



Projected Traffic Impacts from the Proposed Ark Encounter Development

Grant County

This report includes the projected traffic anticipated by the proposed Ark Encounter development, a planning level analysis of improvements to accommodate the additional traffic, and a planning level cost estimate of anticipated improvements.

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12/14/2011

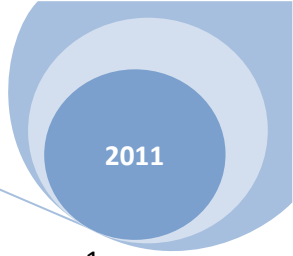


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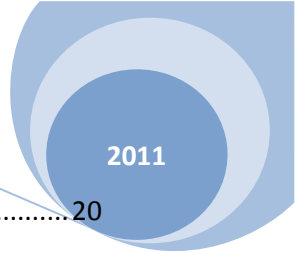


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I. Executive Summary

The Ark Encounter is a large-scale, thematic attraction that will be open on a year round basis. The proposed location for this attraction is in Williamstown Kentucky, with the main entrance on KY 36, west of Interstate 75. The development has the potential to significantly increase the traffic volumes in the area and act as a catalyst for surrounding development. This report examines the impacts of this traffic and preliminarily investigates the infrastructure that will be required to support the Ark Encounter.

The existing KY 36 in the study area is a rural collector with minimal existing traffic. Notable features along this section of roadway include the following:

- Substandard tar and chip Shoulders, some of which is eroding around existing guardrail posts
- Steep embankments along KY 36, for approximately 600 feet west of I-75
- A blueline stream crosses KY 36 through a 52 inch pipe approximately 500 feet west of I-75
- There is an underground sanitary sewer line and waterline within the project limits

The existing 52 inch pipe is likely to need an extension that will cause more than 300 feet of impact to the stream. In order to obtain the necessary permits for this impact, environmental clearance will be required. Preliminary environmental information indicates that impacts to endangered species and hazardous material sites are anticipated. However, impacts to air quality, archeology, historic property, 4 (F) properties, and 6 (F) properties are not likely. Potential impacts should be studied further in the design phase of the project.

In order to evaluate the recommended improvements in the project area, a study area was established. This area included KY 36 west of the proposed access points for the Ark Encounter and ending to the west of the I-75 interchange. I-75 north and south of the interchange was also included in the study area.

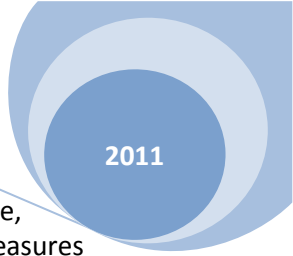
Traffic models were created of the established study areas, based on four different projected traffic volumes. These models were calibrated based on the existing conditions of the study area. The four different traffic volumes scenarios included the following:

- 10:00 AM to 6:00 PM on a Saturday in the summer of the opening year, with an opening year visitor rate of 900,000

- 10:00 AM to 6:00 PM on a Saturday in the summer of the opening year, with an opening year visitor rate of 1.6 million
- 10:00 AM to 6:00 PM on a Saturday in the summer 10 years after the opening year, with an opening year visitor rate of 900,000. A 4% growth rate was used on the annual visitor rate, and a 3% growth rate was used for existing traffic.
- 10:00 AM to 6:00 PM on a Saturday in the summer 10 years after the opening year, with an opening year visitor rate of 1.6 million. A 4% growth rate was used on the annual visitor rate, and a 3% growth rate was used for existing traffic.

Based on an analysis of these traffic models, and the potential for additional development the following improvements will likely be required to accommodate the additional traffic generated by the Ark Encounter:

- Install 10 foot paved shoulders on KY 36 throughout the entire study area.
- At the main entrance to the Ark Encounter, install a right turn lane on eastbound KY 36, two left turn lanes on westbound KY 36, close the existing farm entrance, and install a traffic signal.
- Replace the existing KY 36 Bridge over I-75 to accommodate a left turn lane from eastbound KY 36 onto the I-75 northbound ramps. The new structure will also provide the necessary width for a left turn from westbound KY 36 onto southbound I-75.
- Install a left and right turn lane at the end of the northbound I-75 ramp onto KY 36.
- A countermeasure at the intersection of KY 36 and the southbound I-75 ramps will be necessary to prevent a queue of traffic on I-75. Furthermore, the eight hour volume warrant is not satisfied for the traffic signal discussed in Alternate D.2. This indicates that a roundabout might be the optimal solution at this intersection. The spacing deficiencies along KY 36 would need to be considered in the roundabout evaluation. As a result of this recommendation, the following configurations should be further developed in the design phase:
 - Widen the existing ramp from southbound I-75 onto KY 36 to two lanes with dual right turning movements on to KY 36. Westbound KY 36 will need to be widened to accommodate the dual right turning movements. The additional lane on KY 36 can end as a right turn only into the unnamed commercial development.



- Relocate Skyway Drive to line up with the unnamed commercial entrance, including left and right turn lanes on KY 36, and the following countermeasures as part of this configuration:
 - Install a roundabout at the intersection of KY 36 and the southbound I-75 ramps.
 - Install a traffic signal at the intersection of KY 36 and the southbound I-75 ramps

- Install a roundabout that incorporates Skyway Drive, KY 36 and the southbound I-75 ramps into one intersection.

A planning level cost estimate of the infrastructure improvements recommended to accommodate the additional traffic from the Ark Encounter is shown in Figure 22:

ESTIMATE				
Design	Utilities	Right of Way	Construction	Total
\$830,000	\$750,000	\$390,000	\$9,100,000	\$11,070,000

Table 1 - Planning level cost estimate of improvements

II. Study Purpose

The Ark Encounter is a proposed development in Grant County, Kentucky near the City of Williamstown. Representatives of the development describe the Ark Encounter as, “A family oriented, highly thematic, educational, and entertaining complex that will factually present Noah and the Ark, the Genesis Flood, and other historical biblical Accounts. The development is to be constructed on approximately 860 total acres.” The magnitude of this development would significantly impact the traffic patterns in the surrounding area.

TSIS version 6.2 was used to model the existing and projected traffic. Information from the traffic models was used to identify potential problem areas in the traffic network that may result from the additional traffic generated from the Ark Encounter. This study evaluates the existing infrastructure and determines the necessary improvements to facilitate the proposed development.

III. Project Location

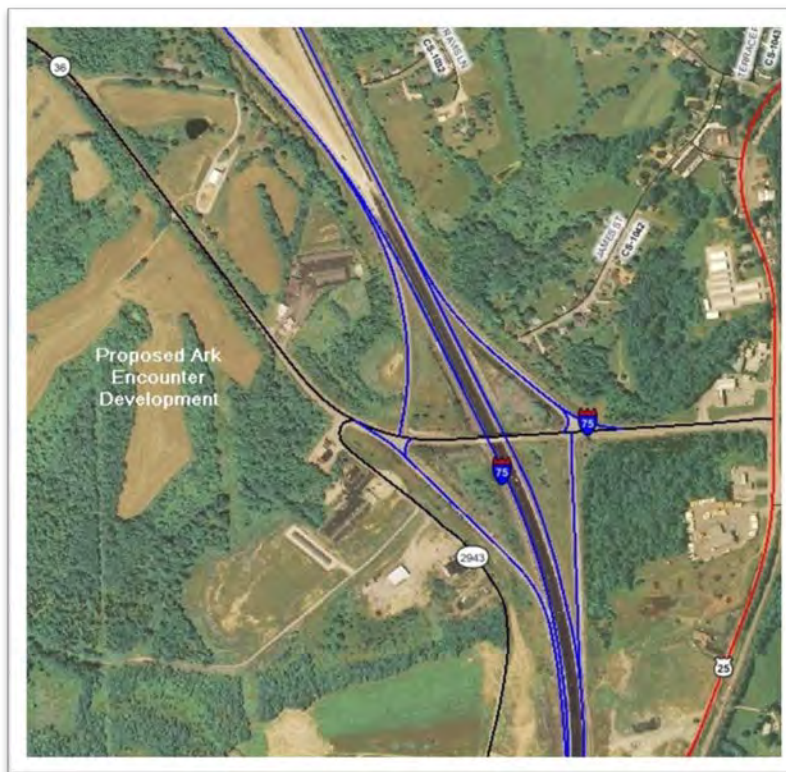


Figure 1 - Proposed Location for the Ark Encounter Development

The proposed location for the Ark Encounter is just west of the KY 36 interchange on I-75 in Grant County, Kentucky, as shown in Figure 1. This is approximately 45 minutes south of Cincinnati, Ohio. As shown in Figure 1, the development is proposed to the south of KY 36. The existing KY 36 is a rural major collector route to the west of I-75 and a rural minor arterial to the east of I-75.

IV. Existing Conditions

The existing KY 36 is a two lane rural roadway with 2 foot paved shoulder and 5 foot tar and chip shoulders. The existing land use in the study area is commercial; however, the amount of existing development is minimal. There are several features within the study area that should be considered in the design phase of improvements within the study area.

A. 52 inch Pipe Under KY 36

There is an existing blueline stream that crosses under KY 36 through a 52 inch pipe to the west of Skyway Drive. Field observations indicate that the pipe is constructed of three sections of materials. The two outside sections are concrete and a relatively short inside portion is corrugated metal. There is approximately 80 feet of fill over the pipe. The structural condition of the existing pipe is acceptable.



Figure 2 - 52" Pipe North of KY 36, inlet



Figure 3 - 52" Pipe South of KY 36, outlet

B. Steep Embankment

Both the north and south side of KY 36 between the southbound I-75 ramps and the western Commercial Entrance have guardrail and slopes greater than 3:1. There is an 80 foot difference in the elevation of KY 36 and the existing pipe in this location.



Figure 4 –On KY 36 looking south, near Skyway Drive

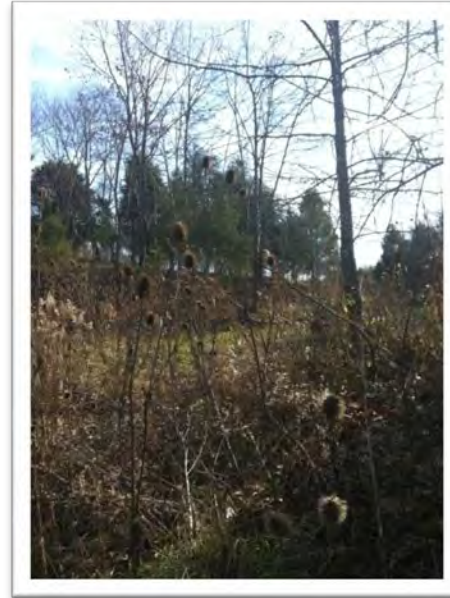


Figure 5 - At bottom of slope north of KY 36 looking east to the I-75 southbound ramp to KY 36

C. Substandard Shoulders on KY 36

The shoulders on KY 36 are constructed of tar and chip material. Guardrail posts are present along the shoulder in most of the study area. However, this material has eroded around the posts, causing a safety issue.



Figure 6 - On KY 36 near the southbound ramps looking east

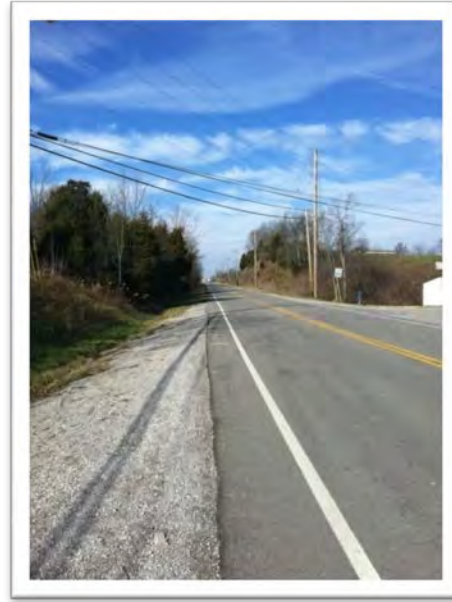


Figure 7 - On KY 36 near Skyway Drive Looking East

D. Utilities

Field observations and the KYTC Geographic Information System (GIS) indicate that underground and overhead utilities are present in the study area. Underground utilities include a sanitary sewer, a water line, and a fiber optic line. Figure 8 shows the approximate locations of the underground sanitary sewer and water lines from the KYTC GIS database. The fiber optic line is not shown in the figure; however it is approximately parallel to I-75 to the west.



Figure 8 - Preliminary underground utility information

Potential utility providers in the area are listed below. Please note that this is a preliminary list. Further analysis will be required to determine a full list of impacted utility providers:

- Williamstown Utility Commission
- Owen Electric Cooperative, Incorporated.
- Williamstown Wastewater Plant
- Duke Energy (Gas)
- Williamstown Kentucky Cable and Internet
- AT & T (Fiber Optic)

V. Environmental

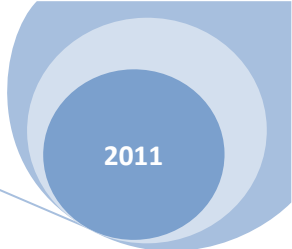
There is an existing blueline stream that crosses KY 36 through a 52 inch pipe. Due to the large amount of fill material above this pipe, it is anticipated that the pipe will need to be extended more than 300 feet to accommodate any widening along KY 36. As a result, an Army Corps of Engineers 404 permit and a Kentucky Division of Water 401 permit will likely be required. In order to satisfy the requirements for these permits, a full environmental analysis will need to be conducted for the project area. A preliminary overview of environmental impacts is included in the following subsections.

A. Air Quality

Grant County is not in a maintenance area or a non-attainment area for air quality.

B. Archeology

Archeological resources are not known for this area. Further analysis will need to be conducted in the design phase for improvements.



C. Threatened and Endangered Species

The United States Fish and Wildlife Service has identified Grant County as a potential habitat for the endangered species shown in Table 1. All of the listed species could potentially be impacted by the proposed project.


		U.S. Fish & Wildlife Service <i>Kentucky Ecological Services Field Office</i>		U.S. Fish & Wildlife Service 330 West Broadway, Rm 265 Frankfort, KY 40601 Phone: 502-695-0468 Fax: 502-695-1024	
Endangered, Threatened, & Candidate Species in _____ GRANT _____ County, KY					
Group	Species	Common name	Legal* Status	Known** Potential	Special Comments
Mammals	<i>Myotis sodalis</i>	Indiana bat	E	P	
Mussels	<i>Pleurobema clava</i>	clubshell	E	P	
Plants	<i>Trifolium stoloniferum</i>	running buffalo clover	E	P	
NOTES:					
* Key to notations: E = Endangered, T = Threatened, C = Candidate, CH = Critical Habitat					
**Key to notations: K = Known occurrence record within the county, P = Potential for the species to occur within the county based upon historic range, proximity to known occurrence records, biological, and physiographic characteristics.					

Table 2 - Endangered Species in Grant County

D. Hazardous Material

There is an abandoned gas station on Skyway Drive (KY 2943) near the intersection with KY 36. There are likely hazardous material areas associated with the gas station. However, further analysis will need to be conducted, in order to completely determine impacts to hazardous material sites.

E. Historic Property

Impacts to historic property are not anticipated. However, further analysis may need to be conducted in the design phase for improvements.

F. Socioeconomic Impacts

No socioeconomic impacts are anticipated within the study area. However, further analysis may need to be conducted in the design phase for improvements.

G. 4 (F) Property

No section 4 (F) impacts are anticipated within the study area. However, further analysis may need to be conducted in the design phase for improvements.

H. 6 (F) Property

No section 6 (F) impacts are anticipated within the study area. However, further analysis may need to be conducted in the design phase for improvements.

VI. Basic Assumptions for Traffic Models

Traffic models were created to help predict the effectiveness of proposed improvements to the existing infrastructure. The basic assumptions required to develop these models are discussed below.

A. Study Area

The existing land use and traffic network around the proposed location for the Ark Encounter was preliminarily analyzed to determine appropriate limits for the traffic model. Four possible routes to the proposed development were identified: I-75 from the north, I-75 from the south, KY 36 from the east of I-75, and KY 36 from the west of the proposed development.

An initial meeting with Ark Encounter representatives indicated that the majority of the traffic generated by the development would arrive and depart via I-75. This indicated that the ramps at the KY 36 interchange and the KY 36 Bridge over I-75 should be evaluated for potential improvement needs.

There are no signalized intersections along KY 36 to the east of the interstate or to the west of the proposed site location that would be impacted by the proposed development. As a result, the traffic model includes the access points to the proposed development, the two access points along KY 36 between the proposed development and I-75, and the I-75 interchange. Additional access points along KY 36 to the east of the I-75 ramps or the west of the proposed site were not included in the traffic model.

B. Design Day/Hours

The potential needs for improvements within the study area are based on the eight hour period in a year with the potential for the highest traffic volume. Since there are no significant traffic generators within the study area, the design day and hours are based on anticipated traffic generated by the proposed development.

The Ark Encounter submitted a Trip Generation and Distribution Analysis prepared by the Troyer Group. Information contained in this report was based on the Economic Impact Study dated February 2010 by America's Research Group and the expertise of Cary Summers. Cary Summers' experience includes President and CEO of Silver Dollar City Corporation of Branson Missouri, the 6th largest group of themed attractions.

The Trip Generation and Distribution Analysis concluded that the proposed development would generate the most traffic in the 14 week period from June through August. This included approximately 42% of the total visitors anticipated in one year.

The report also indicated that a Saturday would generate the highest volume of trips compared to other days of the week, approximately 24%. Assuming an even distribution of visitors over the peak 14 week period, one Saturday in the summer would generate approximately 0.74% of the annual visitors.

Furthermore, the development plans to operate between the hours of 9:00 AM and 7:00 PM. The report distributed the percentages of entering and exiting traffic amongst the operating hours. Based on this distribution, it was determined that the highest volume of traffic generated by the development would be during the eight hour period between 10:00 AM and 6:00 PM on a Saturday in the summer.

C. Existing Traffic

The existing conditions of the study area were modeled as a baseline for the site impact analysis. Since there are imperfections and random variables inherent to all traffic models, the existing conditions traffic model is typically created and calibrated to reflect the field conditions as closely as possible.

In order to create the existing traffic model, a variety of data was collected from the field and input into the model. This data included traffic counts on I-75, turning movement counts on KY 36 at the northbound and southbound I-75 ramps, and various geometric data. A traffic model of the existing traffic volumes was calibrated to reflect the existing conditions. The calibrated traffic model of existing conditions was modified to reflect the projected traffic and access points for the Ark Encounter.

D. Traffic Distribution

1. Entering Traffic

The distribution of trips generated by the Ark Encounter was based on KYTC experience derived from the World Equestrian Games, the Rolex Kentucky Event, Keeneland fall and spring meets, University of Kentucky sporting events, and the information in the Ark Encounter's Trip Generation and Distribution Analysis. The trips generated by the development were categorized by trips entering the development and trips exiting the development.

Visitors to the proposed Ark Encounter can access the study area through four locations: I-75 from the North, I-75 from the South, KY 36 from the west of the Ark Encounter, and KY 36 from the east of the interstate ramps. Traffic was distributed amongst these locations. Figure 10 shows the traffic distributions assumed in this report as white percentages and arrows.

There is one entrance for visitors into the Ark Encounter. This is located on KY 36 and represented in Figure 10 as the blue square. Based on the distributed traffic in the study area, shown as white arrows and percentages, the distributed traffic was consolidated at the proposed entrance to the development. The consolidated traffic at the entrance is represented in blue percentages and arrow.



Figure 9 – Projected distribution of traffic entering the Ark Encounter

Since the Ark Encounter is a destination location, no pass by trips were considered in the traffic distribution analysis. It was assumed that all traffic exiting the proposed development would exit via the same route that was used to enter the development.

The egress configuration showed for vehicles wishing to turn left from the parking lot onto westbound KY 36 was revised in the traffic model. The configuration shown in this report is slightly modified to better reflect the policies and traditional practices of developments along Kentucky routes.

2. Exiting Traffic

The traffic model shows two available exit locations from the Ark Encounter parking lot. One location is west of the entrance and provides right and left turning movement. The second location is east of the entrance and only provides for right turning traffic. There was not sufficient information provided on the layout or circulation pattern of the parking lot. As a result, engineering judgment was used to determine 60% of traffic using the western exit and 40% using the eastern exit.

Figure 11 below shows the anticipated traffic entering the ark Encounter. The two locations to exit the Ark Encounter are represented by blue arrows and percentages. The distributed traffic exiting the study area is shown as white arrows and percentages.

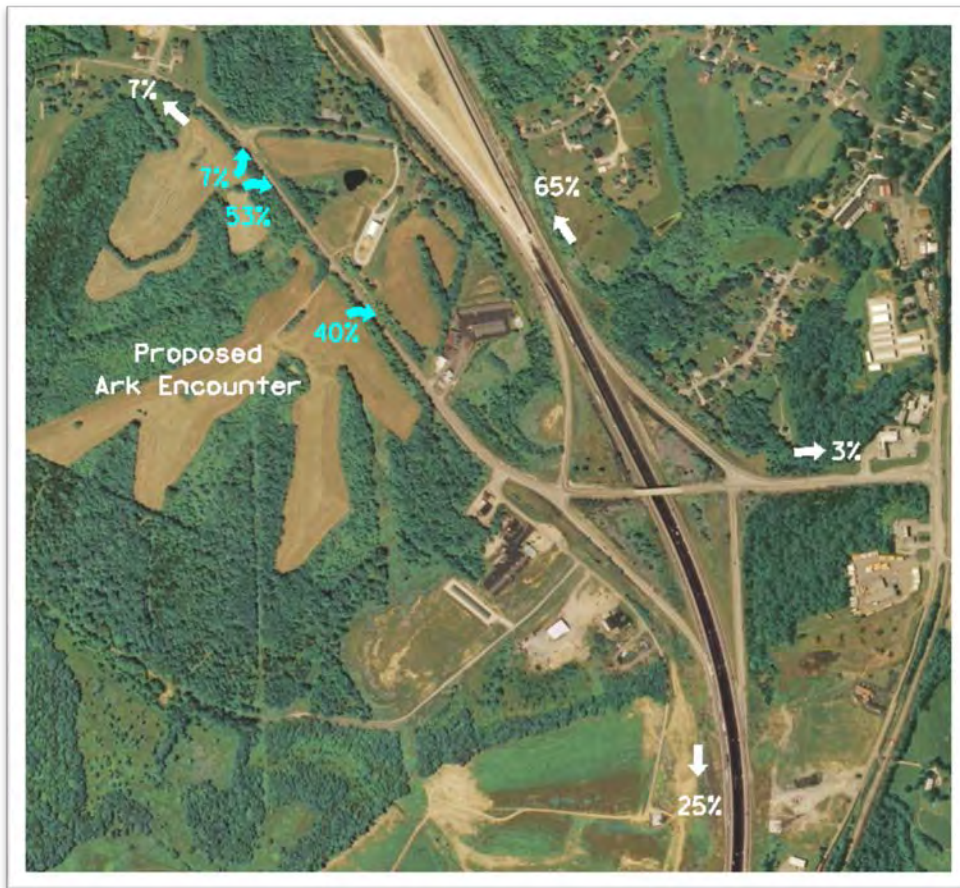


Figure 10 - Project distribution of traffic exiting the Ark Encounter

E. Traffic Volumes Anticipated

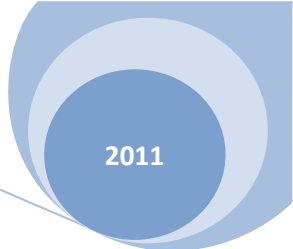
The Traffic Impact Study guidelines for development in Kentucky examine two scenarios: the opening day/year and 10 years after opening. Projected volumes for these scenarios are typically obtained from the Trip Generation Manual based on land use and historic data. However, the Trip Generation Manual does not have a land use type that accurately reflects the Ark Encounter. Due to the unique characteristics of the proposed development, two different methods were used to forecast the anticipated annual visitors per year, resulting in four traffic models of the projected traffic. Each visiting vehicle was assumed to arrive and depart from the development one time per day.

The first method to determine the approximate traffic volumes on the design day and hours was based on the Trip Generation and Distribution Analysis submitted by the Ark Encounter. The report assumed 1.6 million visitors annually for the opening year, based on the Economic Impact Study for the Ark Encounter.

The second method to determine the approximate traffic volumes on the design day and hours was derived from similar land uses in the region. Based on the description of the development, KYTC used the annual visitors from the Cincinnati Zoo, the Louisville Zoo and the Creation Museum to determine the anticipated visitor rate for the opening year. 900,000 visitors were estimated for the first year of operation.

The Kentucky Transportation Cabinet's Traffic Impact Study Guidelines state that three scenarios shall be examined in a traffic impact study. These scenarios include the existing traffic, opening year, and a design year 10 years after opening. The Ark Encounter's Trip Generation and Distribution analysis states that they anticipate a 4% increase in visitors. Furthermore, it states that an expansion is not anticipated until after the 11th year of operation. As a result, the 10 year traffic projection for traffic to the Ark Encounter is based on the 4% annual increase in visitors.

Traffic engineers typically use a range of 1.1 to 2.6 passengers/vehicle for traffic modeling and forecasting based on the anticipated use of busses and other high occupancy vehicles. Since the Ark Encounter anticipates a high amount of bus traffic, a rate of 2.6 passengers/vehicle was used for the traffic model.



1. Opening Year Volumes and Distribution over Design Hours

The following two tables summarize the projected traffic volumes for the hours between 10:00 AM and 6:00 PM on a Saturday in the summer based on the two projection methods. Note that these figures only includes information for the design time periods, which includes 85% of the projected traffic for the Ark Encounter for one day. The 15% of traffic not shown in the tables is estimated to occur outside of the design day and hours.

Ark Encounter Traffic								
1.6 Million Annual Visitors = 11,520 Design Day Visitors								
11,520 Visitors @ 2.6 Visitors/Vehicle = 4430 Vehicles per Design Day								
Hour	10:00 AM	11:00 AM	12:00 PM	1:00 PM	2:00 PM	3:00 PM	4:00 PM	5:00 PM
Entering % (Volume)	25% (1110)	15% (660)	10% (440)	25% (1100)	10% (440)	0	0	0
Exiting % (Volume)	0	0	0	5% (220)	10% (440)	10% (440)	20% (890)	25% (1110)

Table 3 – 1.6 million annual visitor traffic distributed over the design year and hours, the number in parentheses indicates the volume of vehicles for the indicated hour

Ark Encounter Traffic								
900,000 Annual Visitors = Design Day Visitors 6,660								
6,660 Visitors @ 2.6 Visitors/Vehicle = 2562 Vehicles per Design Day								
Hour	10:00 AM	11:00 AM	12:00 PM	1:00 PM	2:00 PM	3:00 PM	4:00 PM	5:00 PM
Entering % (Volume)	25% (640)	15% (380)	10% (260)	25% (640)	10% (260)	0	0	0
Exiting % (Volume)	0	0	0	5% (130)	10% (260)	10% (260)	20% (510)	25% (640)

Table 4 – 900,000 annual visitor traffic distributed over the design day and hours, the number in parentheses indicates the volume of vehicles for the indicated hour

F. Other Assumptions

1. Farm Entrance Across from Ark Encounter Entrance

Correspondence from Ark Encounter representatives indicated that the existing farm entrance could be closed at the entrance to the development. The entrance is assumed to be closed in the traffic models and analysis of the study area. This entrance could significantly increase delay in the roadway system, if it is not closed before the opening day of the Ark Encounter.

2. 10 Year Projected Traffic

In the 10 year projected traffic volumes for KY 36, I-75 and trips generated by the Ark Encounter had to be estimated to show a 10 year traffic model. According to the Economic Impact Study, a 4% increase of visitors is expected each year for the next 10 years. The 4% growth rate was applied over a 10 year period to project the volume of trips generated by the Ark Encounter.

A 3% traffic growth rate was applied to KY 36 and I-75 for the 10 year projected traffic model. This is within the typical growth rate range used in traffic impact studies.

The average daily traffic (ADT) trends on KY 36 and I-75 were studied from data over the past 10 years; however, these trends did not reflect the anticipated growth in the study area. The ADT on KY 36 has decreased, and the ADT on I-75 has not shown a significant increase between the year 2000 and 2009 (the most recent count data in the study area). As a result, the 3% traffic growth rate was used to reflect possible development and changes in traffic patterns that may occur over the 10 years after the opening of the Ark Encounter. The 3% was applied each year over a 10 year period to the existing traffic information.

3. Additional Development Impacting the Study Area

The Ark Encounter may generate additional development that could impact the study area. However, there is no specific data that could be incorporated into the 10 year projected traffic models. A growth rate higher than the existing trend was used to accommodate this variable. Furthermore, possible locations within the study were identified that would impact the roadway system if further developed.

VII. Traffic Models

Traffic models were created using five different combinations of traffic volumes and discussed below. The models were compared and analyzed to determine possible improvements in the study area.

A. Existing Traffic

Existing volume counts were used to create a model of existing traffic during a Saturday in the summer. This model was used to calibrate the study area and improve the accuracy of the projected traffic models. Due to the low existing traffic volume, there are not existing locations within the study area that exceed capacity..

B. Opening Year (A)

The design day used in the Opening Year (A) traffic model was the Saturday in the summer of the opening year, for the peak eight hours starting at 10:00 AM and ending at 6:00 PM. This traffic model used the 1.6 million annual visitor rate and the existing traffic counted in the study area. More information about the basic assumptions can be found in Section III of this report.

C. Opening Year (B)

The design day used in the Opening Year (B) traffic model was the Saturday in the summer of the opening year, for the peak eight hours starting at 10:00 AM and ending at 6:00 PM. This traffic model used the 900,000 annual visitor rate and the existing traffic counted in the study area. More information about the basic assumptions can be found in Section III of this report.

D. 10 Year Projection (A)

The design day used in the 10 Year Projection (A) traffic model was the Saturday in the summer 10 years after the opening of the Ark Encounter over the duration of the peak eight hours starting at 10:00 AM and ending at 6:00 PM. This traffic model used the 1.6 million annual visitor rate with a 4% growth rate and the existing traffic counted in the study area with a 3% growth rate over a 10 year period. More information about the basic assumptions can be found in Section III of this report.

E. 10 Year Projection (B)

The design day used in the 10 Year Projection (B) traffic model was the Saturday in the summer 10 years after the opening of the Ark Encounter over the duration of the peak eight hours starting at 10:00 AM and ending at 6:00 PM. This traffic model used the 900,000 annual visitor rate with a 4% growth rate and the existing traffic counted in the study area with a 3% growth rate over a 10 year period. More information about the basic assumptions can be found in Section III of this report.

VIII. Analysis

Each traffic model discussed in Section VI, was observed and analyzed to determine potential congestion and safety impacts caused by the additional traffic anticipated for the Ark Encounter and possible future development. Each concern noted in the models was further reviewed for potential solutions. The potential solutions were preliminarily evaluated on a planning level to indicate the magnitude of improvements recommended to accommodate the Ark Encounter. The improvements selected in the design phase are subject to change, after further analysis of the study area.

A. Left Turns into the Ark Encounter

There is a high volume of traffic projected to turn left into the Ark Encounter. The projected traffic volumes for all scenarios show a turn signal and two left turn lanes into the development are warranted at the main entrance to the Ark Encounter. A preliminary sketch of the proposed layout is shown in Figure 14. As shown in the figure, the existing sanitary sewer is likely to be impacted by the entrance to the development.



Figure 11 – Preliminary sketch of entrance to the Ark Encounter with dual lefts from KY 36

B. Eastbound KY 36 @ Entrance to the Ark Encounter

Projected traffic volumes did not indicate that a right turn lane will be warranted on eastbound KY 36 at the main entrance to the Ark Encounter for any of the modeled scenarios. However, there are existing residential land uses on KY 36 west of the Ark Encounter. Residents in this area traveling east on KY 36 to I-75 are likely to experience addition delay. A right turn lane into the development would alleviate some of this delay and minimize the impacts of the Ark Encounter to the existing commute. As a result, a right turn lane is recommended at this location. Figure 15 below shows the proposed location for a right turn lane. A preliminary sketch of the plan view is shown in Figure 14, above.



Figure 12 - Existing conditions at the proposed Ark Encounter

C. Inadequate Entrance Spacing along KY 36

Projected traffic volumes in every modeled scenario indicate a right turn lane will be warranted on eastbound KY 36 at the ramp onto southbound I-75. However, a right turn lane at this location is not feasible under the existing configuration. The ramp from KY 36 onto southbound I-75 is separated from Skyway Drive by less than 100 feet. This is not sufficient length to install a right turn lane. Since Skyway Drive does not connect to the highway system in another location, this entrance cannot be closed to accommodate a right turn onto the southbound I-75 ramp.

Furthermore, visitors to the Ark Encounter are likely to patronize the existing and potential future businesses along Skyway Drive. As a result traffic volumes at the intersection of Skyway Drive and KY 36 are likely to increase. An increase of traffic at two intersections with 100 feet of spacing is likely to increase the probability of crashes in this area. Increased spacing between intersections along KY 36 and the installation of a right turn lane on eastbound KY 36 at the ramp onto southbound I-75 is recommended. The following alternates indicate possible improvements that address this issue.



Figure 13 – Diagram depicting the spacing deficiencies between Skyway Drive and the southbound ramp onto I-75

1. Alternate C.1 - Relocate the Entrance to Skyway Drive

There is an existing unnamed commercial entrance located approximately 500 feet west of the existing Skyway Drive. The volume of traffic at the intersection of the unnamed entrance is likely to increase as well as Skyway Drive. Relocating the entrance to Skyway Drive to line up with the unnamed commercial entrance is likely to enhance safety in the study area by improving the spacing between access points and allowing room for turn lanes at the ramp onto southbound I-75.

Turn lanes will also be feasible on KY 36 at the new Skyway Drive intersection with this configuration. Although the existing traffic volumes at this intersection do not warrant turn lanes, additional growth is likely warrant turn lanes in the future.

In order to line up Skyway Drive and the unnamed commercial entrance, a portion of Skyway Drive will need to be extended, and KY 36 will need to be widened to accommodate turn lanes. Impacts associated with this alternate are listed below:

- The 52 inch pipe under KY 36 will need to be extended more than 300 feet, and the Army Corps of Engineers 404 and the Kentucky Division of Water 401 Permit will be required, as well as related environmental analysis. This information is discussed further in Section IV of this report.
- A drainage analysis will be required to determine impacts to the pipe under KY 36.
- The existing sanitary sewer line, waterline, and overhead utilities will also be impacted by this configuration. Preliminary utility information is discussed in Section III of this report.
- The difference in elevation between the stream and KY 36 is approximately 80 feet with steep 2:1 slopes in some places. A large amount of earthwork will be required to accommodate widening along these slopes.
- A right turn lane from KY 36 onto I-75 will require a cut in the existing slope. This slope can be seen in Figure 17.
- The existing gas station on Skyway Drive could be impacted by this alternate, resulting in potential hazardous material impacts.

Preliminary sketches of this alignment are shown in Figure 18 and Figure 19.



Figure 14 – On KY 36 looking east to the ramp onto southbound I-75



Figure 15 – Preliminary sketch of the centerline of the extended Skyway Drive



Figure 16 – Preliminary Sketch of the extended Skyway drive, showing turn lanes at the intersection.

2. Alternate C.2 – Construct Roundabout at I-75 Southbound Ramps

Installing a roundabout at the intersection of KY 36 and the I-75 southbound ramps improves the right turn movement from eastbound KY 36 to the ramp onto southbound I-75. The roundabout would need to incorporate the Skyway Drive intersection, in order to avoid relocating the Skyway Drive entrance. However, the software used for the traffic models in this report does not accurately model roundabouts. This solution will require further evaluation in the design phase of potential improvements.

D. Vehicular Queue on Southbound I-75

All scenarios that were modeled indicated a significant queue at the stop condition at the end of the ramp from I-75 onto KY 36 that extends onto the through lanes on southbound I-75. Stopped traffic on I-75 increases the risk of crashes and delay at this location. Several solutions were evaluated to address this issue:

1. **Alternate D.1 - Widening the Southbound Ramp from I-75 to KY 36**

This alternate includes widening the ramp from southbound I-75 with a lane configuration that allows a dual right turn onto KY 36. This configuration increases the amount of storage and onto KY 36 and decreases the time vehicles will wait in the queue. This configuration will require a deceleration lane on southbound I-75, in order to satisfy the lane balance principle.

Furthermore, an additional lane will need to be constructed on KY 36, west of the intersection in order to facilitate the dual right movement. The additional lane on KY 36 could be terminated in a right turn lane at the unnamed commercial entrance on the north side of KY 36. A preliminary sketch of this configuration is shown in Figure 20.

The impacts associated with this alternate are listed below:

- The pipe under KY 36 will need to be extended more than 300 feet, in order to accommodate the widening of KY 36. As a result, the Army Corps of Engineers 404, the Kentucky Division of Water 401 Permit will be required, and related environmental analysis will be required. This information is discussed further in Section IV of this report.
- A drainage analysis will be required to determine potential impacts to the pipe under KY 36.
- The difference in elevation between the stream and the ramps from southbound I-75 onto KY 36 as well as the difference between the stream and KY 36 is approximately 80 feet with steep 2:1 slopes in some places. A large amount of earthwork will be required to accommodate widening along these slopes.
- There is a high mast light pole located to the east of the ramp from I-75 onto KY 36 that could be impacted.

Although this alternate reduces the amount of time vehicles are queued onto I-75, it does not eliminate the queue entirely. In order to eliminate a queue of vehicles on I-75 for all hours of the day, additional countermeasures must be taken.



Figure 17 – Preliminary sketch showing the widened ramp from southbound I-75 onto KY 36 and the widened KY 36 from the southbound I-75 ramps to the unnamed commercial entrance

2. Alternate D.2 - Signal on KY 36 at the Southbound I-75 Ramps

Traffic models show that widening the southbound ramp from I-75 onto KY 36 and providing dual right movements does not fully alleviate the concern for vehicles queuing onto southbound I-75. With this configuration, the opening year traffic models indicate that a vehicle queue on I-75 is predicted with the 1.6 million annual visitor rate, but a queue not predicted with the 900,000 annual visitor rate. Both visitor rates show a queue on southbound I-75, 10 years after the opening year.

A traffic signal at the intersection of KY 36 and the southbound I-75 ramps shows a significant reduction in the traffic queue in the traffic models. However, new traffic signals in Kentucky are generally based on the eight hour volume warrant. Traffic volumes do not satisfy this warrant in the opening year for either of the projected traffic volumes. Although the four hour signal warrant is not typically used for new signal approval, the projected volumes satisfy this warrant.

3. Alternate D.3 - Roundabout at KY 36 and the I-75 Southbound Ramps

The software used in for this report does not accurately model roundabouts. As a result, a roundabout in this location was not analyzed. However, roundabout options should be evaluated in the design phase of this project.

E. Left Turns from KY 36 onto the Northbound I-75 Ramp

Traffic volumes in all scenarios indicated that left turn lane from KY 36 onto the I-75 northbound ramp is warranted. However, the existing bridge is approximately 28 feet wide, which is not sufficient width for three lanes and shoulder. A picture of the existing bridge is shown in Figure 21. The existing bridge will need to be widened to accommodate an additional lane. An added benefit to widening the bridge is that a left turn lane will also be easily accommodated on westbound KY 36 onto the southbound I-75 ramp. This configuration is shown in Figure 22.

The inspection report for the existing KY 36 Bridge over I-75 shows sufficiency rating of 64 out of 100. Since the sufficiency rating is not below 50, it does not qualify for bridge replacement funding. Furthermore, the superstructure of the bridge is rated as a 5 out of 9 and the substructure is rated a 6 out of 9. This indicates that the superstructure and substructure of the bridge is in fair condition. The most recent inspection report can be found in Appendix A.

Although the bridge is in structurally fair condition, it is recommended that the entire structure is replaced. Since the existing portion of the bridge will need replacement prior to the new portion of the bridge, and the lifespan of a widened bridge utilizing the existing substructure would be shorter than that of a completely new bridge.

Furthermore, a high mast pole is located on the north side of KY 36 near the ramp onto northbound I-75, and would need to be replaced if it is impacted by the new design.



Figure 18 – On the KY 36 Bridge over I-75, looking east to the ramp onto northbound I-75



Figure 19 – Preliminary sketch of the widened KY 36 Bridge over I-75, showing left turn lanes at the northbound and southbound ramps onto I-75

F. Ramp from Northbound I-75 to KY 36

The existing ramp from northbound I-75 onto KY 36, shown in Figure 23, does not have left or right turn lanes at the end of the ramp. The traffic models did not indicate significant delay without turn lanes in this location. However, as the area develops, the opposing traffic for vehicles wishing to turn off of the ramp will increase as well as the queue of vehicles at this location. Constructing left and right turn lanes in this area will help prevent unnecessary delay at this intersection.



Figure 20 – On the ramp from northbound I-75 looking north to KY 36



Figure 21 – Preliminary sketch showing a left and right turn lane at the end of the northbound ramp from I-75 onto KY 36

IX. Infrastructure Improvements

The analysis of the projected traffic models and the existing infrastructure the following improvements will likely be required to accommodate the additional traffic generated by the Ark Encounter. Note that this is a preliminary report for planning purposes only. Any final recommendations should be determined after a more detailed analysis in the design phase of an improvement project:

- Install 10 foot paved shoulders on KY 36 throughout the entire study area.
- At the main entrance to the Ark Encounter, install a right turn lane on eastbound KY 36, two left turn lanes on westbound KY 36, close the existing farm entrance, and install a traffic signal.
- Replace the existing KY 36 Bridge over I-75 to accommodate a left turn lane from eastbound KY 36 onto the I-75 northbound ramps. The new structure will also provide the necessary width for a left turn from westbound KY 36 onto southbound I-75.
- Install a left and right turn lane at the end of the northbound I-75 ramp onto KY 36.
- A countermeasure at the intersection of KY 36 and the southbound I-75 ramps will be necessary to prevent a queue of traffic on I-75. Furthermore, the eight hour volume warrant is not satisfied for the traffic signal discussed in Alternate D.2. This indicates that a roundabout might be the optimal solution at this intersection. The spacing deficiencies along KY 36 would need to be considered in the roundabout evaluation. As a result of this recommendation, the following configurations should be further developed in the design phase:
 - Widen the existing ramp from southbound I-75 onto KY 36 to two lanes with dual right turning movements on to KY 36. Westbound KY 36 will need to be widened to accommodate the dual right turning movements. The additional lane on KY 36 can end as a right turn only into the unnamed commercial development.
 - Relocate Skyway Drive to line up with the unnamed commercial entrance, including left and right turn lanes on KY 36, and the following countermeasures as part of this configuration:
 - Install a roundabout at the intersection of KY 36 and the southbound I-75 ramps.
 - Install a traffic signal at the intersection of KY 36 and the southbound I-75 ramps
 - Install a roundabout that incorporates Skyway Drive, KY 36 and the southbound I-75 ramps into one intersection.

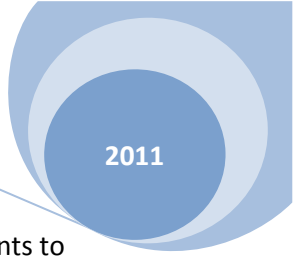
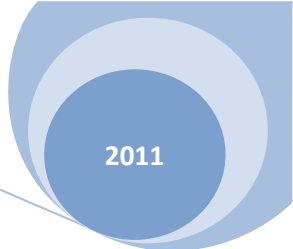


Table 4 shows a planning level cost estimate of the estimated infrastructure improvements to accommodate the additional traffic from the Ark Encounter.

ESTIMATE				
Design	Utilities	Right of Way	Construction	Total
\$830,000	\$750,000	\$390,000	\$9,100,000	\$11,070,000

Table 5 – Planning level cost estimate of improvements



X. APPENDIX A – Inspection Report of KY 36 over I-75

041B00007N

KYTC Bridge Inspection Report

Summary:

Inspection Date: 7/20/2010
 Inspector: GCOCHRAN (23)
 Primary Type: Standard (24 Months)

Types of Inspections Performed:

National Bridge Inventory: Y
 Element: Y
 Fracture Critical: N
 Underwater: N
 Other Special: N

District Review Date: 8/16/2010

Inspector Signature: _____

District Reviewer: BSEITER (55)

IDENTIFICATION			
Bridge ID (8):	041B00007N	MAP BRIDGE	District Number: 6
Route Carried (7):	KY-36		County (3): 41 Grant
Mile Point:	14.469		Feature Intersected (6): I-75
Location (9):	.3 MI W OF JCT US 25		Road Name: JONESVILLE RD
Structure Description:	254.83 Foot - 4 Span Concrete continuous Tee Beam		

NBI CONDITION		SCHEDULE TAB				
Deck (58):	5	Schedule:	Required (Y/N)	Last Date	Frequency	Next Date
Superstructure (59):	5	NBI (90):		7/20/2010	(91): 24 mos	7/20/2012
Substructure (60):	6	Fracture Critical (92A):	N	(93A): 1/1/1901	(92A): mos	1/1/1901
Culverts (62):	N	Underwater (92B):	N	(93B): 1/1/1901	(92B): mos	1/1/1901
Channel/Protection (61):	N	Other Special (92C):	N	(93C): 1/1/1901	(92C): mos	1/1/1901
		Elemental:	NA		24 mos	7/20/2012

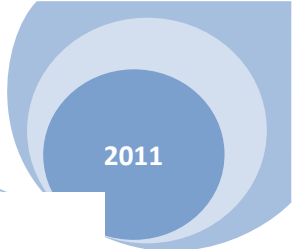
Load Rating and Posting						WATERWAY	
Truck Type	Typ I	Typ II	Typ III	Typ IV	Gross	Scour Critical (113):	N
Recomm. Posting:	-1	-1	-1	-1		Observed 113 Rating:	N
Field Posting:	-1	-1	-1	-1	-1	Waterway Adeq. (71):	N
Posting Status (41):	A Open, no restriction						
Signs Posted:	Cardinal:	N	Non-Cardinal:	N			

DECK/WEARING SURFACE						
Deck Type (107):	1 Concrete-Cast-In-Place					
Wearing Surface/Protective System (108):	Type:	4	Membrane:	0	Protection:	0
Traffic Safety Features (36):	Bridge Rail:	0	Transition:	1	Appr. Rail:	0
Overlay:	Y					
Overlay Type:	Latex					
Overlay Thickness:	2.01					

Vertical Clearances	
Minimum Vertical Overclearance (53):	99.99
Minimum Vertical Underclearance (54):	17.58
Maximum Vertical Clearance (10):	99.99
Minimum Vertical Clearance:	

Sufficiency Ratings		
SR:	64.00	SD/FO: 2 Functionally Obsolete

Element Condition State Data								
Elm/Env	Description	Units	Total Qty.	Qty. CS1	Qty. CS2	Qty. CS3	Qty. CS4	Qty. CS5
110/1	R/Conc Open Girder	LF	1,019.32	991.32	28.00	0.00	0.00	0.00
18/1	P Conc Deck/Thin Ovl	SF	7,537.87	7,537.87	0.00	0.00	0.00	0.00
205/1	R/Conc Column	EA	9.00	8.00	1.00	0.00	0.00	0.00



041B00007N

KYTC Bridge Inspection Report

Summary:

Inspection Date: 7/20/2010
 Inspector: GCOCHRAN (23)
 Primary Type: Standard (24 Months)

Types of Inspections Performed:

National Bridge Inventory: Y
 Element: Y
 Fracture Critical: N
 Underwater: N
 Other Special: N

Element Condition State Data									
Elm/Env	Description	Units	Total Qty.	Qty. CS1	Qty. CS2	Qty. CS3	Qty. CS4	Qty. CS5	
215/1	R/Conc Abutment	LF	108.50	86.50	22.00	0.00	0.00	0.00	
234/1	R/Conc Cap	LF	90.00	82.00	8.00	0.00	0.00	0.00	
302/3	Compressn Joint Seal	LF	72.50	72.50	0.00	0.00	0.00	0.00	
311/1	Moveable Bearing	EA	16.00	6.00	10.00	0.00	0.00	0.00	
313/1	Fixed Bearing	EA	4.00	4.00	0.00	0.00	0.00	0.00	
331/1	Conc Bridge Railing	LF	509.66	509.66	0.00	0.00	0.00	0.00	
359/1	Soffit Smart Flag	EA	1.00	0.00	0.00	0.00	1.00	0.00	
503/1	RC Curb	LF	509.66	509.66	0.00	0.00	0.00	0.00	
604/1	2nd Elem Dist	EA	1.00	1.00	0.00	0.00	0.00	0.00	
611/1	Embankment Erosion	EA	1.00	0.00	1.00	0.00	0.00	0.00	

Element Condition State Data				
Str	Unit	Elm/Env	Description	Description
1		110/1	R/Conc Open Girder	<p>Beams- Beam elements throughout structure are of Tee Beam design. Note that random beam ends located at abutment seats (both rear and forward) were found to have areas of spalling with exposed rusting reinforcing steel. Spalling was also found in beams at encased sole plate locations of bearing devices, random throughout. All concrete beams were found to have dark staining throughout. Exterior beams #1 and #4 were found to have random areas of longitudinal, vertical and diagonal flexure cracking along exterior fascias, with seepage and heavy efflorescence. Longitudinal cracking was mostly detected throughout original construction joint at union of cast-in-place deck to beams. Note that one area of longitudinal cracking found in beam #4, forward abutment appears to have minor opening conditions starting. Area should be closely watched for further changes. Diagonal and vertical cracking found in exterior beam fascias were random throughout, but do note that some areas were found in shear zones, which need to be watched closely as well. All Tee beam elements that could be closely viewed from ground were found to have hairline vertical flexure cracking, which are randomly spaced throughout. Random locations throughout bottom flange of beams were found to have light spalling with exposed rusting reinforcing steel material, which appears to be from lack of clearance between steel and face of beam (incorrect placement of steel during original construction). A minor amount of vibration was noted while structure was under traffic load. Light scrapes were found in bottom flange of both beams #1 and #2 in span #3, due to traffic impact. (See Photos)</p>
1		18/1	P Conc Deck/Thin Ovi	<p>Deck- (Note: Structure was refurbished with the placement construction of new expansion joints and deck surface was overlaid with a modified latex concrete during the year of 2004.) Wearing surface overlay was found to have a minor loss of texture in random locations throughout. Deck wearing surface was not textured much during the placement of overlay, which is now showing a minor loss in texture and stone aggregates are becoming exposed and highly polished. Large areas in overlay surface in spans #1 and #2 appear to have become wet during original placement, leaving ruff surfacing. Minor settlement was noted at both rear and forward approach roadway transitions, which is causing minor impact to structure from traffic flow. Gutter lines throughout deck area were found to have a minor to moderate amount of roadway dirt and debris, which needs to be removed. (See Photos)</p>
1		205/1	R/Conc Column	<p>Pier Columns- Pier column elements were found to be performing as designed at this time. Random areas of light spalling was found with exposed reinforcing steel, due to light cover of fascia concrete from steel during original construction. Several areas of spalling and chipping was found in pier columns, due to traffic impact during the past. (See Photos)</p>

041B00007N

KYTC Bridge Inspection Report

Summary:

Inspection Date: 7/20/2010
 Inspector: GCOCHRAN (23)
 Primary Type: Standard (24 Months)

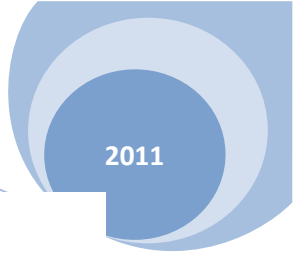
Types of Inspections Performed:

National Bridge Inventory: Y
 Element: Y
 Fracture Critical: N
 Underwater: N
 Other Special: N

Element Condition State Data			
Str	Unit	Elm/Env	Description
1	215/1	R/Conc Abutment	<p>Abutments- Both the rear and forward abutment elements were found to have random cracking located at or near the breastwall union with wingwall's. Note that cracked areas have seepage, dark staining and efflorescence throughout, with exposed rusting reinforcing steel in random areas. Dark staining was found typical throughout both abutment breastwall's, due to leakage and failure of expansion joint devices above. Note that the rear abutment backwall was found to have large areas of deterioration, spalling and exposed rusting reinforcing steel throughout fascia at this time. Abutment seats were found to have a minor to moderate amount of debris buildup throughout, which needs to be removed. (See Photos)</p>
1	234/1	R/Conc Cap	<p>Pier Caps- Pier cap elements were found to be performing as designed at this time. Random areas of dark staining was found typical throughout all caps, due to general age and weathering conditions.</p>
1	302/3	Compressn Joint Seal	<p>Expansion Joints- Expansion joints throughout structure were found to be of Compression Seal design. Both the rear and forward expansion devices were found to be filling with roadway dirt and debris, which could cause failure of seal materials sooner or later. Debris buildup in area of seals place downward pressure on seals under traffic flow. Note that seal material throughout joints were found to be leaking in random areas at this time, which is exposing random structural elements (beam ends, abutment seats, etc.) below to leakage conditions. (See Photos)</p>
1	311/1	Moveable Bearing	<p>Moveable Bearing- Moveable bearing devices throughout structure are of Painted Steel Rocker design. All bearing devices were found to have vary degrees of rusting condition, section loss and pack rust, due to protection paint coating system failures. Exterior devices located at abutment seats were found to be in the worst condition at this time. All bearing devices need to be sandblasted and repainted as soon as possible. Note that all rocker bearing devices were found to have moderate to max tilt at this time, with devices at abutment #1 and pier #2 showing rear tilt towards the west and devices located at pier #4 and the forward abutment showing forward tilt towards the east. Several bearings located on abutment seats were found to be at max tilt at this time. (See Photos)</p>
1	313/1	Fixed Bearing	<p>Fixed Bearings- Fixed bearing devices were found located on pier seat #3. Protective paint coating system throughout bearing devices is showing failure at this time.</p>
1	331/1	Conc Bridge Railing	<p>Bridge Railing- Bridge railing throughout structure was found to have a minor amount of light surface scaling and dark staining, due most to general age and weathering conditions.</p>
1	359/1	Soffit Smart Flag	<p>Soffit- Deck bottom (soffit) was found to have random large areas of concrete deterioration and delamination, due previous deck leakage conditions. Approximately 40% plus of deck bottom has dark water and rust staining, heavy cracking (transverse and longitudinal), efflorescence and stalactites up to 6.0 inches in length found typical throughout. Worst conditions appear to be in spans #2 and #3, which are directly over I-75. Random areas throughout deck soffit were found to be spalling in spans #1, #2 and #3. Note that spalled concrete debris is a hazard to traffic flow, as spans #2 and #3 are directly over I-75 north and southbound's. Delaminated and loose sections of debris needs to be removed as soon as possible. Spalling noted in span #1 was found in bay #1 center of span, which is exposing reinforcing steel. (See Photos)</p>
1	503/1	RC Curb	<p>Curbs- Concrete curb elements throughout structure were found to have random areas of deterioration along interior face, which have fascia cracking, spalling, exposed rusting reinforcing steel and general crumbling of concrete material. Most deteriorated areas noted in curbs are located in the right side element. (See Photos)</p>
1	604/1	2nd Elem Dist	<p>2nd Element Distress- Main diaphragm elements throughout Tee beam system was found to be starting to show hairline cracking and moderate efflorescence.</p>
1	611/1	Embankment Erosion	<p>Erosion- Erosion was found in the rear abutment embankment slope, which does not have a erosion control protection system. Embankment appears to have been seeded and strawed, due to construction work on I-75. Eroding conditions continue at this time.</p>

BRIDGE.Notes

KY-36 over I-75 Northbound and Southbound.



041B00007N

KYTC Bridge Inspection Report

Summary:

Inspection Date: 7/20/2010
 Inspector: GCOCHRAN (23)
 Primary Type: Standard (24 Months)

Types of Inspections Performed:

National Bridge Inventory: Y
 Element: Y
 Fracture Critical: N
 Underwater: N
 Other Special: N

Work Candidates						
Inspector Candidates:						
Candidate ID:	Status	Priority	Assigned	Action	Elem	Date Recommended
041-B00007N-1	Approved	Medium	Unassigned	60	0	7/20/2010
041-B00007N-2	Approved	High	Unassigned	33	311	7/20/2010
041-B00007N-3	Approved	High	Unassigned	31	359	7/20/2010

041B00007N (07/20/10)
Forward to Rear



041B00007N



Forward Abutment



Longitudinal cracking with efflorescence noted in deck soffit, span 4, bay 3.



Seepage noted in abutment seat at forward abutment, right side.



Rocker # 2 at the forward abutment

1

041B00007N



Open cracking noted at beam end # 3 at forward abutment.



Concrete spall found typical throughout beams at sole plate.



Concrete spall and exposed rusting reinforcing steel noted in beam end # 4 at forward abutment.



Compression joint noted at the forward transition.

041B00007N



Concrete spall and exposed rusting reinforcing steel noted in concrete curb element, right side.



Compression joint noted at rear transition.



Rear to Forward



Rear abutment

041B00007N



Concrete spall and exposed rusting reinforcing steel noted in back wall, right side.



Roadway dirt and debris noted in rear abutment seat.



Exposed rusting reinforcing steel noted in beam # 2, span 1.



Structure Stamped
1959
HS-20-44

041B00007N



Traffic impact noted in pier # 2, column
1



Concrete spall noted in deck soffit,
span 2, bay 3.



Vertical flexure cracking with
efflorescence noted in exterior beam #
4.



Bottom side of span # 2 over KY-75
Southbound

041B00007N



Diagonal, longitudinal, and transverse cracking with efflorescence noted in bay 3, span 2.



Bottom side of span # 3 over KY-75 Northbound



Concrete spall with exposed rusting reinforcing steel noted in bay 2, span 3.



Traffic scrape noted in span 3, beam 1.