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Automatic Powered Trike

For the Handicapped

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***Abstract*—This is a final year project carried out in Kozi wheels (Manufacturers of Side cars and Side wheels). Upon doing some market research, we found out that contrary to popular belief, the handicapped population is not all poor. Especially in cities like Mumbai, people are ready to shell out extra, if provided with proper features. There is a market ,both for handicapped and for recreational purposes as well. So we went about making a prototype with this particular purpose in mind – a vehicle to be both used by the disabled and the performance fanatics who want more than two wheels.**

Keywords— Chassis Fabrication, Styling

INTRODUCTION

The project's main objective was to quench the thirst of performance for the handicapped people and someone in general who doesn't prefer two wheels. Now working in Kozi wheels we see lot of people coming for sidecars and side wheels for various reasons - right from handicapped to comfort ones. We saw many modifications being done to bikes also. But for the performance greedy it wasn't enough. They needed a more discrete approach to their wants. So we came up with this idea of a powered trike.

We did some research and found out that an engine from the first generation Maruti Zen would be our best bet due to its compact size and decent power output of 60PS. Also we decided to stick to Automatic Transmission since not only does it add to the convenience but also geared ones have been made in abundance and we wanted to follow a different approach. We are following the layout of 2 at back and one in front,

In a nutshell, there are only two types of Trike that you really need to know about, bike engine and car engine. Having said that, it isn't the engine type that finally influences the decision of what type of Trike you're going to ride, it's the weight of the Trike, and what you are actually licensed to ride; any type of Trike can be built or bought to suit disabled needs. These can realistically vary from a humble 250cc bike engine Trike, all the way up to a growling, car engine V12 monster.

What we are making is to test the mechanical efficiency of the design and see peoples response to the same. Upon receiving appreciable responses we might go ahead with the idea and try with other engine-options also such as diesel for its better efficiency and torque.

I. DESIGNING (ROUGH IDEA)

First of all a rough sketch was created, keeping in mind how we want the trike to look. This was purely carried out for aesthetic purpose – to give us a general idea to work around. Figure No 1

II. CHASSIS FABRICATION

In order to start with the chassis it was important that we have a general idea of the dimensions of the final trike such as the wheel base, width etc. For this purpose we added all the parts connected to the engine originally on the car so as to get a fair idea of the setup. We added the original wheels from the car (Temporarily) - the balance rod was placed after that which was needed for proper alignment of the two suspensions.Figure No 2

We made sure of the positions of the engine mountings and went about constructing the chassis keeping the mountings as reference. Initial prototype for the chassis was made out of Seamless Mild Steel of 4mm thickness and 32mm diameter (which would be later on replaced with thicker and stronger pipes). The engine was supported by the mountings but based on the engine-base-plate, which we connected to the chassis via rubber bush mountings – providing a bit of elasticity.

In the prototype phase the linkages between the engine mountings and chassis were temporary. Further on the lower arm was connected to the chassis via s slot which was added on the chassis. Separators were provided between the rear extreme ends of the chassis to keep them parallel.Figure No 3

After the prototype was made, it was completely dismantled. Catering to the design needs we chose a stronger pipe of 4mm thickness and outer dis 2 inches so as to provide adequate rigidity and support. Welding was carried out as per the prototype requirements and measurements. The joints were welded and further strengthened by placing an additional

slab of circular metal and then placing the chassis's outer edge over them and then welding. Thus giving us the final chassis which would be eventually used for the vehicle.Figure No 4

III. ENGINE

After the chassis was made, the next step was the engine. Now the engine we used is a 60 Bhp, Maruti Zen First Generation engine with Automatic Transmission. Being a second hand engine, it needed refurbishment, so the engine was completely dismantled and then washed. This basically involved three stages - First cleansing with kerosene - then diesel - then industrial grade thinner. Then finally water was used. The water was pressurized so as to reach the hard to find places. After the engine was properly cleaned, it was left to dry for sometime.

Next step was engine repainting. The one that we got from the car was of a grey-black color combination. We needed something a bit more attractive and sober so went for the aluminium finish. Powder coating was carried out and the results were more than satisfactory as.

After water cleaning, the engine is painted using aluminium finish. The cylinder head casing being aluminium in material, was dismantled and made to go under buffing process. The engine was then left to dry up and later on fitted in the chassis. The front forks were fitted in the place provided. Along with the engine the whole suspension setup was fitted too.Figure No 5

IV. GEARBOX

The engine that's fitted in the vehicle comes with an automatic transmission. Non-the-less a convenient gear changing mechanism was required. First of all a Pneumatic system was taken into consideration. But due to the complicated nature of gear change mechanism, the pneumatic system would have been an efficient but expensive option.

The gearbox comes fitted with a knob (directly connected) which on changing changes the gear. The gear sequence is as follows = P R N D 2 L.The mechanism to be fitted had to be in such a way that it moved the knob in both the directions - Linear motion to be converted into a sort of circular motion. The wire system that came with the original car had hardened and become much more difficult to work with. Each gearshift needed a lot of force. So we got rid of the wire system and went with a system that involved rods and plates instead.Fig 6

A flat metal plate was machined and supported on a fulcrum around which it could rotate. So that when pushed from one direction, the other end moved in the other direction. One edge thus was connected to the gear knob and the other end connected to the gearshift lever, placed at the front of the engine. Thus when the gear shift was pushed in one direction the gear knob moved in the opposite direction. Similarly when the gear lever was pulled in the opposite direction, the same motion was reciprocated at the gear knob in the opposites direction.FIG 7

IV. BRAKES AND PETROL TANK

The vehicle employs disc brakes both at the front and the back. While the front brakes are the conventional ones, getting the rear brake control at the front foot was the trickypart.The brakes used in this case are hydraulic ones, We again went for the more reliableand conventional system that came with the car. Time being a constraint we went with the most simple and efficient way - Being a prototype this isn't final and more advanced designs would be researched in the times to come.Figure No 8

The tank that stored the hydraulic brake fluid needed to be placed in a vertical - upright position, for that purpose we chose this certain alignment of the system. This also ensured that the rider gets easy and comfortable access to the brake pedals. The whole system was cleaned and repaired and the fluids replaced. Being a disc brake arrangement, the stopping force was never an issue.

The petrol tank was custom built. For which external resources were employed. The design was done in-house taking into account various examples and inputs seen over the internet. This is the secondary tank – more of a sort of reserve for the primary tank. The primary tank on the other hand was the same one used in the actual car – only altered to fit our vehicle's dimensions – cut from the sides and thickness reduced. Powder coated with blue color.Figure No 9

V. WHEEL ADJUSTMENT ADJUSTER

Being a permanent rear wheel drive vehicle it was important that the engine driven rear wheels have proper alignment, including appropriate castor and camber angle. Now we went on and used a general standard camber angle of -3 degrees. So that when the load starts acting, the wheels can open up to exact 0 degrees.

Second was the castor angle. Being a prototype, the wheels are non-turning in this one. But we wanted to make sure that provisions are provided, so as to if we make it a three wheeled directed vehicle, appropriate adjustments could be made with ease - without any hassle. So we made a wheel adjuster, using a universal joint using which the wheels castor able can be increased and decreased as wished.

The rod as seen in the figure is the wheel adjuster. The black rod has threads inside the nut at the end - thus can go either deeper inside towards the rod or further outside– towards the tire, giving us the toe-in or toe-out arrangement. Figure 10

VI. FINISHING TOUCHES AND END JOBS

The engine was dismounted, and the chassis was painted black. The tank - secondary one - was given a shade of bright red.The front end parts were fitted and by hit-&-trial a correct position for the seat was find out.

Further on the petrol tank (primary) was fittedand then the suspension was depressed to its maximum and checked whether the tank touches the floor or not. If too soft the suspensions were adjusted suitably.

We covered up the base, and provided a metallic flooring. Using an aluminium sheet as base. Weight of the sheet is 7 kg. After cutting out the outline needed to cover up the base, it was given a powder coating of black color. Being aluminium it ensured that rusting wouldn't take place and provide more than enough foot support. Figure No 11

LIGHTING - Headlight used was directly picked from Royal Enfield Thunderbird. It has a HID unit for low beam and a halogen unit for high beam. To give company to the main light we placed two pilot lights of 24 V intensity on either sides.Figure No 12

Now in order to place the headlight, a separate mini-chassis for the lights was needed. The stock headlight itself had three places to connect. Using those as reference points we went about framing a shape out of a rod around the light. Keeping the headlight at the center the pilot lights were then placed on the either sides. The frame was dismantled and then given for chrome plating. Figure No 13

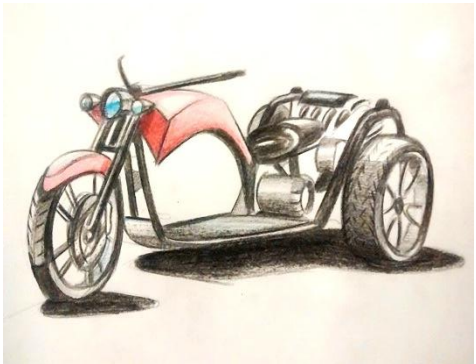
For brake lights we are using two strips of High Intensity LEDs consisting of 8 individual LEDs. Which are both water resistant and low weight at the same time providing optimum light intensity.

The cylinder head was removed. The casing itself was first cleaned and then sent for buffing.The head was cleaned using diesel and lubricated properly. After buffing and cleaning process the casing was reattached onto the head.

The handle bar was custom built catering to the needs of human of average height. The pipe used for making is 1 inch overall and 0.75 at the ends, so as to fit on the grips (with integrated indicators – ordered from eBay). A small fraction of area in the center was knurled at two spots where the handle would be bolted to the front forks. (Knurling – slow speed lathe process carried out so as to give a diamond shape criss cross pattern to the metal.

FIGURES-

No. 1 - The design

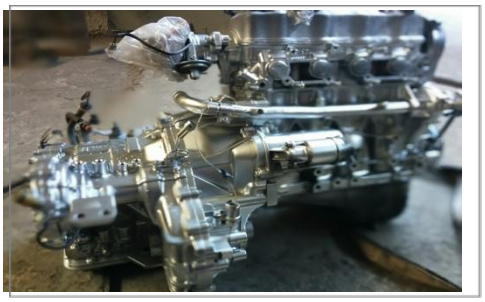


No. 2 - The Chassis –with original wheels and placed on temporary supports.

No. 3 - Temporary Linkages

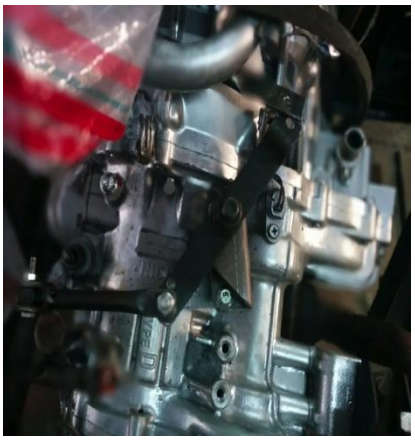
No. 4 - Final Chassis With Thicker Pipes

No. 5 – Engine Cleaning and Painting



No. 6 - The Gear Knob used to change gears

No. 7 - The fulcrum created using a plate.



No. 8 - Conventional Brakes

No.9 – Secondary and Primary Tanks Respectively

No. 10 – Wheel Alignment Adjuster

No. 11 – Finished Chassis

No. 12 Lighting- Headlight and Pilot Lights

No. 12 –Frame for the headlight.

No. 13 – Final Product

RESULT ANALYSIS

The trike when tested was stable around corners with almost zero roll – thanks to the wide footprint of the vehicle and the low-lying engine. Future models can be tested with higher capacity engines producing much more power and torque.

An initial reason for concern was that the front wheel would leave the tarmac on sudden acceleration but thankfully that didn't happen – the secondary petrol tank that we fitted in the front along with the heavy light arrangement made sure that the weight distribution was taken care of to some extent. Also the placement of the battery near the rear seat helped with the issue.

The existence of an automatic gearbox made sure that maneuverability through traffic was a breeze. Presence of three tires also made sure that the passenger needn't put his/her legs on the ground. The custom built seat provided optimum comfort thereby making it suitable for long range touring too.

The stopping power for such a heavy vehicle seemed quite impressive, thanks to disc brakes acting both front and rear. The wide grip Yokohamas at the rear and Pirelli in the front provided optimum grip even in wet conditions.

Although due to time constraints we couldn't find out the mileage of the vehicle – we are nonetheless positive that it would have at-least doubled for sure taking into account the modifications such as – Weight reduction to half, Engine Repair and Renovation, Gearbox Repair and Renovation.

Taking into the aesthetic appeal of the vehicle – it's a good looking piece of engineering with clear hints that a considerable amount of attention to detail has been given – such as the wide swooping custom tank and the low profile tyres on alloys.

Considering the feedbacks we received from many customers coming to the workshop, for sure a trike has a bright future in India especially in metropolitan countries like Mumbai and Delhi where people are ready to shell out more for a better overall vehicle with added features and comfort. Not to mention such vehicles are a boon for the handicap population.This being a prototype much time was spent on R & D. The version two would be much better with smaller engines producing more power, smaller-lighter but stiffer chassis, better power to weight ratio, mileage and overall reduced investment too if made in high numbers. Now all that stands between a prototype and a road ready model is a certification from ARAI which shouldn't be much of a problem if the current vehicle is anything to go by.

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