Estimating the Monetary Benefits of Reducing Delays on Heavily Trafficked Truck Freight Corridors in Georgia

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Task 1: Defining a Study Corridor

1. Introduction

The latest federal legislation, in the form of the 2012 Moving Ahead for Progress in the 21st Century Act (MAP-21) has placed corridors, and in particular freight corridors, front and center, requiring the US Department of Transportation (US DOT) to designate a national freight movement network that includes “major trade gateways and national freight corridors”, and requiring State DOTs to contribute to improved freight movement by developing performance metrics for “critical rural freight corridors” within their jurisdiction (FHWA, 2013). Formally, Title 23 CFR 450.212 provides the authority to regional planning agencies to carry out “corridor or sub-area” planning as part of the federally supported statewide transportation planning process.

This technical memorandum describes the truck freight corridor selected for project case study. The selection process represents the first step in an empirical analysis of the types of freight being moved over the nation’s major highway corridors, and an assessment of the economic costs of delays involved in such movements.

2. Literature on Corridor Definition and Guidelines

Corridor studies are already commonplace in transportation planning, whether dealing with freight, passenger, or mixed passenger-freight movements. These include a number of state DOT sponsored freight corridor and mixed passenger-freight corridor analyses (e.g. Adams et al, 2006 mid-western freight corridor study; Hadi, et al’s 2010 study of Florida freeway freight corridors; IDOT/INDOT’s 2012 study Illinois and Indiana passenger and freight corridors; Schneider and Fish’s 2008 study of Wyoming’s I-80 freight corridor; Liao’s 2009 study of I-90 /I-94 freight corridor performance between Minneapolis and Chicago; Southworth and Gillett’s 2011 study of trucking performance along Georgia’s I-75 corridor; North Carolina DOT’s economic impact assessment of trucking activity and the shipment of goods along I-95 (CSI and ATRI, 2013); and Colorado DOT’s mixed traffic congestion studies of the I-70 Mountain Corridor (CDOT, 2011; Louis Berger, 2014). Such studies either implicitly or explicitly recognize the economies of scale associated with building network infrastructures that concentrate the movement of people and goods along high capacity routes such as multi-lane highways.

However, while a corridor-based approach to infrastructure investment has worked well for a number of decades, the combination of sustained traffic growth and increasingly constrained fiscal resources now places a burden of significant traffic congestion on many of these high-volume routes. One result of this has been the emergence of corridor management plans, as well as guidelines for carrying out corridor-based studies. And not coincidentally, the spotlight theme for the 2015 Transportation Research Board's (TRB) Annual Meeting is **"**Corridors to the Future".

But what do we mean by a transportation corridor, or more precisely for planning purposes, a corridor study area? An internet search throws up the following, more succinct, but single mode definition:

"*A transportation corridor is defined as a combination of transportation networks that link the same major origins and destinations. In simple terms, a transportation corridor is a linear pathway intended for a particular mode of transportation*." http://www.ask.com/question/define-transportation-corridor

According to the Transportation Research Board's (TRB) NCHRP 399, *Multimodal Corridor and Capacity Analysis Manual* (CSI et al, 1998):

"*The definition of a corridor encompasses a broad and loose meaning of the word. Indeed, there is no hard definition of the word. ….. Most corridors are identified by the primary facility or facilities that are included. For instance, portions of the interstate highway system,…*" (page 17).

TRB's more recent Guidebook for Corridor-Based Statewide Transportation Planning (Carr et al, 2010) also offers only some broad insights into corridor study area definition. The principal intent of this guidebook is, rather, to describe a strategic approach for using the results of individual corridor plans in developing a full statewide transportation plan: assuming that practitioners already know how to carry out individual corridor studies. However, while no details are provided for constructing the most appropriate geographic study area boundaries in support of such studies, the report does provide lists of the criteria used in a number of State DOTs for its corridor selection purposes. The guidelines offered by both Smith (1999) and Carr et al (2010) focus principally on the steps required of MPOs and State DOTs, to develop multi-agency and stakeholder relevant management plans; with comparatively limited attention paid to the identification of an appropriate study area. That is, they focus on what Rodrigue et al (2013) term the formal aspects of corridor definition, as opposed to the function definition of a corridor as a geographic entity that captures those flows (of freight and/or passengers) whose movement volumes and spatial patterns collectively determine a study area's travel conditions both now and in the (planning context specific) future.

The TRB funded Guidebook for Transportation Corridor Studies (Smith, 1999) offers the following definition:

"*Broadly defined, a corridor generally refers to a geographic area that accommodates travel or potential travel. Normally, a corridor is considered to be a 'travel shed,' an area where trips tend to cluster in a general linear pattern, with feeder routes linking to trunk lines that carry longer distance trips in a metropolitan area.*"

Smith (1999) also does offer the following broad insights into study area definition (page 1-3):

"The exact extent of the corridor to be studied is best determined during the identification of the problem and determination of the corridor study strategy."

while noting that most practitioners, however they may disagree on specifics, would likely agree that:

- The study area needs to be large enough to incorporate all impacts relevant to the decision at hand; and

- Agencies should try to limit the study area as much as possible to focus the study and control the costs of analysis.

However, the specific details leading to selection of a study area corridor, not developed in detail as part of these guidelines, are then a function of the goals and scope of the study, both geographically and contextually.

In addressing this topic in the context of "integrated corridor management" within metropolitan areas, Reiss et al (2006) provide numerous example definitions, eventually settling for their particular study purposes on:

"Corridor – A largely linear geographic band defined by existing and forecasted travel patterns involving both people and goods. The corridor serves a particular travel market or markets that are affected by similar transportation needs and mobility issues. The corridor includes various networks (e.g. limited access facility, surface arterial(s), transit, bicycle, pedestrian pathway, waterway) that provide similar or complementary transportation functions. Additionally, the corridor includes crossnetwork connections that permit the individual networks to be readily accessible from each other."

Finally, a recent paper by Bahbouh and Morency (2014), albeit with a focus on defining corridors within urban areas, tries to introduce a greater degree of formalism into corridor definition, basing its approach on the visualization and identification of corridors from origin-destination (O-D) data. In doing so, the authors note that "most research has used the corridor concept to recognize travel patterns with no clear definition of the *(corrido*r) concept." They distinguish between two different approaches to corridor definition in the past literature: supply corridors and demand corridors, with the latter usually based on O-D flow patterns. Focusing on demand-defined corridors, they use GIS technology to map an O-D flows matrix, with subsequent clustering to identify and map the main concentrations of flow. They suggest the use of i) a minimum flow density, ii) a suitable corridor width or zone of influence, and iii) a corridor minimum length, as three criteria for corridor definition.

As a practical matter, most U.S, based inter-city or inter-state freight corridor studies carried out over the past decade, including all of the above-referenced studies, make use of geographic information systems (GIS) software in the corridor identification as well as display process. Many of these studies also make use of the federal government's Freight Analysis Framework (FAF) dataset; and notably its GIS-mappable, and highway network database-supplied nationwide truck trip assignment estimates and forecasts (FHWA, 2014), to identify high volume truck corridors of interest/concern.

Few regional features lend themselves more readily to mapping than linear corridors. Three example studies demonstrate the value of GIS technology to the corridor planning/selection process. One of these is the study by Alam and Fepke (1998), who provide one of the earliest examples of applying GIS-based data manipulation techniques to the modeling of annual truck freight movements, in their case along the I-90/I-94 corridor between Seattle, WA and Chicago, IL. With the goal of understanding how these movements were influenced by truck size and weight (TS&W) regulations, the GIS software produced several useful corridor graphics, covering 9 States and showing, inter alia, parallel rail line and the locations of 19 major commercial and population activity centers, and 18 major intermodal terminals (mainly TOFC/COFC rail-truck transfer facilities), metropolitan areas. The study also mapped estimated truck flows by vehicle class to Interstate sections, as well as state specific TS&W restrictions along the corridor.. Using a field survey of some 7,700 trucks using the corridor, this study also describes one of the earliest (and pre-FAF supported) efforts to associate truck size and commodity-related body types with specific highway sections of an inter-city (and inter-state) corridor. Two, more recent example studies, carried out by Liao (2009) and Southworth and Gillett (2011), used GIS software and FAF data to develop truck freight corridor performance measures for the I-75 corridor between Macon, GA and Valdosta, FL, by integrating FAF network link flow and capacity data estimates with Georgia DOT-supplied traffic counts by truck size class, and American Transportation Research Institute (ATRI) supplied, GPS-based, hourly Interstate highway truck traffic speeds.

In summary, and while the details leading to selection of a freight corridor study area are very much a function of a study's specific goals and scope, both geographically and contextually, recent studies display at least five common elements:

1) a pattern and volumes of travel movements feeding into, through and out of a dominant linear transportation network infrastructure, such as a primary highway, major waterway, or major rail line, or an in-parallel combination of two or more of these mode specific features;
2) a common set of travel origins and destinations whose choice of routes (and possibly also modes) lead to significant levels of multi-origin, multi-destination traffic-related interaction;
3) the existence and/or expectation of high traffic volumes, and costly congestion induced travel delays along the corridor's primary network infrastructure (usually an interstate highway); and an assumption that financial economies of scale exist from these corridor-channeled traffic flows;
4) the use of existing, federal government supported datasets, and notably the FAF freight flow and highway network assignment dataset, and both State DOT and FHWA-supported and ATRI supplied truck count and GPS tracking data along the corridor's major facilities; and
5) the use of GIS software to support both the corridor visualization and corridor definition process.

In the scope of developing a national freight network to assist States in strategically directing resources for the improvement of freight on highways, MAP-21 includes factors for USDOT to consider in designating the primary freight network. These factors include: origins and destinations of freight movement; total freight tonnage and value moved; traffic volume; ports of entry; access to energy exploration, development, installation, or production areas; population centers; and network connectivity. Furthermore, MAP-21 sets criteria (some related to the factors for designating the primary freight network) for States to use to designate critical rural freight corridors. Collectively, the criteria state that a corridor can be designated if a minimum share of the annual average daily traffic on that route is attributed to trucks, and if the corridor provides connectivity between the primary freight network or Interstate System and facilities that handle heavy amounts of commodities on an annual basis.

Given the present study's focus on congestion-influenced freight value of time, it was also important to have access to data on (or, more precisely, to data that could be used to estimate) the origin-to-destination movements of specific classes of commodity within the corridor – for which the FAF3 data again provides the basis for model-based estimation.

3. Corridor Selection: The Interstate-85/285 Corridor in Georgia

Using the criteria listed above in Section 2 above, a truck freight corridor based on I-85/I-285 within Georgia was selected for case study. The corridor is roughly 178 miles long, running south-west to north-east between Troup and Hart Counties, and passing through the metropolitan area of Atlanta near its mid-point. The corridor currently exhibits a high level of daily truck traffic, which is expected to grow significantly over the next two to three decades. As illustrated by the latest ATRI rankings of the most congested portions of the nation's interstate system (Short and Murray, 2014) this corridor already experiences significant mixed auto-truck traffic congestion along many sections of its route, and notably where it intersects with other high volume interstates around Atlanta. Such congestion is projected to grow much worse over the next two to three decades if current highway capacities and freight mode shares within the corridor's flow- influencing region remain unchanged. The principal source for this information was FHWA's Freight Analysis Framework, Version 3 (FAF3) dataset and supporting truck flow maps (FHWA, 2014). Figures 1.1, 1.2 and 1.3 map the corridor, showing respectively, how through trucks are routed around Atlanta via that metropolitan area's I-285 "perimeter" ring road (Figure 1.1), the FAF3 2007 estimate and 2040 forecast of annual average daily truck traffic (AADTT) volumes on I-85 and the other interstate corridors within Georgia (Figure 1.2), and the location of the corridor with respect to flows from and to origin-destination (O-D) pairs of places in other states that appear to have resulted in some truck traffic on the study corridor in 2007 (Figure 1.3).

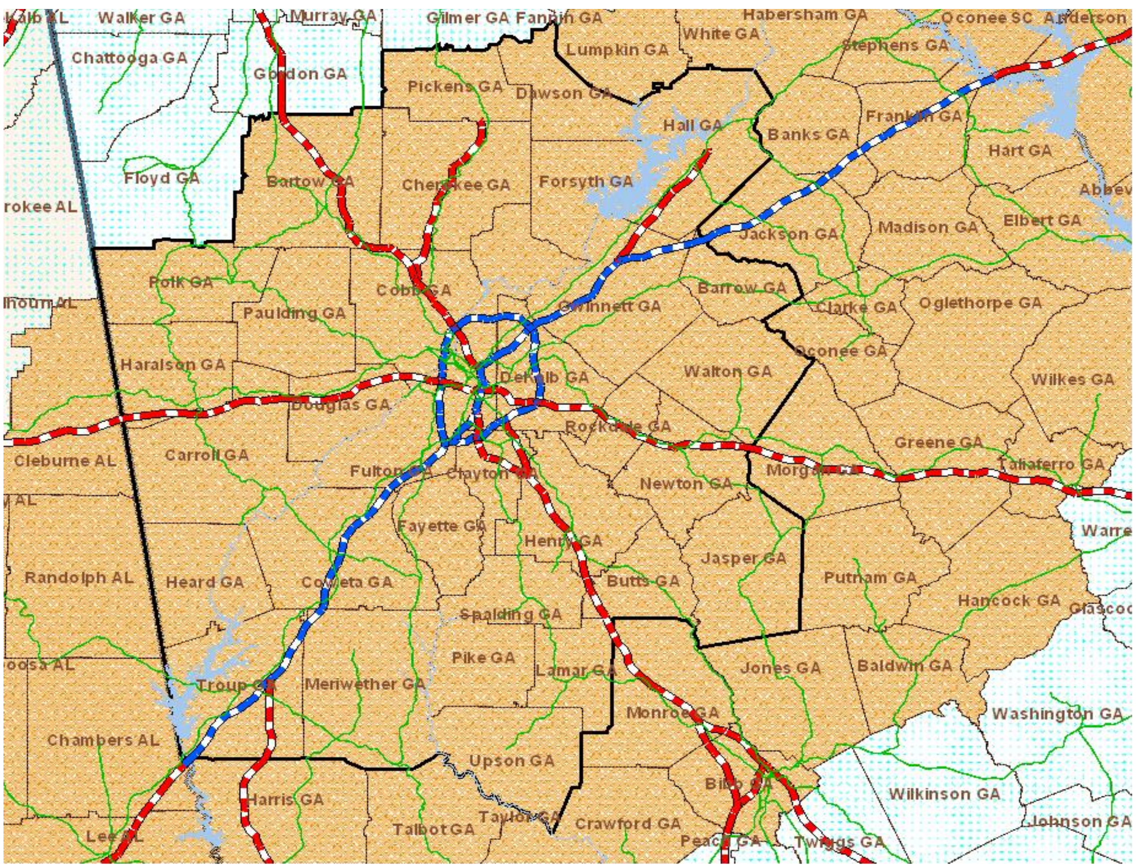


Figure 1.1 The I-85 Study Corridor in Georgia.

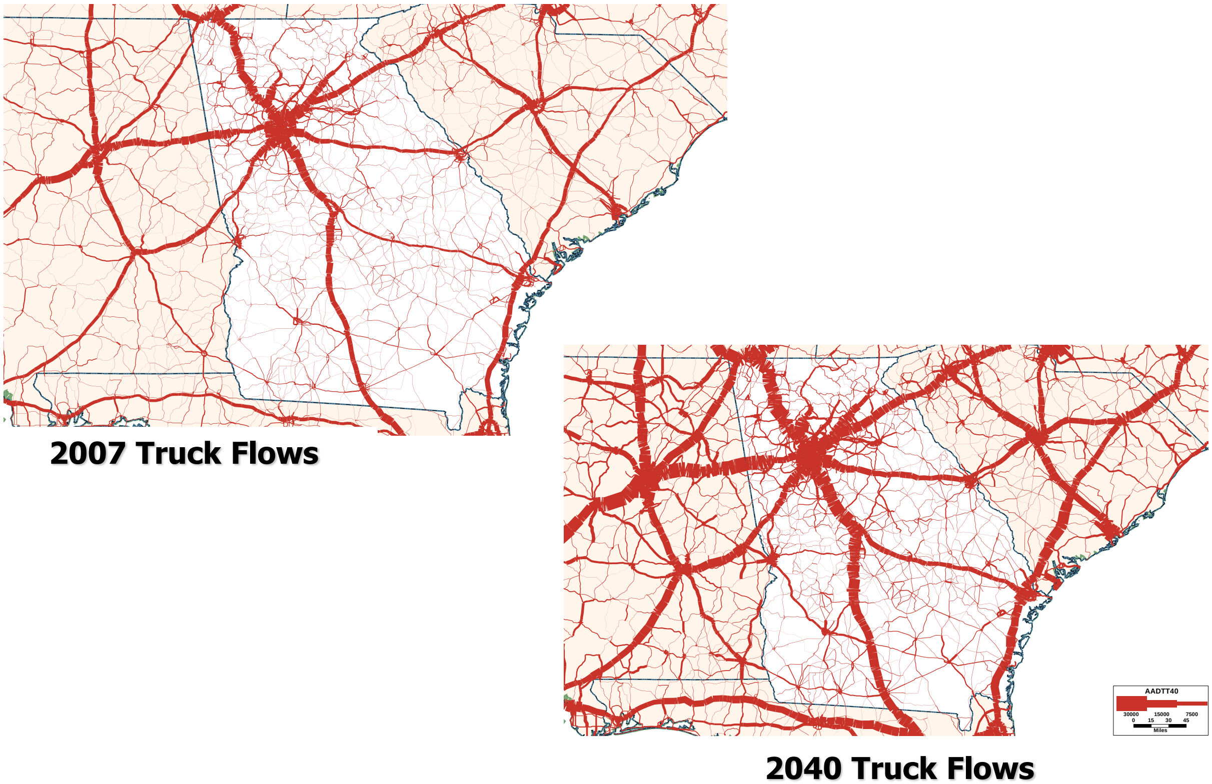
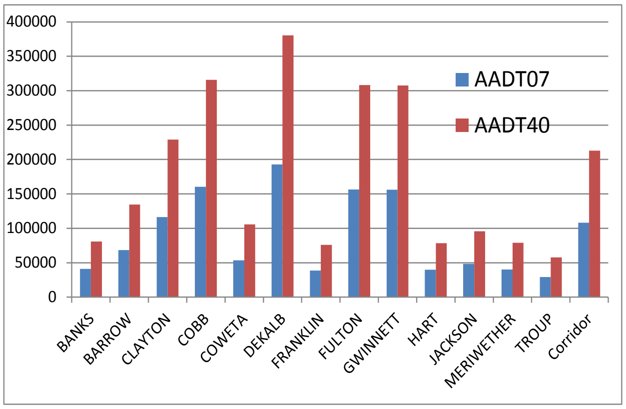


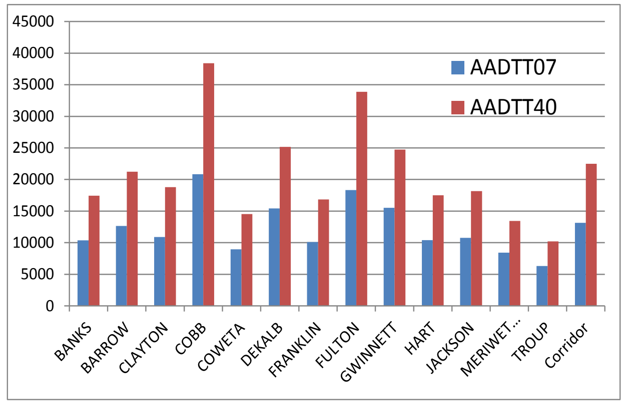
Figure 1.2 FAF3 AADTT Estimates for 2007 and 2040: Georgia Corridors.

Figure 1.3 Truck Flows Between O-D Pairs That Influenced I-85 Corridor Traffic Volumes in 2007 (estimated, based on FAF3 and other data sources).

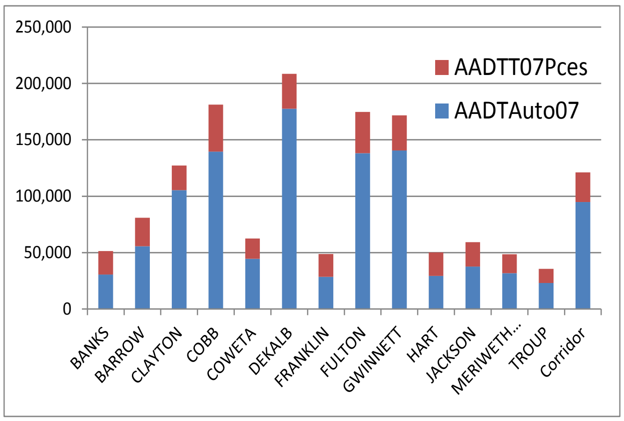
(A) AADT Traffic Volumes by County



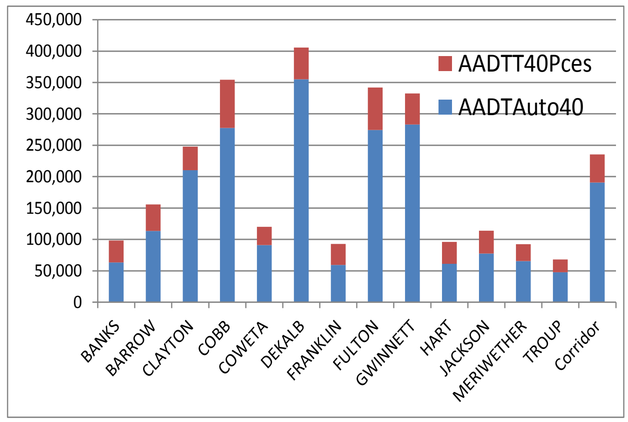
(B) Truck Traffic AADT Volumes by County



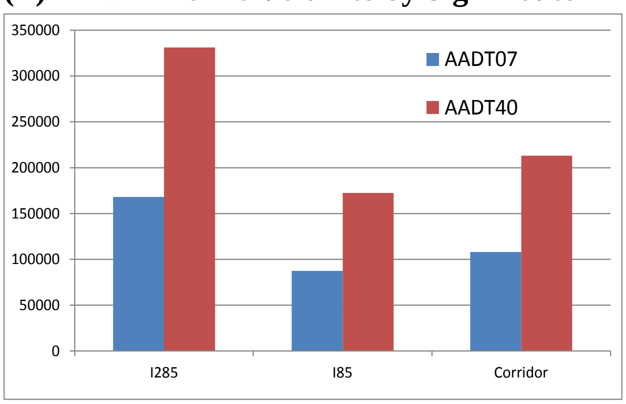
(C) Auto + Truck Traffic PCEs, 2007



(D) Auto + Truck Traffic PCEs, 2040



(E) AADT Traffic Volumes by Sign Route



(F) Truck AADT Volumes by Sign Route

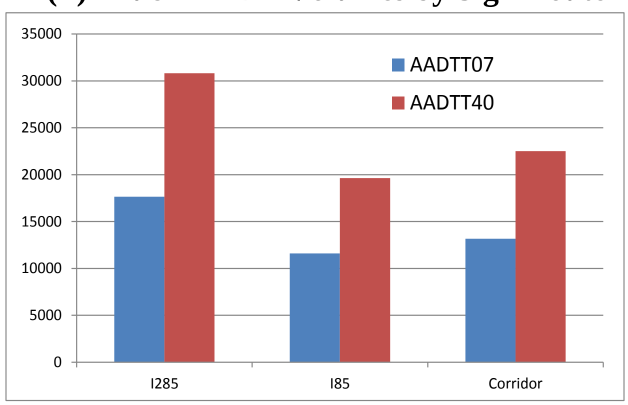


Figure 1.4 Three Views of Recent and Forecast Traffic Volumes on the I-85 /I-285 Corridor in Georgia[1]

[1] County AADTs and AADTTs in Figure 4 are link mileage weighted volumes aggregated to county averages for the 13 Georgia counties through which the corridor passes. PCEs are also link mileage averaged with 1 truck averaging 2 automobile PCEs corridor-wide in Figures 4C and 4D.

Based on FAF3 forecasts, truck tons and ton-miles of freight either generated or received within a six state region that includes Alabama, Florida, Georgia, South and North Carolina and Tennessee are projected to increase by more than 45% and 68% respectively over the 25 year period between 2015 and 2040: *while the monetary value of this freight increases by almost 93%.*

This includes significant anticipated traffic growth over the next two and a half decades along much of the I-85/I-285 corridor within Georgia, on the order of 97% growth in average annual daily traffic (AADT) of all vehicle classes between 2007 and 2040, and with truck AADT growing by as much as 71% on I-85 and 75% on I-285 during this period (see Figure 1.4). Such traffic growth would produce unsupportable v/c ratio increases along the corridor at its current throughput capacity and with no shifts to alternative modes of transportation (see Figure 1.5), with many sections of I-85 and I-285 experiencing average space mean speed reductions of greater than 40% well before 2040. Such estimates are, however, illustrative of the size of the infrastructure investment problem transportation planners and decision-makers will need to face up to if freight demand continues to rise at anything like the pace it has demonstrated over the past four decades.

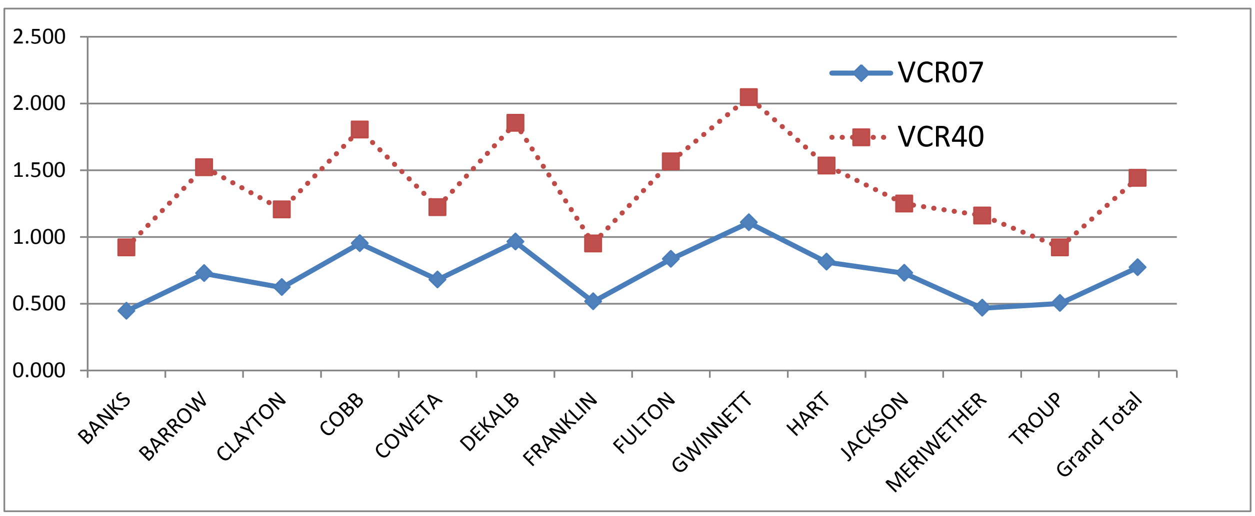


Figure 1.5 2007 and 2040 Volume/Capacity Ratios (VCRs) along I-85/I-285, by County (Source: Derived from FAF3 estimates).

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