ASSESSMENT OF THE CAUSES OF TRAFFIC CONGESTION IN GUSAU, ZAMFARA STATE, NIGERIA

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ABSTRACT

This study assessed the causes of traffic congestion in Gusau, Zamfara State, Nigeria with a view to suggesting solutions to help government and policy makers towards better cost- effective management of the problem as traffic congestion leads to loss of time and several economic and social losses if not mitigated. The method of data collection employed for the study was through traffic count and manual observation of the land use pattern as well as the functionality of the road complimentary facilities along the study route. The study revealed that the highest cause of traffic congestion was found to be too many buses/taxis with 205(30.06%) in 2020 while the least cause of traffic congestion was found to be ongoing construction activities with 3 (6.52%) in 2018. Meanwhile, the vehicular traffic at peak hour was highest on Friday between 08:00 to 09:00 with 5619 (25.63%) while the least peak hour vehicular traffic was recorded on Wednesday between 07:00 to 08:00 with 3680 (24.86%) at the outflow direction. At the inflow direction, vehicular traffic at peak hour was highest on Friday between 09:00 to 10:00 with 5393 (24.60%) while the least peak hour vehicular traffic was recorded on Wednesday between 08:00 to 09:00 with 3906 (25.14%). The study recommended that Public transport schemes made up of large buses should be provided in Gusau, the Zaria Road end of the study route should be dualized and temporary structures along the study route that are within the right of way should be removed so that they do not contribute to traffic congestion.

Keywords – Traffic Congestion, Transport Demand, Transport Supply

1.0 Introduction

Transportation and property are important in physical and economic development of towns and cities all over the world. Property and land values tend to increase in areas with expanding transportation networks, and increase less rapidly in areas without such improvements. Rapid and continued rise in housing and land prices are expected in cities with transportation improvements and rapid economic and population growth (Yang *et al*., 2020).

Transport plays a crucial role in urban development by providing people with access to education, markets, employment, recreation, health care and other key services, especially in cities of the developing world. Enhanced mobility for the poor and vulnerable groups is one of the most important preconditions for achieving Millennium Development Goals (MDGs) (Filho *et al*., 2019). Nigeria is one of the countries in the developing world with rapid urbanization and fast-growing cities. A study of the changing morphology of many Nigerian cities gives an insight into the evolution of urban transport problems in Nigeria. Most of the scholars who have worked on urban transport problems in Nigeria have identified congestion as the most serious (Okeke *et al*., 2021).

While transport enables the economy to grow, if not well-managed, it can also retard growth and the efficient delivery of essential social services. Establishing a sustainable urban transport system requires a comprehensive and integrated approach to policy making and decision making, with the aim of developing affordable, economically viable, people-oriented and environment-friendly transport systems. Urban transport contributes to a better quality of life for all by offering safe, affordable, accessible, and attractive travel that satisfies the mobility needs of the community and supports the economic development of cities (Scorza and Fortunato, 2021).

Road networks are observed in terms of its components of accessibility, connectivity, traffic density, level of service, compactness, and density of particular roads. Level of service is a measure by which the quality of service on transportation devices or infrastructure is determined, and it is a holistic approach considering several factors regarded as measures of traffic density and congestion rather than overall speed of the journey. Traffic congestion occurs when the demand for road space exceeds the road capacity. This situation caused by rapid growth in the motorization and with less than corresponding improvement in the road network, traffic management techniques and related transport facilities. Thus, traffic congestion is a phenomenon that is associated with urban environment all over the world (Koźlak and Wach, 2018).

Improved urban transport, particularly public transport is expected to result in increased mobility of the masses, reduce congestion by reducing the number of vehicles on the road as well as provides the most efficient means of moving large number of people especially in densely populated urban centres. The increase in commuting distance has impact on trip attraction, fares paid by commuters and traffic build-up in some land use areas. It also shows the need for different modes of transportation. Thus, a number of factors have been found to influence trip generation, attraction and distribution in urban environments (Calvo *et al*., 2019).

Traffic and transport policies differ greatly from city to city, from country to

country, as do the travel patterns of the people in these cities and countries. This is well explained by the differences in the social, political, economic as well as the cultural context. Mobility and accessibility provided by the transport system have been playing a major role in shaping countries, influencing the location of social and economic activity, the form and size of cities, and the style and pace of life by facilitating trade, permitting access to people and resources, and enabling greater economies of scale, worldwide and throughout history (Abdullah *et al*., 2021).

Urban traffic congestion must be understood in the wider context of city dynamics and agglomeration benefits. Traffic congestion in urban areas is often the outcome of successful urban economic development, employment; housing and cultural policies that make people want to live and work relatively close to each other and attract firms to benefit from the gains in productivity thus derived. There are many indications that, even though they may not be thrilled by the prospect, urban road users are prepared to live with crowded roads so long as they derive other benefits from living and working in their cities (Volgmann and Münter, 2022).

2.0 Problem Statement

Gusau is a typical example in the history of growth and development of cities in Nigeria. The city became capital of Zamfara State in 1996 and as such, commercial activities like banking, retail/wholesale businesses, and professional services congregated to take advantage of nearness to seat of governance. Concentration of activities attracted consumers and ancillary service providers. However, traffic congestion was triggered at an alarming rate. Yariman Bakura Specialist Hospital intersection to FCET Gusau Gym (Zaria Road) is a route that leads to some part of Katsina State, Kano State, Kaduna state, Niger state, Abuja, etc. The route is always experiencing heavy traffic volume during morning and evening peak periods which culminates in travel delays and longer commuting time. This phenomenon also affects the socio-economic development and well-being of the people. However, no research of this nature has been conducted on this route which is why the researcher has opted to carry out this research.

3.0 Literature Review

3.1 Traffic Congestion

Congestion can be perceived as unavoidable consequences of scarce transport facilities such as road space, parking area, road signals and effective traffic management. Urban congestion mainly concerns two domains of circulation, passengers and freight which share the same infrastructure. Thus, traffic congestion condition on road networks occurs as a result of excessive use of road infrastructure beyond capacity, and it is characterized by slower speeds, longer trip hours and increased vehicular queuing. Congestion in urban areas is dominantly caused by commuting patterns and little by truck movement. This mean that traffic congestion is caused due to rise in population densities, road incidents and broken vehicles on the roads which restrict capacity of roads and impair smooth traffic flows (Abdul *et al*., 2020).

According to Roy *et al*. (2020), another contributing factor to congestion is increasing wealth and high population as well as availability of vehicle loan facilities culminating in more car ownership than current transportation network can handle. It could be inferred from the above statement that there is a relationship between income level and car ownership

and that the dominance of private car usage, particularly within cities, is likely to increase even further as a result of rise in household income with its attendant traffic congestion and high consumption of fuel.

3.2 Transport Demand and Urban Congestion

The demand for transport is a derived demand; an economic term, which refers to demand for one good or service in one sector occurring as a result of demand from another. Users of transport are primarily consuming the service not because of its direct benefits, but because they wish to access other services. Transport demand is about the movement of people and goods and in order to satisfy a need (work, education, recreation etc) which is part of the overall economic activity. Similar to transport supply, it is expressed in terms of number of people, volume, or tons per unit of time and distance (Mourad *et al*., 2019).

Transport can also be perceived as an induced or latent demand, that is a demand response to the addition of transport infrastructure culminating in traffic volume increases. For example, work-related activities commonly involve commuting between the place of residence and the workplace. There is a supply of work in one location (residence) and a demand of labour in another (workplace); transport (commuting) being directly derived from this relationship, hence a derived demand. Although the essence of this demand is the mobilization of persons or things. It also has a traffic dimension in terms of volumes of vehicles moving along the public roadways to carry out these objectives. The aforementioned concentrations of trips in the morning and afternoon generate an increase in the volume of traffic, known as peak times or rush hour, which translates into congestion on different streets and during different periods (Pojani and Stead, 2018).

Urban transport demand tends to be expressed at specific times that are related to economic and social activity patterns. In many cases, urban transport demand is stable and recurrent, which allows a good approximation in planning services. In other cases, transport demand is unstable and uncertain, which makes it difficult to offer an adequate level of service. For instance, commuting is a recurring and predictable pattern of movements, while emergency response vehicles such as ambulances are dealing with an unpredictable demand that can be expressed as a probability (Liu *et al*., 2020).

3.3 Transport Supply and Urban Congestion

Transport supply is the capacity of specific transportation infrastructures and modes over a time period. Transport demands are mobility needs for the same time period, even if they are only partially satisfied. Transport supply entails the capacity of transportation infrastructures and modes, generally over a geographically defined transport system and for a specific period of time. Supply is expressed in terms of infrastructures (capacity), services (frequency) and networks (coverage). Capacity is often assessed in static and dynamic terms where static capacity represents the amount of space available for transport (e.g. terminal surface) and dynamic capacity is the improvement that can be made through better technology and management. The number of passengers, volume (for liquids or containerized traffic), or mass (for freight) that can be transported per unit of time and space is commonly used to quantify transport supply (Wen *et al*., 2018).

Urban transport supply tends to be categorized according to its capacity, that is, the number of persons who can be transported in a given period of time. Just from the infrastructure standpoint, capacity is usually measured as the number of vehicles that can circulate in a given area in a certain period of time; this parameter is meaningful when analysing congestion, but it should not be forgotten that what really matters in a city is allowing people to move around satisfactorily (Acciaro *et al*., 2020).

3.4 Causes of Traffic Congestion

Traffic congestion occurs when a volume of traffic or modal split generates demand for space greater than the available street capacity; this point is commonly termed saturation. There are a number of specific circumstances which can cause or aggravate congestion; most of them reduce the capacity of a road at a given point or over a certain length, or increase the number of vehicles required for a given volume of people or goods. There are principally two factors causing traffic congestion, namely micro-level factors, including the high number of people on the roads at the same time, and the overflow of vehicles on the limited road space; and macro-level factors, such as land use patterns, car ownership trends, and geographical economic development. Congestion is prompted at the micro-level, and steered at the macro-level (Tilak and Reddy, 2016).

Some of the factors causing traffic congestion are **e**xcessive number of vehicles in the city, population increase, inefficient public transport service, inefficient roads and streets management, poor roadway condition, urbanization and unforeseen circumstances. The negative effects of traffic congestion include time wasting of motorists and passengers (opportunity cost). As a non-productive activity for most people, congestion reduces regional economic health. Congestion causes delays, which may result in late arrival for employment, meetings, and education, resulting in lost business, disciplinary action or other personal losses as well as inability to forecast travel time accurately, leading to drivers allocating more time to travel "just in case", and less time on productive activities (Mallah *et al*., 2020).

Congestion culminates in wasted fuel thereby increasing air pollution and carbon dioxide emissions owing to increased idling, acceleration and braking; wear and tear on vehicles as a result of idling in traffic and frequent acceleration and braking, leading to more frequent repairs and replacements; stressed and frustrated motorists, encouraging road rage and reduced health of motorists. In emergency situations, blocked traffic may interfere with the passage of emergency vehicles traveling to their destinations where they are urgently needed (Małecki *et al*., 2022).

4.0 Study Area and Methodology

4.1 Study Area

This study was carried out in Gusau, the capital of Zamfara State located at Latitude 12°9'46.25"N and Longitude 6°40'28.22"E respectively. Based on National Population Commission (2006), the state ranked 21st in terms of population in Nigeria. Gusau is 155.9 kilometres South-West of Maradi in Niger Republic, 49 Km North-West of Kaura Namoda, Zamfara State, 79.7 Km North-West of Talata Mafara, 82 Km North-West of Moriki, in Zamfara State and 99.8 Km South East of Funtua, Katsina State. Gusau metropolis is associated with road traffic congestion especially in Funtua, Zaria

Road at Yariman Bakura Specialist Hospital intersection to FCET Gusau Gym (Zaria Road) which is a route that cuts across Katsina State, Kebbi State, Sokoto State and some Local Government Areas in Zamfara state. The route also leads to some part of Kastina State, Kano state, Kaduna State, Niger State and the Federal Capital Territory, Abuja. The route is always busy with traffic moving to and from these places. Also, the strategic nature of the route and its nearness to the seat of government attracts a lot of activities which culminates in the land use pattern present in Gusau.

4.2 Study Design

Documents from Federal Road Safety Corps (FRSC) were collected with regards to causes, effects and remedies to vehicular congestion along the study route. However, a traffic count form was utilised to collect data on the traffic volume and daily peak periods. Also, special forms were utilised to collect data on the land use pattern and functionality of the road complimentary facilities along the study route as well as the travel time at peak and off-peak periods along the study route within a week. The researcher utilized a week because it is made up of all the days and was satisfactory for the collection of unbiased data. The responses were analysed using descriptive statistics to provide information on the distribution of data collected by means of frequency tables, bar charts and graphs where applicable.

5.0 Results and Discussions

5.1 Causes of Traffic Congestion

Data gleaned from the Federal Road Safety Corps (FRSC) documents for a four (4) years period ranging from 2018 to 2021 and presented in figure 1 revealed the various causes of traffic congestion from poor driving habits to lack of overhead bridges/fly-overs. The highest cause of traffic congestion was found to be too many buses/taxis with 205 (30.06%) in 2020 followed by the same reason with 167 (24.49%) in 2018 while the least cause of traffic congestion was found to be ongoing construction activities with 3 in 2018 (6.52%) followed by the same reason with 7 (15.22%) in 2019. The total of the variables revealed that too many buses/taxis with 682 (10.64%) was the highest cause of traffic congestion in Gusau Metropolis followed by lack of overhead bridges/flyovers with 498 (7.77%) and inadequate road capacity with 456 (7.11%) while the least was construction activities with 46 (0.72%) followed by poor road network with 82 (1.28%) and poor road pavement with 89 (1.39%). The annual total of the causes of traffic congestion in Gusau Metropolis revealed that 2019 with 1750 (27.30%) was the highest followed by 2020 with 1693 (26.41%) while the least was 2021 with 1405 (21.92%) followed by 2018 with 1563 (24.38%). The total causes of traffic congestion from 2018 to 2021 was found to be 6411 (100%).

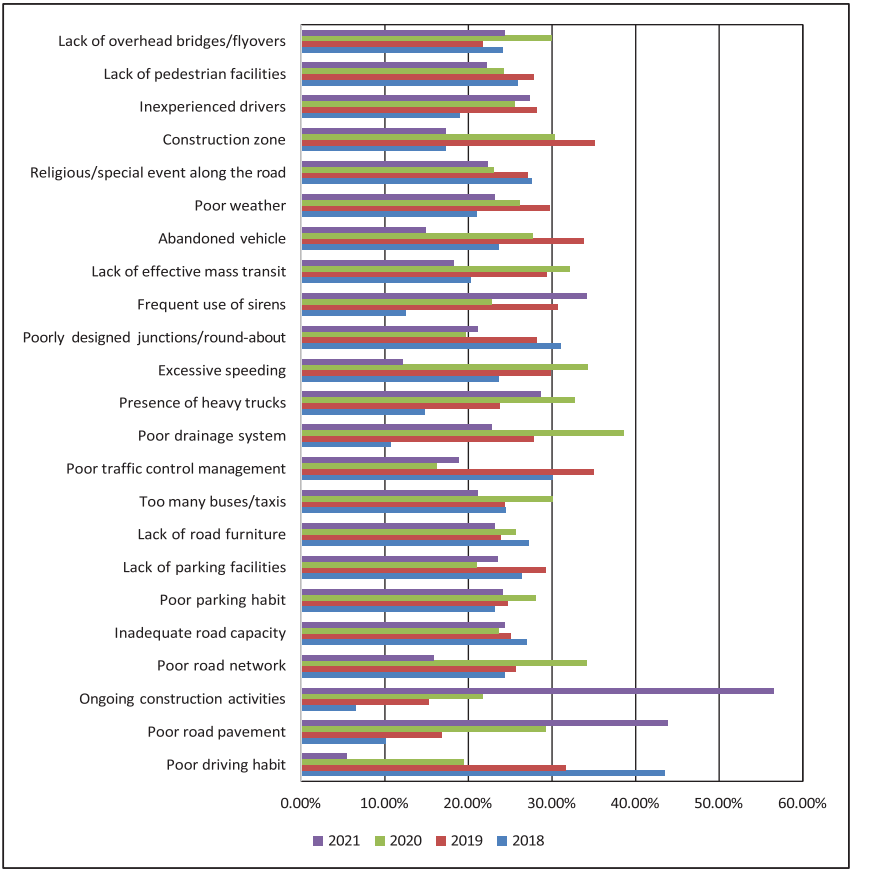

Figure 1: Causes of Traffic Congestion in Gusau

5.2 Effects of Traffic Congestion

From table 1, it was observed from FRSC documents for a four (4) years period ranging from 2018 to 2021 that the effects of traffic congestion in Gusau metropolis ranges from waste of time to global warming. The highest effect of traffic congestion was found to be waste of time with 192 (17.01%) in 2018 followed by the same reason with 163 (16.24%) in 2019 while the least effect of traffic congestion was found to be night driving with 2 (0.24%) in 2021 followed by the same reason with 5 (0.53%) in 2020. The total of the variables revealed that waste of time with 606 (15.52%) was the highest effect of traffic congestion in Gusau Metropolis followed by stress with 513 (13.14%) while the least was night driving with 36 (0.92%) followed by query at work with 103 (2.64%). The annual total of the effects of traffic congestion in Gusau Metropolis revealed that 2018 with 1129 (28.92%) was the highest followed by 2019 with 1004 (25.72%) while the least was 2021

with 836 (21.41%) followed by 2020 with 935 (23.95%). The total effects of traffic congestion from 2018 to 2021 was found to be 3904 (100%).

Table 1: Effects of Traffic Congestion in Gusau

S/N	Causes	2018	2019	2020	2021	Total	Percentage
1.	Waste of time	192	163	121	130	**606**	**15.52%**
2.	Inability to forecast travel time	112	102	129	110	**453**	**11.60%**
3.	Fuel consumption	102	93	84	72	**351**	**8.99%**
4.	Stress	158	120	140	95	**513**	**13.14%**
5.	Spill-over effect	88	90	67	72	**317**	**8.12%**
6.	Pollution	114	106	120	102	**442**	**11.32%**
7.	Delayed movement	98	76	60	52	**286**	**7.33%**
8.	Road rage	50	35	38	26	**149**	**3.82%**
9.	Accident	12	15	25	16	**68**	**1.74%**
10.	Query at work	32	20	39	12	**103**	**2.64%**
11.	Night driving	15	14	5	2	**36**	**0.92%**
12.	Road wear	70	90	49	52	**261**	**6.69%**
13.	Global warming	86	80	58	95	**319**	**8.17%**
Total		**1129**	**1004**	**935**	**836**	**3904**	
Percentage		**28.92%**	**25.72%**	**23.95%**	**21.41%**		**100%**

Fig: Remedies to Traffic Congestion

Figure 2 shows the remedies to traffic congestion in Gusau metropolis based on data collected from the Federal Road Safety Corps ranging from 2018 to 2021. The highest remedy to traffic congestion was found to be rehabilitation of all roads needing attention with 228 (18.37%) in 2020 followed by construction of proper drainages with 173 (12.21%) in 2018 while the least effect of traffic congestion was found to be removal of motorcycles and tricycles on the road with 0 (0.00%) in 2021 followed by the same reason with 2 (0.16%) in 2020. The total of the variables revealed that rehabilitation of all roads needing attention with 588 (11.88%) was the highest effect of traffic congestion in Gusau Metropolis followed by construction of proper drainages with 548 (11.08%) while the least was removal of motorcycles and tricycles on the road with 11 (0.22%) followed by ban on all forms of trading/hawking with 56 (1.13%). The annual total of the effects of traffic congestion in Gusau Metropolis revealed that 2018 with 1417 (28.64%) was the highest followed by 2019 with 1303 (26.33%) while the least was 2021 with 987 (19.95%) followed by 2020 with 1241 (25.08%). The total effects of traffic congestion from 2018 to 2021 was found to be 4948 (100%).

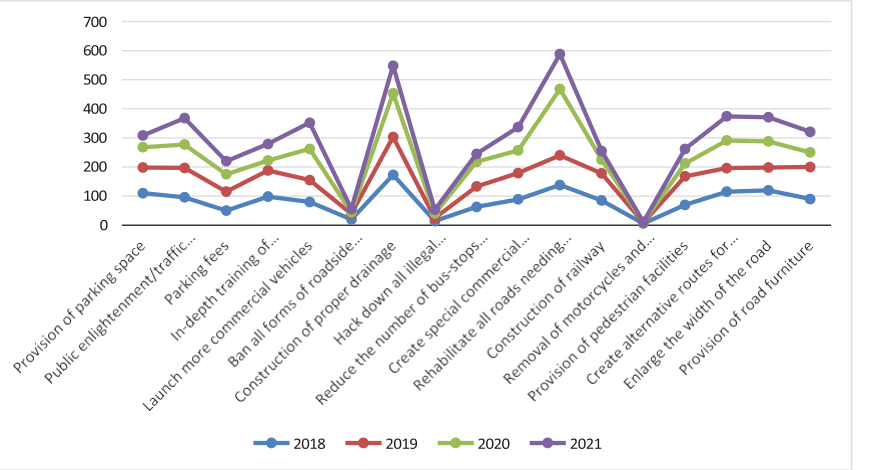

Figure 2: Remedies to Traffic Congestion in Gusau

5.3 Volume of Vehicular Traffic Flow

Table 3 shows the volume of vehicular traffic flow at peak hour from Monday to Friday. From the result of the traffic count, the peak hours were identified and the volume of the vehicular traffic was recorded in the mornings and in the evenings. It was observed that within the week, vehicular traffic at peak hour was highest on Friday between 08:00 to 09:00 with 5619 (25.63%) followed by Friday between 16:00 to 17:00 with 5567 (25.40%) and Tuesday between 15:00 to 16:00 with 4996 (24.54%) while the least peak hour vehicular traffic was recorded on Wednesday between 07:00 to 08:00 with 3680 (24.86%) at the outflow direction. At the inflow direction, vehicular traffic at peak hour was highest on Friday between 09:00 to 10:00 with 5393 (24.60%) followed by Friday between 16:00 to 17:00 with 5341 (24.37%) and Tuesday between 15:00 to 16:00 with 5222 (25.65%) while the least peak hour vehicular traffic was recorded on Wednesday between 08:00 to 09:00 with 3906 (25.14%). This depicts that there is no significant difference between traffic flow volume at the inflow direction and at the outflow direction.

Table 2: Volume of Vehicular Traffic Flow at Peak Hour

S/N	Variable	Outflow	Inflow
1.	**Monday**		
	AM Peak Time	07:00 – 08:00	08:00 – 09:00
	AM Peak Volume	4044 (24.24%)	4270 (25.60%)
	PM Peak Time	16:00 – 17:00	14:00 – 15:00
	PM Peak Volume	4070 (24.40%)	4297 (25.76%)
2.	**Tuesday**		
	AM Peak Time	07:00 – 08:00	08:00 – 09:00
	AM Peak Volume	4959 (24.35%)	5185 (25.46%)
	PM Peak Time	15:00 – 16:00	15:00 – 16:00
	PM Peak Volume	4996 (24.54%)	5222 (25.65%)
3.	**Wednesday**		
	AM Peak Time	07:00 – 08:00	08:00 – 09:00
	AM Peak Volume	3680 (23.69%)	3906 (25.14%)
	PM Peak Time	15:00 – 16:00	15:00 – 16:00
	PM Peak Volume	3861 (24.86%)	4087 (26.31%)
4.	**Thursday**		
	AM Peak Time	08:00 – 09:00	08:00 – 09:00
	AM Peak Volume	5419 (25.58%)	5193 (24.51%)
	PM Peak Time	16:00 – 17:00	16:00 – 17:00
	PM Peak Volume	5401 (25.49%)	5175 (24.42%)
5.	**Friday**		
	AM Peak Time	08:00 – 09:00	09:00 – 10:00
	AM Peak Volume	5619 (25.63%)	5393 (24.60%)
	PM Peak Time	16:00 – 17:00	16:00 – 17:00
	PM Peak Volume	5567 (25.40%)	5341 (24.37%)
6.	**Saturday**		
	AM Peak Time	7:39 – 8:38	08:00 – 09:00
	AM Peak Volume	4479 (24.09%)	4705 (25.31%)
	PM Peak Time	15:00 – 16:00	15:00 – 16:00
	PM Peak Volume	4591 (24.69%)	4817 (25.91%)
7.	**Sunday**		
	AM Peak Time	8:17 – 9:16	8:48 – 9:47
	AM Peak Volume	3807 (24.11%)	4033 (27.39%)
	PM Peak Time	16:30 – 17:29	16:44 – 17:43
	PM Peak Volume	3829 (26.01%)	4055 (27.54%)

5.4 Travel Time

The travel time was recorded in the course of the study for the peak periods and the off-peak periods. Popular landmarks which depicts bus stops for commuters that ply the study route were used as stop and start points. Also, the ride was done in a private vehicle and it was repeated in a

commercial vehicle so that the difference in travel time between commuting in a private vehicle and a commercial vehicle can be ascertained as well as the time lost due to traffic congestion. It was observed that it took 1 hour 50 mins to commute through the study route in a private vehicle during the peak period and it took 41mins 55 secs to make the same journey in the off-peak period culminating in a loss of 1 hour 35 secs. Meanwhile, in a commercial vehicle, it took 3 hours 33 mins and 5 secs to make the same journey in the peak period and 59mins 21 secs for the same journey in the off-peak period which culminated in a loss of 2 hours 6 mins and 44 secs. Understandably, this phenomenon could be due to public vehicles stopping and picking passengers along the route.

Table 3: Travel Time of Private Vehicle at Peak and Off-Peak Periods

S/N	Location (Axes)	Peak Period	Off-Peak Period	Time Loss
1.	Ahmad Sani Yarima Bukura Specialist Hospital – Ten O Seven Bakery and Restaurant	30 mins 02 secs	16 mins 30 secs	14 mins 12 secs
2.	Ten O Seven Bakery and Restaurant – Samaru Primary School, Gusau	10 mins 28 secs	03 mins 13 secs	7 mins 15secs
3.	Samaru Primary School, Gusau – Prince International School	22 mins 15 secs	10 mins 20 secs	12 mins 35 secs
4.	Prince International School – Masjid Bilal	17 mins 13 secs	5 mins 22 secs	12 mins 31 secs
5.	Masjid Bilal – FCET Gym	20 mins 32 secs	6 mins 30 secs	14 mins 02 secs

From table 3 above, the travel time for private vehicles at the peak and off-peak hour was recorded and it was observed that due to traffic congestion a lot of time was lost on the road. The highest time loss was recorded between Prince International School – Masjid Bilal and between Masjid Bilal – FCET Gym where it took more than three (3) times the actual time it would take for the journey to be completed in the off-peak period. The least time loss due to traffic congestion was recorded between Ahmad Sani Yarima Bukura Specialist Hospital – Ten O Seven Bakery and Restaurant where it took almost two (2) times the actual time it

Table 4: Travel Time of Commercial Vehicle at Peak and Off-Peak Periods

S/N	Location (Axes)	Peak Period	Off-Peak Period	Time Loss
1.	Ahmad Sani Yarima Bukura Specialist Hospital – Ten O Seven Bakery and Restaurant	55 mins 16 secs	10 mins 03 secs	45 mins 13 secs
2.	Ten O Seven Bakery and Restaurant – Samaru Primary School, Gusau	45 mins 26 secs	27 mins 10 secs	18 mins 16secs
3.	Samaru Primary School, Gusau – Prince International School	30 mins 40 secs	10 mins 22 secs	25 mins 18 secs
4.	Prince International School – Masjid Bilal	43 mins 44 secs	5 mins 17 secs	15 mins 27 secs
5.	Masjid Bilal – FCET Gym	37 mins 59 secs	6 mins 29 secs	22 mins 30 secs

From table 4 above, the travel time for public vehicles at the peak and off-peak hour was recorded and it was observed that due to traffic congestion a lot of time was lost on the road. The highest time loss was recorded between Prince International School – Masjid Bilal where it took more than eight (8) times the actual time it would take for the journey to be completed in the off-peak period followed by Ahmad Sani Yarima Bukura Specialist Hospital – Ten O Seven Bakery and Restaurant where it took more than five (5) times the actual time it would take for the journey to be completed in the off-peak period. The least time loss due to traffic congestion was recorded between Ten O Seven Bakery and Restaurant – Samaru Primary School, Gusau where it took almost two (2) times the actual time it would take for the journey to be completed in the off-peak period.

5.5 Land Use Pattern

From table 5, the land use pattern along the study route was recorded and it depicted that the study route has a combination of temporary and permanent structures. Most of the permanent structures are well positioned since a lot of them are banks and government structures as well as corporate structures. It was observed that apart from a few, most of them are not within the right of way. However, the temporary structures are mostly within the right of way and contribute to traffic congestion.

Table 5: Land Use Pattern Along the Study Route

S/N	Inflow					Outflow			
	Distance (KM)	Location Name	Purpose	Nature		Distance (KM)	Location Name	Purpose	Nature
1.	0.2	Jagz soft drinks	Commercial	Permanent		0.2	Local tea shop	Commercial	Temporary
2.	0.2	Momo agent	Commercial	Temporary		0.5	Nissak cyber café	Commercial	Permanent
3.	0.7	First monie agent	Commercial	Temporary		0.9	Doctors quarters	Residential	Permanent
4.	0.9	Sterling bank	Commercial	Permanent		1.1	UBA	Commercial	Permanent
5.	1.4	Bilkebab chips N Coffee	Commercial	Permanent		1.4	Suya spot	Commercial	Temporary
6.	1.6	Fed. character commission	Institutional	Permanent		1.8	Zamfara state library board	Institutional	Permanent
7.	2.1	Anasty shopping mall	Commercial	Permanent		2.3	First monie agent	Commercial	Temporary
8.	2.5	Block industry	Commercial	Temporary		2.7	Babagidu livestock farm	Agricultural	Permanent
9.	3.0	Samaru primary school	Academical	Permanent		3.2	Ithanks interior	Commercial	Permanent
10.	3.2	Global links clothing store	Commercial	Permanent		3.2	Car wash	Commercial	Temporary
11.	3.4	Tailoring design	Commercial	Permanent		3.6	Gas station	Commercial	Permanent
12.	3.9	Vulcanizer	Commercial	Temporary		4.1	A. A. Rano filling station	Commercial	Permanent
13.	4.3	Mareni Jumaat mosque	Religious	Permanent		4.6	Fulbe villa restaurant	Commercial	Permanent
14.	4.8	Nissan motors Nigeria	Industrial	Permanent		5.0	Yahya motors petrol station	Commercial	Permanent
15.	5.2	First monie agent	Commercial	Temporary		5.5	Shettima pri. school	Academical	Permanent

5.6 Road Complimentary Facilities

Table 6 shows the road complimentary facilities along the study route. It was observed that the majority of the road complimentary facilities were found between KM 0 – 1 with 107 (48.86%) functioning and 4 (33.33%) not functioning in the inflow and outflow direction. Streetlights were the majority of the road complimentary facilities there with 96 (43.84%) functioning and 3 (25.00%) not functioning while the least was traffic light with 1 (0.46%) present which is functioning. Between KM 1 – 2, 95 (43.38%) functioning road complimentary facilities were found and 5 (41.67%) non-functioning road complimentary facilities in the inflow direction while 92 (42.01%) functioning road complimentary facilities were found and 5 (41.67%) non-functioning road complimentary facilities in the outflow direction. Streetlights were the highest road complimentary facilities found there with 86 (39.27%) functioning and 4 (33.33%) not functioning followed by road signs with 4 (1.83%) functioning and 1 (8.33%) not functioning. Between KM 2 – 3, 13 (5.94%) functioning road complimentary facilities were found with 3 (25.00%) not functioning road complimentary facilities both in the inflow and outflow direction. Between KM 3 – 4, 1 (0.46%) functioning road complementary facilities was found in the inflow direction while 2 (0.91%) functioning road complimentary facility was found in the outflow direction and they were all functioning. Also, between KM 5 – 5.7, 3 (1.37%) functioning road complementary facilities were found in the inflow direction and 2 (0.91%) functioning road complimentary facilities were found in the outflow direction. It was observed that majority of the functioning road complementary facilities were found between KM 0 – 3 with 215 (98.17%) where the road is dualized while the Zaria road end of the road that spans from KM 3 – 5.7 has a few road complementary facilities with just 4 (1.83%).

Table 6: Road Complimentary Facilities Along the Study Route

S/N	Inflow				Outflow			
	Distance (KM)	**Road complimentary facilities**	**Functioning**	**Not functioning**	**Distance (KM)**	**Road complimentary facilities**	**Functioning**	**Not functioning**
1.	0 – 1	Road sign	4	1	0 – 1	Road sign	4	1
		Traffic light	1	0		Traffic light	1	0
		Street light	96	3		Street light	96	3
		Round about	1	0		Round about	1	0
		Layby	1	0		Layby	2	0
		U-turn	2	0		U-turn	2	0
		T-junction	2	0		T-junction	1	0
		Total	**107**	**4**		**Total**	**107**	**4**
2.	1 – 2	Road sign	4	1	1 – 2	Road sign	4	1
		Traffic light	0	0		Traffic light	0	0
		Street light	86	4		Street light	86	4
		Round about	0	0		Round about	0	0
		Layby	2	0		Layby	0	0
		U-turn	1	0		U-turn	1	0
		T-junction	2	0		T-junction	1	0
		Total	**95**	**5**		**Total**	**92**	**5**
3.	2 – 3	Road sign	3	0	2 – 3	Road sign	3	0
		Traffic light	0	0		Traffic light	0	0
		Street light	9	3		Street light	9	3
		Round about	0	0		Round about	0	0
		Layby	0	0		Layby	0	0
		U-turn	0	0		U-turn	0	0
		T-junction	2	0		T-junction	2	0
		Total	**13**	**3**		**Total**	**13**	**3**
4.	3 – 4	Road sign	0	0	3 – 4	Road sign	0	0

		Traffic light	0	0			Traffic light	0	0
		Street light	0	0			Street light	0	0
		Round about	0	0			Round about	0	0
		Layby	0	0			Layby	0	0
		U-turn	0	0			U-turn	0	0
		T-junction	1	0			T-junction	2	0
		Total	**1**	**0**			**Total**	**2**	**0**
5.	4 – 5.7	Road sign	0	0		4 – 5.7	Road sign	0	0
		Traffic light	0	0			Traffic light	0	0
		Street light	0	0			Street light	0	0
		Round about	0	0			Round about	0	0
		Layby	0	0			Layby	0	0
		U-turn	0	0			U-turn	0	0
		T-junction	3	0			T-junction	2	0
		Total	**3**	**0**			**Total**	**2**	**0**

6.0 Recommendations and Conclusion

6.1 Recommendations

From the assessment of causes of traffic congestion in Gusau, Zamfara State, Nigeria, the following recommendations were made:

i. Since the highest cause of traffic congestion in Gusau is too many buses/taxis, public transport schemes made up of large buses should be provided in Gusau Metropolis so that the rate at which buses and taxis litter the roads and cause traffic congestion would be reduced.

ii. There is no significant difference between traffic volume at the Ahmad Sani Yarima Bakura Specialist Hospital end of the study route and the Zaria end of the study route but the Zaria end of the study route is congested and as such, the Zaria Road end of the study route should be dualized so that the traffic congestion at that end of the road would be mitigated.

iii. The land use pattern along the study route depicts the presence of temporary structures along the study route which contributes to traffic congestion and as such, temporary structures along the study route that are within the right of way should be removed. Also, hawking and trading along the study route should be prohibited so that they do not contribute to traffic congestion.

iv. The study revealed a dearth of road complimentary facilities in some axes of the study route and as such, road complimentary facilities should be provided along the study route where there are not sufficient or where there are missing so that the free flow of traffic along the study route can be enhanced.

6.2 Conclusion

Among the various modes of transport, road transport is the dominant means of transportation in Gusau and as such traffic congestion is common place in the city. Traffic congestion leads to loss of time and several economic and social losses if not mitigated and as such this study has assessed the possible causes of traffic congestion in Gusau with regards to providing answers to how the menace of traffic congestion in the city can be curtailed. The results of the study revealed that too many buses and taxis on the road is the major cause of traffic congestion. Also, the land use pattern and the lack of adequate road complementary are factors that contribute to traffic congestion in the study route. It is believed that if these anomalies are addressed, then traffic congestion in Gusau, Zamfara State, Nigeria will be reduced to as low as possible

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