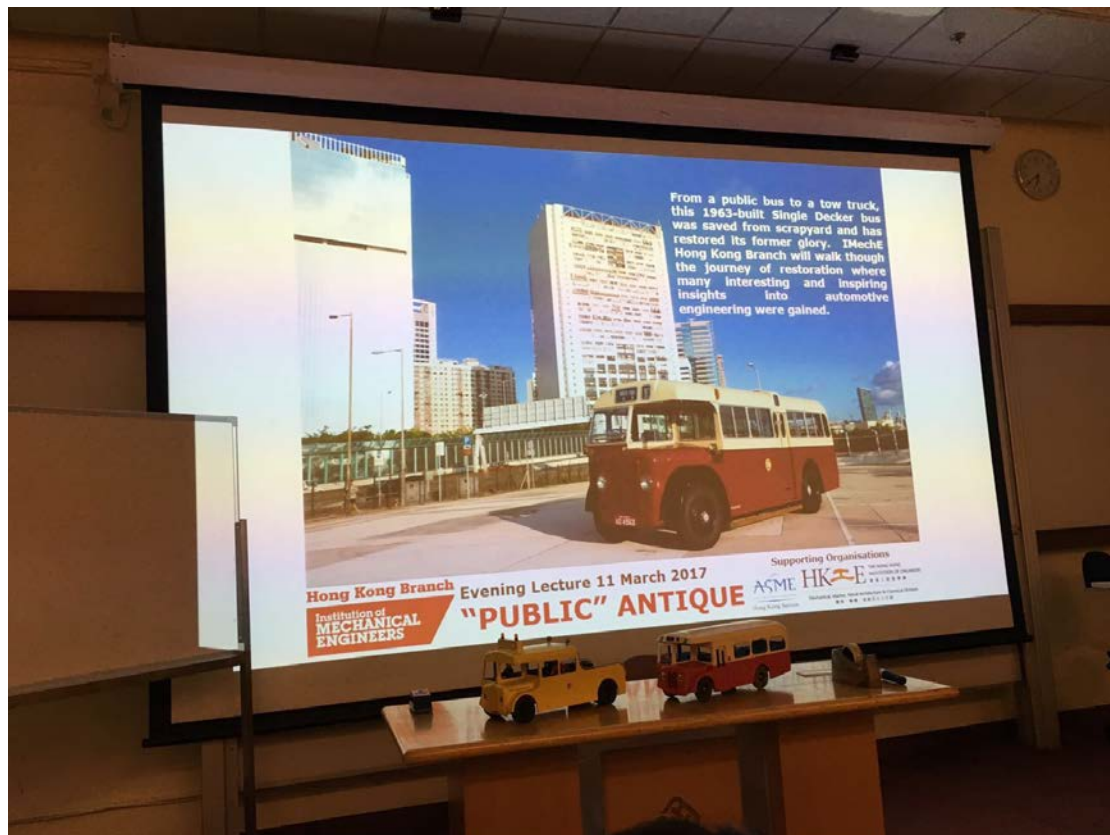


INSTITUTION OF MECHANICAL ENGINEERS HONG KONG BRANCH  
EVENING LECTURE “PUBLIC ANTIQUE” ON 13/3/2017



*The evening lecture held in HJ302 of The Hong Kong Polytechnic University on 13/3/2017*

In Hong Kong, the vast majority of people travelled around the city by public buses and only very few by luxury cars. Conversely, upon preservation of antique vehicles, the luxury cars almost dominated the population and public buses were close to not in existence at all. Classic car is defined in Hong Kong as car over 20 years of age, and out of the 21,025 units licenced for running on the roads in Hong Kong before 1997, 596 units were manufactured prior to 1975. Contrary to cars that may continue enjoy presenting themselves in dignity, reaching the end of service life, the public buses are either converted into auxiliary vehicles or exported for continual service, if not scrapped for the salvage value. Preservation has never been an option for the vintage public buses in Hong Kong, whereas a former Guy Arab V-converted tow truck of China Motor Bus (C.M.B.), which was saved from a scrapyard and restored into its former glory, is a rare exception and a demonstration of possibility of preserving public buses in the territory.

*Dramatic Life*

The vehicle concerned, with number plate AD4563, was new to C.M.B. in 1963 as a single decker bus which was a Guy Arab Mark V chassis with a set of completely knock-down body kits by Metal Sections Company being assembled in Hong Kong. Initially the vehicle was fitted with a Gardner 6LX engine coupled with a Guy Semi-Automatc gearbox. After nine (9) years of passenger service, it was converted into a tow truck and subsequently re-fitted with a more powerful power-train comprising a

Gardner 6LXB engine and a Leyland (Self-Changing Gear Ltd.) SCG GB340 semi-automatic gearbox.

AD4563 was one of the 106 Guy buses in the C.M.B. fleet serving on the roads of Hong Kong Island originally in single deck. 105 of them were unprecedentedly converted from single deck to double deck buses in 1970s to maximise passenger carry capacity. With the outstanding reliability and durability in the hot, humid and frequently over-loading operating environment, the chassis supplied by Wolverhampton-headquartered Guy Motors (Europe) Ltd. was favoured by C.M.B. and it once monopolised the fleet of C.M.B. from 1950s to 1970s. 35 years later after conversion in 1972, the tow truck was withdrawn from the fleet and sold to a scrapyard in 2007, when the current owner intervened and purchased it for preservation. Originally intended to preserve it as a tow truck, the owner and his companions in the restoration team decided to return it to its original state in 1963.

The restoration of AD4563 was known to be the first project of complete re-bodying a privately owned antique public bus in Hong Kong. Owing to land scarcity universal across the territory, the restoration was not carried out in a proper and well-equipped coach body-builder workshop but at a corner of a primitive and poorly equipped garage. Many service equipment and tools acquired were used only once for the restoration, amounting significant investment for the venture. Furthermore, the restoration team initially contemplated to engage contractors to carry out the comprehensive vehicle rebuild works. However, the team noticed that the scope of work was too new to the contractors and, some of them even perceived the job of restoring the vehicle from its condition of scrap as impossible after inspecting the vehicle. Moreover, the workmanship of many contractors was considered to be below the expectation of the restoration team. This led the restoration team to revise the restoration strategy such that a contractor who had been specialized in classic car restoration was commissioned to perform only those straight forward tasks while the complicated works which were often incomprehensible and required attention to the details would be taken care of by the restoration team itself. As a result, uncountable number of weekends and public holidays with tremendous man-hours were spent by members of the restoration team on the project over a period of about 10 years. In order to make the final product to be as close to the condition of the vehicle when it was first in operation back in 1963, the restoration team had to study each and every piece of technical details out of the initial non-existence of technical data, detailed interior design, colour codes and special service tools of the vehicle.

### Missing History

A salient setback was the absence of archive for the technical details of the vehicle. Although Transport Department (TD) is the government department responsible for the registration, approval and filing of technical particulars of all vehicles running on public roads in Hong Kong, despite being requested through the Code on Access of Information, TD was unable to provide any technical data about the vehicle, which should have been submitted by C.M.B. during type approval. Secondary sources, such as books, technical manuals, historical photographs acquired from e-bay were the only available means to reconstruct the layout of the vehicle, both exterior and interior, in conjunction with physical measurement from the remains of the bodywork.

Taking seating plan as an example, there were two (2) identified possibilities for the rearmost seats at the end of the cabin to be configured: either a single bench across the width or two (2) independent two-seaters with an aisle in between. In spite of no drawing or image of the interior was available, by observing the elevation of the left arm of a passenger sitting on the left rearmost seat with respect to the window in a historical photograph, it could be reasonably predicted that the rearmost seat shared the same cushion level with its front counterparts. Moreover, the same photograph revealed the seat above the rear wheel-arch cover was consistent with the seats at the rear compartment, indicating all seats to the rear of the cabin entrance, including the rearmost seat, were elevated on a box. This led to the conclusion of a two-by-two seating configuration for the rear part of the cabin. This configuration was subsequently confirmed by the memories of some C.M.B. retirees who had experience of working with vehicles of the same model, underpinning an accurate reconstruction of this part of the missing history.

Another example was the entrance partition. An entrance partition was known to be in place and its height was initially modelled to be up to the height of waist-rail, with only the partition pillar extended to the cabin roof. However, in an archived photograph of a vehicle of the same model in a traffic accident, it was identified that there was also partition from the cant rail level to the cabin roof. This led to the partition being reworked with the upper part fitted, resulting in the cabin details to be closer to what had actually been there in 1963.

It was the aforesaid large amount of background labour on data collection and design reconstruction that enabled the bodywork drawings to be generated and costs to be accurately estimated.

### Restoration Works

The reconversion from a tow truck back to a bus comprised of chassis reconditioning, bodywork reconstruction, electrical re-works and mechanical re-works.

The chassis frame was badly corroded upon receipt of the vehicle by the owner. After removal of the original bodywork, the chassis frame was sand-blasted for rust removal and subsequently repainted for corrosion protection.

Upon conversion to a tow truck the chassis rear over-hang was cut short, which gave rise to the re-provision of the shortened chassis for the reconversion to a bus. C-channels in the same dimensions as the chassis main frame were used to provide the extended length and they were connected to the chassis main frame by means of plug welding. For each of the two main chassis members, a reinforcing pad with a hole was provided and placed on the inner flange of the existing C-channel member, with the hole facing the chassis centreline. Fillet weld was applied at the hole joining the existing C-channel member and the pad. The inner flange of a new piece of C-channel (for extension of the chassis frame) was then placed against the pad and the outer flanges of the existing C-channel member and the new piece of C-channel were then covered by two L-plates, with one on the top and the other at the bottom, for increasing the bending strength of the extended chassis frame. Finally, the pad, the existing C-channel member, the new piece of C-channel and the L-plates were mechanically fastened together by bolts and nuts. With this installation technique,

albeit empirical without in-depth design calculation, the extended piece of chassis frame joined to the existing chassis frame by minimal welding work and the extension has been found effective. The extension provided support for the rearmost cross member and the rear part of the bus bodywork.

In spite of being a tow truck, the original bodywork inherited certain features of the vehicle when it was a bus. This permitted the bodywork rebuild to adopt a partial approach, which meant the existing bodywork could be utilised with the new bodywork installed only for the missing part. Although this would have benefits of lower production cost and shorter production time, the drawbacks of weaker resulted body strength at joints, uneven body weight distribution and difficulty in achieving a correct body geometry prompted a complete rebuild to proceed with. The weaker body strength was particularly an issue because, as the nearside waist rail gave way to the doorway, the nearside centre door cant rail was a salient longitudinal load-bearing member of the body, and asymmetry of the nearside centre door cant rail in material would compromise the overall structural strength. As a result, a complete rebuild, which provided consistent and adequate body strength, was carried out by a contractor at a corner of a garage where the vehicle was docked and a brand new bodywork, with the right doom-shape cross-section and roof profile with reference to the original tow truck roof-stick, was constructed ready for installation onto the cross members.

Unlike modern buses, Guy Arab V chassis came from the vehicle manufacturer with no integrated cross members. Rather, box-section-made cross members were welded on the top of V-shaped cross member supports, while the bottom of each support was welded to the top of a T-shaped bracket. The lower part of the bracket was mechanically fastened to the outer flange of the main chassis member by bolting. There were brackets at the cross member ends for attachment of bodywork by welding, forming an integrated bus body.

Rebuilding of the body frame on the chassis was followed by reconstruction of all the details inside and outside the cabin, as well as the reconditioning of the mechanical and electrical works. Same as the technical data, installations, fittings and accessories of 1963 for the interior, such as the chequer plates for the floor and aluminium trimmings, were no longer in production and supply and sourcing was again challenging. Usable parts and components were retrieved from disposed vehicles in scrapyards, with modification if necessary, albeit some like To Stop bell and light cover were readily available from open market such as e-bay, to reconstruct the original atmosphere. For instance, the bronze-made central door handrail brackets were straight and, though the only ones sourced were curved, by hot-bending and boring the stem with the insertion of an iron rod inside the bored stem to give additional strength, the straight shape was formed and good for the purpose.

Likewise, the flange of the original waist rail was profiled with a unique curvature and the waist rail was no longer sourceable. The curvature was recreated by covering the box section-fabricated waist rail with profiled sheet aluminium to reproduce the finishing.

The reconditioning of the electrical works also exhibited great challenges. The original dynamo required overhaul and most electricians in the days of the project did not have experience of working on old models like this one. Fortunately, a worker



who was a former C.M.B. electrician experienced in working on the model was found and engaged so that the overhauling could proceed with smoothly and the dynamo was reinstated to its original functionalities.

The C.A.V.-made switch board was initially in a miserable condition. Although it was fortunate that rewiring of the switch board could be aided by a detailed wiring diagram contained in a technical manual obtained in the data collection stage, restoration of the switch board was challenging. The process of rejuvenating the switch board was yet another demonstration of the value of the technical know-how in experienced, albeit retired, personnel.

The switch buttons on the board had to be dismantled from the casing so that the casing could be reconditioned and rewiring could proceed with. There was no replacement part for the buttons and the original ones had to be reused in order to achieve the expected originality. It was however unable to remove these buttons from the casing despite various attempts. The removal remained impossible until a former C.M.B. technician intervened and advised the correct method of dismantlement, which led to the buttons being taken out from the casing properly and quite easily.

A core component inside the switch board was the regulator, which regulated the voltage to the vehicle and the charging current entering the battery at various speeds of the dynamo. The armature and core had to be maintained a certain clearance for being functional, but the clearance required and the means of adjusting the clearance were unknown and unavailable. Unexpectedly, one of the retired C.M.B. technicians had kept the special tool proprietary for the clearance adjustment and his tuning of the clearance with the tool contributed the final puzzle piece for the restoration of the switch board. The technician's wife had urged him to dispose of the tool after retirement and the application turned his decision of keeping the tool to be a right one.

The mechanical parts of the vehicle underwent extensive operation. When the vehicle was towed to the scrapyard, the drive shaft remained engaged to the rear differential thus linking with the gearbox. As a result, all gears inside the original SCG GB340 gearbox, which was technically advanced at the time of production with epicyclic gear trains fitted, were worn to nothing and the original gearbox was beyond repair. It was however fortunate that a reconditioned gearbox of the same model could be sourced from the U.K. and installed, equipping the restored bus with a new transmission set. Salient lesson learnt is, therefore, that the drive shaft should be disengaged from the differential and gearbox prior to towing the vehicle.

The original radiator was inadequate for cooling of the engine. The fins on the brass-made cooling tubes were severely clogged and the effort of removing the dust and dirt would be excessive. Considering that the radiator would hide behind the front grill and out-of-sight, notwithstanding loss of originality, it was compromised to replace it with an aluminium-made one which could offer a higher heat transfer efficiency and thereby addressing the cooling shortfall at the root cause conveniently.

Unlike modern heavy duty vehicles, the worm wheel of the rear axle differential of Guy Arab V was brass-made. This salient material feature had been omitted for years, and the modern gear lubricant standard, such as API GL-5 rated in API 1560, was applied to the differentials of the entire C.M.B. fleet. The sulphur and phosphorous

compounds in the anti-wear additives of the modern gear lubricant, which either physically absorb on or chemically react with the metal surface to form a low shear film at the point of metal-metal contact, react and corrode the brass wheel. Modern API GL-5 lubricant was therefore not suitable for this Guy, and only after referecing historical literature obtained from Aston Manor Road Transport Museum archive, the suitable lubricant, which was equivalent to API GL-1 or GL-2, was ascertained. This lubricant type was no longer supplied in Hong Kong and could only be sourced and tailor-blended through a lubricant supplier in the U.K.

Other mechanical reparations included timing adjustment of the Gardner-made 6LXB engine, provision of new exhaust silencer, fuel tank, brake and tyres before the restored Guy was put on its first road test. Further tuning and adjustment followed the first short road test so that the vehicle was refined to a satisfactory condition for roadworthiness and ready for its public debut outside City Hall in Central on 15/1/2017 (Sunday).

### *Beyond Preservation*

AD4563 is known to be the first successful case of restoring and preserving a vintage public bus by a private group of bus enthusiasts in Hong Kong with its body completely rebuilt; yet the private preservation of the public road transport history in the territory remains full of challenges. Unlike classic cars, classic public buses have no resell value and no licence or exemption is given by TD to permit them running on public roads. They can only be driven on public roads with Trade Plates by which Certificate of Roadworthiness (COR) test necessary for registration and licensing with TD is not prerequisite. To be licenced with TD, AD4563 has to comply with Hong Kong Legislation Chapter 374A “Road Traffic (Construction and Maintenance of Vehicles) Regulations” and satisfy all the tests required, such as Axle Loading (Regulation 14), Passenger Seating Capacity (Regulation 27), Exhaust Emission (Regulation 31A) and Stability Test (Regulation 55).

Besides, classic buses are higher in physical height and much bigger in size than most classic cars and they cannot be parked in ordinary car parks in the same way as the classic cars. Places available for storage of vintage buses are limited and costly. The resources involved in restoring and preserving classic public buses are so demanding that only bus companies can afford such resources for restoring their own vehicles in scale to date. In parallel, the general public has not acknowledged classic public bus preservation in a positive and supportive way, while an organised and systematic archive of the vehicle technical details is awaiting establishment initiative. Although there were attempts of private preservation of classic public buses, not all of these have been successful.

In contrast, there is a thriving classic bus preservationist community favoured by government policy in the U.K. Classic buses in the U.K. are categorised historic (classic) vehicles for which regulation is different and differentiated from that for the ordinary modern vehicles. Vehicles first registered on 8/1/1976 onwards require passing MOT (Ministry of Transport) test and paying vehicle tax, whereas vehicles first registered between 1/1/1960 and 7/1/1976 are exempted from vehicle tax, albeit MOT test remains mandatory. Conversely, vehicles first registered before 1/1/1960 require neither passing MOT test nor paying vehicle tax. Buses used for voluntary or

community purposes are entitled to the MOT test and tax exemption. The provision has facilitated preserving classic buses to be viable and many classic buses are still preserved in adorable conditions.

For example, Ensign Bus based in Purfleet, Essex possesses a fleet of top-class maintained classic buses, which are not only displayed in rallies but also active in serving the communities, such as providing rail replacement services upon railway service destruction. Separately, local councils have leveraged the attractiveness of classic buses and transformed classic bus rallies to become district carnivals, where the public may enjoy free ride on these classic vehicles for leisure yet unforgettable experience.

Notwithstanding the difficulties, it does not mean that private preservation of classic public buses in Hong Kong is impossible and of no interest. While physically preserving classic buses cannot be done in a large scale, recognising the essence of technical documents in contributing towards classic bus preservation, the restoration team has commenced the campaign of collecting and archiving automotive-related dossiers. The team has retrieved technical drawings, manuals, handbooks and literatures alike from archives in companies, libraries and museums in both Hong Kong and the U.K. Some valuable dossiers have even been salvaged from trash bins, at the onset of disposal and permanent disappearance. The team envisages that a systematic archive for Hong Kong motoring history can be established, which can serve as a knowledge and technical data base for classic vehicles. In the long run, the automotive database may lead to the establishment of an on-line transport museum, shedding light on the history of automotive engineering and transport for the real and virtual world.

### Remark

The restored AD4563 offers the contemporary Hong Kong a glimpse of its past in public transport. The lengthy restoration process was a journey of reconstructing the missing history of the vehicle in its 1963 livery and discovery of the engineering and technologies over five (5) decades ago applied to power the vehicle in motion. With diligence paid to every detail, in conjunction with due care to the restoration of engineering, the once subject of scrappage has been rejuvenated and has returned to its beauty and vigour. The AD4563 project is a comprehensive mechanical engineering lesson and a linkage of automotive engineering and history, bridging the past and the present.



*Institution of Mechanical Engineers Hong Kong Branch Past Chairman, Mr. Edmund K.H. Leung presented Certificate of Appreciation to the speaker, Mr. Yonie Sung*

Institution of Mechanical Engineers Hong Kong Branch thanks Mr. Yonie Sung and his restoration team for their generous sharing of the AD4563 story.

Photographs were taken by Mr. Benny C.Y. Sit with permission to use. Copyright reserved.

Encl.  
WHT: AW



From a public bus to a tow truck, this 1963-built Single Decker bus was saved from scrapyard and has restored its former glory. IMechE Hong Kong Branch will walk through the journey of restoration where many interesting and inspiring insights into automotive engineering were gained.

**Hong Kong Branch**

**Institution of  
MECHANICAL  
ENGINEERS**

**Evening Lecture 11 March 2017**

**"PUBLIC" ANTIQUE**

**Supporting Organisations**

**ASME**  
SETTING THE STANDARD  
Hong Kong Section

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INSTITUTION OF ENGINEERS  
香港工程師學會  
Mechanical, Marine, Naval Architecture & Chemical Division  
機械、輪機、造船及化工分部



# IMechE Seminar: Public Antique

## Classic Bus Restoration & Preservation in Hong Kong

Presented by: Yonie Sung

# Yonie Sung

Head of Aftersales Division - Mazda Hong Kong  
Vang Iek Motors (Hong Kong) Ltd

Member of Classic Car Club of Hong Kong

BEng, Industrial & Manufacturing Systems Engineering, HKU  
MSc, Mechanical Engineering, PolyU



# Video 1: A Bus Ride on Hong Kong Island



botography 2017

Photo Copyright: Louis Mak

# Content

**1. Classic Car in HK**

**2. What is AD4563?**

**3. Restoration process**

**4. Classic bus preservation in HK**

**5. Future works**



# The Fate of a Classic Public Bus vs a Classic Car in Hong Kong



Photo Copyright: Jackson Lo



# Classic Cars in Hong Kong

An aerial photograph of a classic car show in Hong Kong. The street is filled with a large crowd of people and numerous classic cars of various colors and models, including red, blue, white, and black. The cars are parked along the sides of the street, and the crowd is walking through the middle. The surrounding buildings are modern, and the scene is set in an urban environment.

*Photo Source: Classic Car Club of HK*



An aerial photograph of a classic car show on a city street. Numerous vintage cars of various colors (red, blue, white, black) are parked along the street, surrounded by a large crowd of people. Buildings with storefronts like 'Van Cleef & Arpels' and 'Van der Linde' are visible on the right side of the street.

**Classic Car Club Membership: Cars more than 20 years**

**Classic Car Club HK members: About 500**

**Motor Trade Association Vehicle Statistics as of 31 Dec 2015:**

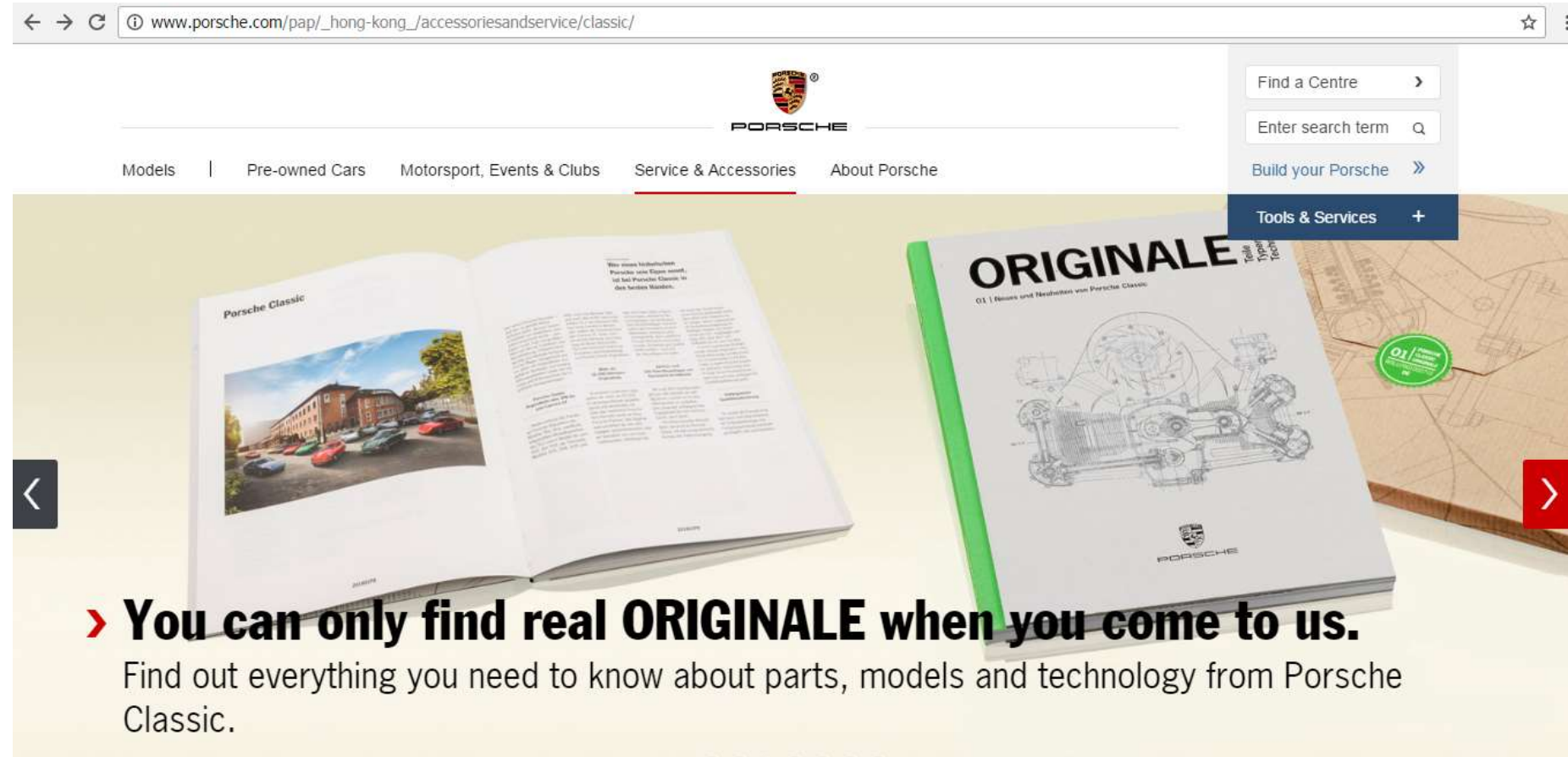
**Licenced PC before 1997: 21,025 units**

**(596 units manufacture year before 1975)**

Source: [www.porsche.com](http://www.porsche.com)

Over 70 per cent of all Porsche vehicles ever built are still on the road today.

We want to make sure that it stays that way: with quality "Made in Germany" and more than 52,000 Porsche Classic Genuine Parts, from over 1,000 Classic suppliers.



The screenshot shows the Porsche website's 'Service & Accessories' page. The browser address bar displays the URL: [www.porsche.com/pap/\\_hong-kong\\_/accessoriesandservice/classic/](http://www.porsche.com/pap/_hong-kong_/accessoriesandservice/classic/). The website header includes the Porsche logo and navigation links: Models, Pre-owned Cars, Motorsport, Events & Clubs, Service & Accessories (highlighted), and About Porsche. A search bar and a 'Find a Centre' button are visible in the top right. Below the navigation bar, a promotional image features two Porsche Classic books. The left book, titled 'Porsche Classic', shows a photograph of a building and several cars. The right book, titled 'ORIGINALE', features a technical diagram of a car chassis. A green circular badge on the right book reads '100 Jahre Porsche'. Below the books, a red arrow points to the text: **You can only find real ORIGINALE when you come to us.** Underneath this, it says: 'Find out everything you need to know about parts, models and technology from Porsche Classic.'





*Photo Copyright: Yonie Sung*



# How about the fate of a Public Bus?



**In Use**



**Converted to Auxiliary Vehicles**



**Scrap**



**Sell to Overseas**



# The Story of AD4563



*Photo Copyright: Jackson Lo*

**New in Year 1963 to China Motor Bus**

**Chassis: Guy Arab Mark V chassis**

**Body: TI Metal Section – CKD local build at Hong Kong**

**Engine: Gardner 6LX & later Gardner 6LXB**

**Gearbox: Guy Semi-Automatic & later Self-changing  
Gear Ltd SCG GB340**





**Total 106 units single-deckers when new in 1963**

**105 units converted to Double Decker from 1972**

**AD4563 was the only unit retained  
& Converted to towing truck in 1972**



*Photo Source: ebay*



*China Motor Bus Memorial Page*

# GUY Motors



*Photo Copyright: Jackson Lo*

# New Low-frame Guy Arab Chassis

THE latest version of the Guy Arab double-decker bus chassis, the Mark V model, has a modified frame design to permit the use of a lower floor level. With forward-entrance bodywork, this is claimed to make possible the use of only two steps of normal height to gain access to the interior. The main portion of the side-members has been lowered  $2\frac{1}{2}$  in., as compared to the existing Mark IV model, giving a laden frame height of 1 ft. 9 $\frac{1}{2}$  in. This is only about 3 to 4 in. higher than the various low-floor double-decker models of unorthodox layout, yet the Arab V is otherwise entirely conventional in design.

The main mechanical units are those used on the present Mark IV model. The standard engine is the Gardner 6LW unit, although the 6LX and, in certain

cases, the 5LW engine of the same make are offered as alternatives. The front engine mounting continues to be of the two-point type incorporating inwardly inclined bonded rubber sandwich blocks. At the rear, a system similar to that used on the Invincible goods models has now been adopted. This incorporates large bonded rubber bushes mounted one at each side of the flywheel housing, with a stout tubular cross-member passing through them.

Transmission alternatives are a single-plate clutch and four-speed constant-mesh gearbox or fluid flywheel and four-speed direct-acting air-operated epicyclic gearbox giving two-pedal control. In both cases the gearbox continues to be mounted amidships.

The rear axle is an underslung worm-driven unit, with 8-in. worm centres, whilst the front axle is an I-section beam unit with 2 $\frac{7}{8}$ -in.-dia. stub axles. Road

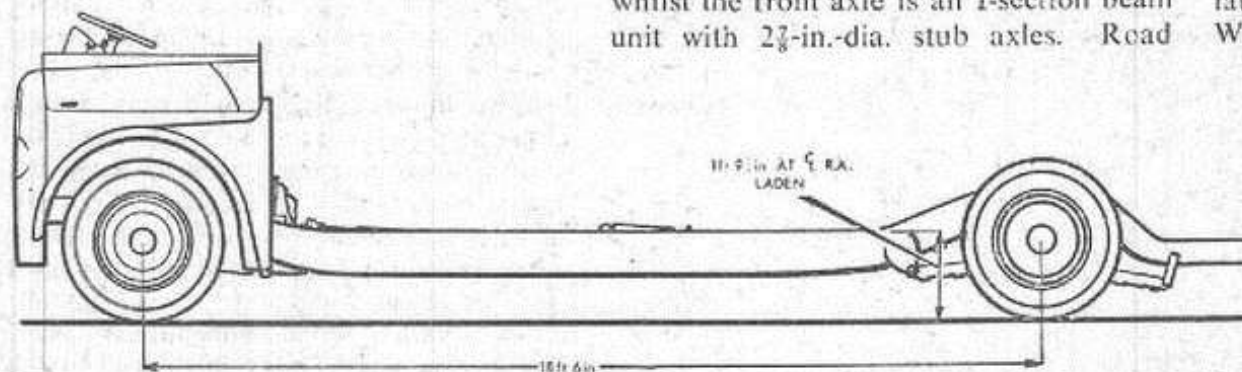
springs 4 in. wide are used for both axles in conjunction with telescopic dampers.

The air-pressure braking system incorporates diaphragm brake chambers in place of the cylinders used on the Arab IV.

The new side members are 10 $\frac{1}{16}$  in. deep,  $\frac{1}{4}$  in. thick and have 2 $\frac{5}{8}$ -in.-wide flanges at the point of maximum section. They terminate just behind the rearmost spring shackles, but dropped or straight extensions can be provided.

The wheelbase of the Arab V is 18 ft. 6 in. and the chassis is being offered in a form suitable for vehicles of approximately 30 ft. overall length only. Among the optional extras are automatic chassis lubrication and 24-volt A.C. electrical equipment.

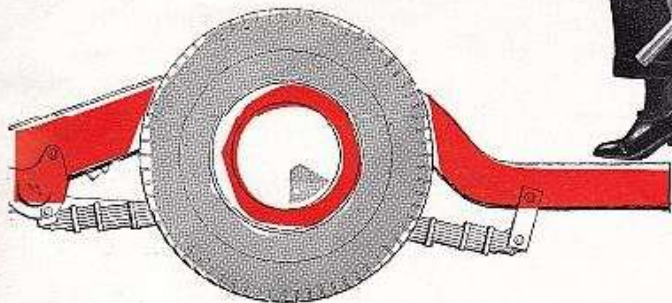
The Arab V is going into production later this year and an example for Wolverhampton Corporation is to be exhibited at the Commercial Motor Show at Earls Court in September. The new model is of particular interest as it is the first to be announced by Guy Motors (Europe), Ltd., since the take-over by Jaguar Cars, Ltd. The Wulfrunian is not being displaced by the Arab V, which has been developed in response to continuing demand for a double-decker chassis of orthodox layout.



*The frame of the Arab Mark V is designed to give a low floor height.*



**GUY's**  
designers  
take a step  
in the  
right direction



If you want to get ahead, the best way to move is forward. That's just what we are doing at this moment. Already Guy designers are doing brilliant things with buses... putting excitingly original ideas to work on a tried and trusted design.

### and the answer's an ARAB (MARK V)!

The 'ARAB' Mark V is a direct descendent of the famous 'ARAB' Mark IV which is still widely respected all over the world as an example of British vehicle building at its best. The new model retains the same major units as the Mark IV but adds to their proven reliability a number of important new features:—

- \* New low height chassis for easy access—lower centre of gravity.
- \* Economical Gardner 6/LW 112 B.H.P. Diesel Engine. \* Super-rigid all-bolted frame. \* Full air brakes for greater safety. \* Automatic Brake adjusters. \* Radiator of bolted construction. \* Simplified Engine mounting.
- \* Heavy Duty Front Axle. \* Front and rear telescopic Shock Absorbers.
- \* Variable Rate Rear Springs for all operating conditions. \* Cam and double roller type steering. \* Choice of Transmission: clutch and constant mesh gear-box or Fluid Flywheel and semi-automatic gear-box. \* And the price is right too!

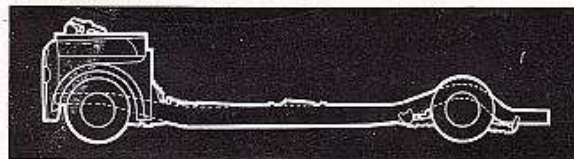


This latest model in the world famous ARAB series upholds the Guy tradition of high quality passenger vehicles designed for reliable and economical performance, and produced to give long and satisfactory service under widely varying operating conditions.

# GUY



GUY MOTORS (EUROPE) LIMITED,  
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THE INDEX



# GUY Motors & CMB



*Photo Source: Internet*

# How about the fate of a Public Bus?



**In Use**



**Converted to Auxiliary Vehicles**



**Scrap**



**Sell to Overseas**





*Photo Source: ebay*



*Photo Source: Internet*



*Photo Source: Louis Mak*



*Photo Source: Jackson Lo*

- **The first ever privately owned classic bus to have complete body rebuild in HK.**
- **The restoration did not take place in coach builder's workshop.**
- **A restoration which highly depended on volunteers' effort.**

# **Phases for the Rebuild of AD4563:**

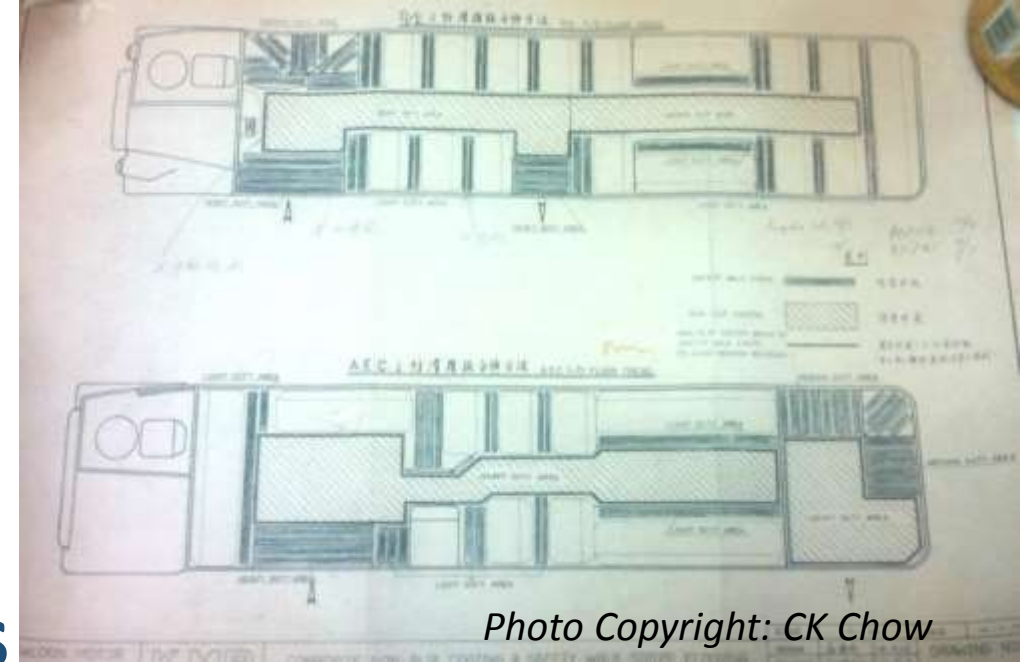
- 1. Data Collection**
- 2. Design Concepts and Evaluation**
- 3. Drawings**
- 4. Budgeting**
- 5. Production**
- 6. Road Test**

## **Challenges:**

- The concept is too new to contractors**
- Majority of the contractors workmanship is not up to standard**
- Land resources for the rebuild works**
- Equipment and tools investment**

## Something disappeared:

- Technical Data
- Special Service Tools
- Body parts become obsoleted
- Paint materials and colour codes





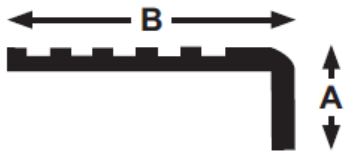
## Mouldings - Aluminium

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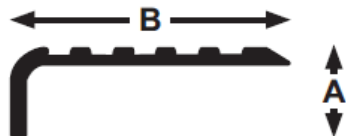
Flat Tread (FAT)



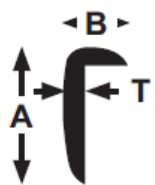
LAT



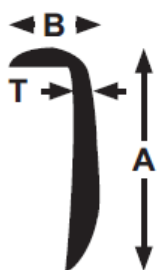
LAT2



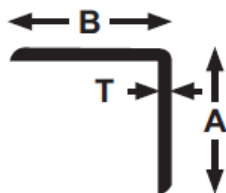
ACC1



ACC5



ACC10



DRB Moulding

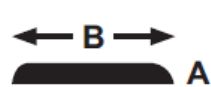


Photo Copyright: Yonie Sung

# 1. Data collection:

Sources from Books, Technical Manuals, Old photos from ebay, measurement from remains of the bodywork etc.

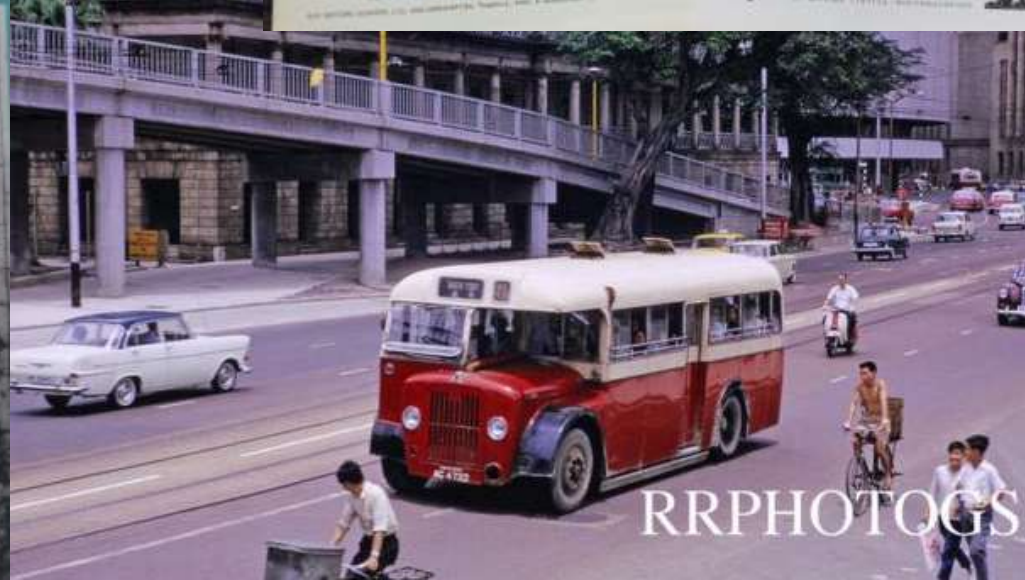


Photo Source: Internet

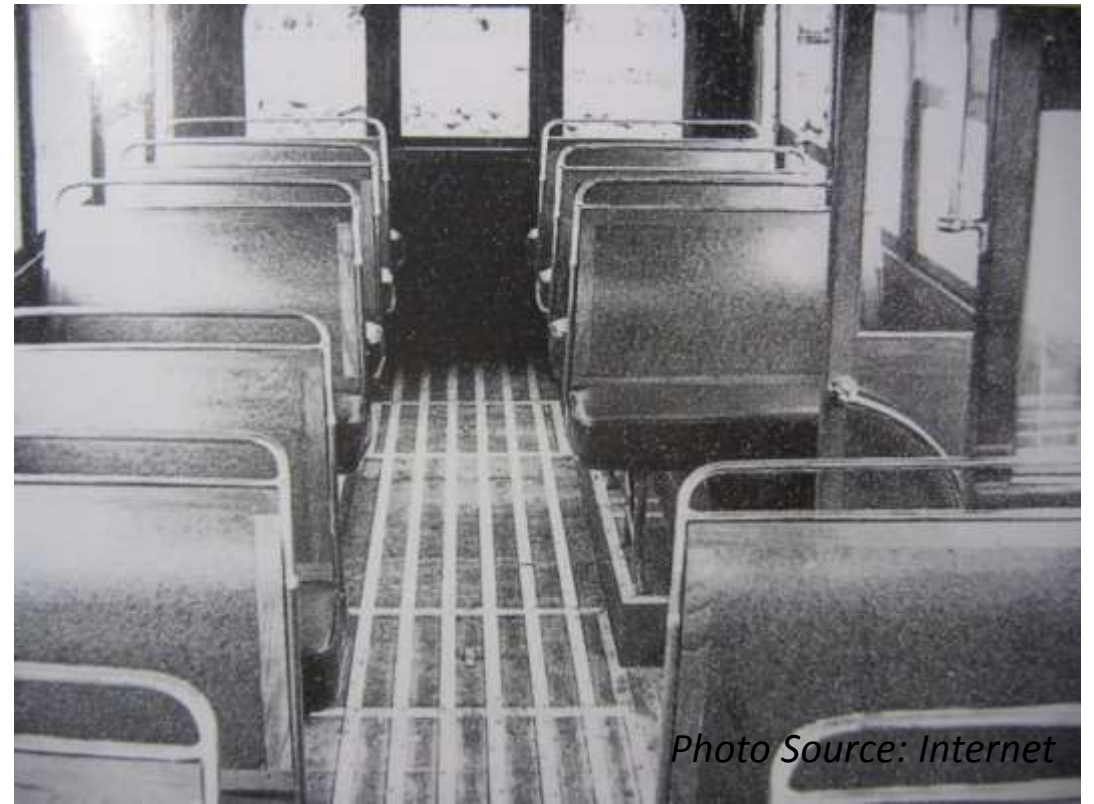


## Difficulties in data collection:

- No proper archived documents & record
- TD does not keep the related Type Approval doc
- Need to rely on memories from retired staff from CMB
- **Example: Seating plan**

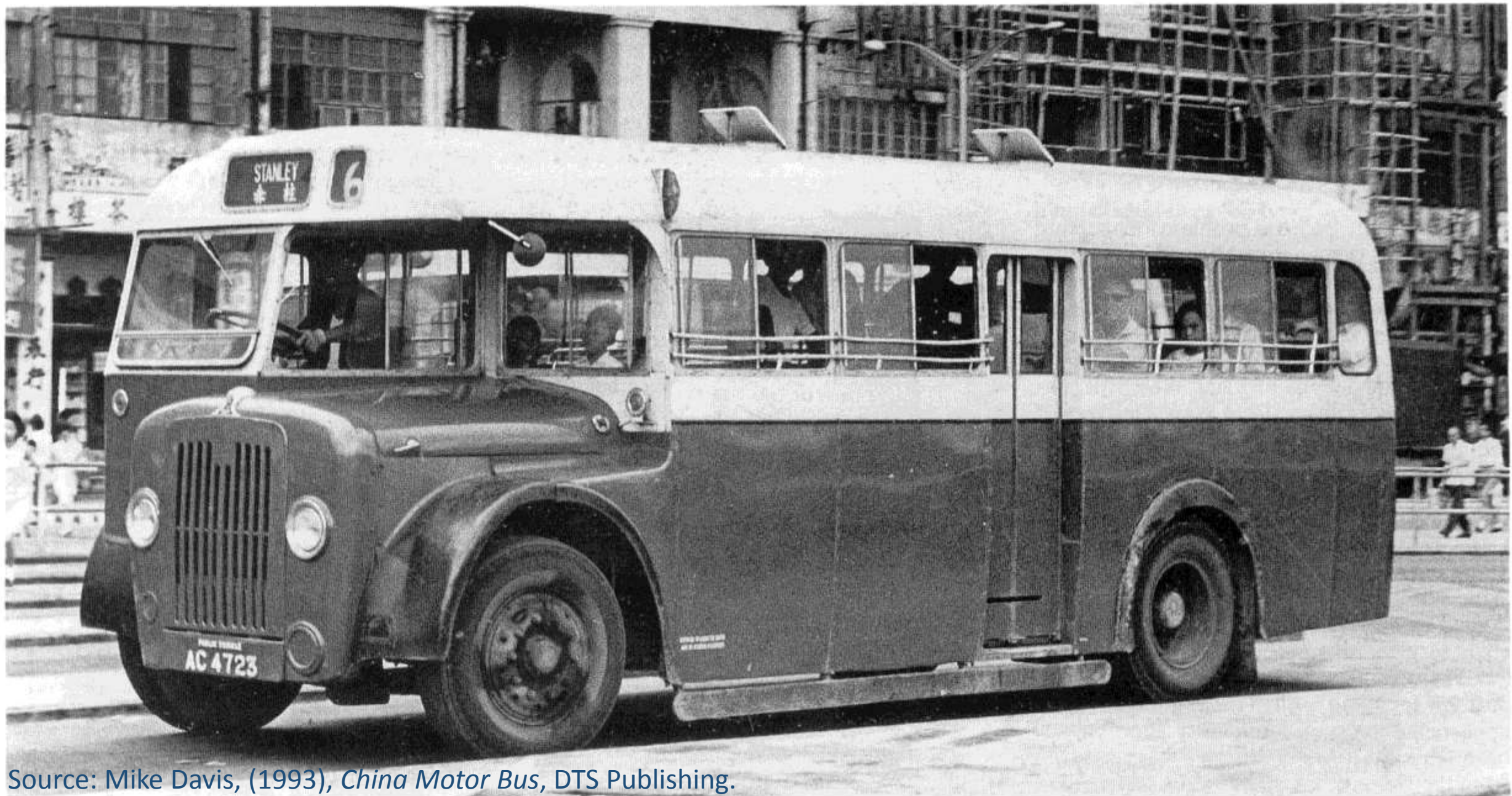


*Photo Copyright: Yonie Sung*



*Photo Source: Internet*





Source: Mike Davis, (1993), *China Motor Bus*, DTS Publishing.

**ABOVE:** AC4723 was later destined to become double-deck S19 in 1972 but was only one year old when photographed at the Vehicular Ferry Pier in 1966. (Mike Davis)





**Thanks for sitting at the back row to show me the level of the seat cushion.**



*Photo Copyright: Yonie Sung*



## Difficulties in data collection:

- **Example: Interior Details**



*Photo Copyright: Yonie Sung*



Accident record photo tells  
clues for interior details



*Photo Source: Internet*





*Photo Copyright: Yonie Sung*

## **2. Design:**

- **Majority of effort was focus on bodywork structural rebuild**
- **Base on experience**
- **No calculation, tilt test etc**

## **3. Drawings**

## **4. Budgeting**

## **5. Production by phase, by job type:**

- **Volunteers team**
- **Contractor team**



# Restoration Process



*Photo Copyright: Louis Mak*

# Restoration : Target Result



*Photo Copyright: Jackson Lo*



# Restoration process – Chassis



*Main Features*

*Photo Source: Guy Arab Mk V Catalogue*



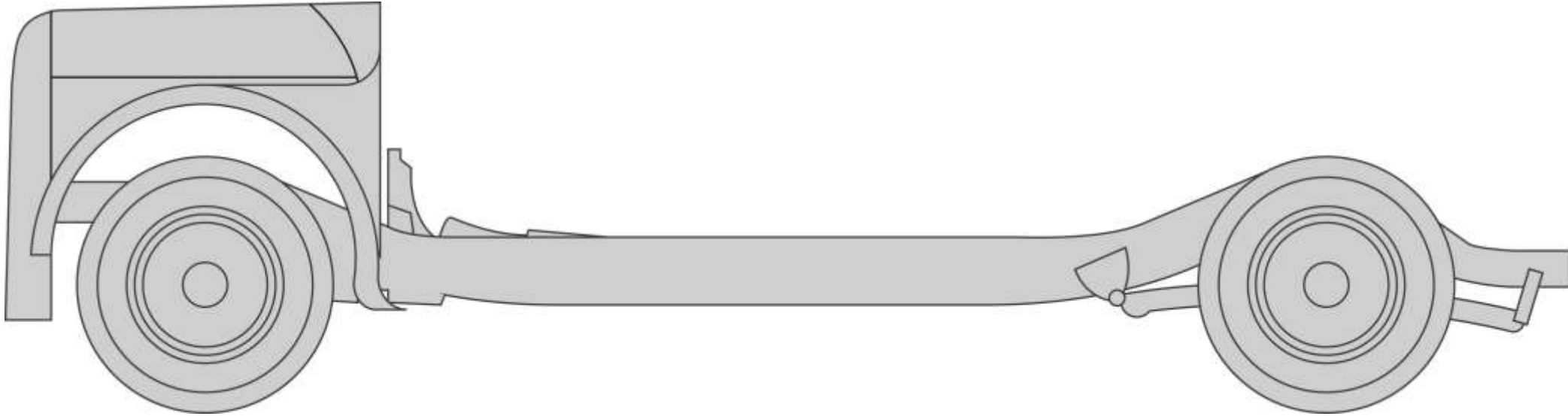
# Restoration process: Chassis Rust-proofing works



*Photo Copyright: Jackson Lo*

# Restoration process: Chassis

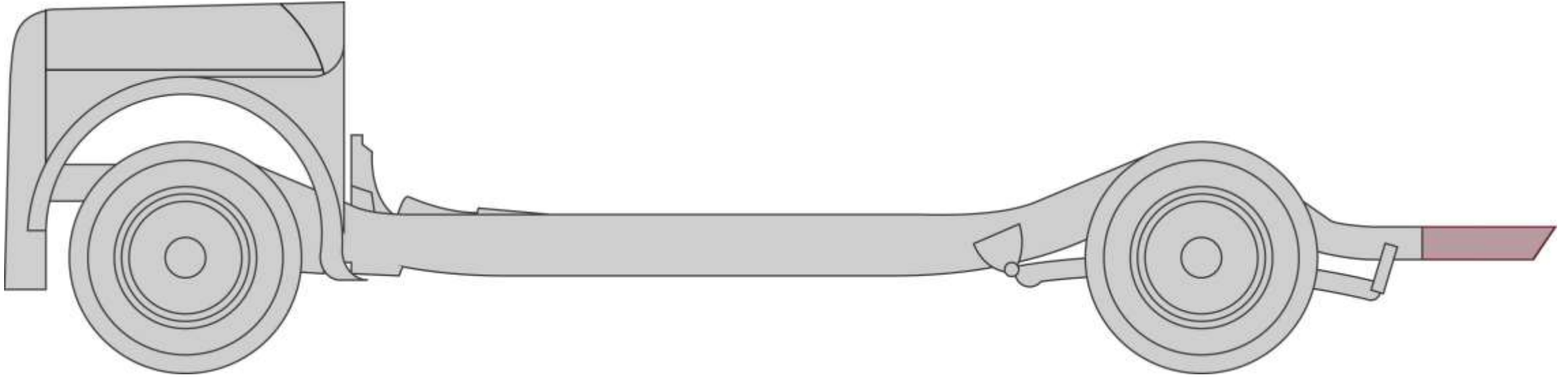
## Extension of Chassis for Body Rebuild





# Restoration process: Chassis

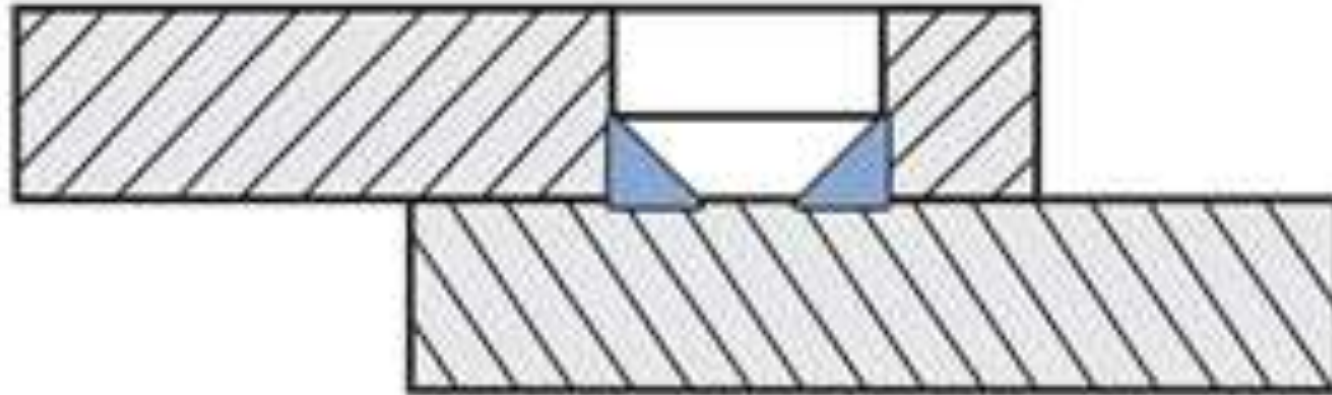
## Extension of Chassis for Body Rebuild



# Restoration process: Chassis

## Extension of Chassis for Body Rebuild

Chassis Extension – By plug welding



**Fillet Weld in a Hole**





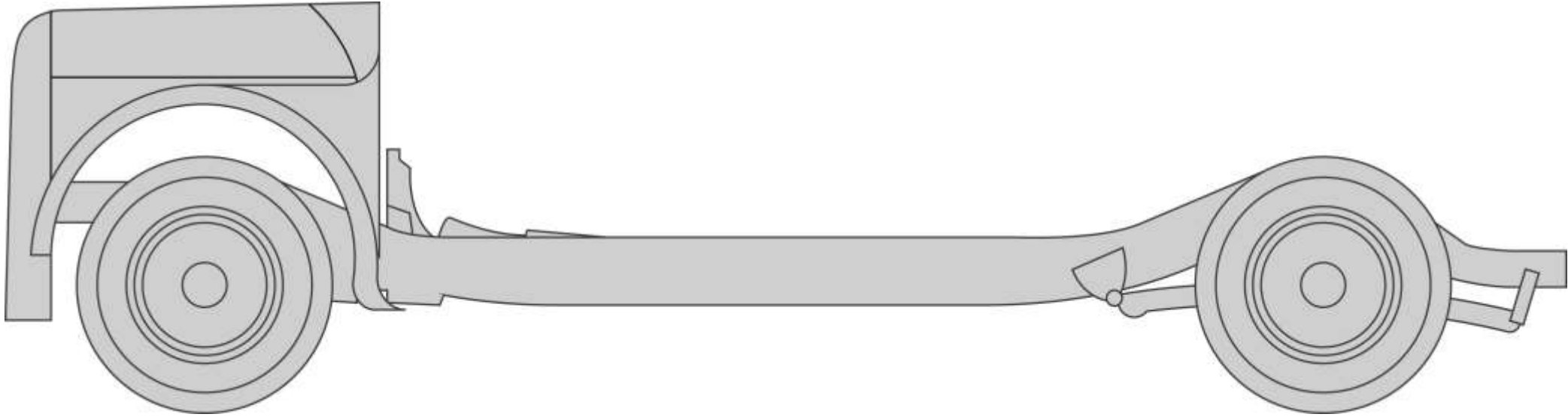
*Photo Copyright: Jackson Lo*



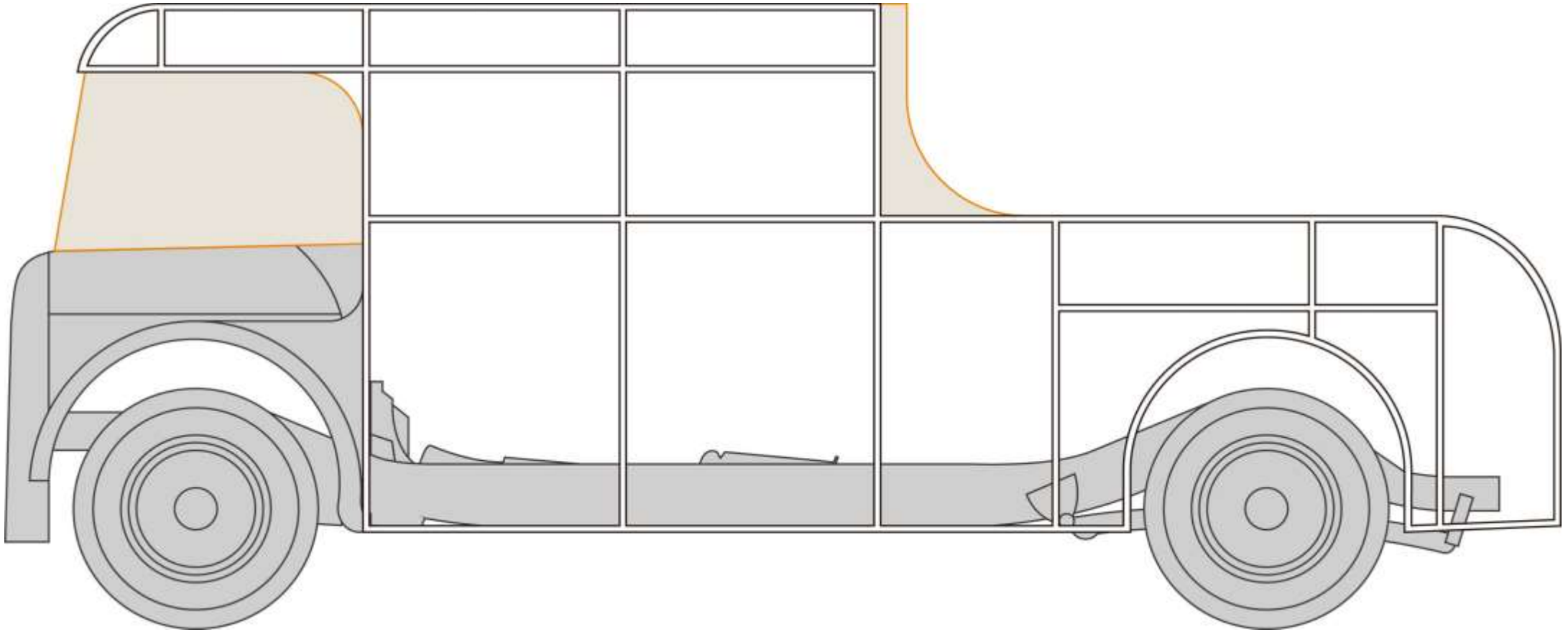
*Photo Copyright: Jackson Lo*



# Restoration process: Body Structure Rebuild

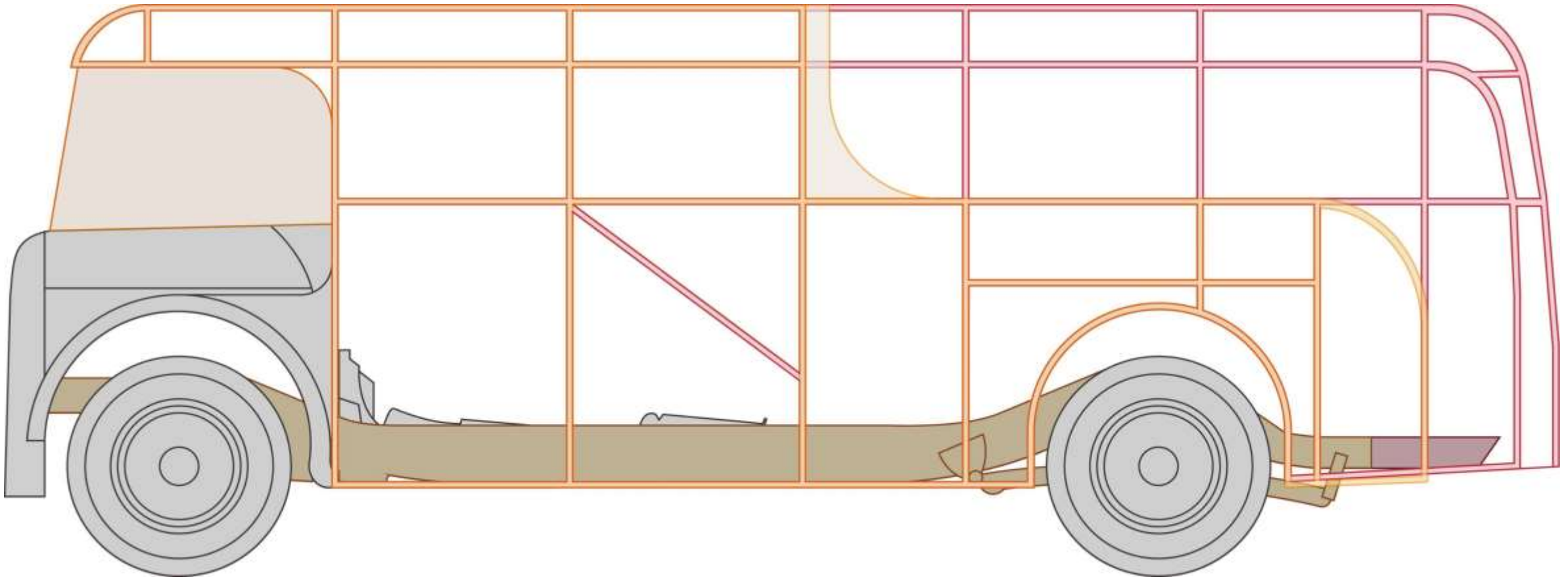


# Restoration process: Body Structure Rebuild

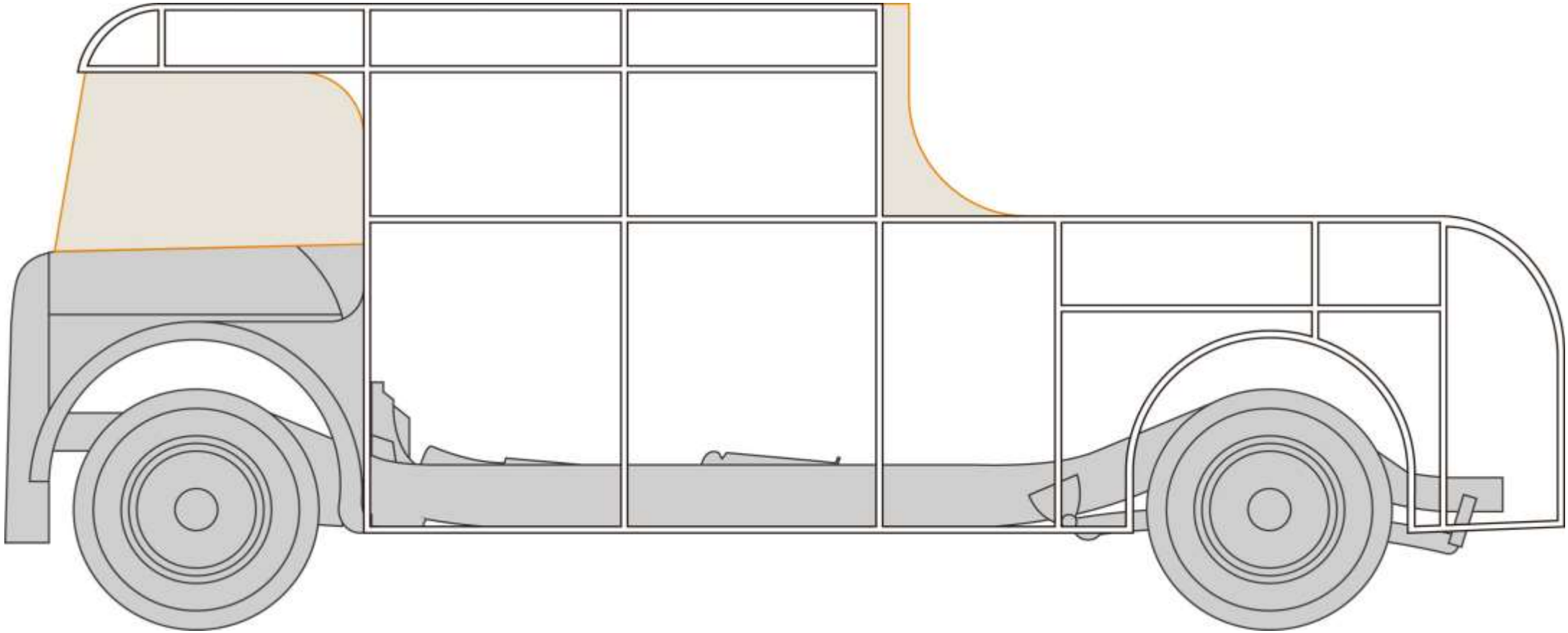




# Restoration process: Body Structure Rebuild

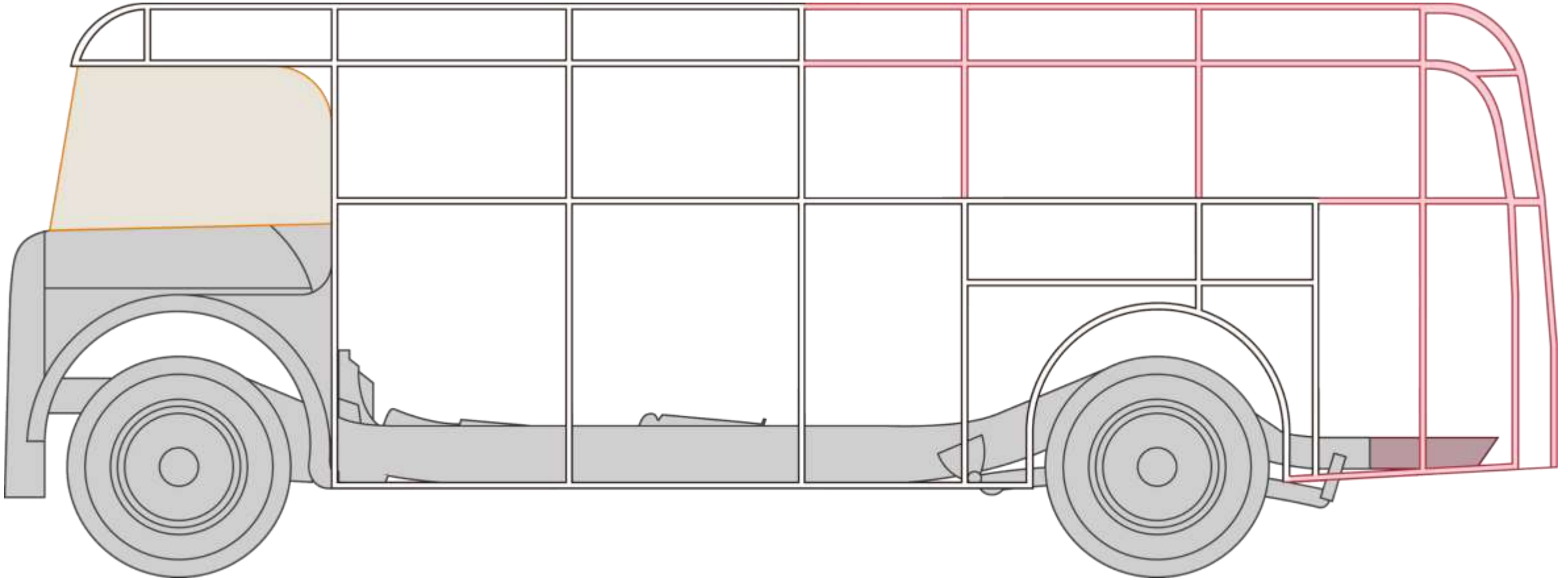


# Design 1: Partial Rebuild





# Design 1: Partial Rebuild



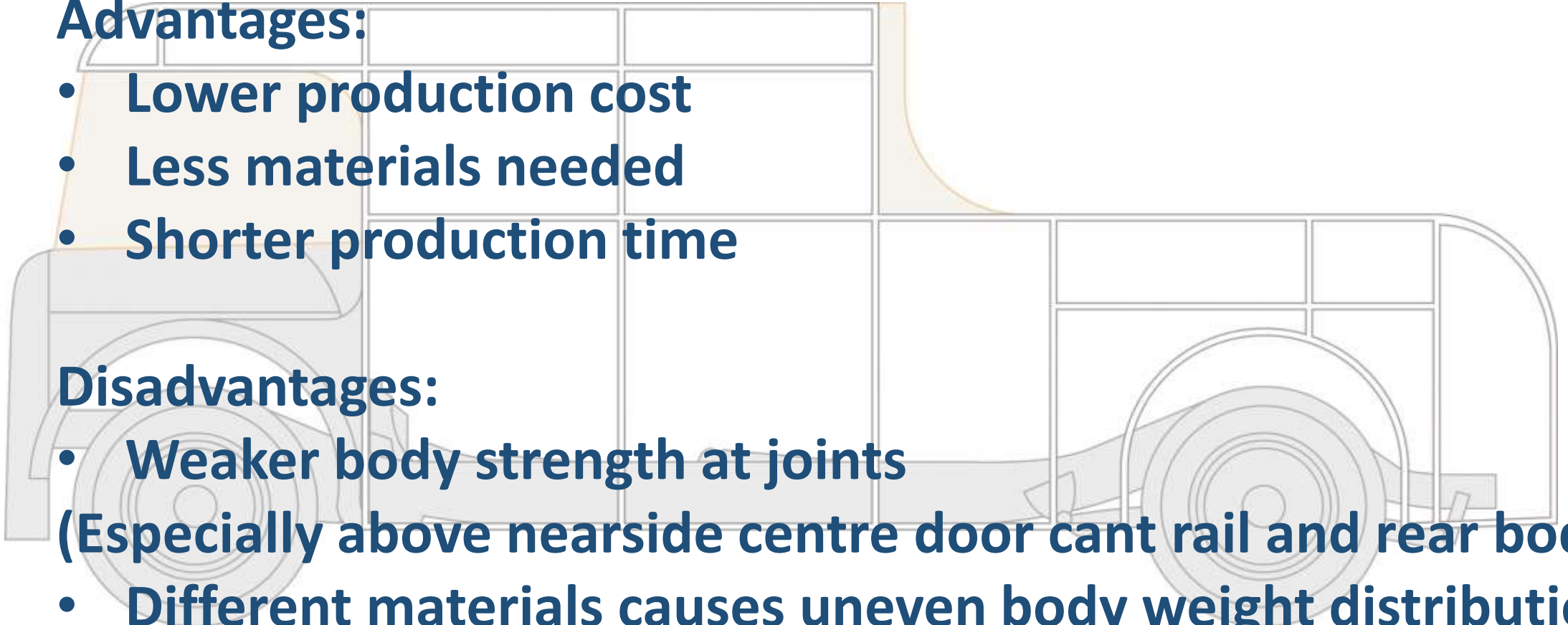
# Design 1: Partial Rebuild

## Advantages:

- Lower production cost
- Less materials needed
- Shorter production time

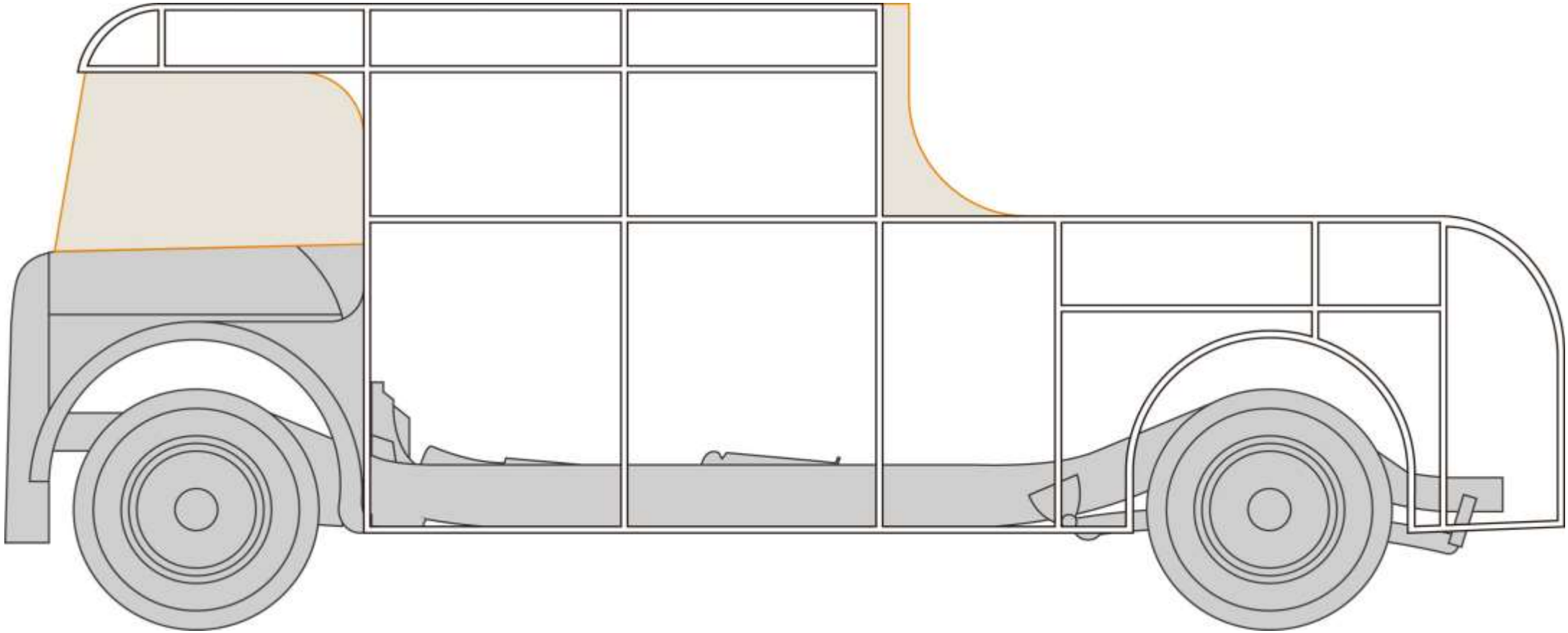
## Disadvantages:

- Weaker body strength at joints  
(Especially above nearside centre door cant rail and rear body)
- Different materials causes uneven body weight distribution
- Difficulties in building a correct body shape geometry

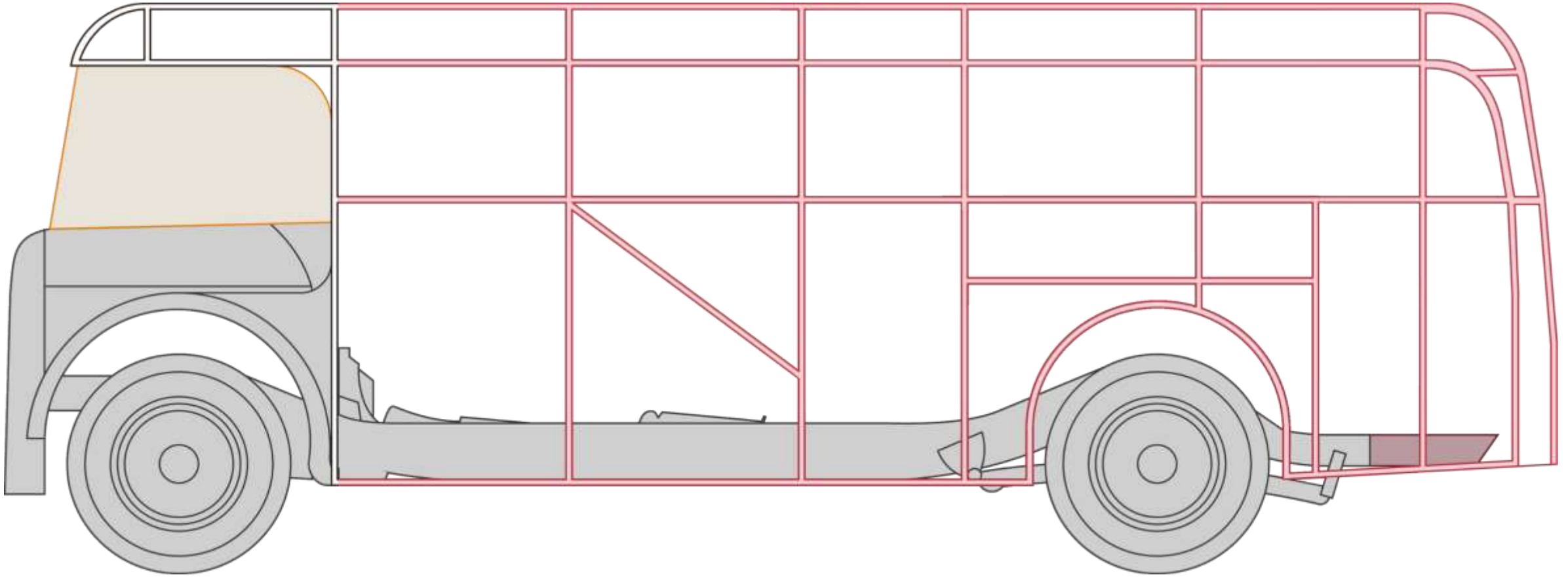




# Design 2: Complete Rebuild



# Design 2: Complete Rebuild



# Design 2: Complete Rebuild

## **Advantages:**

**Unified body with better strength**

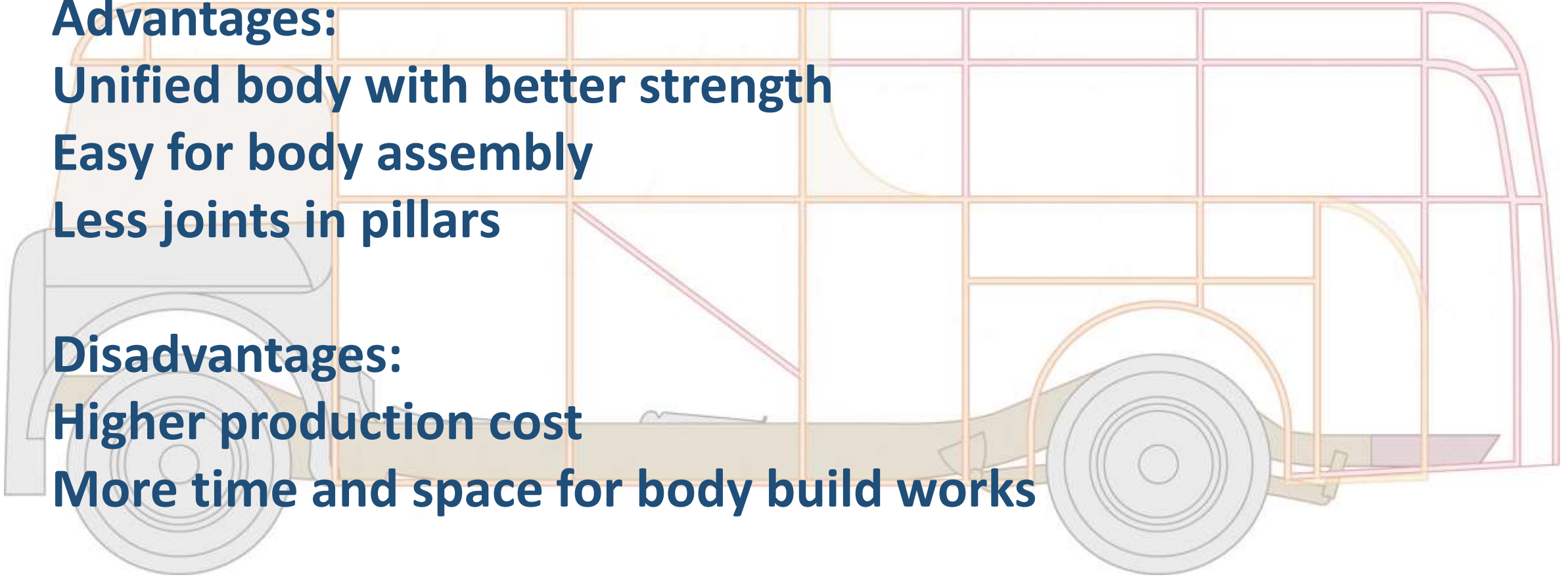
**Easy for body assembly**

**Less joints in pillars**

## **Disadvantages:**

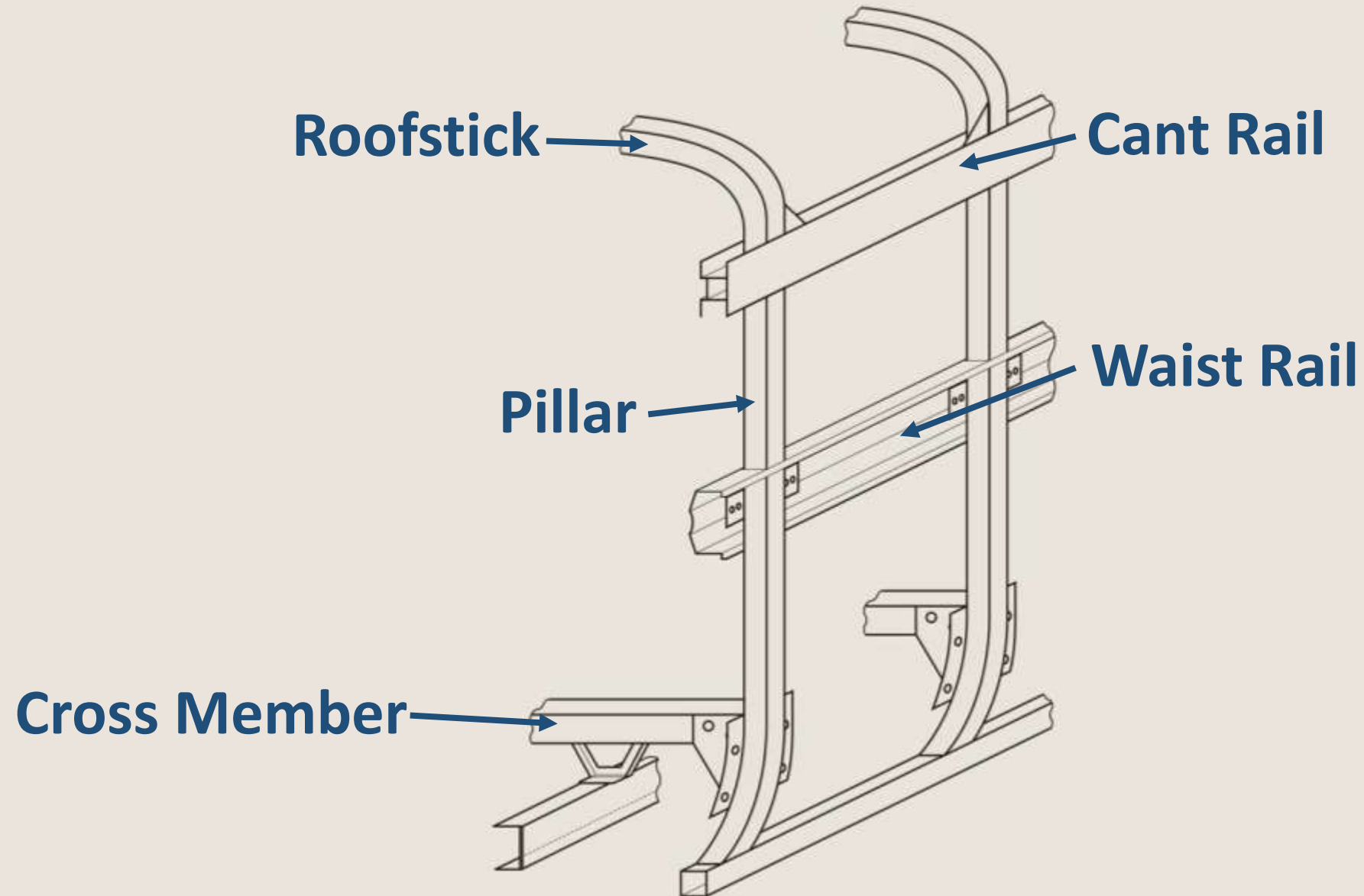
**Higher production cost**

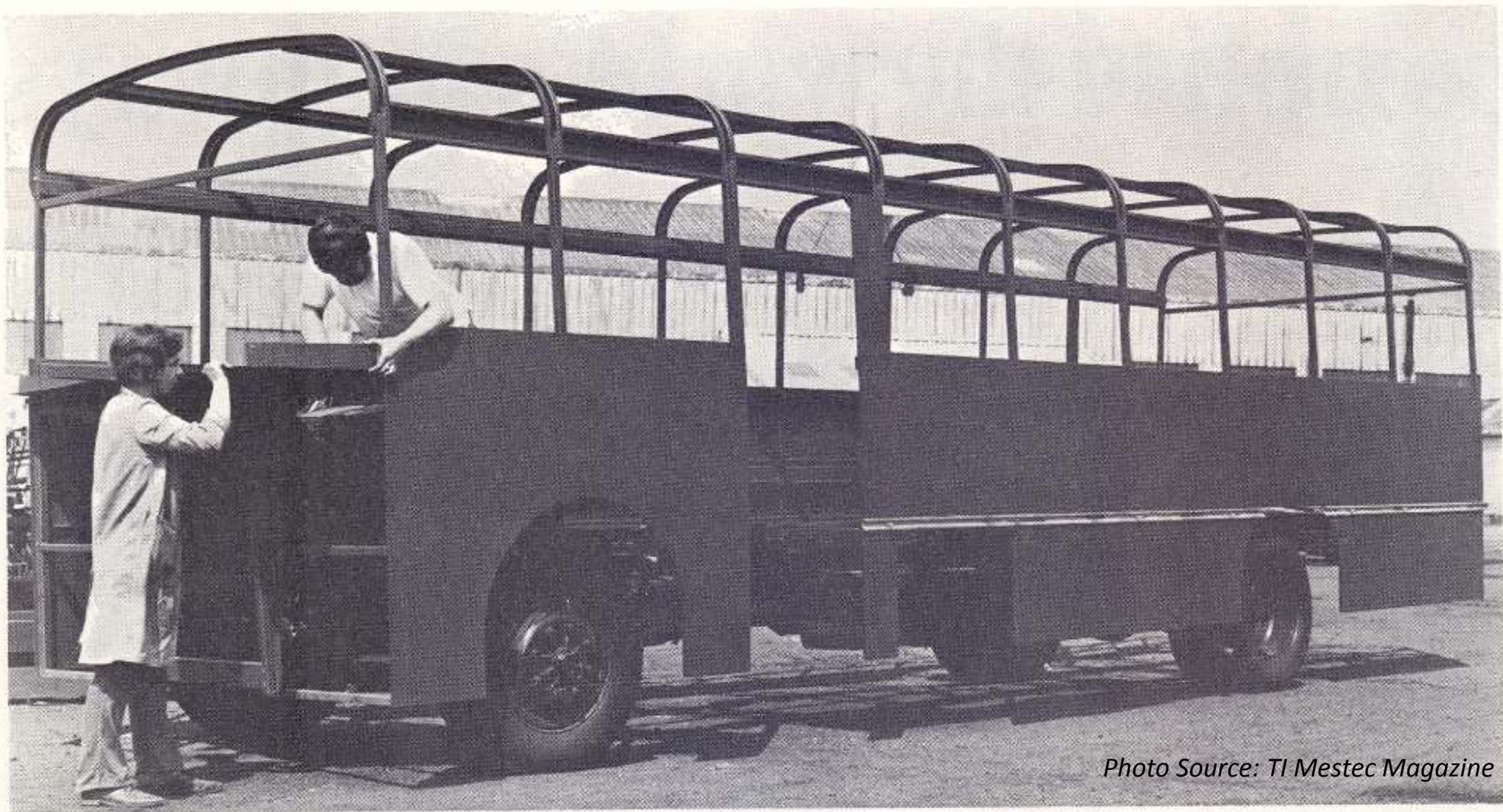
**More time and space for body build works**





# Understanding TI Metal Section body frame





*Photo Source: TI Mestec Magazine*

Rare sight at Oldbury: only new designs are trial-assembled to ensure there is no snag when the customer puts them together



# Restoration process: Body Structure Rebuild



*Photo Copyright: Jackson Lo*



# Restoration process: Body Structure Rebuild



*Photo Copyright: Jackson Lo*





*Photo Copyright: Jackson Lo*





*Photo Copyright: Jackson Lo*





*Photo Copyright: Jackson Lo*

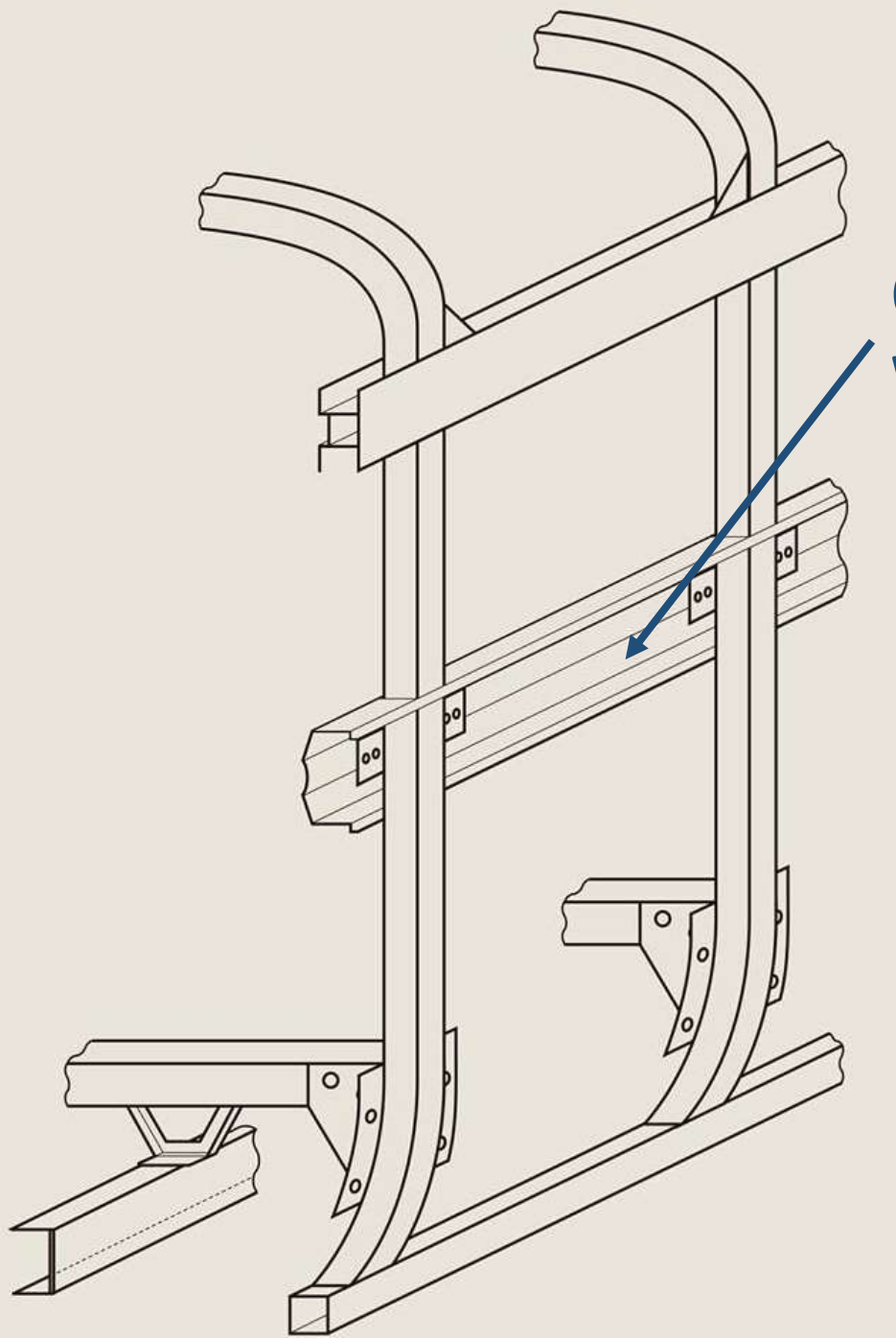


# Body Parts



Photo Copyright: Louis Mak





**Original  
Waist Rail**

**Fabricated  
Waist Rail Cover**



*Photo Copyright: Yonie Sung*



Photo Copyright: Yonie Sung





*Photo Copyright: Louis Mak*

# Restoration process: Electrical



*Photo Copyright: Louis Mak*



*Photo Copyright: Jackson Lo*





Photo Copyright: Yonie Sung

# COMPLETE ELECTRICAL CONTROL

in one *comprehensive* unit



*Simplifies*

- ★ INSTALLATION
- ★ MAINTENANCE
- ★ OPERATION

Switches, fuses, regulator and all accessory circuits are provided for in this attractive new control unit for public service and heavy goods vehicles which eliminates the usual two or three separate units, greatly simplifies electrical layout and effects a considerable saving on wiring. Losses in servicing time are reduced to a minimum due to the ease with which the complete unit can be removed from the vehicle and a replacement fitted. As all component parts are readily removed and are interchangeable, maintenance can be efficiently carried out by simple bench work. Normally mounted to the right of the driver on the rear bulkhead its attractive modern finish in high grade black enamel with chromium fittings, harmonises with any modern vehicle design.



Labels in diagram include: Dynamo Warning Light, Full-pull Switches for lighting and accessory circuits, Lighting and Accessory Circuit Fuses, Starter Button, Inertia operated, heavy type Stop Lamp Switch, Combined Voltage Regulator and Cut-out, Main Dynamo Fuse, Spare Dynamo Fuse, Main Cable Connection, Main Battery Cut-off Switch, Accelerator Switch, Inspection Lamp Sockets, Main Battery Connection, Main Dynamo Connection, Battery Sockets for three wiring or four from an external source.

**TOTAL WEIGHT**  
20 lbs.

Maximum protrusion from Bulkhead: 4 1/2"  
Area: 14 1/2" x 10"

The illustration above shows the front cover removed and indicates the extreme accessibility of all parts. Fuses are visible through a hinged, 'Perspex' cover, and plugs and sockets are provided on all main chassis wiring connections thus making for quick detachability and ease of maintenance.

A DETAILED SPECIFICATION IS AVAILABLE ON REQUEST



## CONTROL UNIT

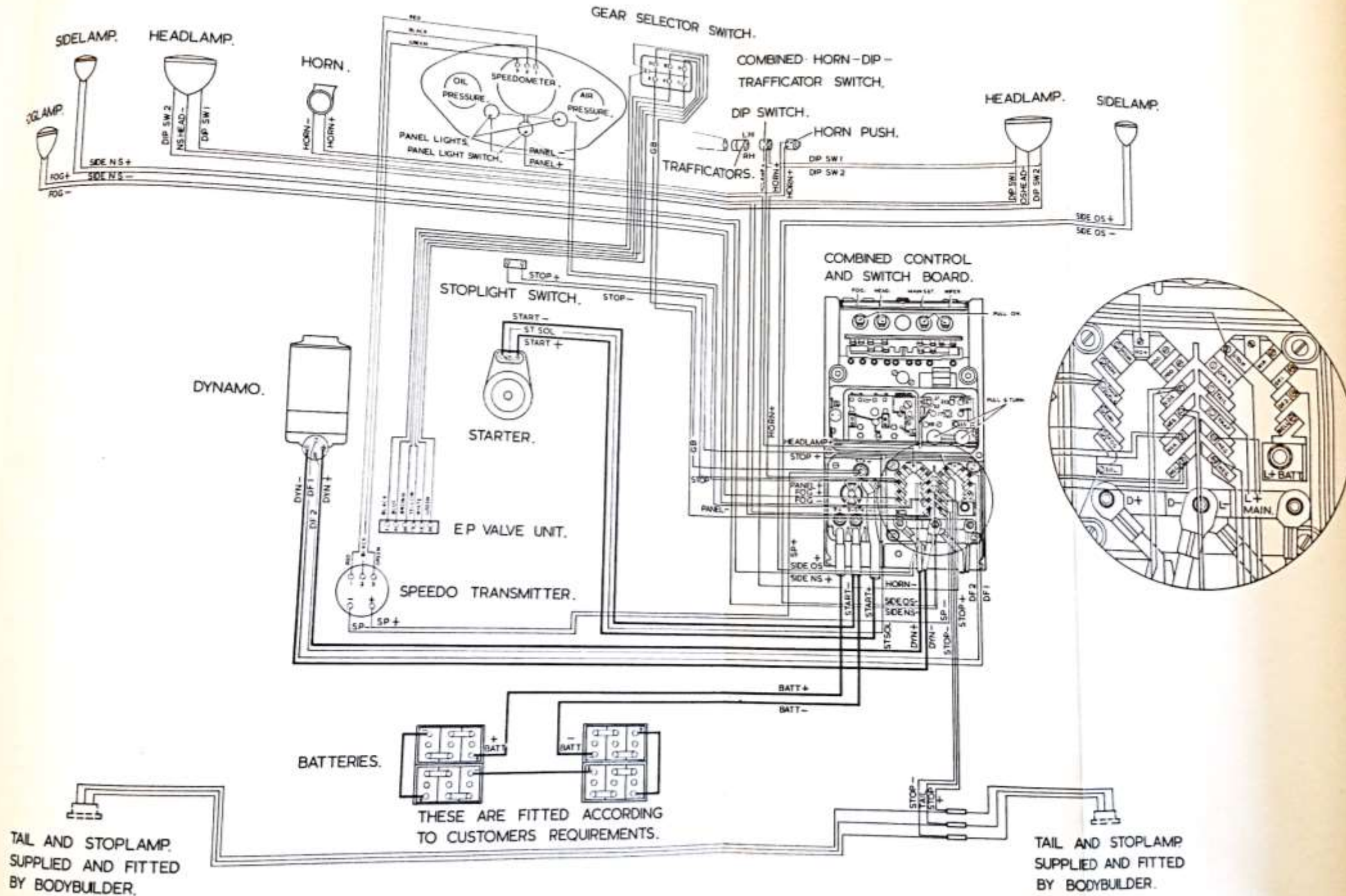
### COMBINED SWITCH FUSE AND REGULATOR BOARD

C.A.V. LIMITED, ACTON, LONDON, W.3.



118









*Photo Copyright: Louis Mak*



*Photo Copyright: Jackson Lo*

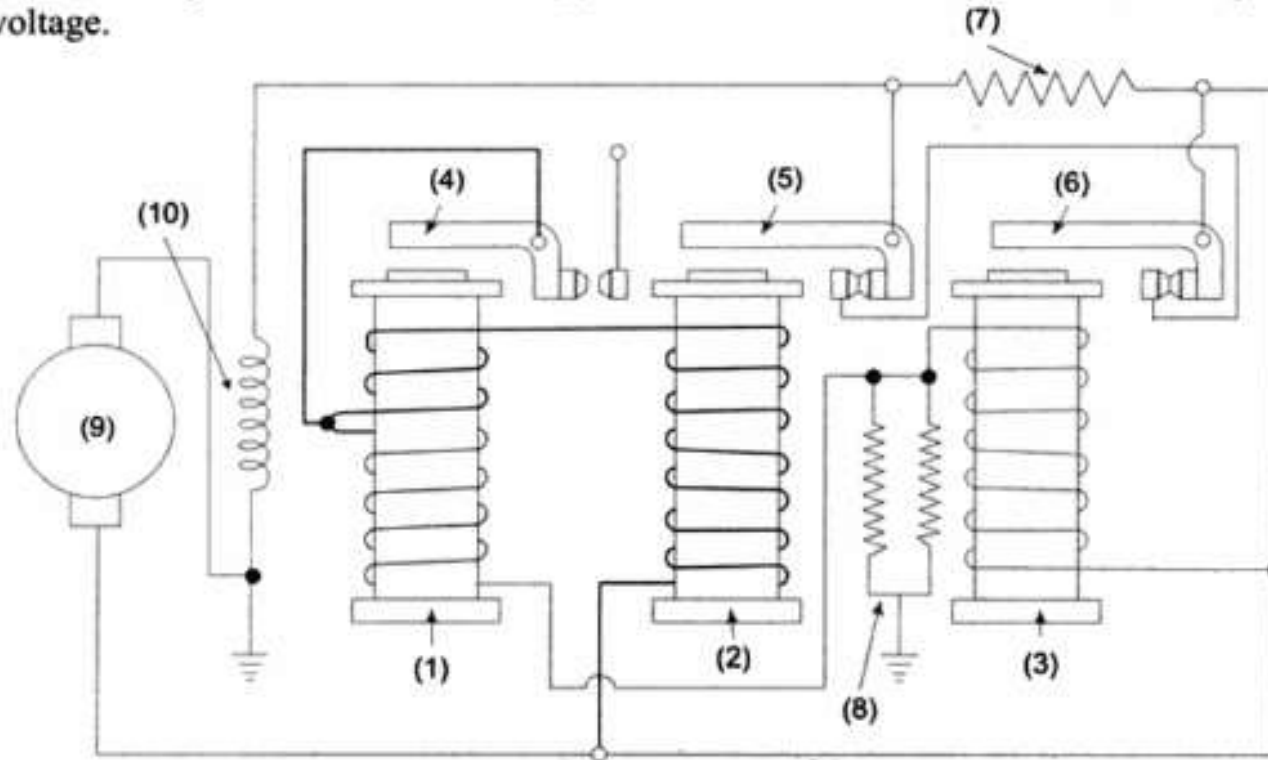




*Photo Copyright: Louis Mak*

Figure 27.5 shows various parts of the regulator. It consists of the cut-out relay, current regulator, voltage regulator, dynamo and field coil. When dynamo (9) is started, the voltage builds up. When sufficient voltage is reached, the cut-out relay comes into action. By this, armature (4) is pulled towards the soft iron core of the cut-out relay. This gives a connection between the dynamo and battery.

When the dynamo starts running at a higher speed, the voltage regulator immediately comes into action. Armature (6) is pulled away from the contact points of the voltage regulator. The contact points are now opened. Point resistance (7) is then introduced in the field coil, thereby bringing down the voltage.



**Fig. 27.5** Regulator

1. Cut-out relay; 2. Current regulator; 3. Voltage regulator; 4, 5, 6. Armatures;  
7. Point resistance; 8. Swamp resistance; 9. Dynamo; 10. Field coil



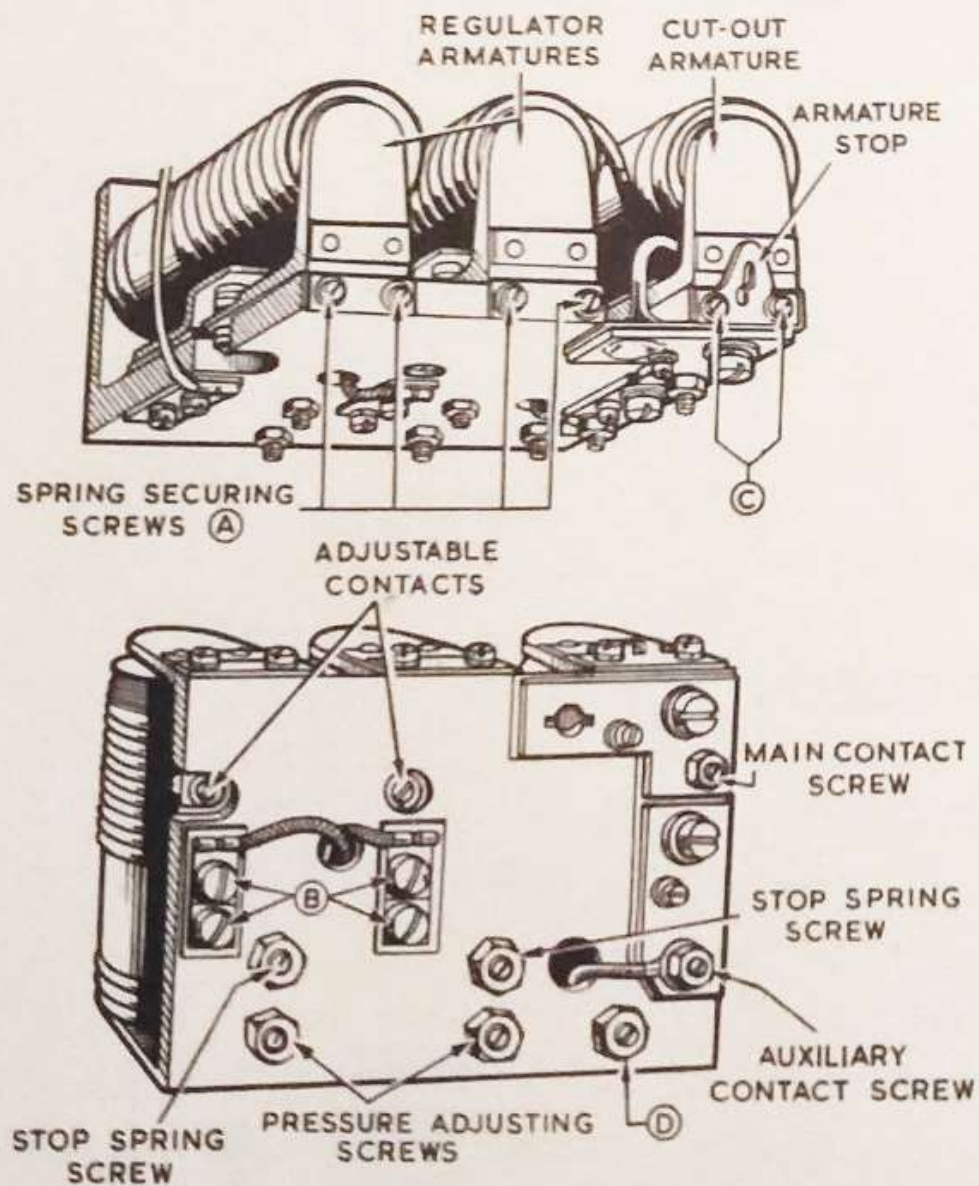


FIG.N14. REGULATOR AND CUT-OUT.

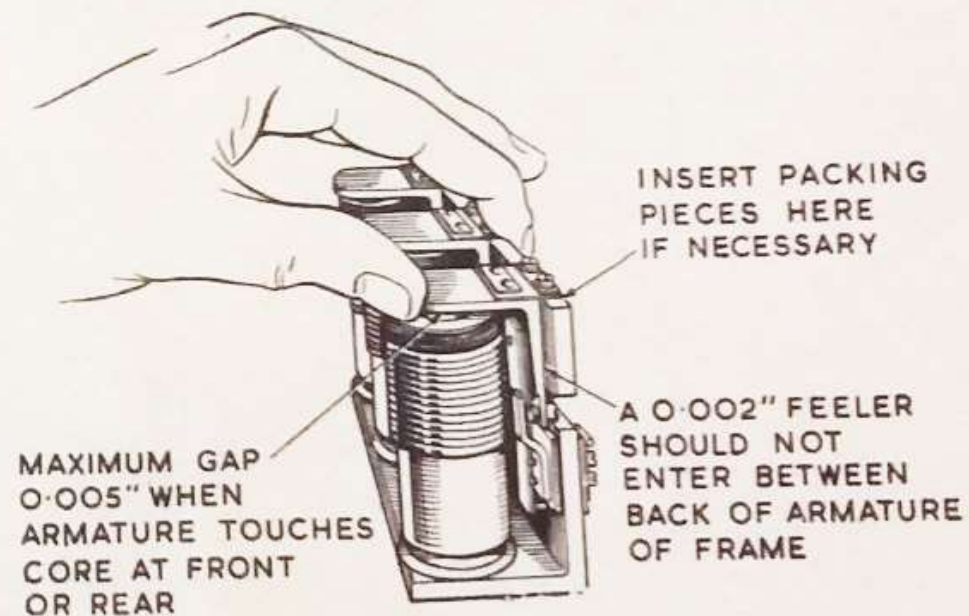


FIG.N15.CHECKING GAP BETWEEN ARMATURE AND CORE.

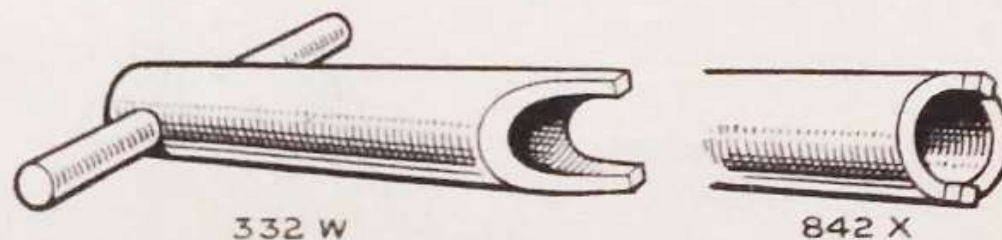


FIG.N16. SPECIAL TOOLS.









*Photo Copyright: Louis Mak*

# **Gear Selection Control**

## **Electro-Pneumatic Gear Control**

- **With EP valve**
- **Quicker response in gear changing**
- **Reliability of EP valve causes maintenance concern**

## **Pneumatic Gear Control**

- **Direct pneumatic control from gear selector**
- **Larger size gear selector**
- **Response time of gear changing is longer**



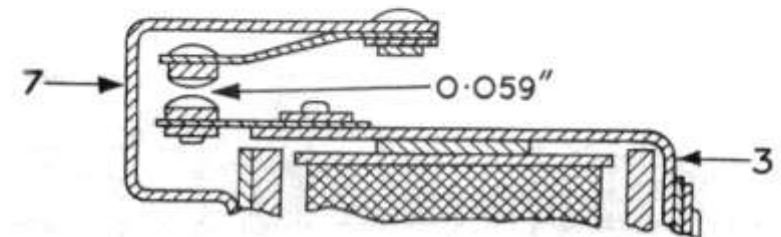
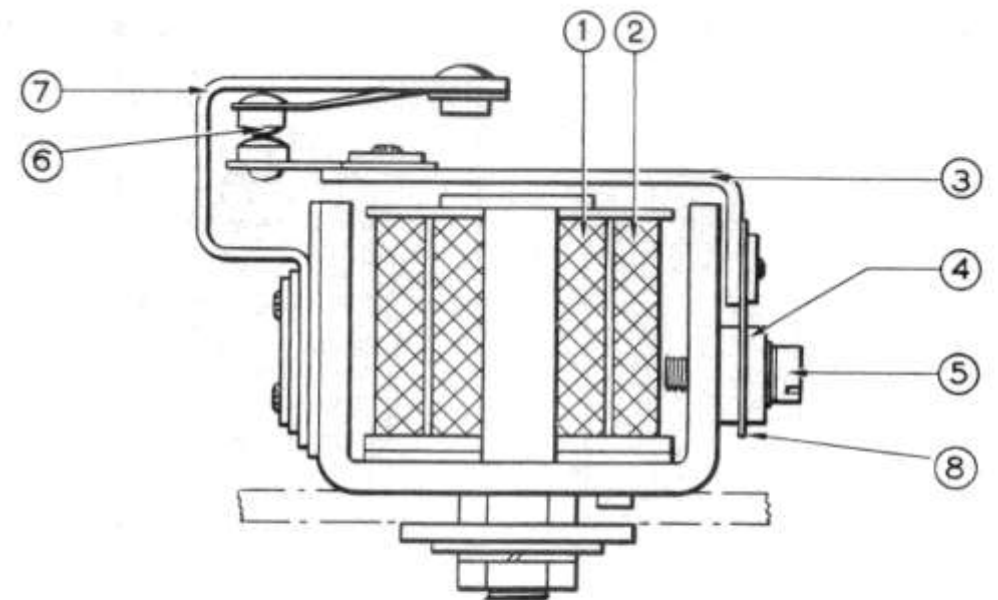
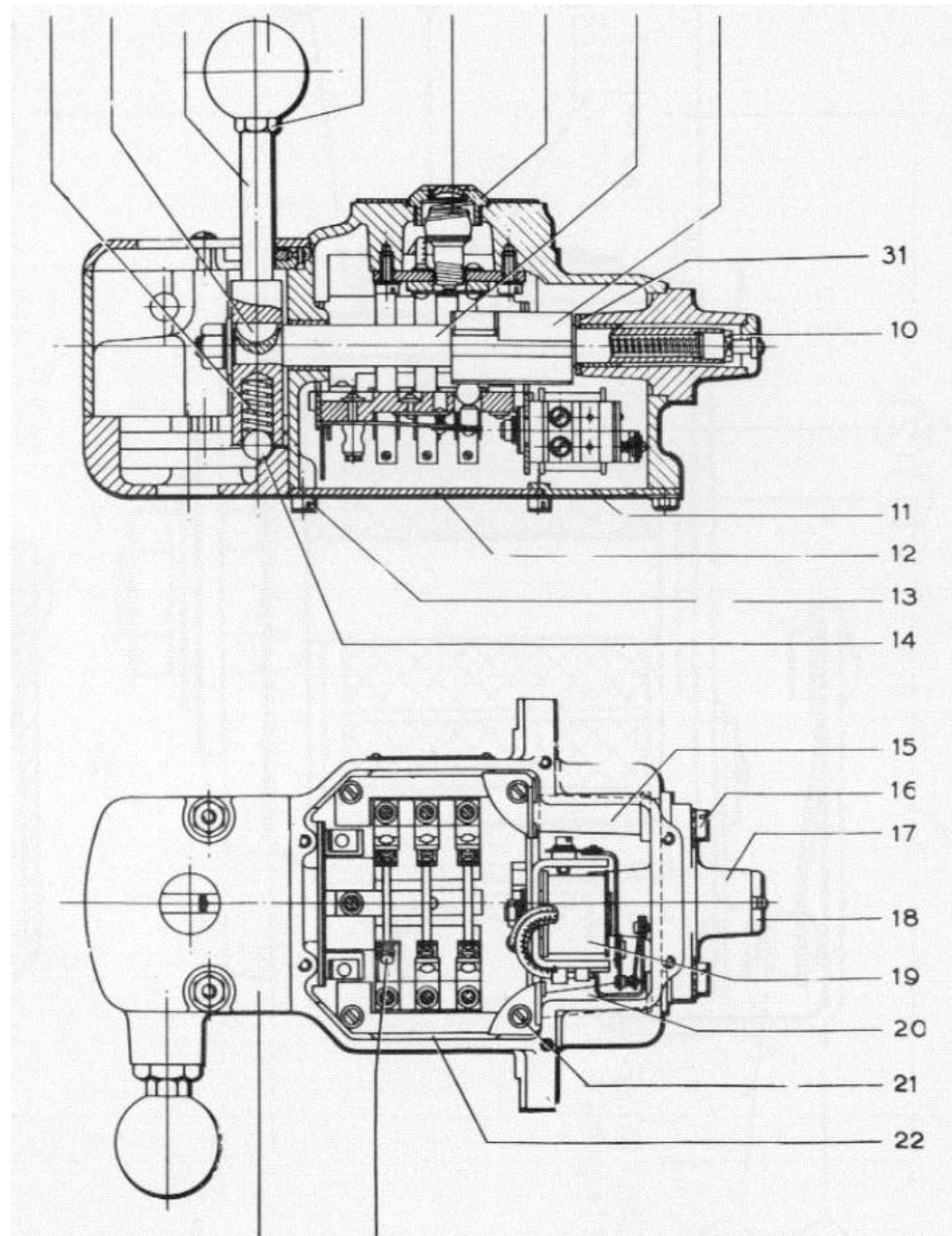


**Gear Selector on a Guy Wulfrunian**



**Gear Selector on a Leyland PD**

*Photo Copyright: Yonie Sung*



SETTING CONTACT GAP.

ADJUSTMENT OF BACK SPRING ANGLE.

 $11\frac{1}{2}^{\circ}$ 

FIG.F4. SAFETY RELAY.



# Restoration process: Mechanical

Radiator

Gearbox

Rear Differential Gear

Other repairs

**Towing without removing the drive shaft is fatal to the gearbox.....**



*Photo Source: Internet*





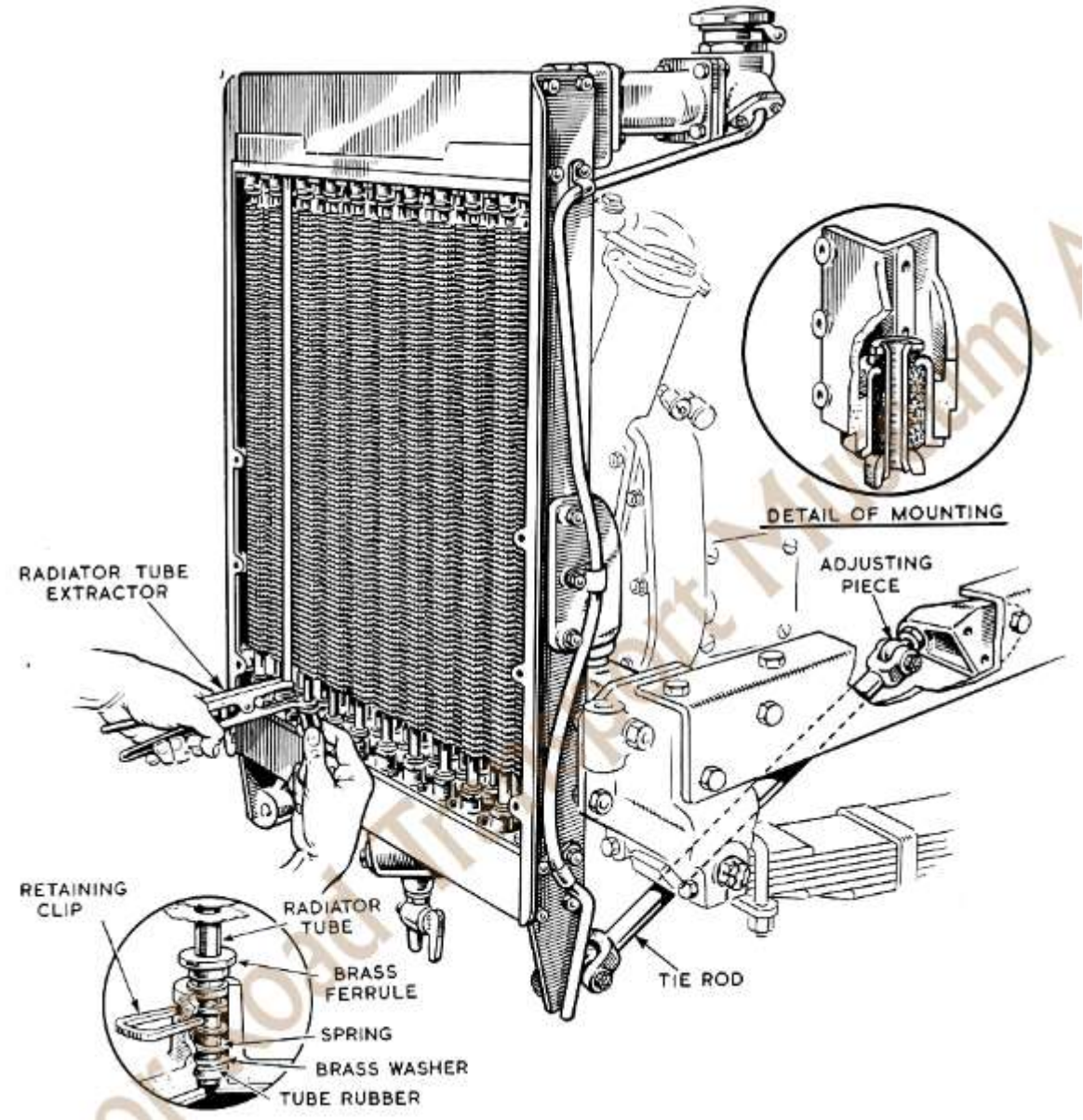
Photo Copyright: Yonie Sung



# Original brass tube radiator with inefficient cooling effect



Photo Copyright: Yonie Sung





# Additional Expansion Tube Modified by CMB



Photo Source: Internet



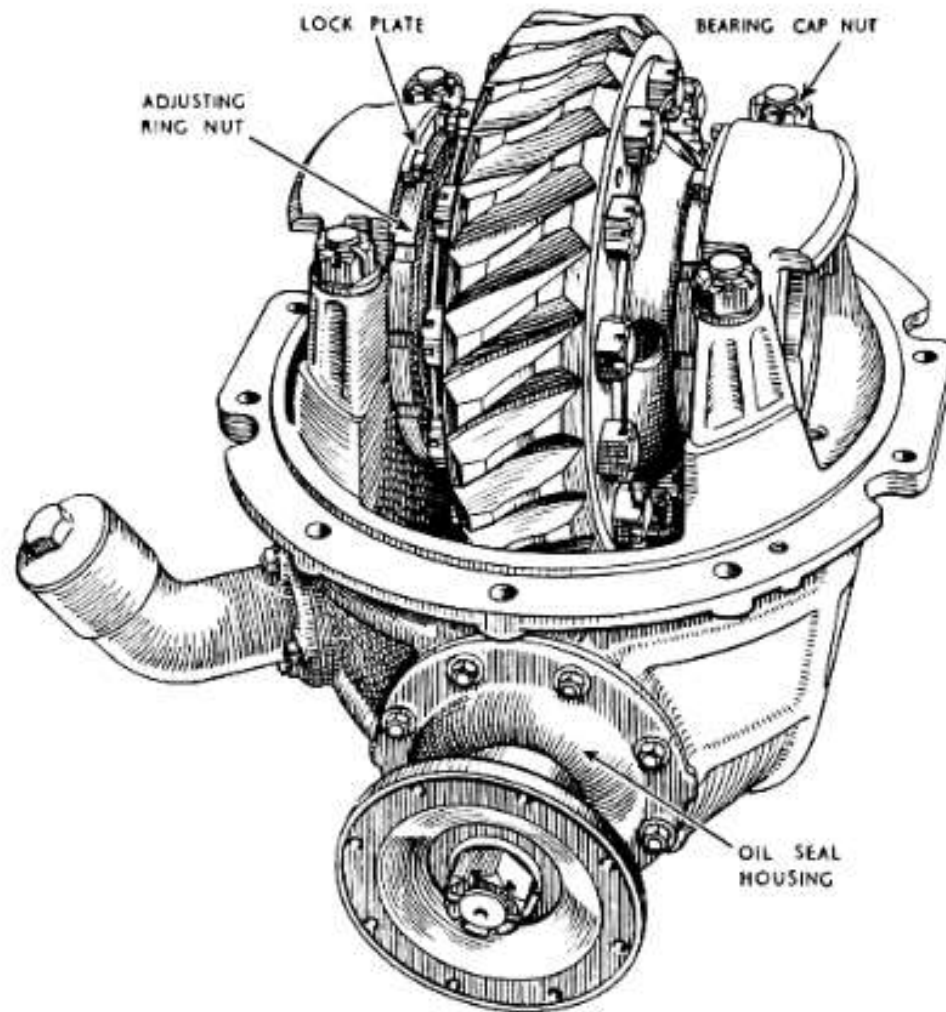
**Aluminium radiator  
replaced provides better  
cooling efficiency**



*Photo Copyright: Yonie Sung*

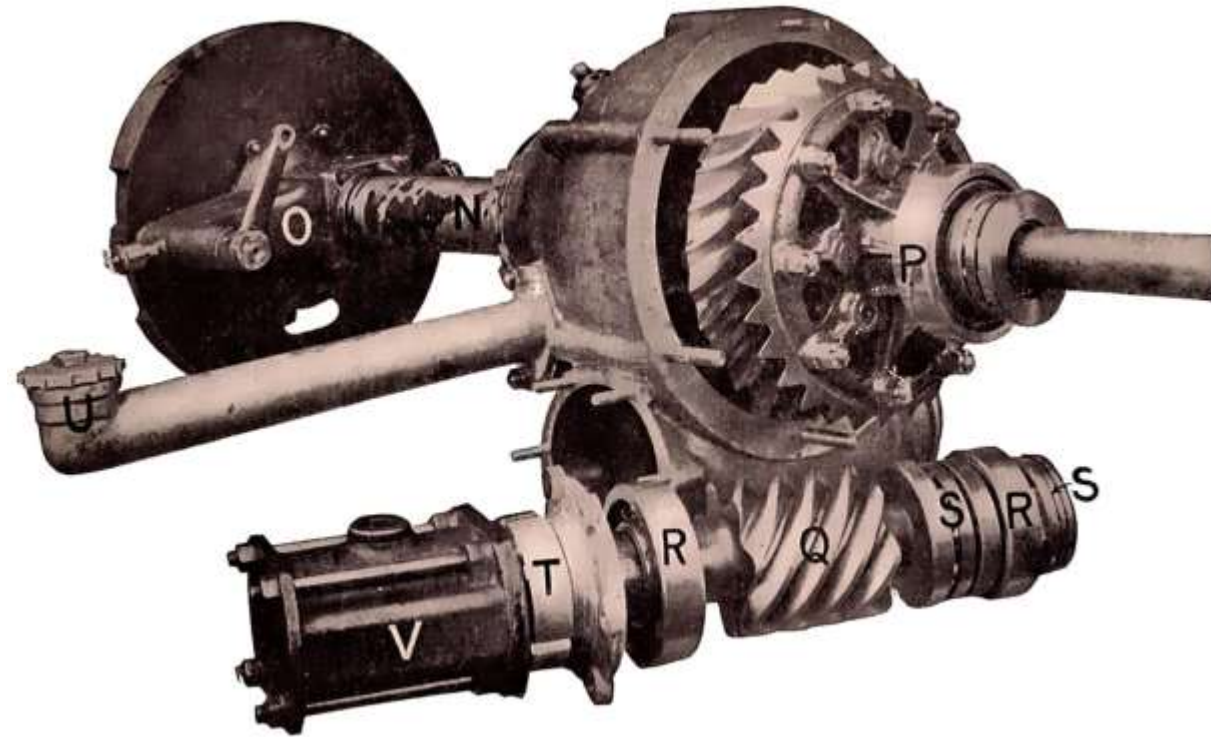


# REAR AXLE



**Fig. 4. Differential Assembly.**

*Photo Source: Guy Arab Mk V Service Manual*



*Photo Source: Internet*



*Photo Copyright: Yonie Sung*



# Brass corrosion on Rear Differential Gear

Modern gear oil with Extreme Pressure (EP) and anti-wear additives prevent metal-to-metal contact by adding film-forming compounds that protect the surface either by a physical absorption or a chemical reaction with the metal surface in order to form a low shear film at the point of contact.

These additives containing sulfur and phosphorus compounds, which reacts and corrodes brass gear.



*Photo Copyright: Yonie Sung*

## APPROVED LUBRICANTS (OVERSEAS)

9 (A)

[illegible]



### APPROVED LUBRICANTS (OVERSEAS)

9 (A)

[illegible]

Gearbox oils are classified by the American Petroleum Institute (API) using GL ratings. Modern gearboxes require a GL-4 oil, and separate differentials require a GL-5 oil.

#### API Category:

GL-1 (inactive\*) designates the type of service characteristic of manual transmissions operating under such mild conditions of low unit pressures and minimum sliding velocities, that untreated oil may be used satisfactorily. Oxidation and rust inhibitors, defoamers and pour depressants may be used to improve the characteristics of lubricants intended for this service. Friction modifiers and extreme pressure additives shall not be used.

GL-2 (inactive\*) designates the type of service characteristic of automotive type worm-gear axles operating under such conditions of load, temperature and sliding velocities, that lubricants satisfactory for API GL-1 service will not suffice.



**Other mechanical repairs:**  
**Engine timing adjustment, New exhaust**  
**silencer, New fuel tank, Brake and tires**  
**etc...**



*Photo Copyright: Yonie Sung*

# Video 2: Road Test

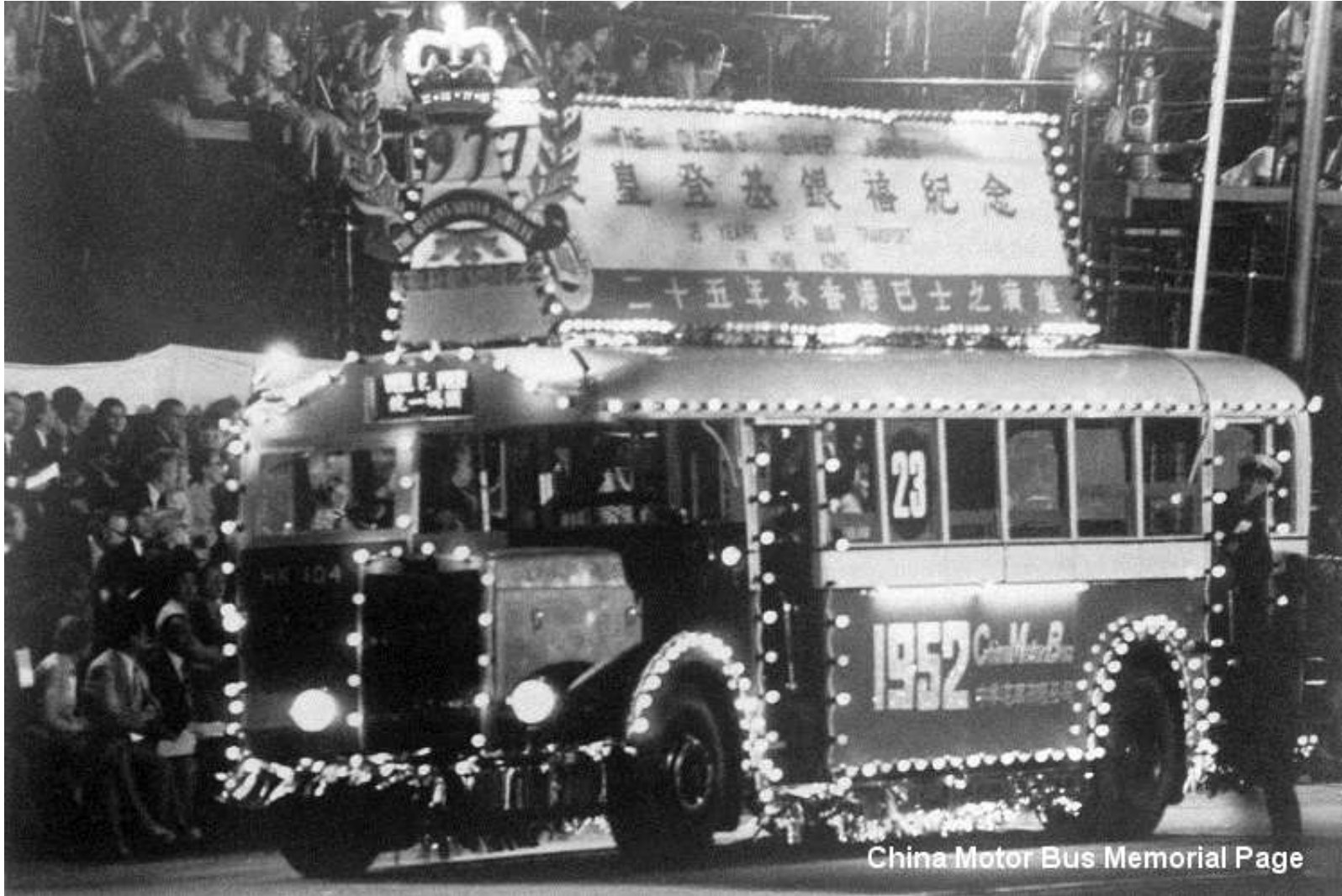


*Photo Copyright: Jackson Lo*



# Classic Bus Preservation in HK

---



# How about the fate of a Public Bus?



**In Use**



**Converted to Auxiliary Vehicles**



**Scrap**



**Sell to Overseas**



# Challenges in HK:



*Photo source: Internet*

# Challenges in HK:



*Photo source: Internet*





# Challenges in HK:

- Unlike Classic PC, Classic buses have no re-sell value
- No licence nor exemptions given
- Storage issue, which is also a cost issue
- Public awareness and recognition
- Lack of proper archive records for restoration
- Successful restoration limited to company own vehicles



Photo Copyright: Jackson Lo





History should be presented in a way that encourages involvement

&

History is not just in some dusty old books in the library, but is right there waiting for you to discover it



*Quote from: Watershed Hong Kong*



# How buses are preserved in UK



- Exemption on licencing
- Bigger preservationists community
- Better archive support



*Photo Copyright: David Chow*

# Historic (classic) vehicles: MOT and vehicle tax

## Date the vehicle was first registered

### 8 January 1976 onwards

You must get an MOT and pay vehicle tax.

### 1 January 1960 to 7 January 1976

You must get an MOT, but don't have to pay vehicle tax.

### Before 1 January 1960

You don't need to get an MOT or pay vehicle tax.

## Eligible vehicles

You can apply for these vehicles to be made exempt:

- cars
- vans
- motorcycles tricycles

### Large vehicles and buses

You can apply for these vehicles to be made exempt:

- private heavy goods vehicles (HGVs) - they can't be designed or adapted for transporting goods, or be used for driver training
- buses used for voluntary or community purposes

### Specialist vehicles

You can also apply for these vehicles to be made exempt:

- mobile cranes and pumps
- road rollers, works trucks and digging machines
- agricultural machines and mowing machines
- snowploughs and gritting vehicles
- electric vehicles
- steam vehicles



BEFORE



Having been recovered from the USA in March 2006, it was in August 2006 it moved into the workshop

DURING



May 2008 the majority of the reframing is complete

AFTER



At Willesden Bus Garage open day

## 1935 Leyland Cub C4 Restoration Period: September 2008 - December 2012

BEFORE



Being readied for its move to restoration facility in October 2008

DURING



The low tide point with strip down complete, December 2008

AFTER



As is August 2013



BEFORE



As acquired in December 2011

DURING



Re-framing largely complete in May 2012

AFTER



First trip back in service, December 2013

## 1938 - AEC 10T10 T499 Restoration Period: October 2010- December 2013

BEFORE



At Purfleet having just arrived back from Australia in December 2004

DURING



A year into restoration with new framework largely in place

AFTER



It's debut on running day December 7, 2013 in its temporary ARC livery and now in its current Green livery



# Oversea Example (Video 3 & 4): London Country Vintage Bus Running Day in April of every year





# Oversea Example: Rail replacement Service

Source: [www.ensignbus.com](http://www.ensignbus.com)



[Home](#) [Hire a Bus](#) [Weddings](#) [Restorations](#) [Blog](#) [Testimonials](#) [Links](#) [Contact Us](#)

Search





# Old HK buses in UK



*Photo Copyright: David Chow*

# Oversea Example: Cardiff Transport Museum A165

- Shipped back to UK in 1988
- Privately owned and maintain in good condition



Photo Copyright: Yonie Sung



# Oversea Example: Scottish Vintage Bus Museum LV36

- Denoted by a bus company to SVBM
- Carry Passengers for Museum events
- With valid MOT and licence



*Photo Copyright: Yonie Sung*

# Oversea Example: ex-Citybus & First Bus vehicles at UK collectors

- Shipped back to UK after withdrawn from service
- Private own and maintain in good condition
- With valid MOT and licence



*Photo Copyright: Dave Rogers*

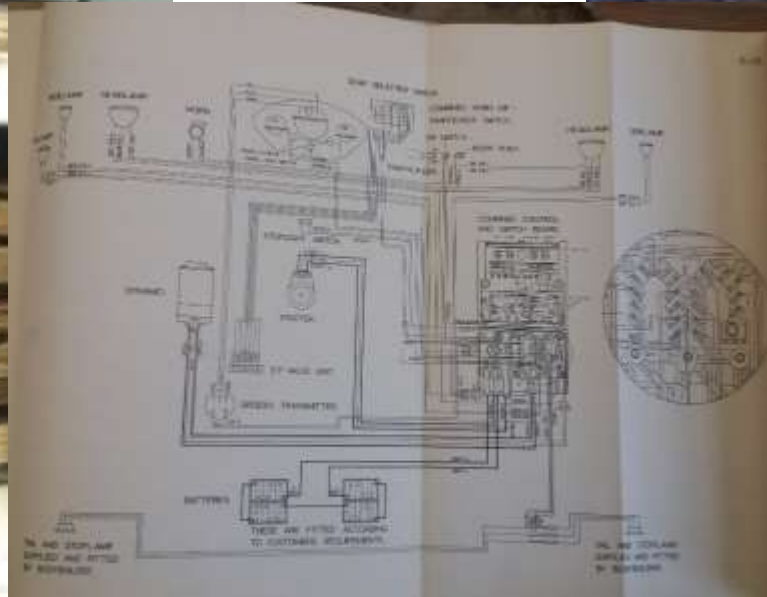


# **Is Transport Museum feasible in HK?**

- **Land resources issue**
- **The use of public funding**
- **Collection items maintenance**
- **Sustainability issue**

# What's next: Motoring Archive

Preservation of records and document is equally important as the vehicle....



*Photo Copyright: Yonie Sung*





*Photo Copyright: David Chow*



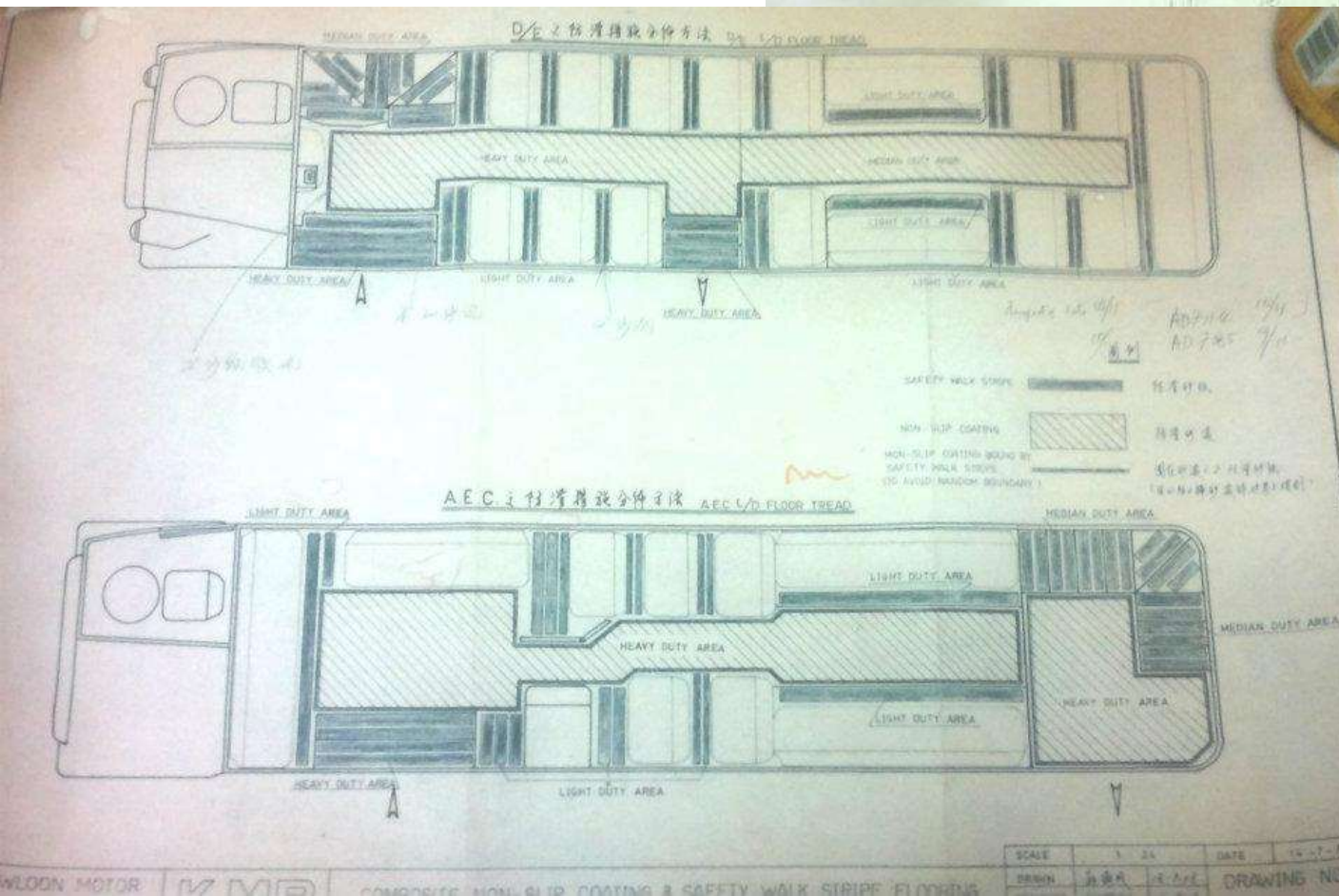
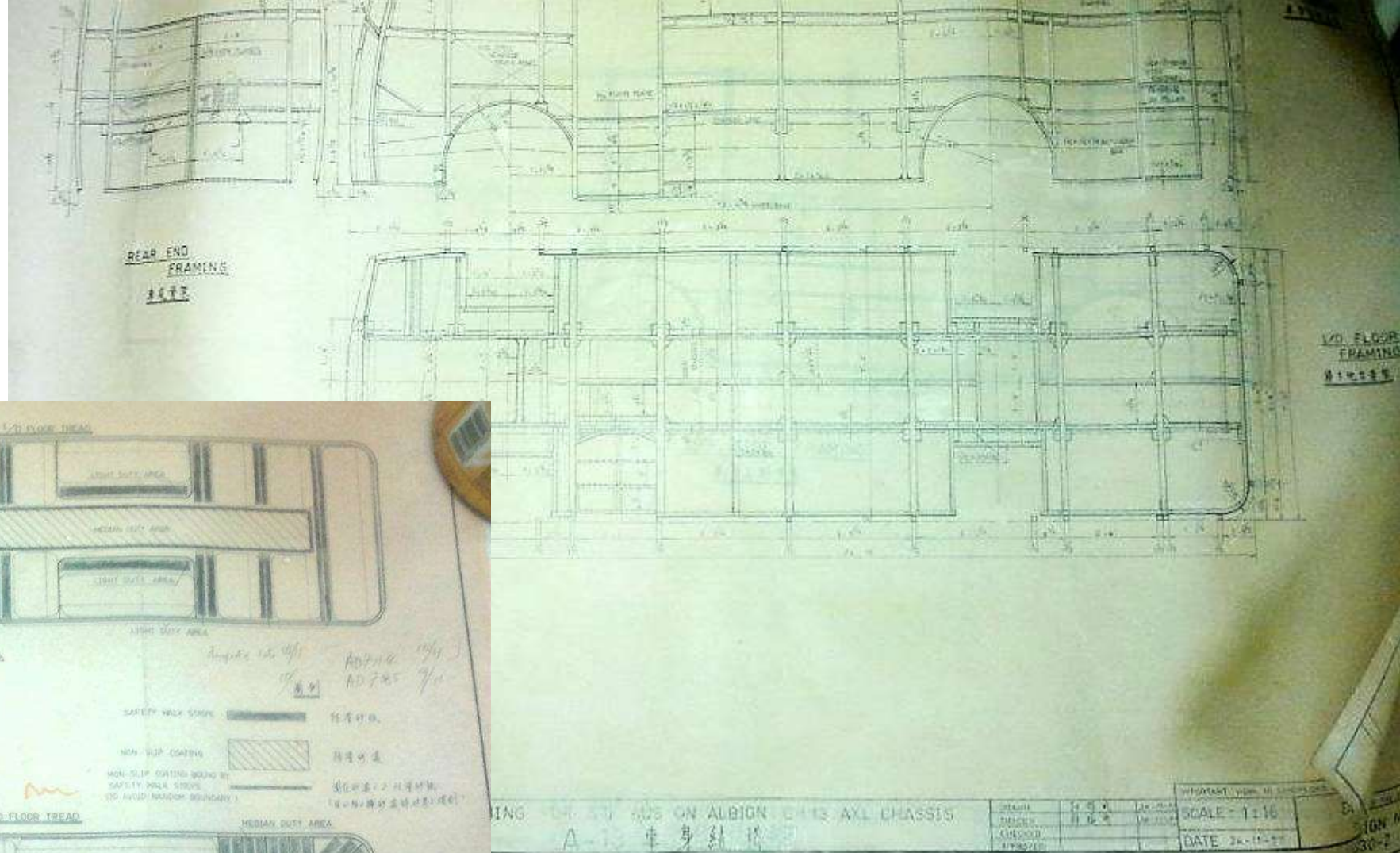


Photo Copyright: CK Chow



- A systematic archive for Hong Kong Motoring History is needed
- A proper archive for technical documents
- A knowledge base information centre for classic vehicles
- Online Transport Museum



Photo Copyright: David Chow



# What's next: Motoring Festival

## 500老爺車聚首中環



■ 香港車會嘉年華昨日於中環愛丁堡廣場舉行，展示五百部老爺車、名車及電單車等，其中香港老爺車會首次公開展示剛翻新的「豬肝紅色」中巴。香港老爺車會會籍秘書及老爺車認可證管理人吳嘉輝表示，不少人以為中巴只有藍色一種，導致誤認該架紅色中巴是九巴，希望透過展覽及宣傳，加深市民對香港汽車歷史及文化的認識。

(何天成攝)



# 香港車會嘉年華 經典靚車任你睇

經典靚車，一次過晒冷！由非牟利機構「香港運輸工具歷史文化博物館」主辦嘅香港首屆「香港車會嘉年華」，昨日喺中環愛丁堡廣場舉行，免費開放予公眾參觀，公諸同好，吸引大細車迷到場，有參展車會話，難得一次過齊集逾三百架靚車、古董車，包括經過翻新嘅一九六三年中巴，好復古！

嘉年華活動旨在將香港不同年代、不同款式嘅車汽展出，有經典珍藏車、巡航車、綿羊、超級電單車等。參與活動嘅香港老爺車會會籍秘書及老爺車認可證管理人吳嘉輝同Kelly講，一九六三年由中華巴士購入、曾服務港島半山區及南區嘅紅色古董巴士，去年完成翻新工程，復原至六十年代面貌，同場仲有去年老爺車展選美得獎車嘅藍色一九五二年Bentley，以及偉士綿羊仔等。



一九六三年中巴



偉士綿羊仔



## 古董中巴現身中環

【本報訊】香港運輸工具歷史文化博物館昨日在中環愛丁堡廣場舉行第一屆香港車會嘉年華，不同年代、款式共500部老爺車、經典汽車雲集，有Harley HOGS、超級電單車等，令不少車迷大開眼界。其中經過翻新、1963年的中巴，成為車迷拍照留念熱點。一般市民印象中，昔日主要在港島行駛的中巴是藍色，九巴是紅色，其實60年代中巴是紅色車身，這輛特別的軍用中巴昨日成為焦點。



小朋友在古董電單車旁拍照。







# Advantage to Motor Repair Industry: Attract new blood for the trade



# Classic bus is also a type of Classic Car



*Photo Copyright: Victor Yuen*

Don't miss the bus!





# Thank you



Photo Copyright: Louis Mak

photography 2017

**Q & A session**



**Q1: Would you have any good suggestions to make these vintage commercial vehicles re-licenced once again in HK?**

**Q2: What kind of support do you think you can contribute to the preservation of classic public transport vehicles? For example: Donation of obsoleted parts, Technical manuals, Special tools and equipment?**

**Q3: Any other new ideas for the Motoring Archive Project?**

Date: 13 March 2017  
Time: 18:30 to 20:30  
Venue: HJ302, The Hong Kong Polytechnic University

From a public bus to a tow truck, this 1963-built single decker bus was saved from scrapyard and has restored its former glory. IMechE Hong Kong Branch will walk through the journey of restoration where many interesting and inspiring insights into automotive engineering were gained.



For registration, please scan the above QR code or visit IMechE webpage:

<http://nearyou.imeche.org/near-you/north-east-asia/hong-kong/events>

Members of IMechE, PolyU and Supporting Organisations only

**Hong Kong Branch**

**Institution of  
MECHANICAL  
ENGINEERS**

Evening Lecture 13 March 2017

**"PUBLIC" ANTIQUE"**

Supporting Organisations

**ASME**  
SETTING THE STANDARD  
Hong Kong Section

**HKIE** THE HONG KONG  
INSTITUTION OF ENGINEERS  
香港工程師學會  
Mechanical, Marine, Naval Architecture & Chemical Division  
機械、輪機、造船及化工分部