

IMPROVEMENT RECOMMENDATIONS

INTERSECTION OF US 17 & US 21 GARDENS CORNER, SC

Prepared for:

Beaufort County



Prepared by:

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GARDENS CORNER

INTRODUCTION

Wilbur Smith Associates has been retained by Beaufort County to evaluate and determine potential infrastructure improvements for the intersection of US 17 and US 21 known as Gardens Corner located in northern Beaufort County. As such, WSA has reviewed the current geometry and operating characteristics of Gardens Corner, and made recommendations to help alleviate some of the traffic and safety constraints at this intersection. To address these issues, this study includes the following:

- A brief review of existing traffic conditions at the subject intersection(s),
- Projections of future traffic growth;
- Improvement alternatives and associated costs; and
- Conclusions.

Evaluation of the effectiveness of the Gardens Corner intersection first requires a thorough description of the study area intersection.

PROJECT DESCRIPTION

Gardens corner is located in northern Beaufort County and is made up of two US routes, US 17 and US 21. These two routes intersect in the shape of three skewed intersections, which result in a large triangle between the intersecting routes. Within this triangle, a gas station/ convenience mart currently operates which has access to/from US 17 (northern leg of the triangle) and the roadway to the east between US 17 and US 21, which make up the easterly leg of the triangle (US 17 Spur).

The County wishes to have the operational characteristics of this intersection reviewed in order to plan for future improvements that will alleviate current problems at this intersection. As requested, the improvement strategy for this intersection is intended to be an effective and efficient solution which will better serve traffic for an intermediate number of years, and not be a long term solution which is currently being planned by the SCDOT.

CURRENT CONDITIONS

US 17 is orientated in an east/west direction, while US 21 is a northerly orientation. West of the intersection, the US 17 and US 21 are a "combined route" for approximately 5 – 6 miles where US 21 then turns in a northerly direction towards Yemasee and US 17 continues west towards I-95. The Gardens Corner intersection is actually comprised of three intersections in the form of a triangle. The westerly intersection is the intersection of US 17 (easterly approach), US 21

(northerly approach), and US 17/US 21 (westerly approach). This intersection operates under STOP sign control where vehicles northbound on US 21 are required to stop. This intersection provides for through movements on US 17, left-turns from US 21 (northbound from Beaufort), and right-turns from US 17/US 21 (towards Beaufort). Although not prohibited (by signage or geometry) very few westbound left-turns or northbound right-turn movements are made at this intersection. These movements towards/from Charleston between US 17 and US 21 are typically made at the easterly intersection where a short "connector" (US 17 Spur) is provided between US 17 and US 21. At this intersection, the northbound right-turn movements are under YIELD sign control.

The southerly intersection intersects US 21 at US 17 Spur to and serve westbound left-turns, and northbound right-turns towards Charleston. This intersection is under STOP sign control where vehicles from the connector roadway (southwest bound) are required to stop.

Access drives serving the convenience mart are provided along US 17 and US 17 Spur, and an access to the furniture store is provided on US 21 just south of US 17. **Figure 1** depicts the general regional location of the study area intersection(s).

Existing traffic volumes were collected for this intersection in order to determine both the existing traffic demand, and directional flow of traffic. **Figure 2** depicts the AM and PM peak-hour traffic volumes at this intersection. As shown by this figure, peak-hour traffic flow is nearly equally split between US 21 and US 17 respectively headed to/from Beaufort. One characteristic of the current traffic flow that needs to be identified is the composition of traffic at this intersection. Traffic on US 17 eastbound and westbound consisted of a moderately high volume of heavy vehicles; a truck percentage of over 5-percent was gathered in the field. This was much greater than the truck percentage on US 21 which was less than 2-percent.

After reviewing the intersection volumes and completing a site visit detailing the geometry of the intersection including sight distances, signage, etc., the following issues were observed to be operational problems at this intersection:

- Intersection geometry may be somewhat confusing;
- Directional signage is confusing;
- Moderate truck volumes on US 17;
- Speeds on US 17 typically exceed the posted speed limit;
- US 17 reduces in cross-section from a 4-lane to a 2-lane resulting in a lane drop;
- US 21 NB acceleration lane on to US 17/US 21 WB;
- Vehicular movements into and out of the convenience mart;
- Access to/from the furniture store located in radii of intersection; and
- US 21 to US 17 toward Charleston YIELD control;

Accident History

Information regarding the number of accidents that have occurred at this intersection has been provided by the SCDOT for a 4½ year time period between the years of 1998 to 2002. According to this data, a total of 57 accidents occurred at this intersection which results in an average of 12⅔ accidents per year. From this data, it was identified that 40 of the 57 accidents occurred along the easterly leg of the triangle (US 17 Spur), either at the easterly, or southerly intersections. The remaining 17 accidents occurred at the westerly intersection (US 17 at US 21). Further review indicates that one fatality has taken place during this time period which occurred at the westerly intersection and involved a truck.

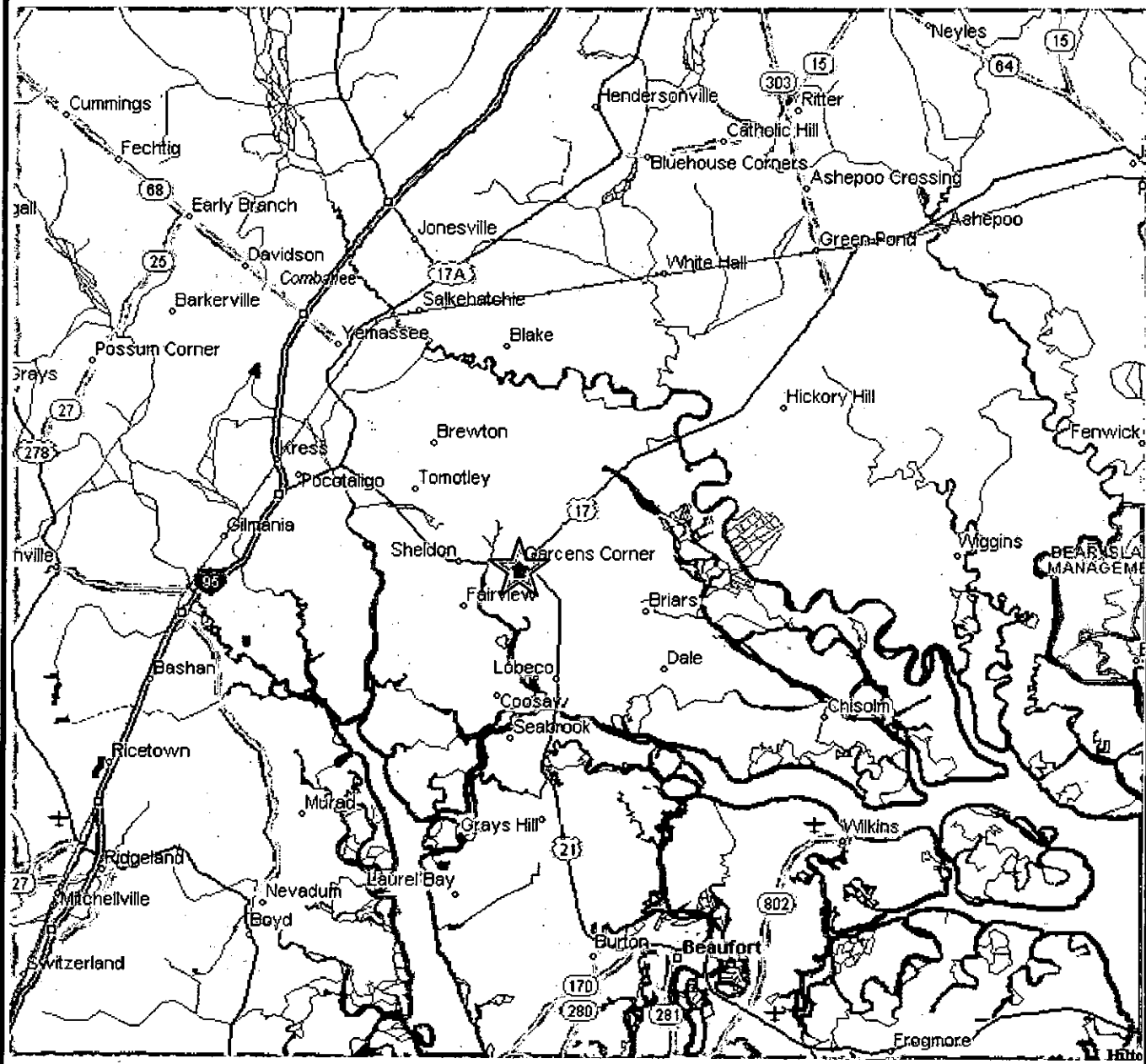
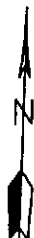
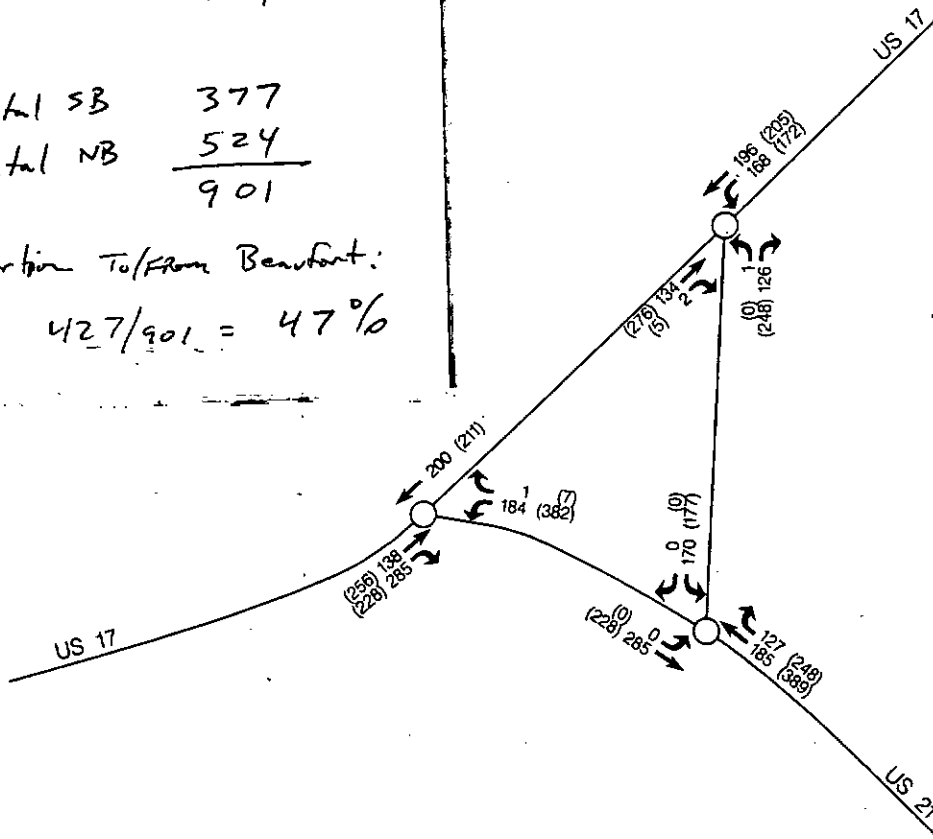


Figure 1
PROJECT LOCATION
 Gardens Corner Beaufort



<u>PM PEAK</u>	
SB L.T.	172
NB R.T.	<u>255</u>
	427
Total SB	377
Total NB	<u>524</u>
	901
Proportion To/From Beaufort:	
	$427/901 = 47\%$



Key
 ○ = Unsignalized Intersection

Figure #2
 2002 EXISTING TRAFFIC VOLUMES
 AM & (PM) PEAK-HOUR
 Gardens Corner Beaufort.



A majority of the accidents at the easterly intersection were rear-end type accidents. The second most frequent type of accident was angular type or sideswipe which has a frequency at the westerly intersection, in part due to the acceleration lane in the median of US 17 westbound.

FUTURE TRAFFIC VOLUMES

To estimate the impact of traffic volume growth at this particular intersection under Future conditions, the Beaufort County Transportation Model was used.

For the process of evaluating this intersection, the model was programmed to reflect turning movement specific traffic volumes for Gardens Corner. These numbers were then compared to the existing network to develop annual growth rates which would be used to test the capacity of the mitigation strategies under future traffic loadings.

These future traffic volumes were then used to analyze the intersection in order to determine what improvements would be needed in order to adequately accommodate traffic flow at this intersection.

INTERSECTION IMPROVEMENTS

In reviewing the intersection traffic flow and geometry, it was determined that the Gardens Corner intersection could be cost effectively modified to accommodate future projections and improve safety issues at this location. As requested, WSA reviewed potential improvements that would provide an effective and cost efficient alternative to the ultimate roadway improvements that the SCDOT has designed for Gardens Corner which includes grade-separation and bridging over the adjacent wetlands. Potential improvements would be able to accommodate existing traffic and growth and allow time until sufficient capital is available to construct the ultimate design. The goal was to identify improvements that would not be a waste of money if it were to be removed and totally reconstructed in the future with the ultimate design.

Two concepts have been identified which can each accommodate future traffic growth and improve upon the existing geometry. Both concepts maintain the existing roadway alignment, improve upon the skewness of the intersection by eliminating the easterly leg of the triangle (US 17 Spur) and provide for traffic signal control. Each Scenario will require acquisition of right-of-way to accommodate the recommended improvements. The following presents a description of the two concepts:

Jug-Handle Intersection

Construct a loop ramp "jug-handle" on US 17 WB that curves back into US 17 opposite US 21 towards Beaufort. This jug-handle will provide access from US 17 WB to US 21 SB and will replace the current connector roadway between US 21 and US 17 east of the convenience mart. Access from US 17 to this connector roadway will be closed which will result in a concentration of vehicular turning movements at the new jug-handle intersection. With this consolidation, traffic signalization will be warranted based on the existing traffic flow. This alternative requires the acquisition of property on the north side of US 17 (for the jug-handle) and the westerly side of the convenience mart.

The jug-handle design is intended to remove the need for westbound left-turns within the intersection, and replaces this movement with southbound through movements which are a more efficient move as compared to a left-turn. Also, the jug-handle can provide more than sufficient vehicular queuing area for vehicles headed toward Beaufort from Charleston. Additional

improvements would be to widen the US 21 approach to US 17 to provide two left-turn lanes, a separate right-turn lane, and two receiving lanes. This alternative is shown by **Figure 3**.

Typical Three Legged Intersection

Construct dual left-turn lanes in the westbound direction of US 17 to serve traffic orientated towards Beaufort. Additionally, construct two northbound left-turn lanes and a separate right-turn lane on US 21. This alternative would also close the connector road between US 21 and US 17 to the east of the convenience mart and concentrates traffic at the newly aligned intersection. With this concentration, signal warrants would be met. This alternative requires the acquisition of property on the westerly side of the convenience mart site. **Figure 4** depicts this concept.

General Comments

Generally both alternatives significantly improve upon the existing geometry of the Gardens Corner intersection and allow for the installation of signal control. Additionally, the eastern leg of the intersection (US 17 Spur) would end in a cul-de-sac at US 17, which would still allow access to the convenience mart but not access to US 17. This improvement alone should significantly reduce the accident rate which currently occurs at the easterly and southerly intersections.

Impact to wetlands are anticipated to be minimal as the design shifts vehicular movements away from the northerly marsh and takes advantage of the center median in US 17 to accommodate the through traffic on US 17. Minimal land acquisition is required for both alternatives of the westerly corner/side of the convenience mart site. The jug-handle concept requires land on the northside of US 17 be acquired for the jug-handle segment of the design.

One constraint is applicable to both alternatives, the current access to the furniture sales retail/store is located in close proximity to the intersection within the radii of the eastbound right-turn movement towards Beaufort. If possible shifting this access to the south would benefit the intersection and improve the business access. Optimally aligning opposite the connector road would be the best.

Intersection Operations

Generally, either concept will operate very well with the implementation of traffic signal control. A slight efficiency is gained via the jug-handle concept verses the traditional intersection due to the ability to remove the heavy volume of left-turn movements and convert this volume to SB through movements which would be accomplished in two lanes. Additionally, sufficient storage area can be created via the jug-handle design for the southbound movement.

The ability to adequately serve future growth in traffic volumes was reviewed for each alternative. Using the anticipated growth in traffic as is anticipated by the Beaufort County Transportation Model, the jug-handle alternative is estimated to have a functional life span of nearly 15 years, until a LOS E would result. The traditional intersection design would have a functional life span of 10-11 years ending in a LOS E at the end of this time period. One point regarding the traditional intersection should be made; the westbound left-turn movement will have a queue constraint prior to the 10-11 year period. This constraint will have an impact on the functional operation of the intersection.

Cost Opinion

As requested, cost estimates for each alternative have been completed based on the specific improvements suggested. These cost opinions are as follows:

Jug-handle \$500,000.00

Traditional \$325,000.00

As shown the traditional design is more cost effective than the jug-handle alternative which is due to the necessity of the jug-handle design to acquire more private land to the north of US 17 to accommodate the alternative.

The following depicts the relative benefits for each alternative.

<u>Jug-Handle</u>	<u>Traditional</u>
<u>Pros</u>	<u>Pros</u>
Longer operational life	Less impact to adjacent land owners
Provides sufficient vehicular storage	Easier for directional signage
Provides signal control	Provides signal control
Closes easterly leg access (US 17 Spur)	Closes easterly leg access (US 17 Spur)
Removes the westbound left-turn movement	Less costly alternative than jug-handle
Should reduce accident rate	Should reduce accident rate
Area for beautification (center of jug-handle)	

CONCLUSIONS & RECOMMENDATIONS

Either of the two studied alternatives provide a significant benefit over the current geometry at Gardens Corner. Each alternative share significant benefits which will advance operations and safety at the intersection. By consolidating all of the vehicular movements to/from US 17 and US 21 to a single intersection, closing one intersection, and reducing the turning movements at the last intersection which will be placed under signal control. Additionally, the intersection that is proposed to be closed has the highest accident frequency. Ultimately, the County would be well served with either alternative for an interim time period until such time that the SC DOT plan can be implemented.

Based on the analysis, WSA's recommendation for this intersection would be the described jug-handle alternative. While this alternative has a slightly greater cost, it is anticipated to have a greater useful life span than the traditional intersection.