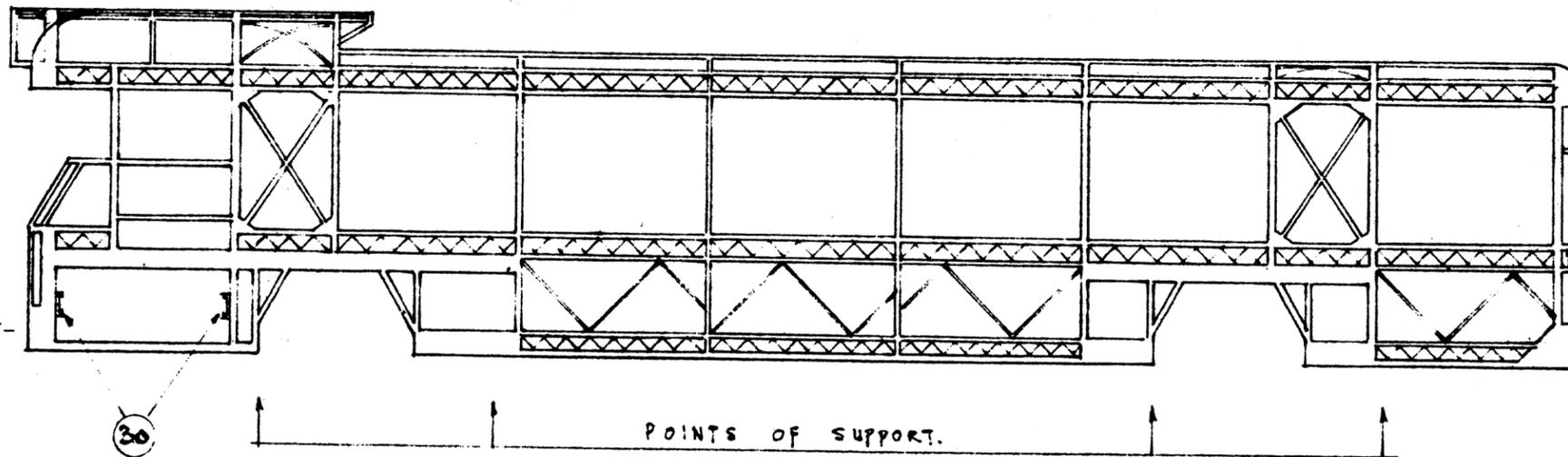
D. J. MEIKLE ENG. DEPT. T.T.C. NOV. 30, 55



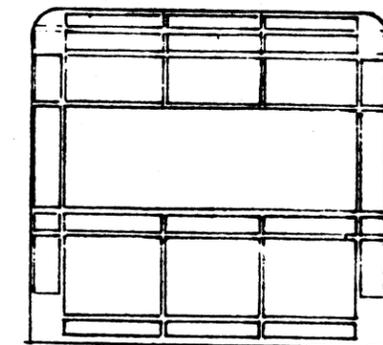
FRAMING CURB SIDE



FRAMING FRONT



FRAMING ROAD SIDE

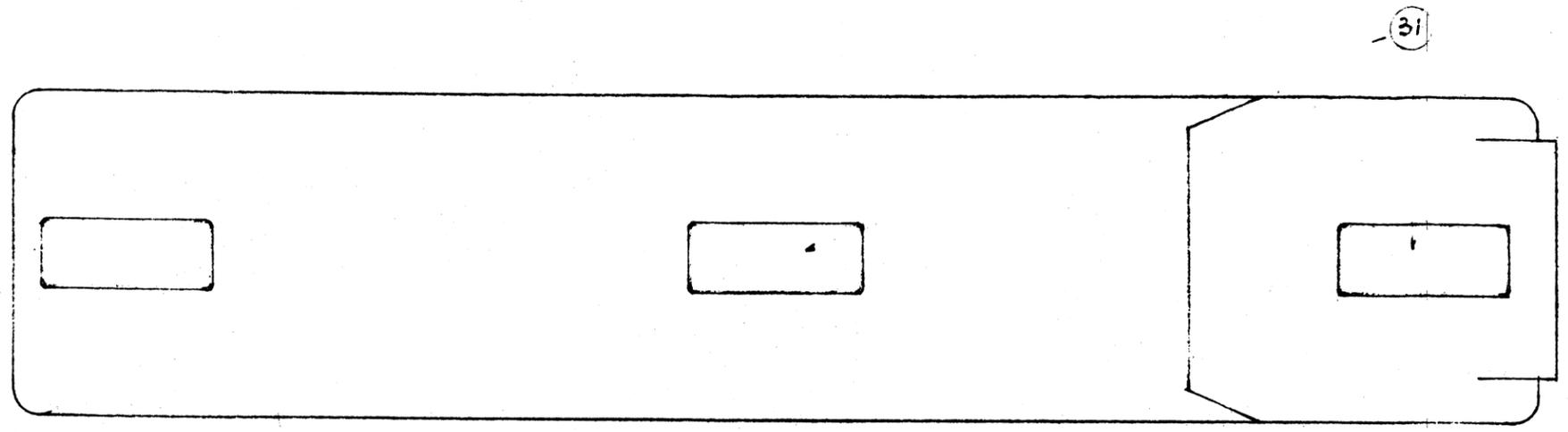


FRAMING REAR

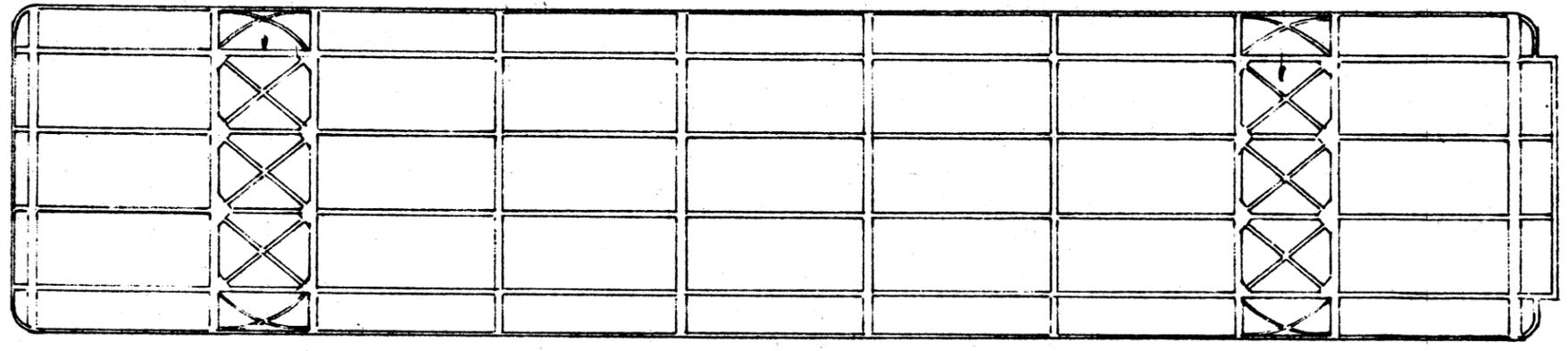
PLATE 19

SHEET 5

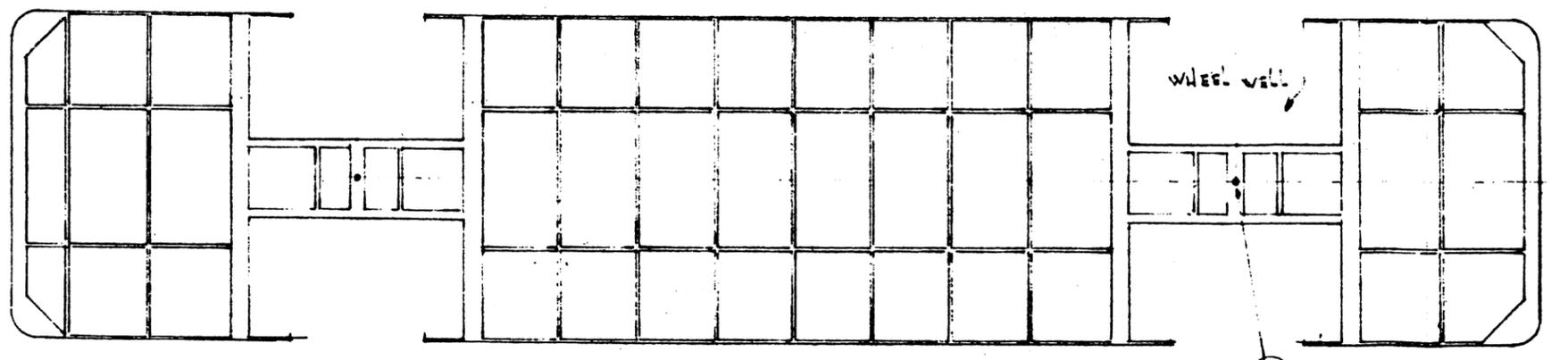
D. L. MEIKLE ENG. DEPT. T. I. C. NOV. 30 '35



29 ROOF PLAN 29



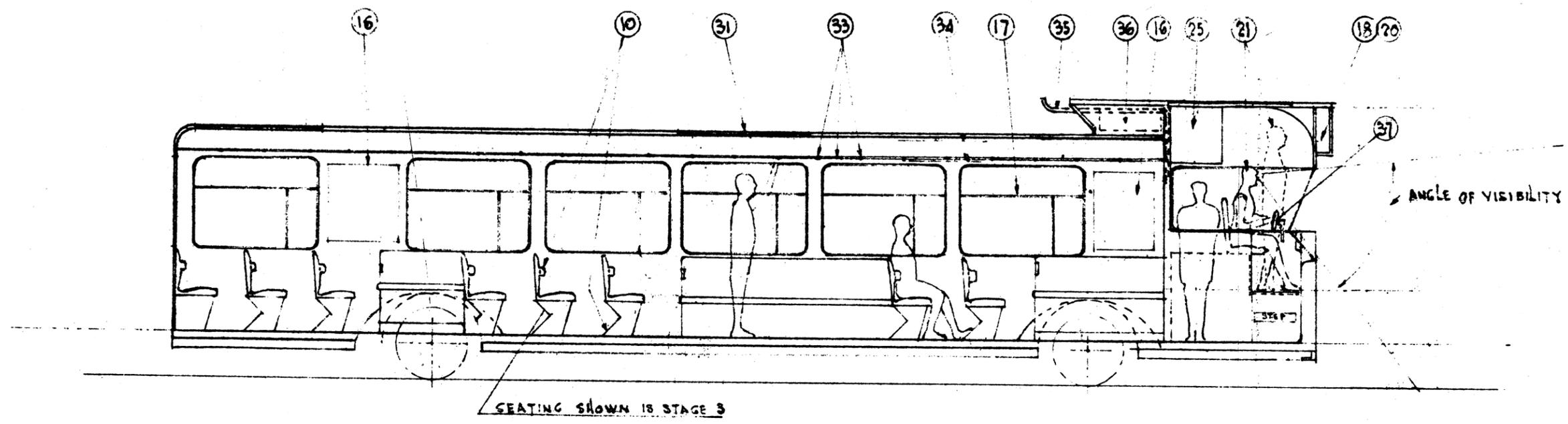
ROOF FRAMING PLAN



FLOOR FRAMING PLAN

PLATE 20

SHEET 6
 O. J. MEIKLE ENG. DEPT. W. I. C. NOV 30 55



INTERIOR ELEVATION

PLATE 21

SHEET 7

D. J. WEINLE ENG. DEPT. I.T.C. Nov. 30, 55

