

AN AUTOMOBILE DEALERSHIP

Thesis submitted in  
partial fulfillment of  
the requirements  
leading to the degree of  
Bachelor of Architecture  
by:

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21 May, 1956

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Dear Sir:

In partial fulfillment of the requirements for a  
Bachelors of Architecture Degree, I submit this thesis  
entitled, "An Automobile Dealership."

Respectfully submitted,

/ Gordon A. Cultum

*Arch. Aug. 23. 1956*

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## Acknowledgments

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I wish to express cordial thanks to Mr. Sutton, General Manager of the T. C. Baker Corporation, for his most helpful encouragement and cooperation. My appreciation is also extended to Mr. William Smith, Service Manager for Lincoln-Mercury; Mr. Creamer, Assistant Head Sales Manager of Cadillac-Olds; Mr. Arthur Cote of Cote Ford Agency; and Mr. R. C. Costello, General Manager of Connolly Buick Company.

I am indebted to the teaching staff of the Department of Architecture at Massachusetts Institute of Technology for valuable guidance and service.

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General acceptance of the automobile has forced many sociological and economic changes upon the public. This is especially true in the United States, where the great majority of families have at least one car. The automobile has virtually become a personal necessity. Its use has permitted metropolitan areas to expand and rural areas to exist. The automobile is playing an important part in forming our way of life.

The automobile's function as a beneficial device for our society cannot be argued; however, the spirit of present-day design is questionable. Industry is trying to achieve prestige cars. Their advertising characterizes cars as symbols of wealth and prosperity. Combining this with an attempt to have new styles every year, present automobile styling is more regressive than progressive. This trend, to the gaudy and the bizarre, has had its counter-part in the design of some automobile agencies.

My solution has a very clean and straightforward expression--pure in taste and in style.

Designing facilities for an automobile agency is a very difficult task. Difficulties stem from the great diversification of functions and a need for their careful co-ordination and integration. Special problems also arise in regard to structure, illumination and acoustics.

T. C. Corporation is one of the largest and oldest Ford dealers in this locality. Over the years they have established a reputation for good workmanship and prompt service. They also have a very active sales department.

The company's most important function is the sale of new cars. All other services are subordinate to this function. A tabulation of the major services, in relation to their gross profit, is necessary for an understanding of the business. Order of gross profit:

1 - New car sales

1-A Used car sales--is often considered a "necessary evil" but retains gross profit from new car sales.

2 - Maintenance and repair

3 - Parts sale

This business demands a special enclosure. It demands a building composite which will establish a congenial environment for selling automobiles and an efficient system for their maintenance.

The company's present facilities are grossly inadequate. The building very meekly expresses new car sales. It can only display one auto at a time. The sales area and office facilities are cramped. Off street parking for customers coming to see new cars is non-existent. Due to the lack of sufficient space, some of the services were even forced

across the street. Circulation within the repair department is also very poor. Such a brief sketch clearly illustrates the need for new facilities.

An automobile showroom should be situated where it may be seen by concentrations of both auto and pedestrian traffic. This requires the site to be situated on an arterial road and preferably in conjunction with businesses drawing many people.

The majority of customers desiring automobile repairs can be classified into two groups. First are the working people who leave their cars in the morning for the entire day, picking them up on their return home. Second are the family customers and traveling salesmen who wish to wait for their cars. Such considerations require that the site, besides being readily accessible by auto, must be serviced by some means of public transportation. Adjacent shopping facilities are also an incentive for patronization of this dealership. Considerations must also include real estate values and the availability of public utilities, such as electrical power, water supply, sewage system and fire protection.

After weighing all these factors, a site was chosen on Route 9 (Boylston Street) opposite the Chestnut Hill Shopping Center. This location affords good visibility from the shopping center and from cars using Boylston Street. Route 9 is a good transportation link joining with Boston in one direction and Routes 1, 1-A and 128 in the other. Two separate bus lines offer service to Kenmore or Park Squares,



where connections with the underground transit can be made.

The lot, being nearly rectangular in shape, is bounded on three sides by public roads. This offers easy access and natural circulation around the property. The ground is generally flat except for the portion away from Boylston Street. Here is noted a rise of ten feet which offers natural access to a second floor. Since its size is not excessively large, and for economic reasons, the use of a two-story building is justified.

The Showroom is to facilitate new car sales by creating an environment to which the public will be attracted. Here people can see, feel and experience the newest styles of glittering automation.

From a study of showrooms and an analysis of their functions, I have derived several postulates for a new design.

The space should be clean, simple and even chaste. It should have a psychological anchor, definite orientation, definite extensions and achieve a sense of security through its straightforward expression. This character must be consistent throughout the building, the interior and its furnishings. A spacial personality of this type can be made to harmonize with the show pieces.

One car should be featured and the others supplemented for closer inspection. The client desires to display only three cars in his showroom. Since Ford is one of the leading automobiles in sales, he feels that a sufficient diversification of styles can be seen on the streets.

Lightness is desirable. Psychological lightness will relieve the building's confinement and help to associate cars in their natural setting. Sufficient illumination will levitate the auto and improve visibility from both interior and exterior.

Closing Rooms--areas set aside for automobile display and those for contract making should be separated. The sales area requires an intimate and confidential atmosphere where the salesman may converse with the client.

A Waiting Area is required for those having their cars repaired. It is desirable to have this area associated with the new car display. The cashier, the rest rooms, and the area for presenting new cars and delivering the repaired ones must have direct access to the waiting area.

An Office Area is to include the management and accounting departments. In addition, two private offices and a meeting room are requested.

The Stock and Supply Parts Room--the function is partly self-explanatory. Besides storage space there must be provisions for retail and wholesale selling, for dispersing parts to the mechanics, and for a service area. Here parts are received from the factory and are also sent out to local establishments via the service truck.

A Machine Shop is provided to contain all equipment which is too bulky or too expensive to leave in each repair stall. This includes such equipment as an arbor press, drill press, 10" lathe, vapor cleaning tank, valve grinding equipment, drum lathe, brake shoe reliners, etc. In addition all motors will be assembled here before they are mounted in the vehicles.

A Used Car Display Area is mandatory. However, it should be so located that it will not detract or impair the vision of the showroom; yet it must be visible from Boylston Street. It might be located adjacent to the side street permitting easy access of those who are interested.

A Parking Area is anticipated for customer, employee, and company vehicles. All parking lot stalls are numbered to facilitate an orderly repair service. Mechanics are assigned to different autos by these numbers.

The Employees' Lounge must contain space for relaxation and dining. In addition, mechanics' lockers, rest rooms, and showers are required.

A Garage is necessary to house a minimum of fifty-seven cars, including such areas for light repair, tune-up, overhaul, lubrication, washing, body repairing and painting. It is also advisable to set aside space for displaying some of last year's new cars which have not been sold.

A Service Entrance Area, external to the building, must have sufficient space for casual parking and permit direct circulation to the new car display, garage, and parts sale.

The types of spaces are easily divisible in two distinct groups, and are expressed by two separate buildings.

First is the clean and quiet atmosphere of the showroom building. Here are located the car displays, closing rooms, office and waiting areas. In general, this is where the public will spend the greater percentage of its time. Here are located all personnel who have so-called "white collar" jobs.

The showroom is located in the front portion of the lot, set apart from the garage and parking areas, and is accentuated by landscaping. It maintains the most dominant position on the site, accentuating its advertising quality.

The other structure will house all noisy and less clean functions of the dealership. This is primarily a repair facility, and contains all associated spaces. This garage is planned in a rectangular form to permit other possible uses in the future. Such a "generalized space" will have a higher resale value than one suited only for automobiles.

A connecting link between the two buildings serves a dual purpose: Besides providing circulation it affords a car delivery portico adjacent to the waiting area.

A reinforced concrete, flat-slab construction has been chosen for the garage. This type of structure is like a "one-way slab" in both directions, and is characterized by the absence of beams. This facilitates the installation of lighting gear, heating apparatus, and an automatic water sprinkling system. Shallow depth in the span direction minimizes the second floor height, while still retaining a high and uncluttered ceiling on the ground floor.

Flat-slab construction permits almost unrestricted use of openings, with proper reinforcements, and allows alternate columns to be placed off the gird system. A structural system of this type is also a first class, fire protected building.

Two methods of analysis are commonly used: An Elastic Analysis and the Empirical Analysis. For simplicity the Empirical Analysis is used whenever possible. This method of calculation requires the building to meet several limitations:

- 1 - The structure must have at least three continuous panels.
- 2 - The ratio of length to width should not exceed a ratio of 1.33 ( $4/3$ ). It is common practice to use slab dimension ratios as high as 2 to 3, in excess of the ACI code. However, this has not been employed.
- 3 - Columns are to be arranged in a rectangular grid pattern.

4 - Alternate spans must not differ from  
the grid system by more than 20 per cent.

Since the design meets these stipulations, an Empirical  
Analysis has been used to size all parts.

It is noted that allowable uniform live loads were  
found critical instead of the concentrated loads. It is  
important to check shears in such a slab design; however,  
bond requirements are usually not critical.

The showroom is heated by a forced air system with 80 per cent air recirculation. Outlet grills are located in the floor adjacent to the show windows and at various points in the exterior walls. Return grills are located in the ceiling. Provisions are made to use this equipment as an air conditioning system in the summer.

Half of the heating load of the garage is carried by an independent forced air heating system. Here there is no air recirculation.

An exhaust system to remove engine fumes is mounted within the floor slab. Flexible tubes connect this system directly with the cars' exhaust pipes.

The other half of the heating load in the garage is carried by suspended type, unit heaters. Air velocities are in the magnitude of 250 f.p.m. Spacing of unit heaters is approximately 50 feet. Heater outlets are arranged to blow at an angle with the walls so as to produce a gentle movement of all air throughout the space.

An oil fired boiler is located in the grage so as to be accessible to both buildings.



Special consideration must be given to the showroom. There is a difficult problem to gain visibility from the outside during daylight hours. Large over-hangs help, but a high intensity of illumination is required from within the showroom. All lighting fixtures are recessed in the ceiling. A white ceiling and a very light terrazzo floor are used to "bounce" light. Spot lights located at the top of the windows accent the auto and bring out high lights.

Lighting within the garage is provided by ceiling fixtures. This is supplemented by portable lights for the mechanics and body repair crew.

Transmission noise is effectively controlled by segregating the sounds and by blocking their passage through the air and through the structure.

The office area is included in the showroom on a mezzanine floor. Here a special problem arises, requiring acoustical treatment for the entire volume. It is anticipated that the noise level in the showroom will be in the range of 35 to 40 decibels. The closing rooms are divided by stud walls, covered with metal lath and plaster. Overhead is a concrete slab exceeding the 4 inch minimum for a 40 decibel transmission loss.

Since the showroom has a volume exceeding 84,000 cubic feet, a reverberation time of about 0.9 seconds is desirable. The space is characterized by large expanses of glass and other hard, rigid surfaces. This requires the ceiling to be covered with a sound absorbing material. One inch perforated tile cemented to plaster was selected. Because of area limitations imposed by lighting and heating apparatus, the entire 3,500 absorbing units ( Sabins ) are not achieved, but a close approximation is obtained so that the space will be satisfactory.

A flutter problem is created by the highly absorbative ceiling spanning over two opposed glass walls. This is important because the walls are hard, run to a ceiling

height of eighteen feet, and are spaced forty-five feet apart. To counter act flutter the glass has been splayed a minimum of one foot out of twenty in plan.



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Program

twenty - one

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Title : An Automobile Dealership

Client : T. C. Baker Corporation, Brookline, Massachusetts

Site : Corner of Boylston and Tully Streets, Brookline

Program :

Facilities	Present Size	New Design
1- Showroom and Sales Area	1 auto	max 4
Closing Rooms	2 areas	3 rooms
Waiting Area	none	required
2- Office Area	7 employees	same
Management		
Accounting		
Cashier		
3--Stock and Supply Parts Room	3 employees	same
4- Maintenance and Repair		
Entry Area (Shop foreman, & inside parking)	16 autos	adequate
Light Repair and Tune-up	included above	
Overhaul and Repair	22 autos	adequate
Lubrication	2 autos	"
Wash Rack	2 autos	"
Wheel and Headlight Alignment	1 auto	"
Body Shop		
Repair	12 autos	"
Painting	1 auto	2 autos
5- Employee Lounge and Dining Area		
Rest Rooms		
Employee Lockers and Showers		
6- Used Car Lot, Display and Sales Area	24 autos	enlarge
7- Parking		
Customer	60 autos	enlarge
Employee		
New Car Storage		
Company Vehicles		
8- Gas facilities for Company cars and trucks		
9- Service Entrance Area		
Circulation and casual parking		

Summation of Minimum Areas:

		<u>Sq. Ft.</u>
Sales	3 autos	1200
Closing Rooms (3)		250
Office		450
Entry & Light Repair	16 autos	4200
Mechanical Repairs	22 autos	8100
Lubrication	2 autos	1000
Wash Rack	2 autos	1100
Front End Stall	1 auto	650
Body Repair	14 autos	7500
Paint Spray Booth	2 autos	1410
Waiting Area (Service Customers)		300
Stock and Supply Room		2500
Locker Room & Heads (50 lockers)		500
Lounge		200
Parking	100 autos	2500

Location:

Brookline, Massachusetts  
Intersection of Boylston and Tully Streets  
Opposite Chestnut Hill Shopping Center, on Route 9

Lot Size:

Frontage on Boylston Street (Route 9)	187 ft.
Length of Lot (approximately)	400 ft.
Area	1.7 acres

General Description:

Zoning block number 428

Boundries:

North	Boylston Street	
West	Tully Street	
South	Heath Street	
East	North Half	Private residence
	South Half	Heath Court (Private Way) for use of five residences

The lot is basically rectangular; the longer axis running nearly North and South. The majority of the lot is generally flat; however, the southern portion affects a gradual rise up to Heath Street. In the South-western corner are noted large stone out-croppings. Electric utility poles and fire hydrants are located on the Northern and Western boundries.

The Eastern perimeter is emphasized by a row of trees, of various types, running the entire length and forming a separation from the adjacent residences.

Transportation Facilities:

Busses:

MTA every 12 minutes, running to Kenmore Square, Boston and connecting with underground transit

B & W every 30 minutes, running to Park Square, Boston  
and connecting with underground transit

Automobile

Located on Route 9, which connects and is directly  
accessible from Routes 1, 1-A, and 128.



Traffic Patterns:

Automobile Traffic:

Heavy on Boylston Street during morning and evening peak loads.

Traffic signal at next intersection east of site causes traffic to stop in front of lot during morning peak loads.

Pedestrian Traffic:

Primarily concentrated in the Shopping Center across Boylston Street.

Bus Stop one block west of site on the same side of Boylston Street.

Tabulation of Adjacent Facilities:

West of site:

Tallino's Restaurant and Cocktail Lounge  
Bus Stop

East of site:

Brookline Trust Company  
Chestnut Hill Cooperative Bank  
Pierre and Robert Hairdressers

North of site: (across Boylston Street)

Chestnut Hill Shopping Center

R.H. Sterns	Women's apparel
S.S. Pierce	Retail store
Filene's	Department store
Frank Simon	Women's apparel
Pierre-Marcel Inc.	Coiffures
Lauriat's Books	Book store
London Harness Company	Leather goods
Otis Clapp and Son	Pharmacists
Dorothy Muriel's	Pastry shop
Brigham's	Candy
Jack Sheltzer	Photography
Howes	Cleaners
Chestnut Hill Liquors Ltd.	Liquor store

Zoning Regulations:

Zoning Block Number 428

Building Classification:

Numbered District "2" Business  
Height, Bulk and Area District "C"

Building Restrictions:

Maximum height 50 ft.  
Maximum percentage of lot occupied by building (Art. 6, Sec. 27 B.B.L.) 80 %  
First Class Building (i.e. fireproof as specified by Art. 15, Brookline Building Law)  
Maximum floor area between exterior and/or fire walls:  
12,000 sq. feet without sprinkler protection  
24,000 sq. feet with a fully equipped automatic sprinkler system  
(Art. 6, Sec. 28, B.B.L.)

Garages:

Fireproof construction  
Properly ventilated  
On all sides movable windows  
Five foot open space from any other building  
Two exits required for floor area over 25,000 sq. ft. (Art. 22, Sec. 230, B.B.L.)

Sky Signs:

Eight feet back from street edge  
Maximum height of 16 feet above roof  
(Art. 23, Sec. 238, B.B.L.)

Off-Street Parking:

Buildings used for the display and sales of motor vehicles having a gross floor area in excess of 2,000 sq. ft. shall have a parking area not less than half the area within the exterior walls of the building.  
(Art. 5, Sec. 2, Zoning By-law)

Heating and Ventilating Requirements:

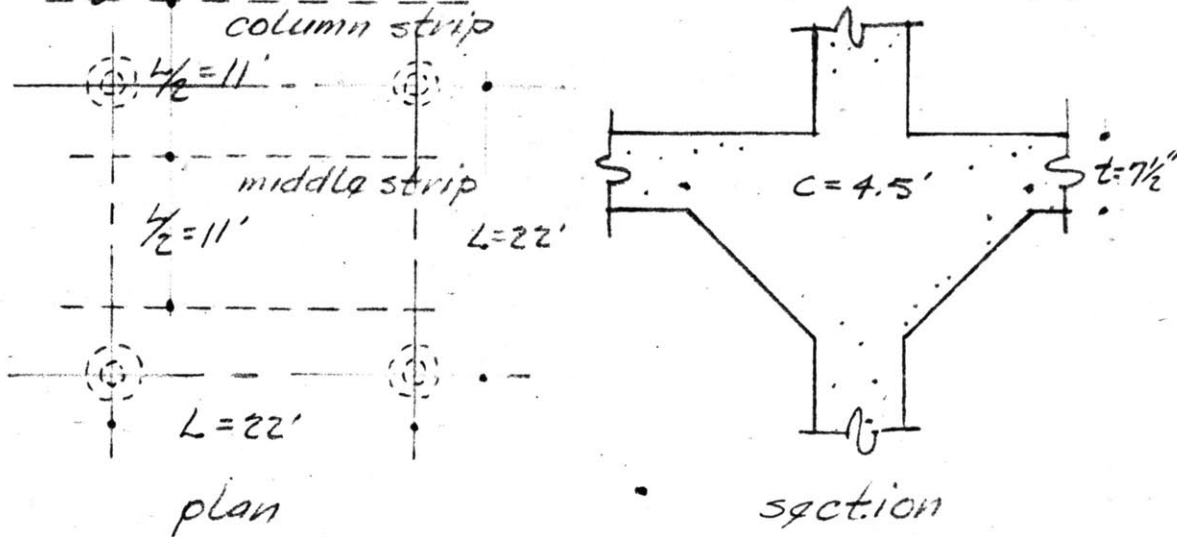
Minimum outdoor design temperature	-5 F.
Average Wind	11.2 M. P. H.
Degree days heating season	6045
Length heating season	189 days
Maximum grains moisture added to outside air	2.99 per cu. ft.

Natural Light:

Latitude	42 21' N	
Longitude	71 04' W	
Sun	June Solstice	Noon 71 (azimuth O.S.)
	December Solstice	Noon 26 (azimuth O.S.)

STRUCTURAL DESIGN      twenty-seven

Method of analysis for garage floor slab - 2<sup>nd</sup> floor.  
 typical interior floor slab (A.C.I code)



total load  $W = w' \times L \times L$   
 $w' = \text{dead} + \text{live loads}$

$$M_o = 0.09 W L \left(1 - \frac{2}{3} \frac{C}{L}\right)^2 F$$

$$F = 1.15 - \frac{C}{L}$$

$$F \geq 1.0$$

	$M_o$	neg. M	pos. M
column strip	1.0	0.46	0.22
middle strip	1.0	0.14	0.16

$$d = \sqrt{\frac{M}{bR}}$$

$$b = \frac{3}{4} \times \frac{L}{2}$$

shear check

$$V = W - w' \frac{\pi D^2}{4}$$

$$D = 2(C + d)$$

$$v_c = \frac{V}{b j d}$$

$$b = \pi D$$

minimum values for thickness:

- 1- for construction proficiency 5"
- 2- for deflection  $l/36 < t$
- 3- for moment

$$t_1 = \left[ 0.028 L \left( 1 - \frac{2c}{3L} \right) \sqrt{\frac{w'}{f'_c/2000}} \right] + 1\frac{1}{2}''$$

allowable  $v_c = 0.03 f'_c = 90$  psi.

when at least 50% of the total neg. reinforcement in column strip passes over column capital.

spacing of bars:

- 1- max  $s = 2t$
- 2- pos. or neg. steel area shall equal  $0.025 bd$ .

from calculations:

$f'_c = 3,000$	$\therefore R_c = 236$
$f_c = 1,350$	uniform load controls
$f_s = 20,000$	$w_L = 125$ psf.
$n = 10$	

$W = 115,000 \#$      $M_o = 170,000 \#'$

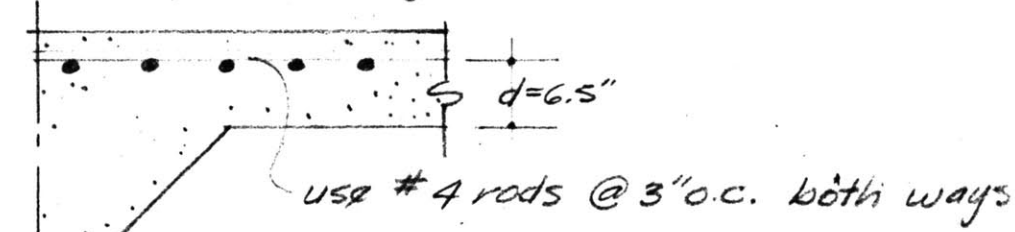
use  $d = 6\frac{1}{2}''$      $t = 8''$

$v_c = 88.5$  psi.

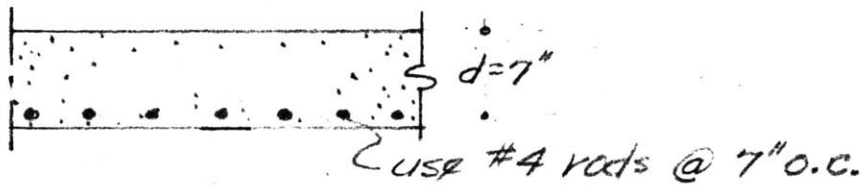
	neg. M	pos. M.
column strip	78,100	37,400
middle strip	27,200	27,200

twenty-nine

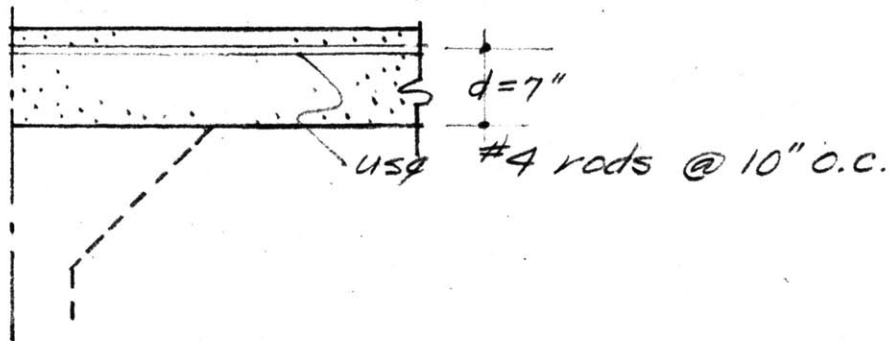
column strip, neg. M



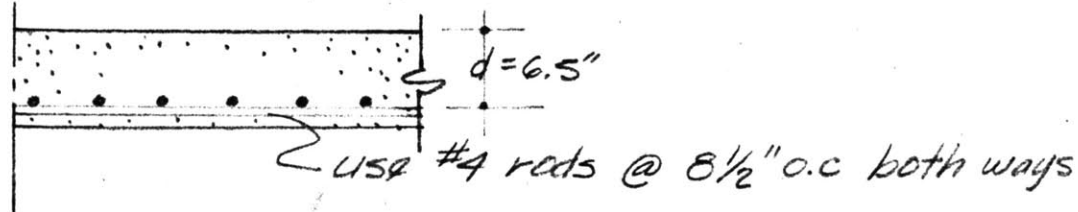
column strip, pos. M



middle strip, neg. M



middle strip, pos. M



$$A_s = \frac{M}{f_s j d (\frac{1}{2})}$$

## Column strip

Neg. Reinforcement alternate bars

#4 { A bars 13'-2" long } centered over  
      { B bars 11' long } column line

Pos. Reinforcement alternate bars

#4 { A bars 16'-6" long } centered on  
      { B bars 21'-6" long } mid-span

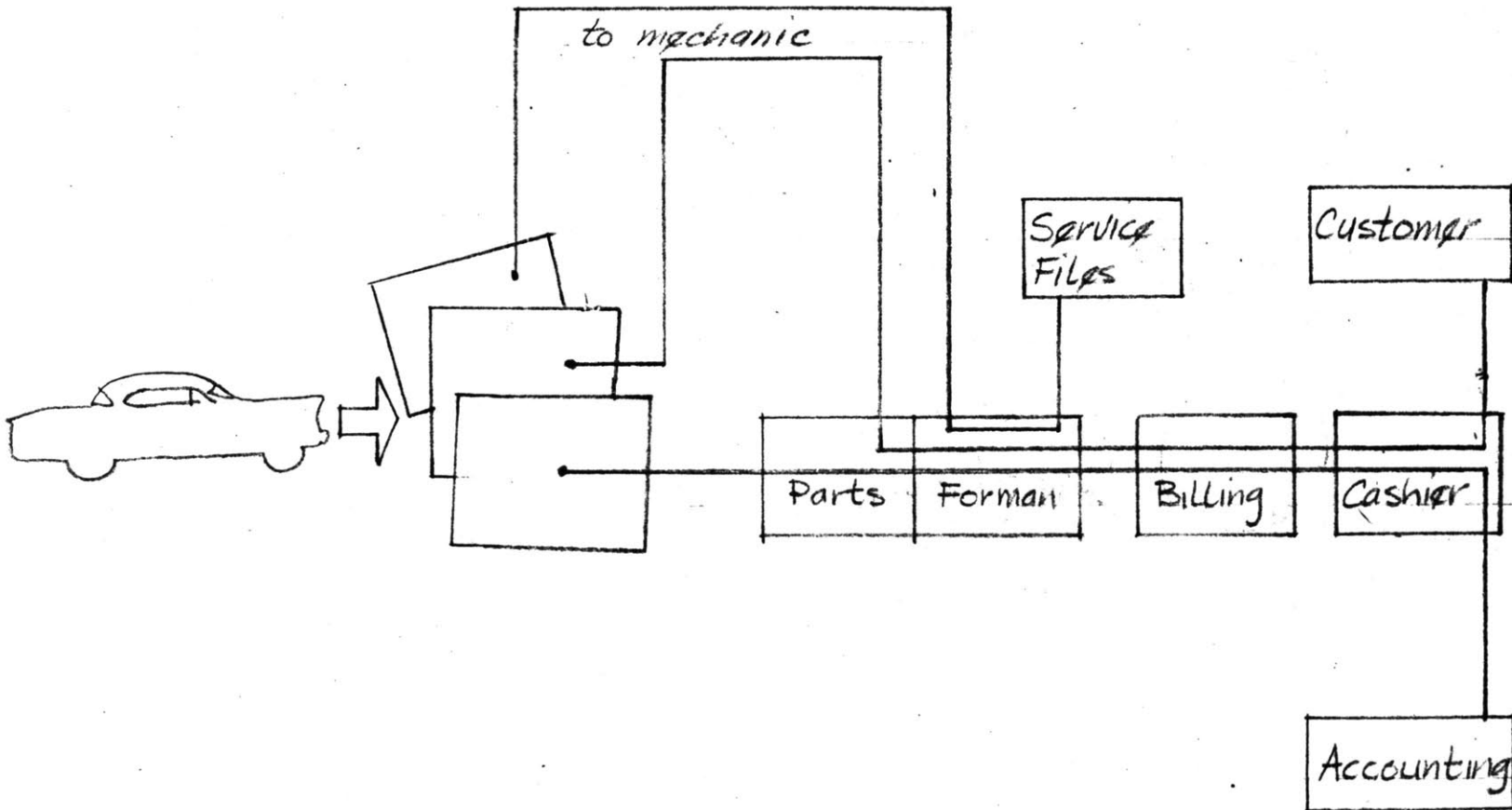
## Middle strip

Neg. Reinforcement

#4 { All bars 11'-0" long } centered over  
      column line

Pos. Reinforcement alternate bars

#4 { A bars 15'-6" long } centered on  
      { B bars 21'-6" long } mid-span



FLOW DIAGRAM FOR BILLING REPAIR WORK  
THIRTY ONE



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