Smt.S.R.PATEL ENGINEERING COLLEGE

HYDRAULIC ACTUATOR DESIGN AND INSTALLATION FOR STRICTLY CONTROL OF TRAFFIC

Group No: 03

Group ID:46398

Guided by Prof. H.C.PATEL

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CONTENTS

Abstract

- Apart from offering other advantages features hydraulic actuators are first choice if heavy loads have to be moved , lifted or controlled. This system design hydraulic actuators operated by PLC programming for controlling traffic according to change the signal will decided by calculating no. of vehicles passes through.

Introduction

Traffic Engineering

- That phase of engineering which deals with planning geometric design and traffic operation of roads and streets highways, their networks, terminals ,abutting lands Relationship with other modes of transportation for the achievement of safe, Efficient and convenient movement of person and goods.

- As vehicular traffic began to increase the congestion on the streets began to hamper the safe and efficient movement of traffic. More and more accident were caused and serious problems of parking and Environmental pollution began to be felt. It was therefore, necessary to give increasing attention to the operational Characteristic of highway transportation and study the need for better geometric design Capacity, intersection, traffic regulation, signals, traffic signs, and roadway markings Parking facilities, design of bus stands and truck terminals and street lighting.

Conti.

- Even as early as 1904 traffic survey were made in a number of places in the united states And much of this pioneering work is due to W.P.Eno, through whose endowment the Eno foundation, Saugatuck is carrying on useful work on traffic research. The now familiar three colour light signals made their appearance in 1918.

Conti.

❖ PROBLEM IDENTIFICATION

- Number of accident increasing at uncontrolled intersections.
- Delay to passengers.
- Indians are not following traffic rules and regulation therefore, haphazard traffic movement take place.

❖ NEED OF THE STUDY

- Need to reduce Number of accident on Intersection.
- Need to improve and settle automatic traffic control system at intersection.
- Following the traffic rules and regulations Strictly.

LITERATURE REVIEW

1. Kavya P Walad et al. “Traffic Light Control System Using Image Processing”

- Paper discusses about some of the existing traffic light control system and their drawback and image processing technique i.e. edge detection techniques that helps in finding traffic density. Here also discussing so bell, Prewitt, and Robert, Canny edge detection and their advantages and disadvantage. To find traffic density edge detection techniques can be used. The edge detection is a well-known technique in image processing in identifying an image object, image segmentation, image enhancement. Each edge detection techniques have its own advantages and disadvantages in various fields. Gradient- based or first order edge detection and laplacian based or second-order edge detection operators are discussed in this paper can be implemented in MATLAB.

2. A. Ms Promila Sinhmar et al. “Intelligent Traffic Light and Density Control Using IR Sensors and Microcontroller”

- In this paper we studied the optimization of traffic light controller in a City using micro controller .The system tries to reduce possibilities of traffic jams, caused by traffic lights, to an extent. The system is based on microcontroller. The micro-controller used in the system is 89V51RD2 which is MCS-51 family based. The system contains IR transmitter and IR receiver which are mounted on the either sides of roads respectively. The IR system gets activated whenever any vehicle passes on road between IR transmitter and IR receiver. Microcontroller controls the IR system and counts number of vehicles passing on road. Microcontroller also store vehicles count in its memory. Based on different vehicles count, the microcontroller takes decision and updates the traffic light delays as a result. The traffic light is situated at a certain distance from the IR system.

3. K.Vidhya, A.BazilaBanu et al. “Density Based Traffic Signal System”

- The project is designed to develop a density based dynamic traffic signal system. The signal timing changes automatically on sensing the traffic density at the junction. We can calculate the density of the vehicle by using mat-lab tool by comparing the four side of the image which is given as a input. we can simulate the result of the four given input image but this cannot be used in real time applications as it is very slow and the software is not free of cost like open to overcome this disadvantage of mat lab, opens software is used which is very easy to install and is open source software and can be used in real time application in a quick manner. In this paper we have shown the density measurement in the signal by using opens in the System.

4. Ashwini Basavaraju1 et al.“Vehicle Density Sensor System to Manage Traffic”

- The aim of this study is to solve traffic congestion which is a severe problem in many modern cities all over the world. To solve this problem, we have a framework for a dynamic and automatic traffic light control system. Generally, each traffic light on an intersection is assigned a constant green signal time. It is possible to propose a dynamic time-based coordination schemes where the green signal time of the traffic lights is assigned based on the present conditions of the traffic. In this study, we adapt the approach to take data/input/image from by using this system configuration we try to reduce the possibilities of traffic jams, caused by traffic lights. No. of passing vehicle in the fixed time slot on the road decide the density range of traffic and on the basis of vehicle count microcontroller decide the traffic light delays for next recording interval. Object/ subject/vehicle and to process the input data by Computer and Microcontroller and finally display it on the traffic light signal to control the Closed Loop System.

5. **Rashid Hussian, SandhyaSharma,Vinita Sharma, Sandhya Sharma et al. "Automated Intelligent Traffic control system"**

- The Concept Proposed in this paper involves use of Wireless sensor network technology to sense presence of Traffic near any circle or junction and then able to route the Traffic based on Traffic availability or we can say density in desire direction. This system does not require any system in vehicles so can be implemented in any Traffic system quite easily with less time and less expensive also. This system uses Wireless sensor networks Technology to sense vehicles and a microcontroller based routing algorithm programmed for excellent Traffic management.

Research Gap

- Further improvement required for control of traffic at intersection.
- Any researcher not used Hydraulic actuators for strictly control of traffic.

OBJECTIVE

- To regulate the traffic at intersection strictly by introducing automatic traffic control system.
- To reduce accident rate at intersection.
- To reduce delay due to traffic.

SCOPE OF THE STUDY

- New Signal Design for 4 phase.
- Computer programming for automatic control signal cycle.
- Hydraulic Actuator installation.
- Working of hydraulic jack as per signal cycle at intersection.

Methodology

- Input data of traffic volume
- Signal Cycle Design
- Computerized program of signal design
- Connectivity of hydraulic Actuators with algorithm
- Hydraulic Actuator working And installation


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Traffic survey

Method used for traffic survey count

1.Manual method

The fields data sheet can be prepared to the particular requirement at any intersection At a four arm intersection the count At each arm of the traffic entering the intersection can be broken down in to three categories, via left turning, right turning, straight ahead traffic then take a reading in a data sheet.

2.Combination of Manual and Mechanical method.

An example of a combination of manual and method is the multiple pen recorders. A chart moves continuously at the speed of clock. Different pens record the occurrence of different event on the chart. The actuation of the event recorder pen by pressing the electric switch associated with each pen recorder.

3.Video photography

Video photography gives a permanent record of volume count. Its analysis can be done conveniently in the office by replying the cassette on a TV monitors.

4.Photographic method

Time–lapse camera photography has been used to successfully to determine the speeds of vehicles accurately in crowded streets. According to this method, photographs are taken as fixed intervals of time on a special camera's by projecting the film on a screen, the passage of any vehicle can be traced with reference to time, and video camera can also be used.

Passenger Car Unit (PCU) Table

It is usual to express capacity in term of "Passenger Car Unit". This system is also being followed in India, the basic consideration behind this practice is that different types of vehicles offer different degree of interference to offer traffic and it is necessary to bring all types of a common unit, the common unit adopted is the passenger car unit.

Types of vehicle	PCU
Passenger car	1.0
Auto Rickshaw	1.0
Bus, truck	3.0
Tractor-trailer unit	3.0
Motor cycle, scooter, pedal cycle	0.5
Horse drawn vehicles	4.0
Bullock cart	6.0

Actual data of survey

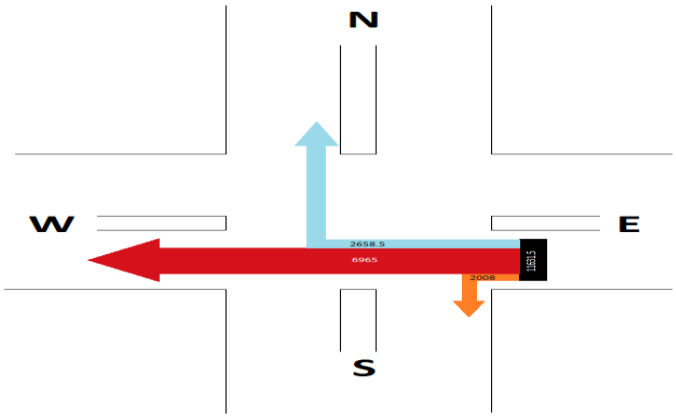
CLASSIFIED VOLUME COUNT AT INTER SECTION

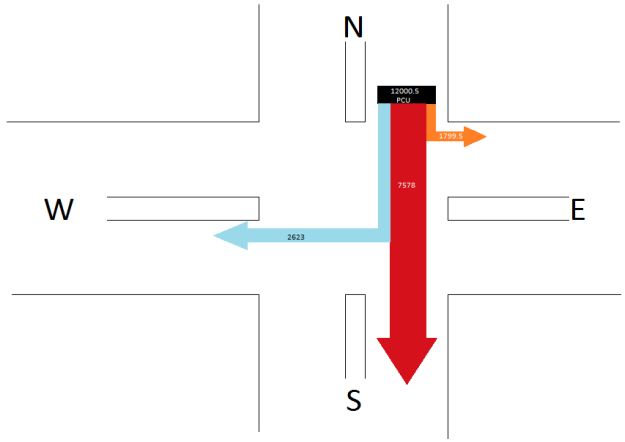
Location: Vijay char Rasta Approach: G.u

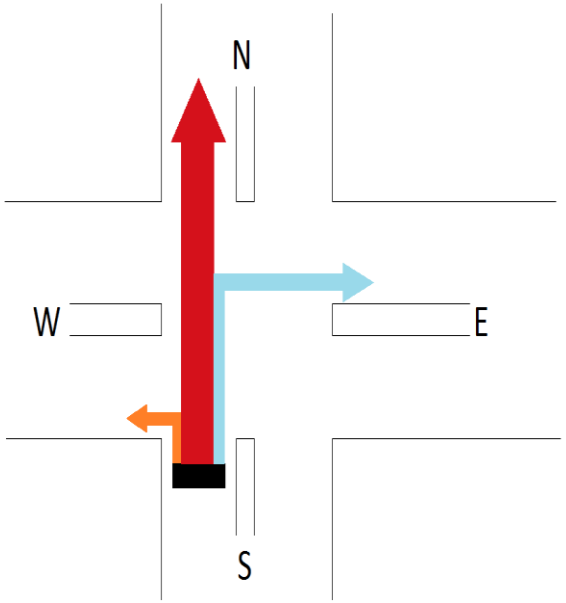
Flow: East-South West North

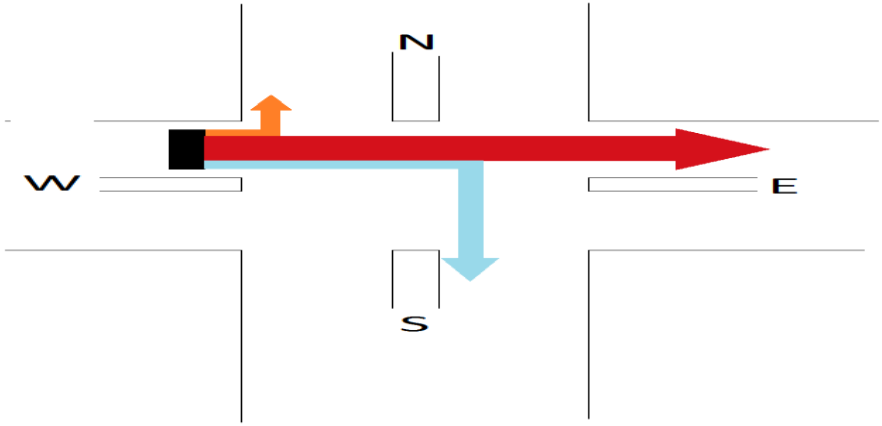
TIME	LEFT TURNING					STRAIGHT					RIGHT TURNING				
	2W	3W ,4W	Busses , Trucks	Cycle, Slow moving	TOTAL	2W	3W ,4W	Busses , Trucks	Cycle, Slow moving	TOTAL	2W	3W, 4W	Busses , Trucks	Cycle, Slow moving	TOTAL
8:30 TO 9:00	157	88	3	2	250	695	297	5	5	1002	163	101	8	7	279
9:00 TO 9:30	144	102	8	13	267	693	350	2	8	1053	221	151	4	2	378
9:45 TO 10:15	108	88	4	9	209	661	310	5	13	989	168	130	10	12	320
10:15 TO 10:45	101	94	12	6	213	466	327	12	12	817	168	152	11	8	339
12:00 TO 12:30	120	108	2	4	234	571	358	7	14	950	181	158	4	10	353
12:30 TO 1:00	113	92	6	4	217	499	361	9	11	880	173	140	4	2	319
1:00 TO 1:30	112	98	4	3	217	588	434	7	8	1037	217	183	4	6	410
4:00 TO 4:30	97	70	7	12	186	401	325	10	5	741	72	84	5	9	170

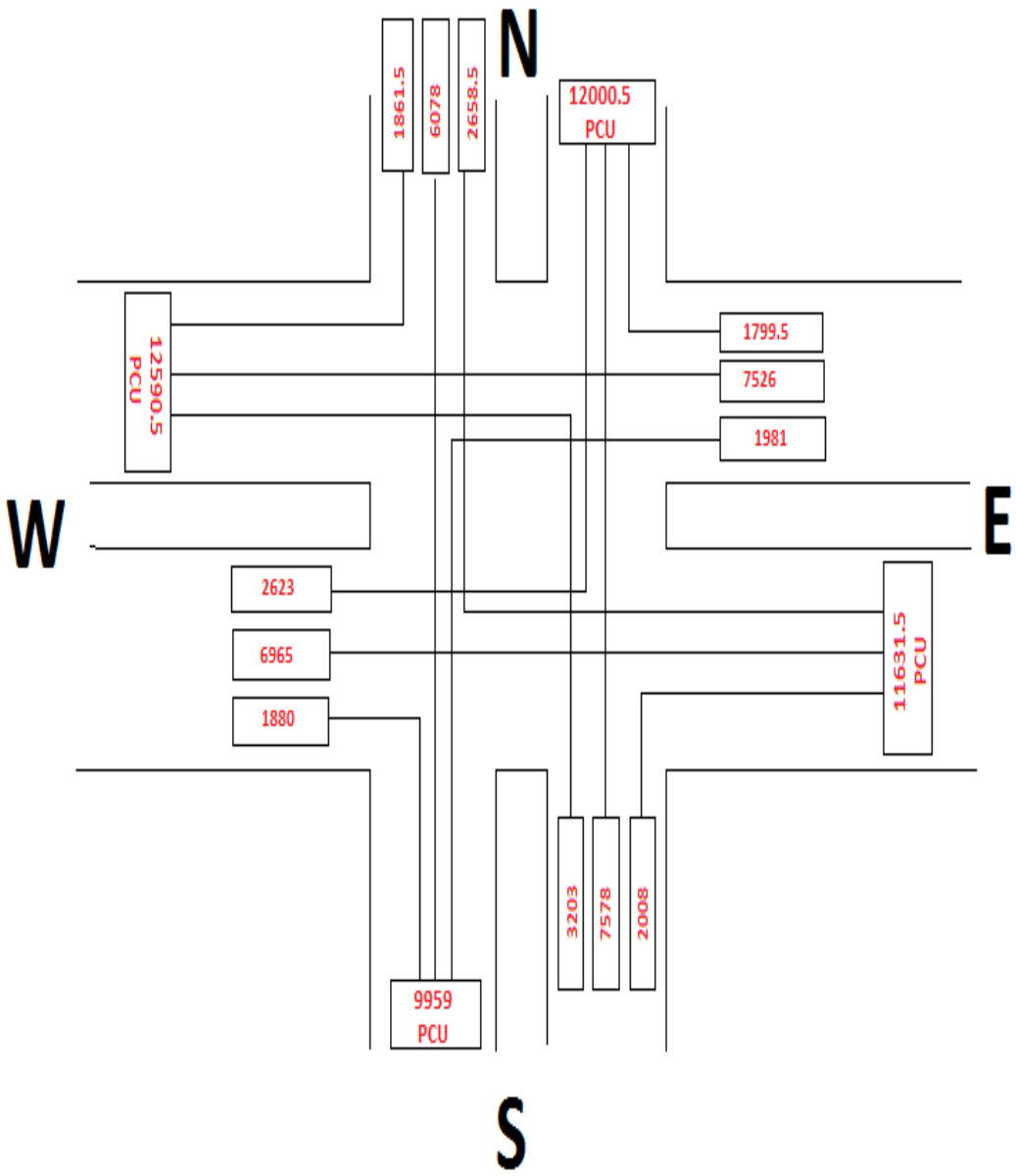
Analysis of traffic volume at Intersection





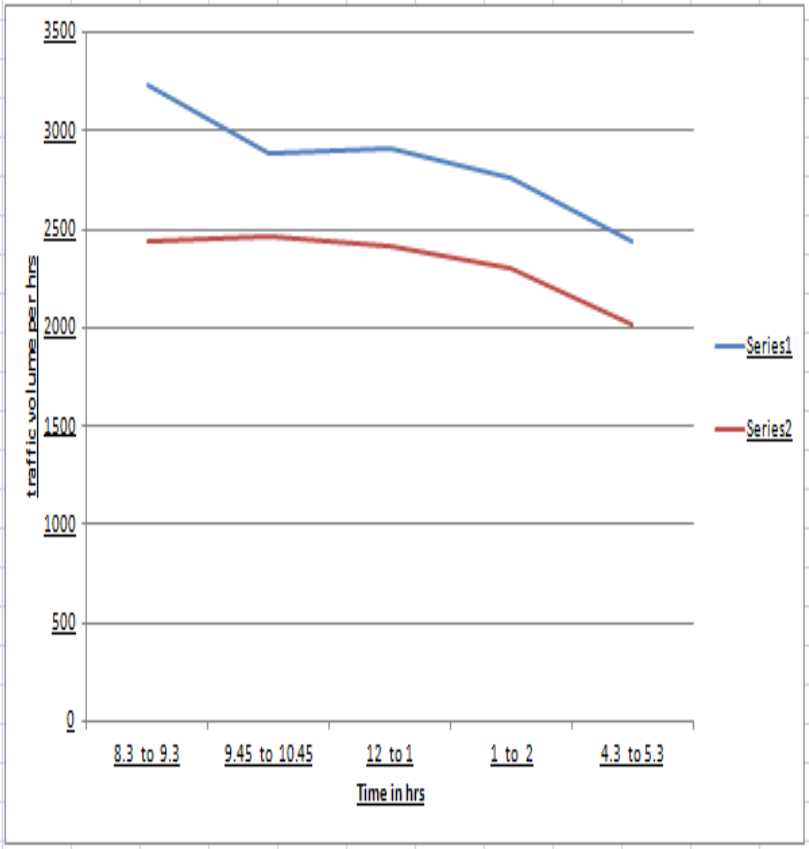


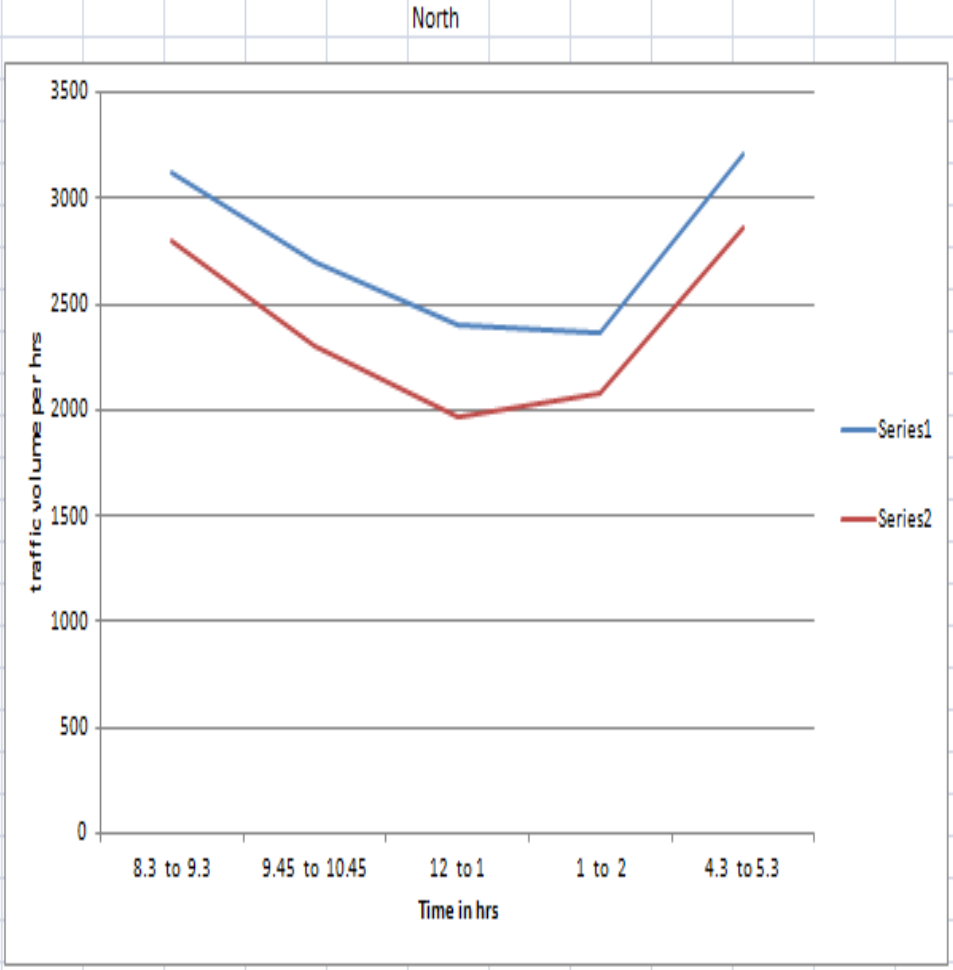



N
1861.5
6078
2658.5
12000.5
PCU
12590.5
PCU
1799.5
7526
1981
W
E
2623
6965
1880
11631.5
PCU
3203
7578
2008
9959
PCU
S

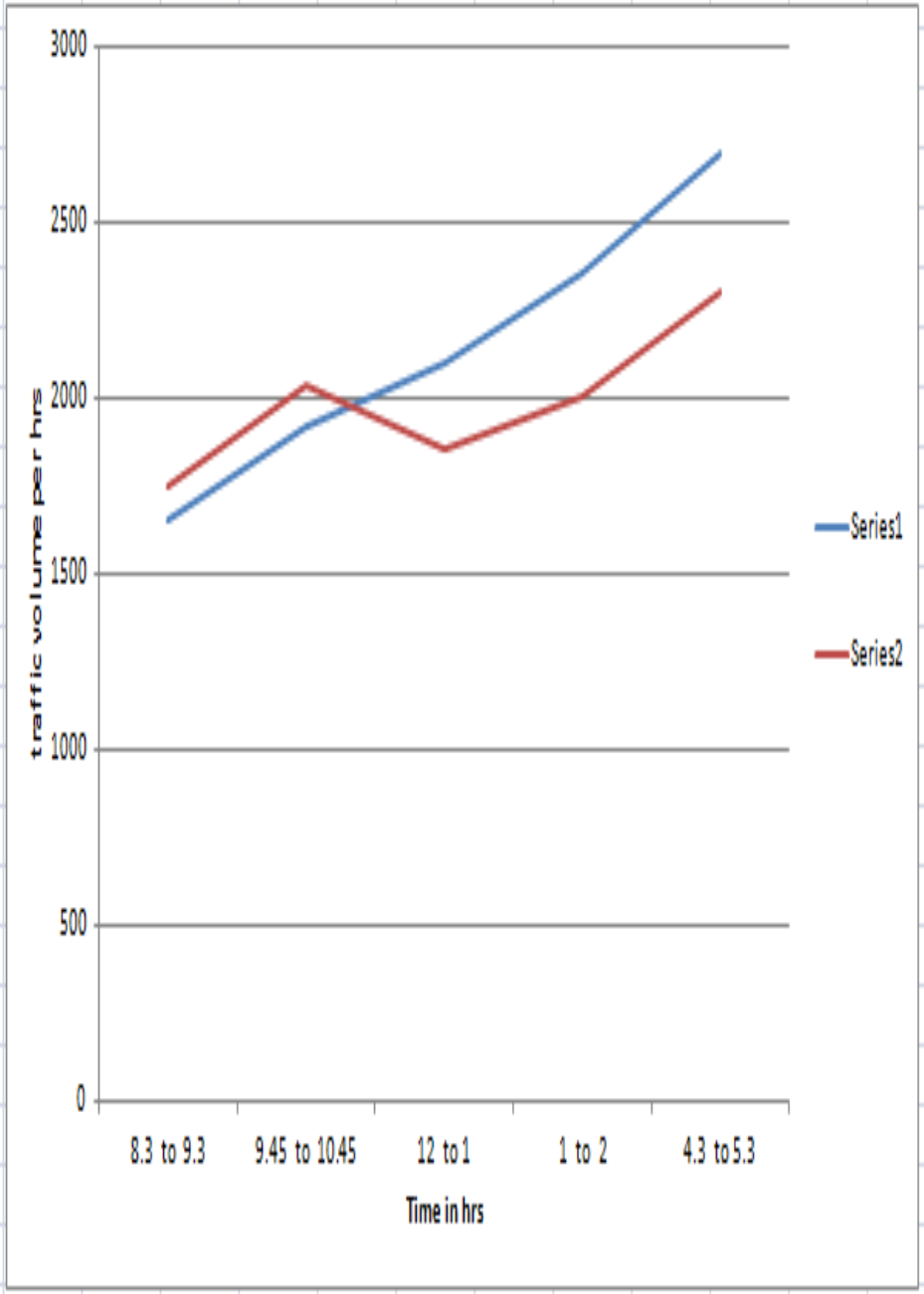
Graphical representation of PCU and NON PCU data

- **RED Indicate PCU/hours**
- **BLUE Indicate non PCUhours**

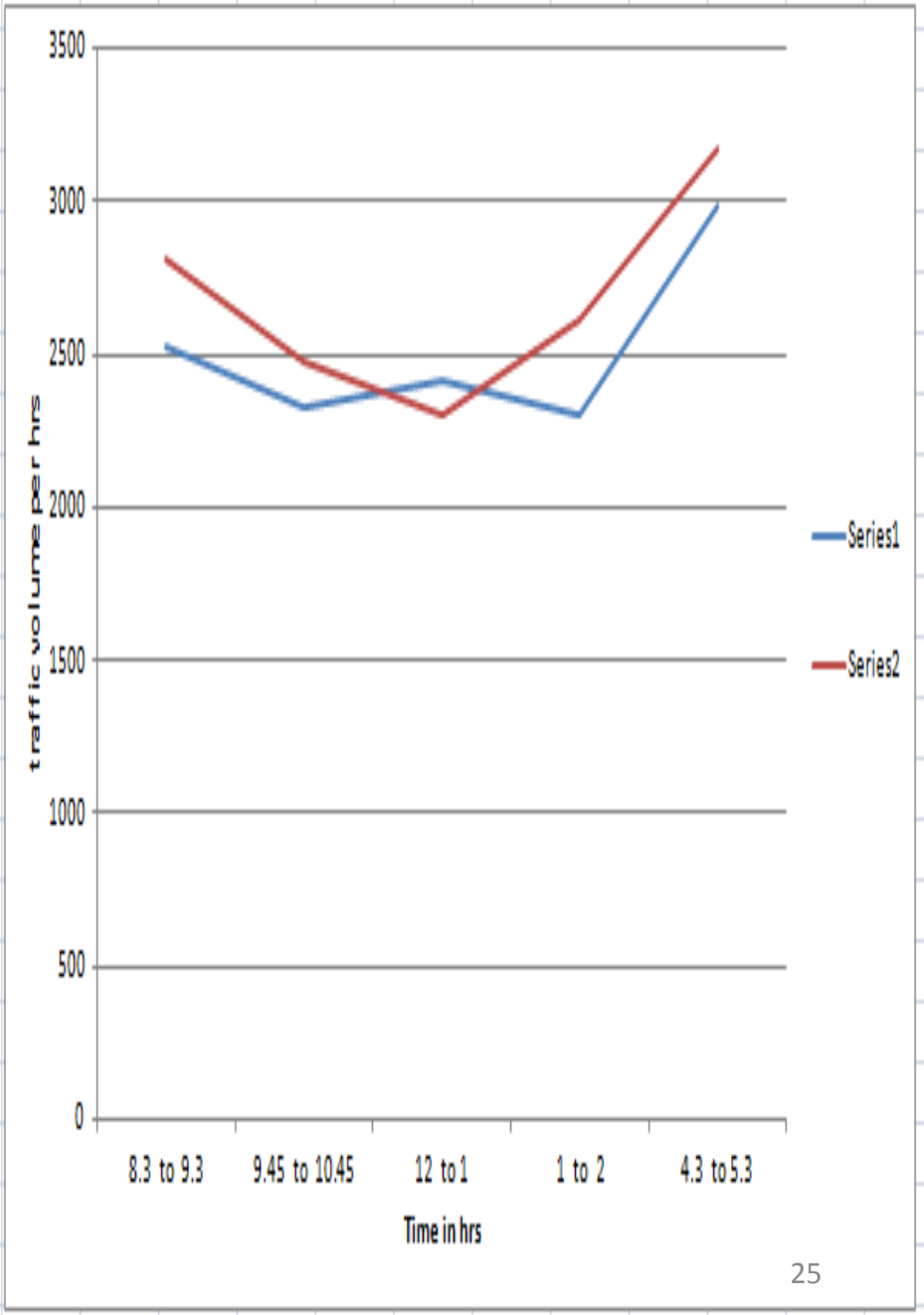




South


3000
2500
2000
1500
1000
500
0
traffic volume per hrs
8.3 to 9.3
9.45 to 10.45
12 to 1
1 to 2
4.3 to 5.3
Time in hrs
Series1
Series2

West


3500
3000
2500
2000
1500
1000
500
0
traffic volume per hrs
8.3 to 9.3
9.45 to 10.45
12 to 1
1 to 2
4.3 to 5.3
Time in hrs
Series1
Series2

Example

The dimensions of the approach widths of the four approaches A,B,C,D and the actual volumes of traffic flow in PCU per hour , from each direction are shown in the figure for a right angled intersection of two roads AB and CD . the intersection is located in normal environment on a flat ground and the turning traffic is not substantial .

For design of a 2-phase traffic signal at this intersection , the intergreen period may be taken as 5 seconds on one approach and 6 second on another (2 seconds of red /red amber time on one approach and 3 seconds of red /red amber time on other).using the above data and TRRL method of designs,

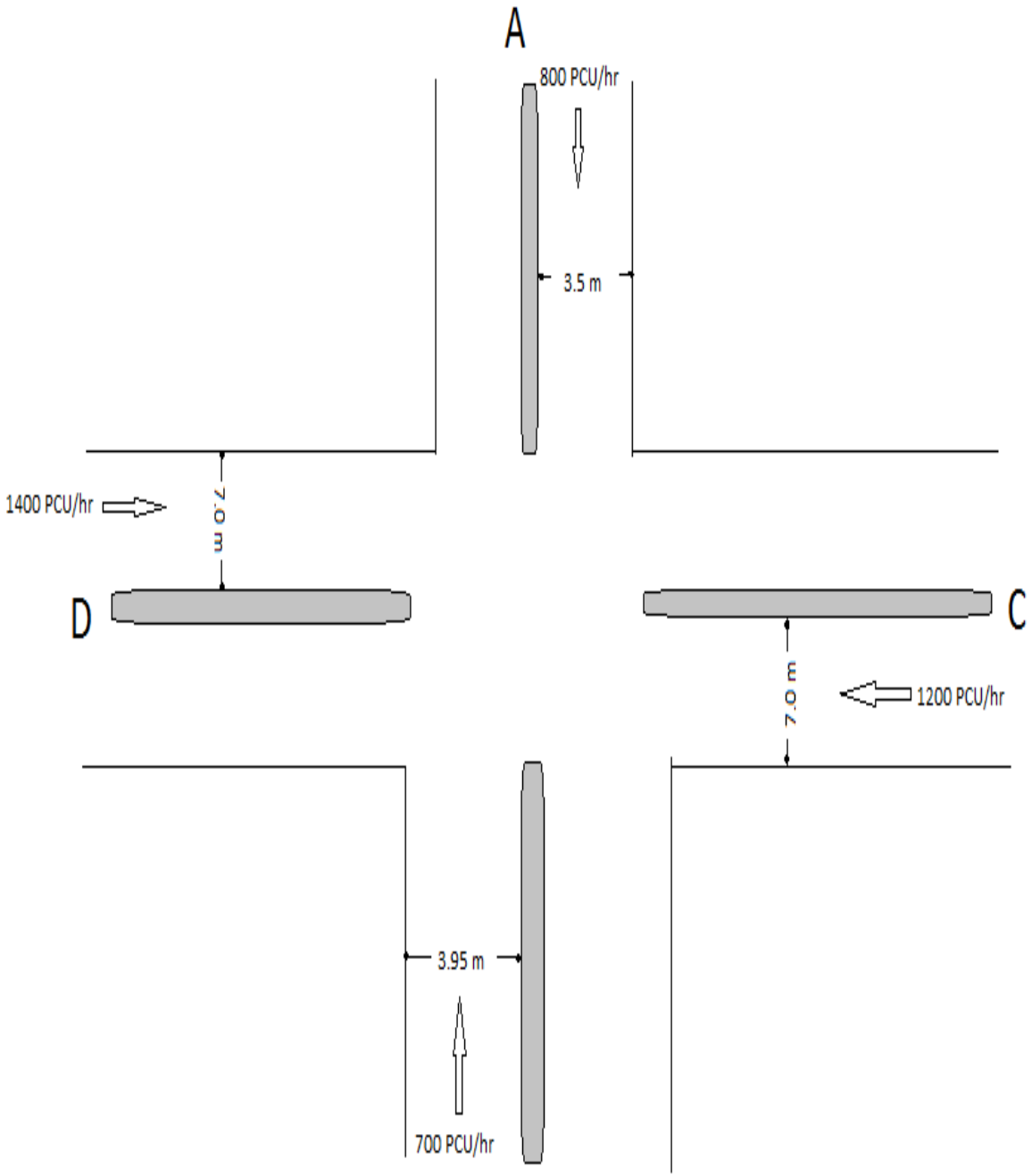
calculate :

1)The optimum cycle length

2)The distribution of green time on two roads

3)The delay to vehicles at approaches and

4)Draw the cycle diagram for the two phases.


A
800 PCU/hr
3.5 m
1400 PCU/hr
7.0 m
D
C
7.0 m
1200 PCU/hr
3.95 m
700 PCU/hr

- Solution:

(1) calculate the total delay (L)

total delay L=2n+R=2*2+(2+3)=9second

L=(inter green time-1)=(5-1)+(6-1)=9 second

(2) calculate the Y value in tubular form as below

Particulars	Approaches to intersection			
	A	B	C	D
Normal flow q (PCU/h) given.	800	700	1200	1400
Saturation flow s (PCU/h)	1875	1950	7*525=3675	7*525=3675
Y= q/s	0.42	0.36	0.33	0.38
Y max	0.42		0.38	
Y=∑Ymax	0.8			

(3)optimum cycle length C0=(1.5L+5)/(1-Y)

=(1.5*9+5)/(1-.8)

=92.5 seconds

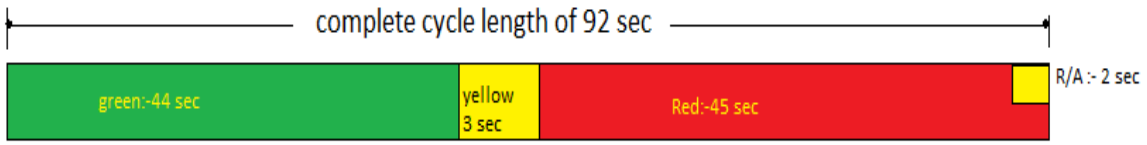
take 92 second

(4)calculate the green times in proportional to value of the approaches:

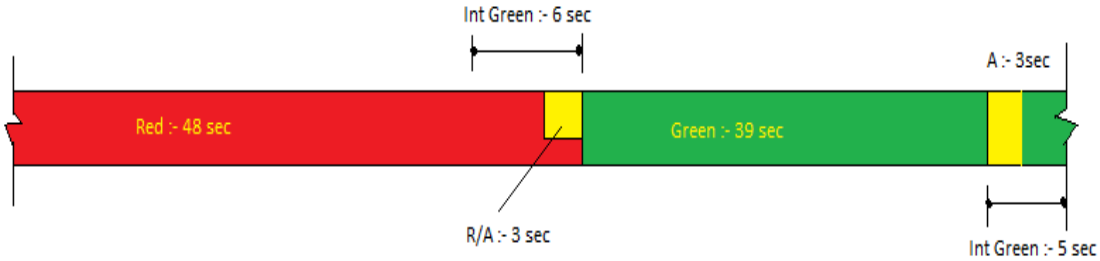
$G_{AB}=Y_{AB}(C0-L)/Y$ =.42(92-9)/0.8=44 second

$G_{CD}=Y_{CD}$ (C0-L)/Y=.38(92-9)/0.8=39 second

(5) Draw the cycle diagrams as shown below:



[CYCLE DIAGRAM for AB APPROACH]



[CYCLE DIAGRAM for CD APPROACH]

(6) calculation of delay(d):

the delay formula is expressed in vehicle per hour and not n PCU/hour . the ratio of volume in PCU per hour over vehicle per hour is called overall PCU factor and may vary from 1.10 to 1.35 .

to calculate the saturation flow in vehicle per hour we may assume a PCU factor of 1.15 , to convert PCUs factor into vph , for different approaches below :

	A	B	C	D
Normal flow q(vph)	696	609	1043	1217
Saturation flow s(vph)	1630	1696	3196	3196

- The delay on approaches dA can be calculated:
- $dA = 0.9\left[\frac{s(c-g)^2}{2c(s-q)} + \frac{1800\,qc^2}{gs(gs-qc)}\right]$

$$=0.9\left[\frac{1630(92-44)^2}{2\times92(1630-696)} + \frac{1800\times696\times92\times92}{44\times1630(44\times1630-696\times92)}\right]$$

$$=0.9\left[\frac{1630\times2304}{184\times934} + \frac{1252800\times8464}{71720\times7688}\right]$$

$$= 0.9\ \ [21.85+19.23]$$

=36seconds delay per vehicle.

- Delay at other approaches B , C and D can be calculated by similar calculations.

Cycle diagram for the four phases by webster's method

Here take,

Red/red amber time =2 sec for one approach

=3 sec for other approach

(1)Calculate total delay (L):

total delay L=2n+R=2*4+(2+3)=13sec

take L =14 sec

(2)Calculate the 'y' value's as below:

here saturation flow is to be obtained from careful field studies by noting the number of vehicles in the stream of compact flow during the green phases, and the corresponding time interval precisely.

Particulars	Phase A	Phase B	Phase C	Phase D
Normal flow q(pcu/hr)	2548	1915	2181	1986.5
Saturation flow s (pcu/hr)	11300	9500	11000	9100
Y=q/s	0.23	0.20	0.198	0.21
∑Y	0.83			

(3)Optimum cycle length

Co=(1.5*L+5)/1-Y

=(1.5*14+5)/1-0.83

=144 sec

take 150 sec

Total green time

G.T.=Co-L

=150-14

=136 sec

(4) Calculate green time

effective total green time =Y*G.T/∑Y

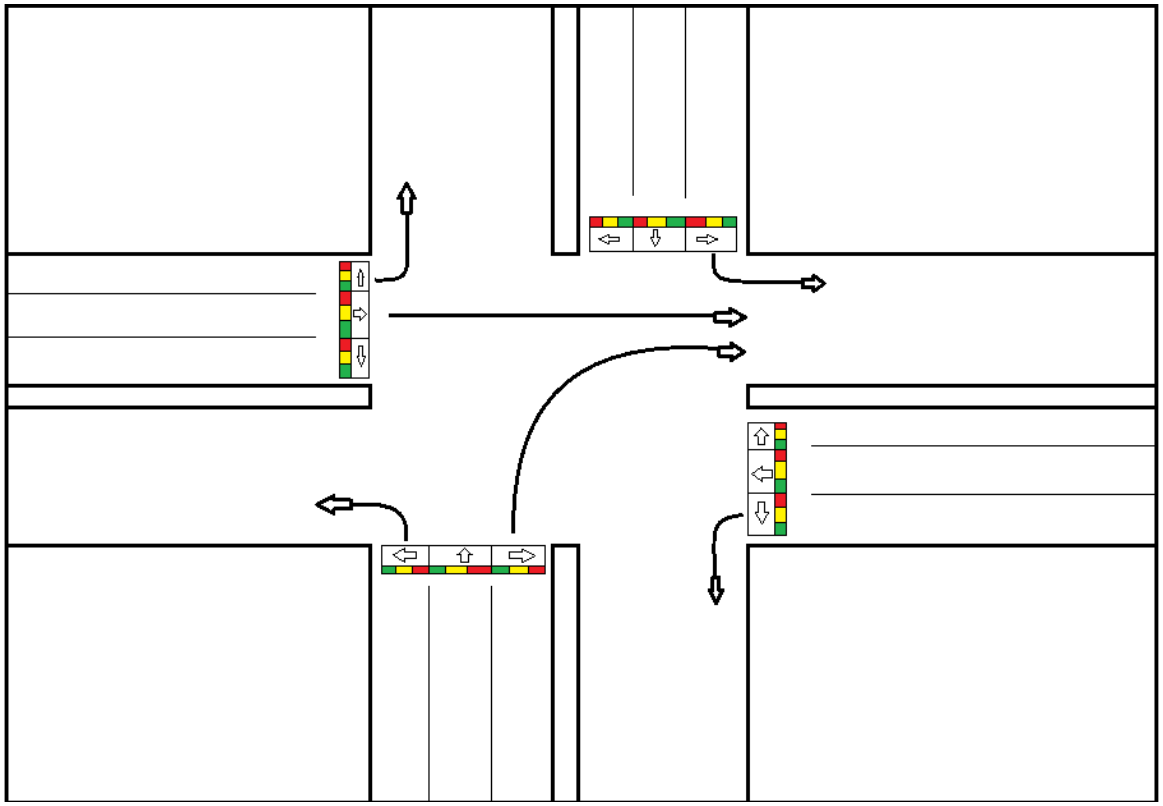
Phase A=0.23*136/0.83=37.68 sec

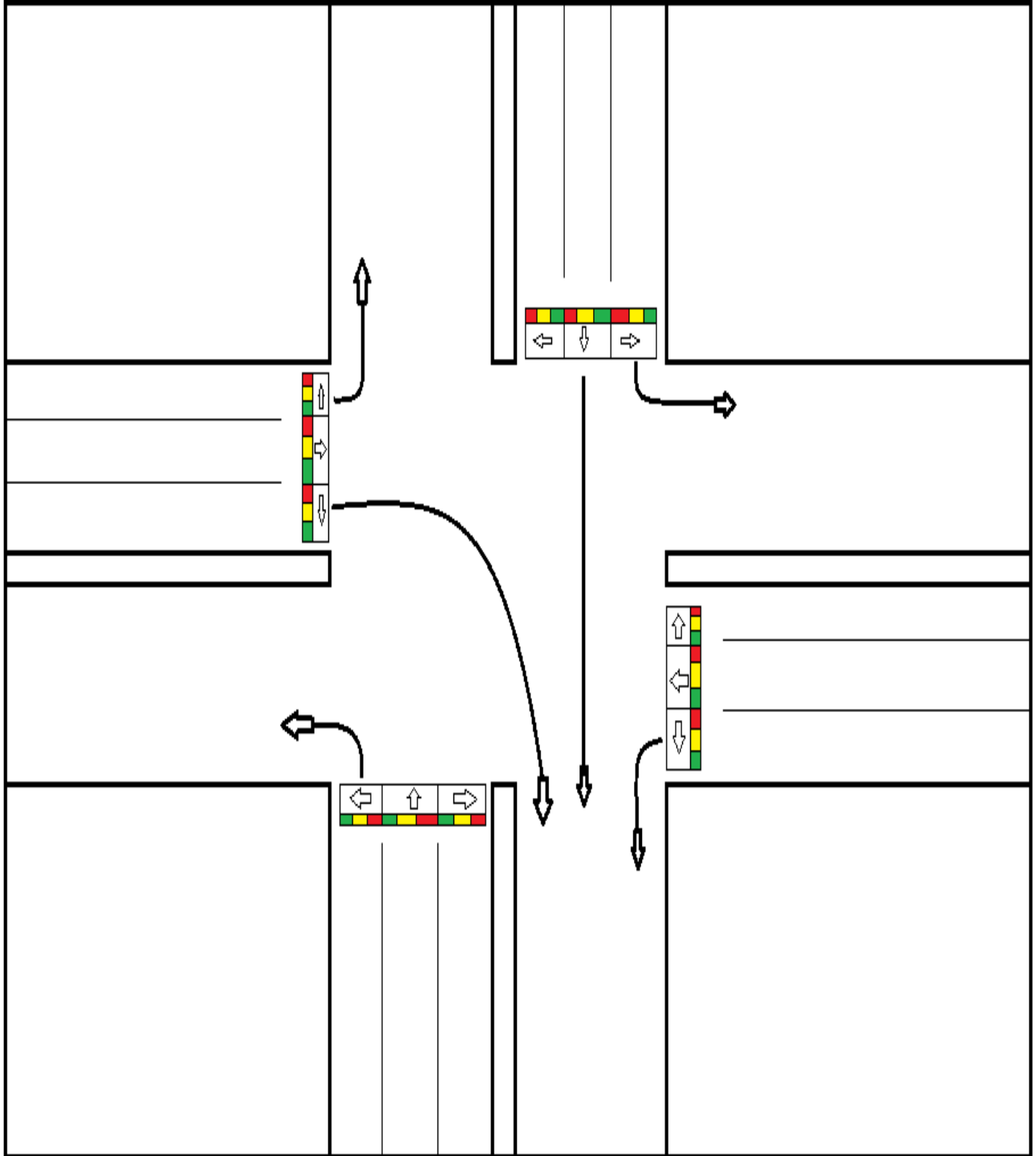
Phase B=0.20*136/0.83=32.77 sec

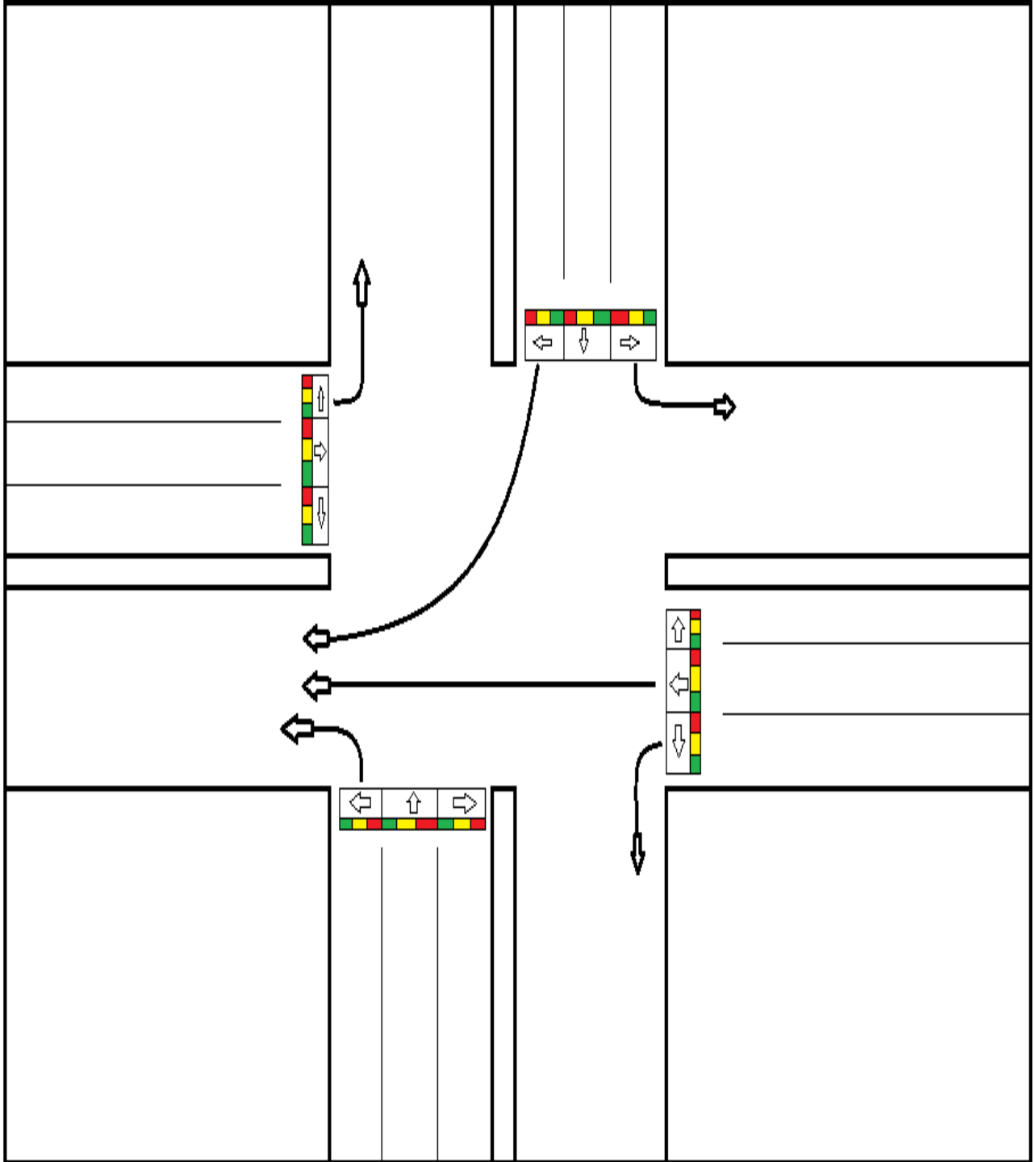
Phase C=0.19*136/0.83=31.13 sec

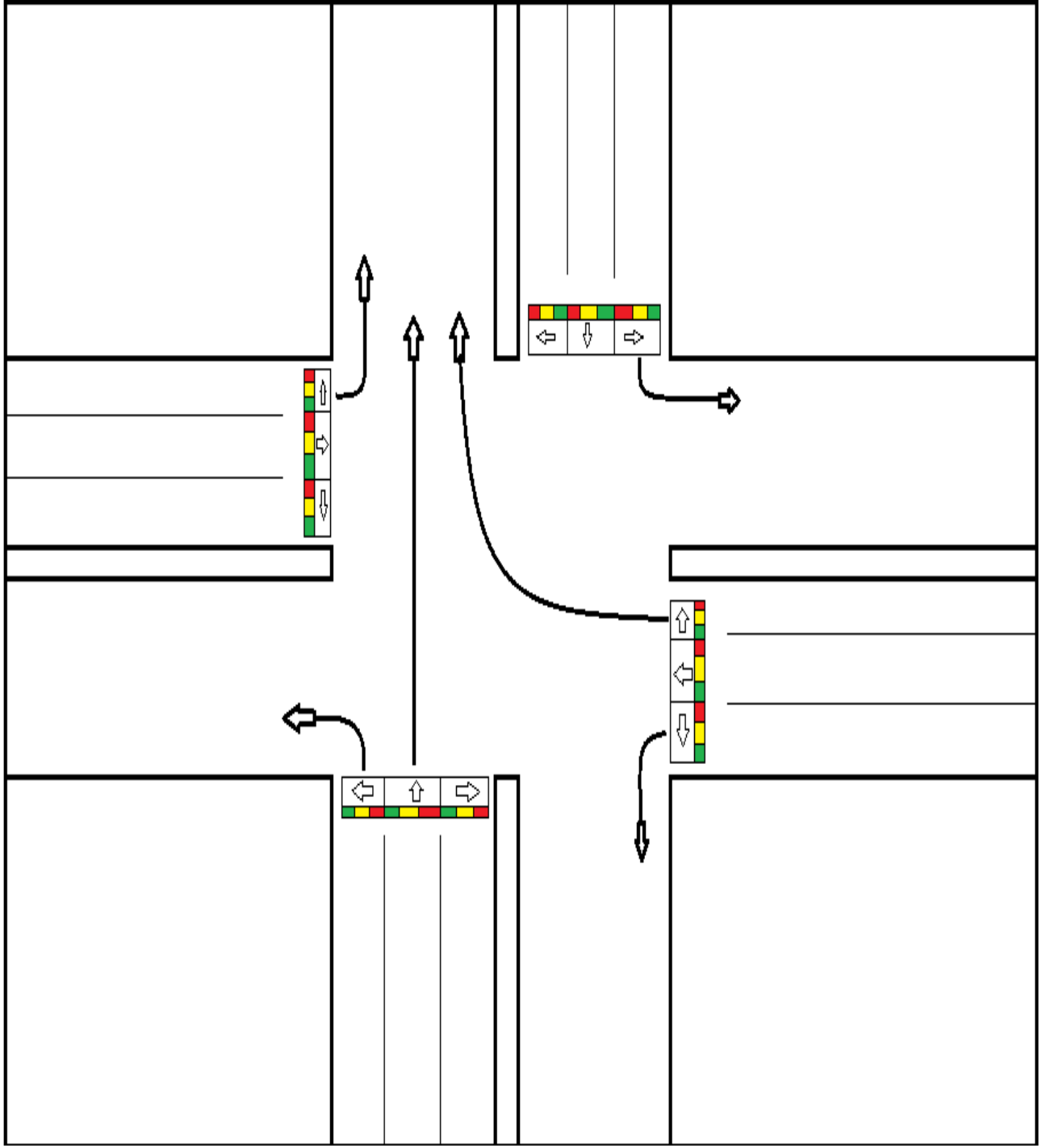
Phase D=0.21*136/0.83=34.40 sec

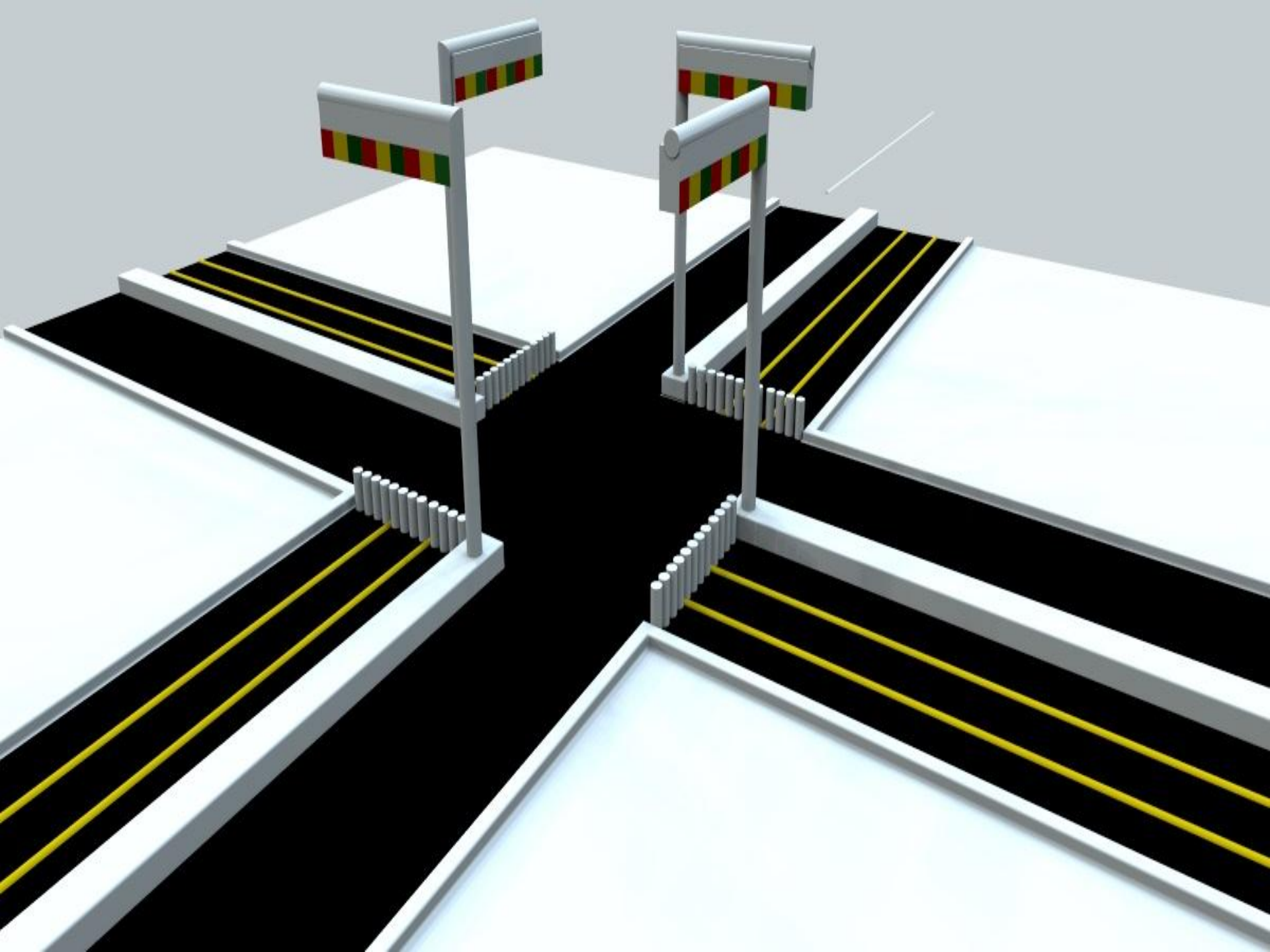
LAYOUT OF INTERSECTION











Hydraulic Actuators

- Hydraulic Actuators, as used in industrial process control, employ hydraulic pressure to drive an output member. These are used where high speed and large forces are required. The fluid used in hydraulic actuator is highly incompressible so that pressure applied can be transmitted instantaneously to the member attached to it.

- Principle Used in Hydraulic Actuator System Pascal's Law Pressure applied to a confined fluid at any point is transmitted undiminished and equally throughout the fluid in all directions and acts upon every par to of the confining vessel at right angles disinter or surfaces.

DESIGN OF HYDRAULIC ACTUATORS

$$AREA = \pi r^2 = \pi\left(6*10^{-2}\right)^2 = 0.0113 m^2$$

$$PRESSURE = \frac{FORCE}{AREA} = \frac{30*9.81}{0.0113} = 2.60*10^4 \frac{N}{m^2}$$

$$FLOW - RATE = \frac{12*60*VELOCITY*AREA}{231} = \frac{12*60*4*0.0113}{231} = 14.23\frac{m^3}{\text{sec}}$$

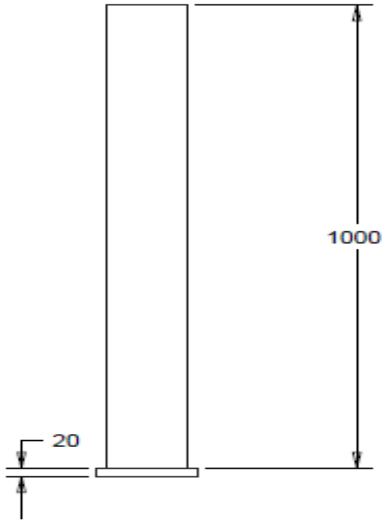
$$VOLUME = \frac{AREA*STROKE}{231} = \frac{0.0113*1}{231} = 4.89*10^{-5} m^3$$

$$F.M.TORQUE = \frac{Q*P*36.77}{n} = \frac{14.23*2.60*10^4*36.77}{1.12*10^6} = 12.14\frac{Nm}{\text{sec}}$$

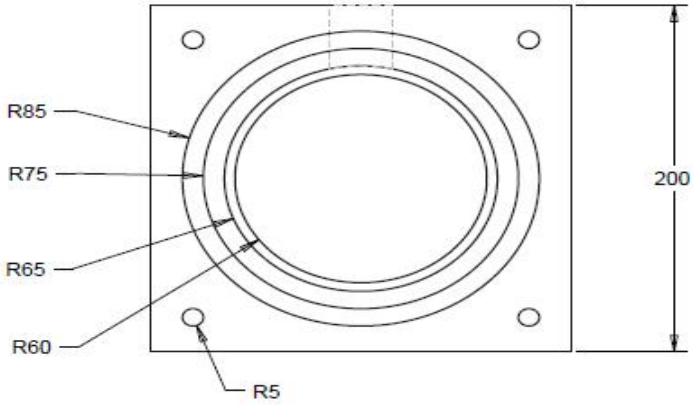
$$F.M.SPEED = \frac{231*Q}{DISPLACE-VOLUME} = \frac{231*14.23}{4.89*10^{-5}*60} = 1.12*10^6 rps$$

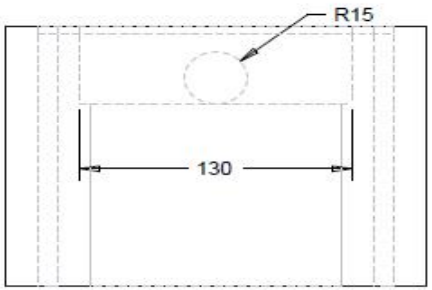
$$F.M.POWER = \frac{T*n}{63025} = \frac{12.14*1.12*10^6}{63025} = 215.85\frac{Nm}{\text{sec}} = 215.85\frac{J}{\text{sec}}$$

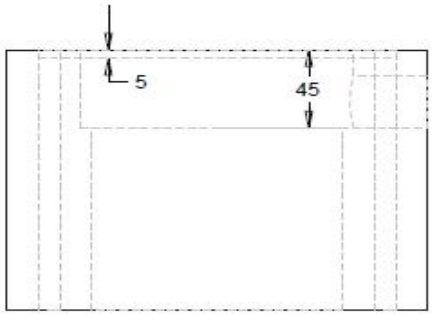
PISTON



Rod End Port







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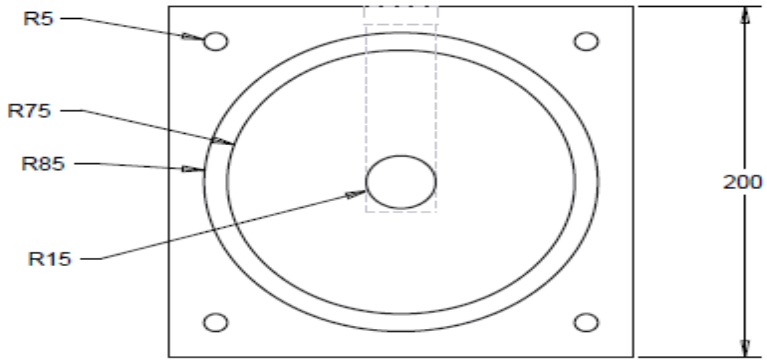
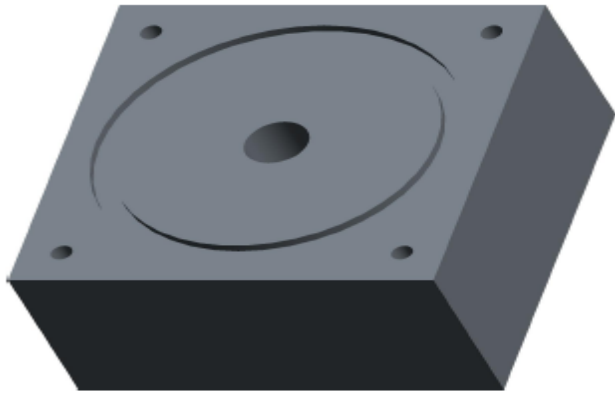
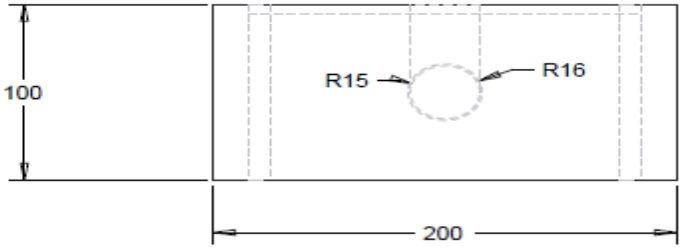
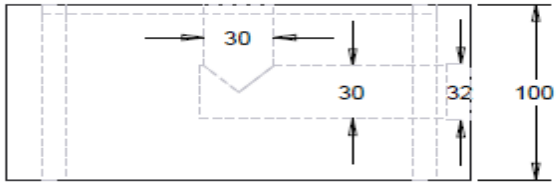
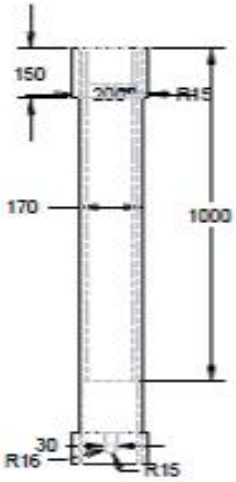




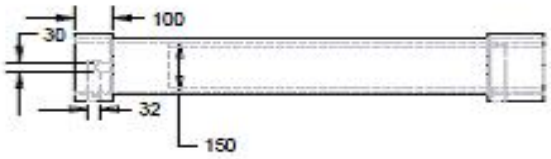






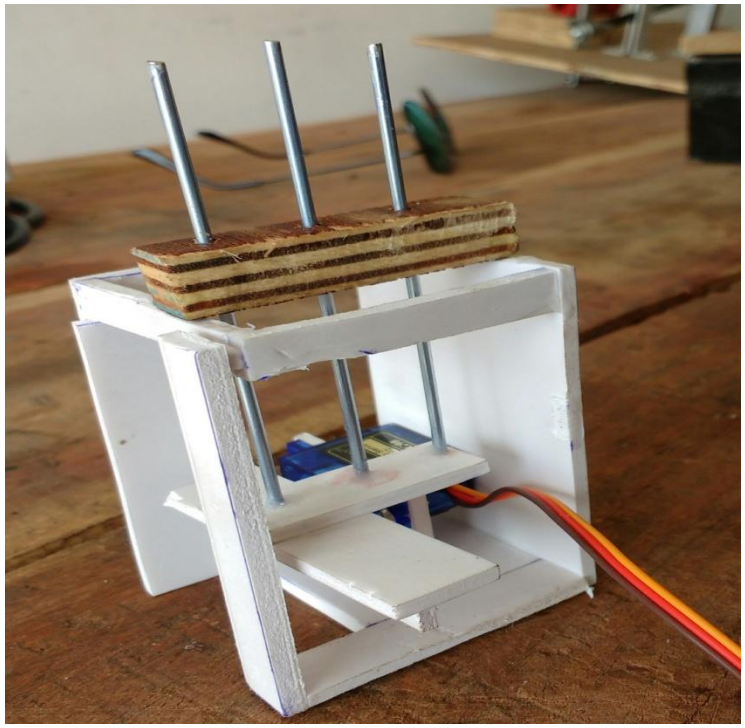
SCALE 0.100

SCALE 0.190



Working Model

- To lift the hydraulic actuators as per the signal timing for respective lane a mechanism prepared with the help of servo motor.



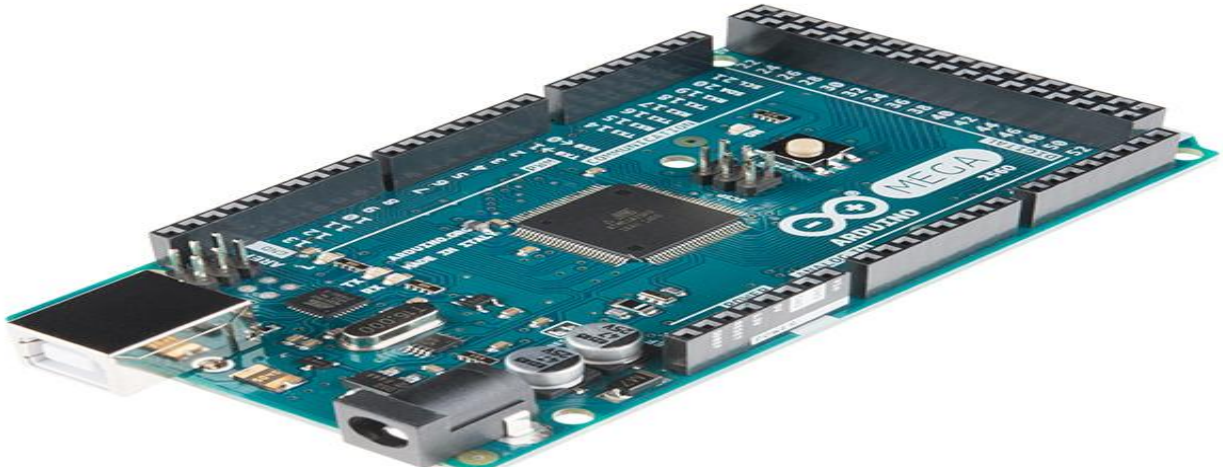
Servo Motor

- A servomotor is a closed-loop servomechanism that uses position feedback to control its motion and final position. The input to its control is some signal, either analogue or digital, representing the position commanded for the output shaft.

Conti..

- Motor works to lift the hydraulic actuators on different lanes as timing set in the program . for green and red timing on different lanes a program is written on arduino software.

Micro Controller



- We are using such type of controller that is Adriano controller in our model work

- **Features:**
- ATmega2560 microcontroller
- Input voltage - 7-12V
- 54 Digital I/O Pins (14 PWM outputs)
- 16 Analog Inputs
- 256k Flash Memory
- 16Mhz Clock Speed

Conclusion

- In this study traffic volume flow diagram is prepared by survey to know the peak hour and non-peak hours of a day. Webster method is used to design the four phase traffic signal design. After computation of Green, Red, Yellow amber time for different approaches .A algorithm is written for the working of hydraulic actuators as per signal time design. A working model is designed to reflect the real life situation for traffic flow on different approaches. Hydraulic actuators can be useful for strictly control of the traffic rules. Therefore the designed project will be helpful at the intersections where frequent accidents occur.

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Working plan

June 2015	July 2015	August 2015	Sept 2015-Mar 2016	Apr 2016	May 2016
Topic selection	Literature review	Manual traffic survey Signal cycle design	Computerized programme of signal design	Connectivity of hydraulic actuator with process of algorithm	Result Conclusion

Thank you