TRANSPORTATION AND ENVIRONMENTAL ANALYSIS

OF THE

ATLANTIC STEEL DEVELOPMENT PROPOSAL

May 10, 1999

Prepared for the United States Environmental Protection Agency by Hagler Bailly, Inc.

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I. SUMMARY

To evaluate the expected air emissions impacts of the Atlantic Steel Project XL (eXcellence and Leadership) project, the United States Environmental Protection Agency (EPA), in consultation with stakeholders including the Federal Highway Administration, the Atlanta Regional Commission, and local citizen's groups, undertook three analyses:

1. Regional transportation and air emissions impacts

2. Local hot spot impacts

3. Site level travel and multi-media impacts

EPA analyzed six site/design combinations for these impacts. This memorandum reports the results of these analyses.

LOCATION IMPACTS

To analyze the transportation and air emissions impacts of locating new development at the Atlantic Steel site, EPA used the Atlanta regional transportation and MOBILE 5 emissions models to compare the Atlantic Steel site to three other possible development locations for similar-scale development in the Atlanta region. EPA's evaluation of the Atlantic Steel site's impacts is driven by two facts. First, Atlanta will grow over the next 20 years. Second, without redeveloping the 138 acre Atlantic Steel site, more of this growth will locate in outlying areas.

Analysis of regional transportation and air emissions impacts of the proposed Atlantic Steel development shows that absorbing a portion of Atlanta's future growth at the Atlantic Steel site would create less travel and fewer emissions than developing likely alternative sites. Figure 1 shows the results of EPA's regional location analysis.

Regional Vehicle Miles Traveled

Site	Regional total (VMT/day)	Associated with site (VMT/day)	Site VMT difference from AS
Atlantic Steel	139,172,200	340,300	
Sandy Springs	139,221,572	389,672	14.5%
Cobb/Fulton	139,339,398	507,498	49.1%
Henry County	139,350,097	518,197	52.3%

Using Mobile 5, vehicle miles traveled drive…

Regional Emissions

	NOx			VOC		
Site	Regional total (tons/day)	Associated with site (tons/day)	Site NOx difference from AS	Regional total (tons/day)	Associated with site (tons/day)	Site VOC difference from AS
Atlantic Steel	191.95	0.400		153.230	-0.390	
Sandy Springs	192.10	0.548	37.00%	154.374	0.754	293.33%
Cobb/Fulton	192.24	0.690	72.50%	154.312	0.692	277.44%
Henry County	192.27	0.724	81.00%	154.464	0.844	316.41%

Figure 1: Travel and emissions impacts of regional location

LOCAL HOTSPOT IMPACTS

EPA analyzed whether additional traffic resulting from the redevelopment of Atlantic Steel would cause CO hotspots — levels of CO exceeding national environmental and safety standards. Analysis indicates that development would create no violations of EPA standards. Areas where CO would increase tend to be those that currently enjoy a low CO concentration.

SITE DESIGN IMPACTS

EPA analyzed the transportation and air emissions impacts of the new development's site design. EPA evaluated three designs for the Atlantic Steel site:

1. The design submitted at the time of the Project XL application by Jacoby Development Corp.,

2. A design by Duany Plater-Zyberk & Co. (DPZ), a leading town planning firm, and

3. A redesign by Jacoby responding to aspects of the DPZ design.

The Atlantic Steel site designs differ substantially in ways that affect travel behavior and thus emissions. Compared to Jacoby's original design, the subsequent DPZ design and Jacoby redesign excel in three areas in particular. First, they improve the mix of uses on-site by integrating them at a finer scale. Second, they provide better connectivity on- and off-site. Finally, the pedestrian environment is improved through street design, more direct routing and slower traffic speeds.

Figure 2 shows the results of EPA's site design analyses.

Regional Vehicle Miles Traveled

Site, design	Regional total (VMT/day)	Associated with site (VMT/day)	Site VMT difference from AS, DPZ
AS, DPZ	**139,152,340**	**320,440**	
AS, Jacoby	139,159,289	327,389	2.2%
AS, Jacoby redesign	139,154,690	322,790	0.7%

Using Mobile 5, vehicle miles traveled drive…

Regional Emissions

Site, design	**NOx** Regional total (tons/day)	Associated with site (tons/day)	Site NOx difference from AS, DPZ	**VOC** Regional total (tons/day)	Associated with site (tons/day)	Site VOC difference from AS, DPZ
AS, DPZ	**191.93**	**0.376**		153.206	-0.414	
AS, Jacoby	191.94	0.386	2.66%	153.216	-0.404	2.42%
AS, Jacoby redesign	191.93	0.381	1.33%	153.208	-0.412	0.36%

Figure 2: Travel and emissions impacts of site design

In sum, EPA analyzed the impacts of development *location* and *design* on regional VMT and emissions. EPA found that the most regionally central, most transit accessible, and most pedestrian friendly location and site design combinations — those at the Atlantic Steel location — produced the least VMT, emissions, and other environmental impacts. Of the three Atlantic Steel site designs, the applicant's original site design produced the most VMT and emissions, the design from DPZ the least. The applicant's revised design performed between these two.

This report describes the analysis methodology, presents draft results, and discusses the results. Please contact Geoff Anderson with comments.[1] Please note that while EPA does not expect results to change materially, they are *draft*.

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II. INTRODUCTION

Jacoby Development Corp. (Jacoby), a developer in Atlanta, Georgia has proposed redeveloping a 138-acre site near Atlanta's central business district currently owned by Atlantic Steel. The site is a brownfield—that is, it contains some contamination. The site location is shown in Figure 2. The proposed development would mix residential and business uses, and includes an auto and transit bridge that would cross the interstate to connect to the neighborhood east of the interstate. In addition, Jacoby has proposed three ramps to provide improved interstate access for the neighborhood and proposed development. The bridge and ramps are shown in Figure 3.[2]

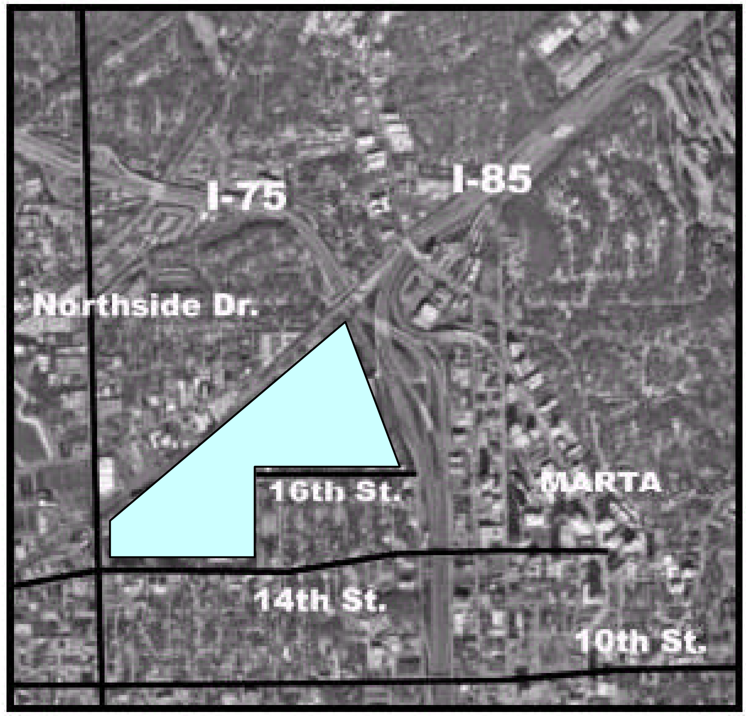

Figure 2: The Atlantic Steel site (North)

Atlanta is currently out of compliance with federal transportation conformity requirements, meaning that it has failed to demonstrate that its transportation activities will not exacerbate existing air quality problems or create new air quality problems in the region. As a result, Atlanta (with limited exception) is not allowed to use federal funds to add to its highway system nor may it construct certain types of transportation projects that require federal approval even if not federally funded. Construction of the proposed bridge/ramps is covered by this prohibition.

Figure 3: The proposed bridge and ramps

Jacoby Development Corp. believes that developing the Atlantic Steel site,

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[2] Figure 2 adapted from developer Project XL proposal. Figure 3 from developer Project XL proposal. The feasibility of the HOV ramp is being examined.

including the access bridge/ramps, would result in the production of fewer transportation air pollution emissions than not developing the site. Underpinning this assessment is the belief that if development does not occur in this location it will locate instead at sites in the region that produce more VMT and more transportation emissions.

Transportation literature suggests travel emissions resulting from a developed Atlantic Steel site might be lower than emissions resulting from another site because:

1. the proposed development would include high densities, a mix of uses, and would be located near transit, and would therefore generate fewer total auto trips than comparable amounts of development placed in locations without these features; and

2. the proposed development would be regionally central to more activities, so auto trips to and from the site would on average be shorter.

Previous work by EPA has quantified the magnitude of potential improvement in the transportation and environmental performance of a development if located to produce regional and transit accessibility. The EPA Office of Policy study "Transportation and Environmental Impacts of Infill and Greenfield Development" found that locating development on regionally central infill sites can produce emissions benefits when compared to locating that same development on greenfield sites on the fringe of the currently developed area. In three EPA case studies, per-capita VMT associated with a development site was reduced by as much as 61% at infill sites compared to the greenfield sites, and NO_x emissions were reduced by 27% to 42%. This and related literature suggested that allowing the Atlantic Steel project to be built may reduce future emissions growth in the region.

Any future emissions reductions from the proposed project were deemed likely to be a function of its regionally central *location*, and its *design* — compared to the location and design of growth that would have taken place absent the development of the Atlantic Steel site. Therefore, EPA analyzed the likely environmental performance of the Atlantic Steel site at two levels. First, EPA evaluated the performance of the Atlantic Steel site relative to three other likely regional growth locations. As part of this regional evaluation, EPA evaluated CO emissions associated with the Atlantic Steel site for potential "hot spots." Second, EPA investigated the performance of three greenfield site designs, and three designs for development on the Atlantic Steel site:

a. the site design originally proposed by Jacoby Development Corp.;

b. A site design commissioned by EPA to find opportunities to improve the travel and environmental performance of the site;

c. the revised site design submitted by the developer as the result of discussions with EPA.

The regional location analysis is described in Section III, and the site design analysis in Section IV, following.

III. REGIONAL PERFORMANCE

This section describes EPA's investigation of the performance of the Atlantic Steel site relative to other potential regional growth locations.

A. WHAT ALTERNATIVES TO COMPARE?

In order to answer the question "will the proposed development reduce future air emissions by virtue of its location?", EPA first needed to decide, "compared to what?"

1. Alternative selection assumes growth in the greater Atlanta region

The Atlanta region is one of the fastest growing metropolitan areas in the United States. EPA and other project XL stakeholders believe that the Atlanta region will continue to grow whether or not the proposed development is built, and that the total amount of growth coming to the Atlanta region will not be significantly affected by the proposed development — only its location in the region. In other words, if the proposed development is built, it will absorb a portion of the Atlanta region's projected growth. If the proposed development is not built, the growth will go elsewhere within the region.

Where is growth projected to go, and how does the proposed Atlantic Steel development represent a change from this scenario? Current projections used by the Atlanta Regional Commission (ARC) in regulatory submissions of future transportation plans anticipates that between 2000 and 2010 (Atlantic Steel's projected build out period) the City of Atlanta will add 18,199 residents and 33,646 jobs. During that same period, Midtown, the subarea where Atlantic Steel is located, is projected to add 4,528 jobs and 193 residents. By comparison, the proposed Atlantic Steel development is projected to add at least 17,483 jobs and 6,000 residents to the Midtown subarea. (The original Jacoby proposal included 17,483 jobs and 6,000 residents. The redesign included 21,173 jobs and 7,750 residents. All analyses use the lower numbers, unless otherwise noted.)

The development proposed for the Atlantic Steel site is large enough to significantly affect regional development patterns. At build-out it would add more than 50% to city of Atlanta 2000-2010 employment growth, and 33% to population growth in that same period. For the Midtown subarea the effect is even more significant: more than three times faster employment growth, and 20 times faster population growth. Clearly development at Atlantic Steel would shift growth to Midtown, but from where? Some Project XL stakeholders were concerned that the development might absorb growth that would otherwise have gone elsewhere in the regional center, rather than elsewhere outside the regional center. As shown in Figure 4, the proposed development is so large that even if it absorbed the growth projected for all other regionally central major activity centers (the CBD, Midtown, etc.), the Atlantic Steel site would still add employment and population to the regional center. In addition, the average projected distribution of new regional growth between 2000 and

2010 is 18% in Atlanta and 82% in the surrounding jurisdictions. If the proposed development draws growth from these areas in rough proportion to where it is projected to go, it appears certain that the proposed Atlantic Steel development would draw some, and likely the majority, of its growth from outer areas of Metro Atlanta, rather than from other parts of the City of Atlanta.

	Employment growth	% of total	Population growth	% of total
Atlanta	33,646		18,199	
Subareas				
CBD	4,224	12.6%	2,474	13.6%
Midtown	4,528	13.5%	193	1.1%
Buckhead	6,179	18.4%	1,405	7.7%
Perimeter Center	4,166	12.4%	-50	-0.3%
Sub-Areas total	19,097	56.8%	4,022	22.1%
Proposed Atlantic Steel	17,483	52.0%	6,000	33.0%
Revised Jacoby proposal	21,173	62.9%	7,500	41.2%

Figure 4: City of Atlanta Projected Population and Employment Growth (2000-2010)

These high growth figures suggest that an alternatives analysis must compare the Atlantic Steel development to scenarios in which growth goes elsewhere in the region, and specifically to areas outside central Atlanta. In order to conduct comprehensive analysis, EPA had to develop scenarios of where that growth would go if not to Atlantic Steel.

EPA considered two approaches to developing alternative scenarios for analysis.

1. Drawing growth from a number of places throughout the region — as though Atlantic Steel displaced a little growth from each of many locations. Thus, the paired comparison would be

   a) the region with Atlantic Steel and a little less development in a number of locations, versus
   b) the region with a little more development in a number of locations.

   This approach would require running ARC's regional land use model in order to identify the appropriate parcels from which to shift growth.

2. Comparing Atlantic Steel to one or more equivalent developments located further from the regional center (to reflect future growth location projections).

The Project XL team chose the latter approach for reasons discussed below (number 4 this section). For this analysis, EPA developed three scenarios of where growth might go, if not to the Atlantic Steel site.

The Project XL team recognized that this approach would provide only relative measures of the Atlantic Steel site's performance. That is, the Atlantic Steel site may perform better than other sites but nonetheless fail to improve the region. Thus, the Atlantic Steel site's performance was also compared to average regional performance measures where appropriate.

2. Selection criteria

For the alternative scenarios, EPA, supported by Criterion Planners/Engineers, Inc., sought greenfield land parcels that could support development of the scope proposed for the Atlantic Steel site. The greenfield land area required is based on the amount of development proposed for the Atlantic Steel property, but developed at suburban densities typical for the Atlanta region, as shown in Figure 5.

Atlantic Steel Plan (9/10/98)	Assumed Suburban Density	Greenfield Acres Needed
2400 dwellings	4 dwelling units/acre	600
4.8 mm sq.ft. office	0.5 FAR*	220
1.4 mm sq.ft. retail	0.5 FAR	65
0.8 mm sq.ft. hotel	0.5 FAR	40
Subtotal		925
Rights-of-way and public spaces**		250
Total		1,175 acres

*Floor to area ratio
**Space for roads, parks and other public uses

Figure 5: Greenfield space requirements

The geographic scope of the study area is defined as the 13-county region that is in Clean Air Act non-attainment. This is also the area covered by Atlanta Regional Commission's (ARC) transportation model. The primary data sources were ARC's "Economic Development Information System," its transportation model, and land-use and infrastructure plans for each county. Staffs from ARC and county planning departments were consulted in the course of work, particularly about constraints recommended for use in screening out unsuitable lands.

Potential greenfields were located by identifying the region's vacant land and applying a series of nine constraints in order to find locations that are both unconstrained and large enough to accommodate the proposed Atlantic Steel development. This series of successive screenings was performed with geographic information systems (GIS) software and included the following steps:

a. Gross Available Land

The only available electronic inventory of vacant undeveloped land in the region is ARC's "agriculture and forestry" land cover inventory (this is existing land status as opposed to future land-use designations). Consultation with ARC and county planning staff indicated that the agriculture and forestry land cover is considered the functional equivalent of a vacant lands inventory for parcels larger than 100 acres. Three of the 13 counties (Forsyth, Paulding, and Coweta) are not covered by ARC's land cover database, but in those counties subsequent steps compensated for this by eliminating all protected and developed lands, leaving essentially the equivalent of agriculture and forestry. With this inventory as a starting point, the following lands were then eliminated.

b. Surface Water Exclusions

Using the ARC database, all surface water areas were eliminated, along with buffer lands immediately adjacent to them. For the Chattahoochee River, a 2,000-ft. buffer on either side of the river was used; for all other major water bodies 500 ft. was used.

c. Wetland Exclusions

All wetland areas in the ARC database were eliminated.

d. Protected Groundwater Exclusions

All groundwater recharge areas in ARC's database were excluded. Because this data was unavailable electronically, groundwater boundaries were manually transferred into this study's GIS coverages as accurately as possible.

e. Constrained Water Supply Exclusions

All Georgia Environmental Protection Division -designated "small water supply" watersheds were excluded. Again, because of a lack of electronic source information, these areas were manually delineated as accurately as possible in this study's GIS.

f. Constrained Highway Exclusions

Using the ARC transportation model's 2010 projections, lands were eliminated within traffic analysis zones having over 1,000 ft. of capacity-constrained highway segments.

g. Municipal Boundaries

All lands inside the region's municipalities were eliminated based on ARC and county planning staff conclusions that the amount of greenfield acreage required could not be found inside any city (excluding the New Manchester site in Douglasville, which nonetheless has been committed to that project).

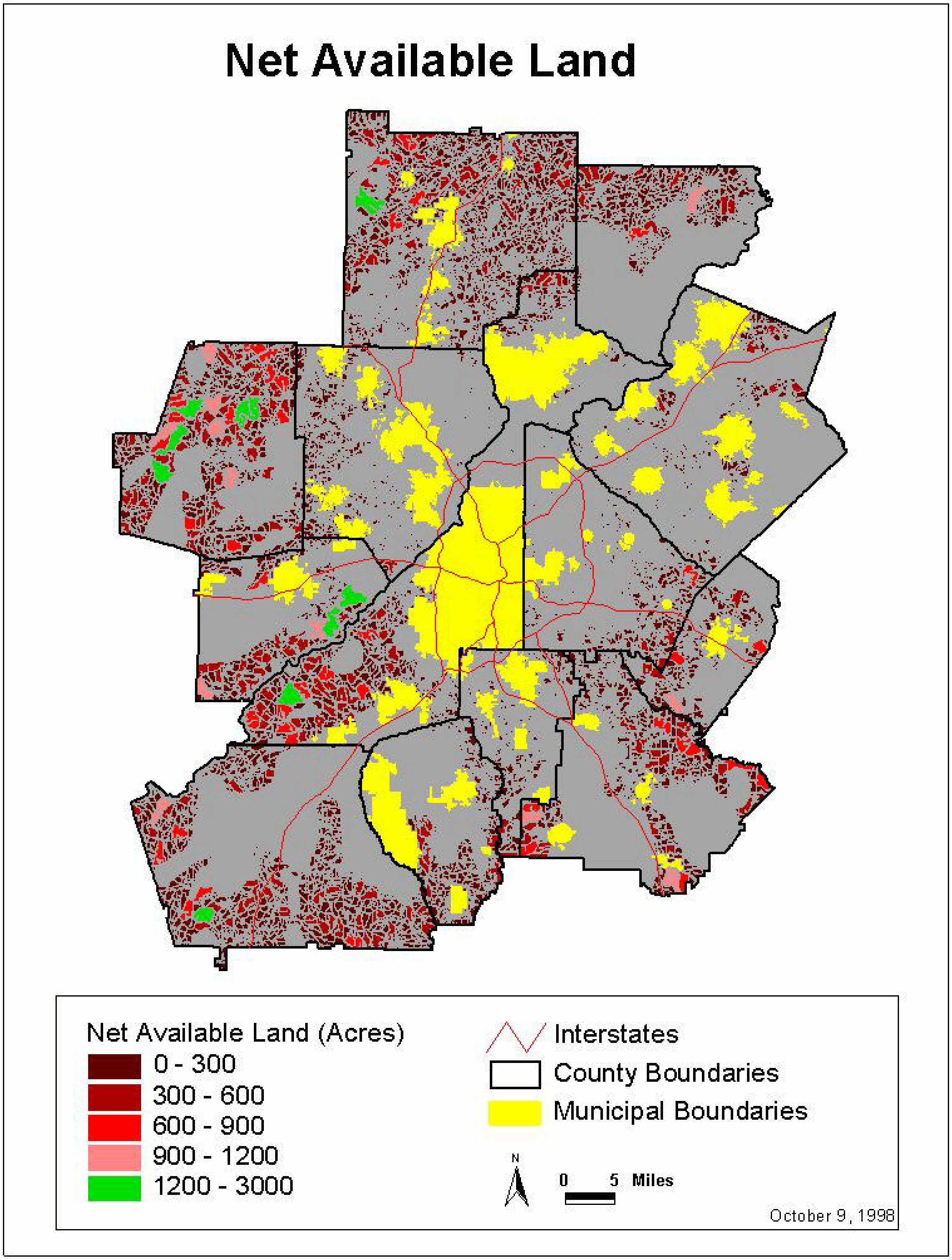
h. County Land-Use Plan Exclusion Areas

Those areas designated for non-development purposes in county land-use plans were eliminated, including such designations as parks, civic facilities, and institutional uses. Because plans were unavailable electronically, these boundaries were transferred manually into this study's GIS as accurately as possible for the largest sites (e.g., over 100 acres) in each county.

i. Committed Lands

A final screening was made for those lands already committed to some level of development as reflected by local street construction. Using the ARC electronic database, lands within 500 ft. of all streets were eliminated. This had the effect of removing existing built-out and partially built-out residential subdivisions and commercial strips fronting thoroughfares.

The resulting net available land and candidate sites are shown in Map 1 by range of size in acres. Note that this definition of "net available land" in the Atlanta region is useful in this case, but is not a description of all land available for development.



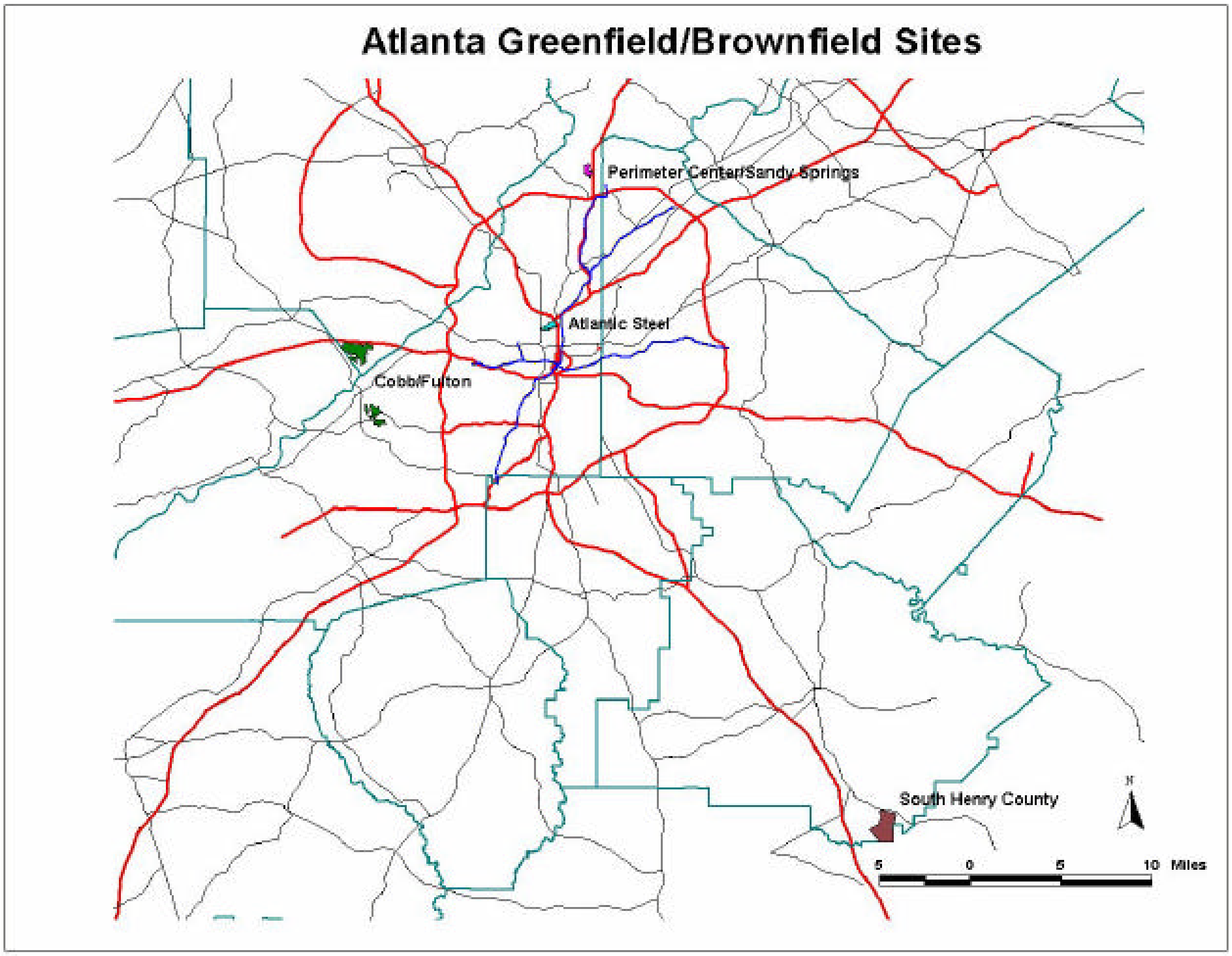
Map 1: Land available for significant development in the Atlanta region

3. Stakeholder panel

The land use screens produced eight contiguous parcels large enough to absorb the proposed development at suburban densities. The screens also produced numerous parcels that, combined with others nearby, could absorb the development.

EPA asked a panel of regional project stakeholders for their individual input on what sites or combination of sites would be useful to analyze. EPA then chose two sets of parcels from Map 1. The first set of parcels is in south Henry County adjacent to a highway, far from the regional center and without transit access. The second set of parcels is on the border between Fulton County and Cobb Counties, again along a highway, just beyond the Perimeter Beltway, and with bus transit.

In addition, EPA selected an "edge city" site in north Fulton County, adjacent to the planned Sandy Springs MARTA rail station just north of the Perimeter Beltway. Perimeter Center is part of Atlanta and is not projected to grow substantially between 2000 and 2010. This site is not representative of where future growth is projected to locate. Instead it was chosen as an alternate site representing one end of a spectrum of locations where future growth could possibly locate. This site was not large enough to accommodate the planned development at suburban densities, but could absorb the development at the same densities planned for the Atlantic Steel site. This site could be considered infill in a suburban activity center. It has rail transit access, is located adjacent to higher density development, and is near a mixture of activities.



Map 2: Regional location of sites evaluated

Together, these three sites represent a range of possible locations and types of most development likely to occur in the Atlanta region, and in so doing capture several important variables that help determine travel behavior:

Location	Development density	Regional location	MARTA rail served?
Atlantic Steel	Urban	Regionally central	Yes
Cobb/Fulton	Suburban	Suburban	No
South Henry County	Suburban	Exurban	No
Perimeter Center/ Sandy Springs	Urban	Just past the perimeter	Yes

Although these four sites do not cover all possible locational variations, they represent the locational options most available. It is worth noting again that only two (South Henry and Cobb/Fulton) of the three selected sites are consistent with the region's projected pattern of exurban growth. Regionally, little of the growth projected in the future is predicted to locate in the suburban infill scenario represented by Perimeter Center/Sandy Springs. Modeling the regional travel expected as a result of development on each of these sites helps EPA and stakeholders understand the role of location in other site-specific characteristics in determining environmental impact.

4. Alternatives selection methodology not chosen: running the regional land use model

Selecting discrete alternative locations for growth makes the subsequent analysis of environmental performance particularly useful for policy analysis, because it helps stakeholders shed light on "what if" questions: *what if* future regional growth tends to concentrate in places *like* Perimeter Center/Sandy Springs? Or *what if* future regional growth tends to concentrate in places *like* Cobb/Fulton on I-20? In allowing stakeholders to ask more questions, the analysis is more flexible, and depends less on any one particular future being especially likely. This discrete approach was also essential to allow accurate "apples to apples" site design comparisons.

However, this is not the only possible approach. As suggested previously, another approach would have been to model future regional development patterns using Atlanta's regional land use model, DRAM/EMPAL. In this approach, EPA would have developed two regional land use forecasts: one without the Atlantic Steel development, and one with the development. In the latter case, the Atlantic Steel development would not absorb growth from a single set of parcels, as it does in the approach EPA did take. Rather, the Atlantic Steel development would absorb growth from many, widely dispersed parcels.

EPA did not use the DRAM/EMPAL approach for two reasons. First, EPA did not believe that this approach would yield more useful, nor necessarily more accurate results. Current land use forecasts project that growth would have been drawn dominantly from sites which are similar to the Cobb/Fulton or South Henry site with much smaller amounts coming from sites like Perimeter Center/Sandy Springs. In other words, growth would have been distributed to a variety of sites whose regional characteristics (from a transportation perspective) would be similar to the greenfields chosen for this study — albeit in smaller parcels. To some degree the result of such a growth scenario can be inferred from the individual site model runs. Jobs and households taken from a site with characteristics matching the Cobb/Fulton site would likely create differences similar to those created by Cobb/Fulton. Similar parallels can be drawn with the other sites.

One difference that may have resulted from a DRAM/EMPAL approach and its consequent small parcel distribution is the impact such a distribution would have on intrazonal trip-making (trips within a sub-area/traffic analysis zone). For the greenfield sites in this study, residential and non-residential uses may be more clustered than would have occurred in a DRAM/EMPAL distribution with a resulting increase in intra-zonal travel and possibly an associated reduction in some trip lengths. However, it is impossible to assess the magnitude or frequency of any such changes.

Understanding the transportation impacts of locating development on the Atlantic Steel site versus other possible locations was one of the goals of this study. Selecting distinct types for analysis — infill in a suburban activity center, suburban greenfield with bus transit, and a relatively isolated exurban greenfield site in a community with a rural character — would produce information about a variety of development locations. These different scenarios serve to illustrate the effects of displacing growth from a variety of locations and provide EPA with a better understanding of the sensitivity of any emissions reductions to these different locations. A highly dispersed scenario would not produce this type of information.

The results, as summarized on page two, suggest that the decision to analyze discrete alternative sites was in fact useful. Not only is there a clear difference between the Atlantic Steel site and the other three locations, but there are also clear differences between the three locations. This serves to highlight site location characteristics such as access to transit, regional accessibility, etc. that produce different levels and types of performance. Had EPA simply compared regional development with and without the Atlantic Steel development, EPA would have learned very little about which site location elements are important, since the results would have blended elements from many different sites.

The second factor dictating the use of the current approach was that ARC, which operates DRAM/EMPAL, would have found it difficult to make the model and/or the modeling staff available to EPA for this purpose, given other demands on its time. Even with staff available, running DRAM/EMPAL requires significant time and resources. It was EPA's judgment that investing those resources would not add fundamentally to the insight gained from the chosen analysis method.

5. Alternatives chosen for analysis

Using the results of the land use screens and the advice of the individuals on the stakeholder panel, EPA chose three alternative sites to compare to Atlantic Steel. EPA believes that these sites represent the likely *range* of development alternatives to the Atlantic Steel site and sheds light on other variants.[3]

a. Growth absorbed in Cobb/Fulton

The site is located in South Fulton County, near the convergence of Interstate 20 and Interstate 285. The existing land-use is primarily light industrial and warehouse facilities. The area is served by bus

[3] EPA does not expect that development would *necessarily* go to these sites in lieu of Atlantic Steel; EPA believes only that the sites represent the plausible range of likely growth locations in lieu of Atlantic Steel.

service connecting to downtown's Five Points MARTA rail station. The area is economically depressed and has been targeted by the 'Empowerment Zone' program as an area in need of economic development assistance as well as increased mobility options for low-income residents.

The western portion of the I-285 perimeter highway has experienced small increases in congestion relative to the more rapidly expanding areas. The site has easy access to downtown and the airport.

b. Growth absorbed in Henry County

Located in the southern portion of Henry County, the site is not served by MARTA bus service. Henry County has been experiencing significant growth in the northern portion of the county, and subdivisions have gradually emerged in the southern portion of the county.

Of the alternatives, the site is the most removed from regional activity centers and transit service. The county maintains a rural character despite significant development pressures. Henry County's growth has lagged behind that of the booming northern counties but has gradually gained attention given the Northside's higher land values and congestion levels. Henry County's proximity to Atlanta Hartsfield Airport has also raised the county's attractiveness as a site for freight and warehousing companies.

c. Growth absorbed in Perimeter Center/Sandy Springs site

The Sandy Springs site is located in the Perimeter Center area, one of the region's largest employment concentrations. The proposed site is scattered on parcels north and south of the I-285 freeway. All parcels are within two miles of existing or proposed MARTA heavy rail stations. Of all sites modeled, this location is the most congested, with many facilities experiencing low levels of service in the peak periods. Local surface vehicle traffic is accommodated through a handful of arterials, with few alternate routes available.

The North Fulton area has been experiencing rapid growth rates, with most new growth occurring in the far northern fringes of the county (Alpharetta). Perimeter Center/Sandy Springs is the only suburban 'edge-city' in the region with heavy rail service.

Although nearby housing is largely comprised of single-family detached dwellings, relatively high concentrations of multi-family housing are found nearby (Roswell Road in the north, Peachtree Road in the south/east).

d. Growth absorbed at the Atlantic Steel site

The Atlantic Steel site is situated at the convergence of I-75 and I-85. Located in Midtown Atlanta, the site is located within one mile of the Arts Center MARTA station, and several bus lines serve the site. The Georgia Institute of Technology is within two miles of the site, and the site is abutted to the south and north by established neighborhoods of single-family dwellings. Access to the site is somewhat restricted by the downtown connector (I-75/I-85) that inhibits direct access to the midtown business district. The closest access is the 10th/14th street bridge, nearly a mile to the south.

The Midtown business district has attracted large amounts of office employment and housing in the last decade. Plans are underway to fill in vacant parcels and redevelop deteriorated buildings.

B. METHODOLOGIES FOR COMPARING THE ALTERNATIVES

EPA analyzed the regional transportation and air emissions performance of each site using the following methodologies.

1. Travel and emissions analysis

EPA used the ARC regional transportation model to model the transportation behavior associated with developing each of the four geographic sites. This is the same model that ARC (Atlanta's MPO) uses for regulatory submittals to EPA. ARC's model is a version of TRANPLAN adapted by ARC and applied to the Atlanta metropolitan area.

The ARC version of TRANPLAN is a relatively sophisticated application of traditional four-step travel modeling.

a. Applying the ARC travel model

For all alternatives, EPA modeled the performance of Atlanta's transportation system in the year 2015 using as a base the "expected and committed" network of transportation facilities, both road and transit networks. The model runs incorporate the following assumptions:

Existing + Committed transit and highway networks

Both transit and highway networks include all projects that have either been completed and those included in the ARC Interim Transportation Improvement Program that will be completed by year 2000. These are currently the only approved additions to the transportation network and represent the same scenario used by ARC when it makes future projections. The one exception is the proposed 17th street bridge. In the three Atlantic Steel scenarios, the highway network includes the proposed 17th street bridge, the addition of the three ramps connecting to the adjacent interstate, and a shuttle service linking the site to mass transit.

Land use and socioeconomic data

TRANPLAN models behavior given the population and employment projected and distributed for year 2015. Population and households were distributed across income classes and household sizes based on the regional average distribution, due to lack of information about households.

Congested travel

EPA assumed that 60% of daily VMT occurred under congested (peak period) conditions, and 40% in uncongested (off-peak) conditions. This split is supported by ARC model documentation.

b. Outputs

TRANPLAN provides the following performance indicators relevant to the EPA analysis, and to stakeholder interest in how each alternative will perform in the community.

i. Congestion
ii. Regional accessibility
iii. Trip length
iv. Travel time
v. Vehicle delay rate
vi. Mode split
vii. Personal vehicle use
viii. Vicinity congestion
ix. Regional congestion

2. Regional VOC and NO_x emissions

The Project XL application requests flexibility from the Clean Air Act regulations which are triggered by Atlanta's violation of the ground level ozone standard. The project sponsor believes that the Atlantic Steel development would reduce, relative to the baseline, emissions of the ozone precursors volatile organic compounds (VOCs) and nitrogen oxides (NO_x). VOCs and NO_x combine to form ozone, a human health hazard. Thus, EPA evaluated emissions of VOCs and NO_x under each alternative. VOCs and NO_x are regional pollutants: they do not decompose rapidly, so NO_x emitted in one part of the region can travel and combine with VOCs emitted in another part of the region, forming ozone that in turn can spread throughout the region. Thus it was appropriate to analyze *regional* production of these emissions under each scenario. EPA investigated the production of these pollutants in the following ways.

VMT-based approach To calculate emissions from the modeled travel, EPA used MOBILE 5a emissions factors, which are currently required by the Agency for use in regulatory submittals. The MOBILE model is a VMT- and speed-based emissions model. Calculating emissions with MOBILE involves distributing the VMT projected by a travel model into speed categories, and multiplying the mileage in each speed category by the emissions factor appropriate for that speed. This is done for each vehicle class, for the region's vehicle fleet. Emissions factors vary with vehicle type, season, emissions inspection and maintenance programs in place, regional clean fuels programs, etc.

For this analysis EPA used the regional fleet mix and emissions factors used by Atlanta for its regulatory submissions.

Trip-based approach In starting from VMT, the MOBILE approach does not explicitly take into account trip ends. Rather, trip-end emissions (cold start, hot soak, etc.) are incorporated into the per-mile emissions rates used to convert VMT to emissions. While this works well for many purposes, it has limitations in a comparison between alternatives where vehicle trip generation varies substantially. To shed light on the change in emissions produced by the different number of trips produced by each site, EPA conducted a trip-based analysis of VOC and NO_x emissions. This analysis involved two steps:

1. Use ARC TRANPLAN analysis to predict number of vehicle trips for each site,

2. Multiply those trip numbers by an accepted per-mile emissions factor for miles driven in cold-start mode. The average vehicle operates in cold-start mode for the first 3.6 miles of a trip, so one multiplies each trip by "cold start emissions per mile" by 3.6.

Thus,

$$\text{Cold start emissions per site} = \text{Vehicle trips}_{site} * \text{Cold start emissions/mile} * 3.6 \text{ miles}$$

3. Local CO emissions

Although Atlanta, and the Project XL application, focus on NO_x and VOC as pollutants of regional concern, EPA must ensure that any approved project does not produce local pollution problems while reducing regional emissions. CO is the pollutant of concern at the local level.

To analyze the proposed project's impacts on CO emissions, EPA analyzed changes in traffic and resulting changes in CO emission rates on roads in the immediate area of the Atlantic Steel site. Like the *regional* emissions analysis, the *local* area analysis examined conditions under "build" and "no build" scenarios. However, for the local analysis, the no build scenario was simply the "expected and committed" road network with the proposed project's growth located elsewhere in the region. No additional traffic from any source on that road network was assumed for the no build. The build scenario assumed the new roads, ramps and transit proposed by Jacoby Development, including the site's internal roads and transit, the proposed 17^{th} Street bridge, and the three ramps from I-75/I-85 to the 17^{th} St. bridge.

Traffic was modeled using a road network simulation constructed for the Atlantic Steel site area. EPA's consultants, a team from the Georgia Institute of Technology, used regional travel demand model results, the MOBILE5a emission rate model, and the CALINE4 line source dispersion model to model emissions CO emissions and resulting concentrations under the worst-case wind angle conditions for each receptor in the region. The microscale analyses were based upon the CORSIM traffic simulation model, run for the years 1998, 2005, and 2025. The CORSIM analyses were prepared by Moreland Altobelli, Inc.[4] using system constraints provided from travel demand model runs prepared by Hagler Bailly, Inc. (TRANPLAN model runs for the years 2000 and 2015). The microscale modeling team made no changes to any of the TRANPLAN or CORSIM runs.

C. RESULTS

Performing the regional analysis described above for each of the four sites, and the CO analysis for the Atlantic Steel site, produced the following results.

1. Basic travel results, and the emissions that travel would produce

Figure 6 shows basic travel results. The increment of travel attributable to each site is broken out. Emissions are calculated from this travel. The VMT associated with each site is highlighted in Figure 7.

Regional Vehicle Miles Traveled

Site	Regional total (VMT/day)	Associated with site (VMT/day)	Site VMT difference from AS
Atlantic Steel	139,172,200	340,300	
Sandy Springs	139,221,572	389,672	14.5%
Cobb/Fulton	139,339,398	507,498	49.1%
Henry County	139,350,097	518,197	52.3%

Using Mobile 5, vehicle miles traveled drive…

Regional Emissions

	NOx			VOC		
Site	Regional total (tons/day)	Associated with site (VMT/day)	Site NOx difference from AS	Regional total (tons/day)	Associated with site (tons/day)	Site VOC difference from AS
Atlantic Steel	191.95	0.400		153.230	-0.390	
Sandy Springs	192.10	0.548	37.00%	154.374	0.754	293.33%
Cobb/Fulton	192.24	0.690	72.50%	154.312	0.692	277.44%
Henry County	192.27	0.724	81.00%	154.464	0.844	316.41%

Figure 6: Basic travel and emissions results

[4] Applicant's consultants.

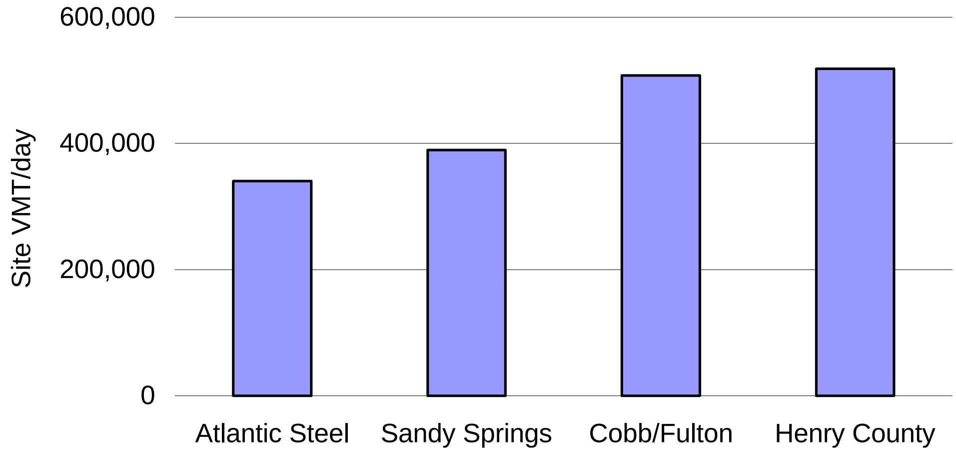


Figure 7: VMT associated with each site

Developing at the Atlantic Steel site shows a net decrease in VOC emissions because the construction of the interstate ramps relieves substantial congestion in the area. Emissions are sensitive to speed, especially in the low speed ranges currently experienced in the area. This decrease is not expected to persist over time, and is not the basis for EPA's judgment that developing the Atlantic Steel site would show superior environmental performance in the context of Project XL. Atlanta's traffic may continue to grow, decreasing or eliminating the small net decrease in VOC emissions over time. Such growth in traffic would not likely change the performance of alternatives relative to each other. It is this relative, not absolute, environmental performance that is the basis for EPA's finding of Superior Environmental Performance.

2. Trips-based emissions

Figure 8 shows the total trips associated with each site and the emissions difference attributable to differences in starts. The total emissions calculation used in MOBILE 5 does include an element to account for cold starts, so it would be incorrect to add the emissions calculated below to the emissions calculated above. However, because MOBILE 5 uses the same cold start emission adjustment for each scenario, it underestimates the difference in air emissions attributable to differences in total number of trips. Number of vehicle starts and associated emissions are presented here to bound the magnitude of any under-estimation of emissions.

Vehicle Starts

Site	Regional total	Associated with site	Difference from Atlantic Steel
Atlantic Steel	11,242,685	16,498	
Sandy Springs	11,251,226	25,039	51.8%
Cobb/Fulton	11,258,480	32,293	95.7%
Henry County	11,259,067	32,880	99.3%

Vehicle starts drive…

Cold Start Emissions

	NOx			VOC		
Site	Regional total (tons/day)	Associated with site (tons/day)	Difference from Atlantic Steel	Regional total (tons/day)	Associated with site (tons/day)	Difference from Atlantic Steel
Base	32.00			32.77		
Atlantic Steel	32.06	0.061		32.83	0.062	
Sandy Springs	32.09	0.090	46.9%	32.86	0.092	46.9%
Cobb/Fulton	32.37	0.371	509.3%	33.15	0.380	509.3%
Henry County	32.54	0.536	779.5%	33.32	0.549	779.5%

Figure 8: Trips-based emissions analysis

3. Travel behavior, and land use/transportation system performance

a. Performance

The ARC transportation model forecasts travel behavior by forecasting the number of trips people will take, and the path those trips will take. In the model, the region is divided into "traffic analysis zones (TAZs)," small areas that people travel to, from, and within. The forecast gives the number of trips originating in a zone and ending in a zone. These trips can be described by their purpose: work, non-work, other, or non-home based (NHB). For each forecast, statistics about the speed, length, and mode of different kinds of trips describe the performance of the regional transportation system.

The table below quantifies and describes the forecast performance of the transportation system under four scenarios: with the Atlantic Steel site developed, and with each of three alternative sites developed. A regional average for each descriptive or performance measure is given where appropriate.

Measure	Regional Average	Atlantic Steel	Perimeter/ Sandy Springs	Fulton/Cobb	Henry County
Daily VMT					
per capita	34.05/capita	20.78/capita	31.19/capita	31.98/capita	15.58/capita
per household	85.26/hh	51.79/hh	77.97/hh	79.94/hh	38.96/hh
Daily VMT per employee	14.54	9.42	13.15	14.35	26.68
Transit share of trip starts[5]	7.7%/Work 1.9%/Non-work	27.07%/Wk 10.68%/NW	12.5%/Wk 6.0%/NW	1.8%/Wk 0.8%/NWk	0%/Wk 0%/NWk
Transit share of trip ends	7.7%/Work 1.9%/Non-work	27.07% 10.68%	12.3% 2.2%	1.73% 0.61%	0% 0%
Average length (miles), trips originating in TAZ	14.35/Work 8.18/Other 8.61/NHB	5.28/Wk 3.36/Other 5.57/NHB	6.50/Wk 5.43/Other 7.62/NHB	11.01/Wk 6.34/Other 8.85/NHB	6.29/Wk 6.17/Other 5.01/NHB
Average length (miles), trips ending in TAZ	14.35/Work 8.18/Other 8.61/NHB	10.47/Wk 7.26/Other 6.48/NHB	14.35/Wk 9.39/Other 7.72/NHB	13.15/Wk 6.35/Other 8.34/NHB	26.68/Wk 11.65/Other 1.68/NHB
Average trip time (minutes)	36.99/Work 21.141/Other 22.88/NHB	33.84/Wk 22.26/Other 20.06/NHB	44.97/Wk 30.29/Other 25.29/NHB	33.93/Wk 17.82/Other 22.87/NHB	86.15/Wk 39.98/Other 5.42/NHB
Regional accessibility: % of jobs within 30/45 minutes congested travel time	n.a.	27.03%/30 min 52.09%/45 min	18.6%/30 47.6%/45	10.7%/30 32.5%/45	1.09%/30 1.63%/45
% of population within 30/45 minutes congested travel time	n.a.	15.96%/30 min 34.96%/45 min	8.04%/30 27.35%/45	9.9%/30 27.3%/45	1.03%/30 2.31%/45

[5] Unless otherwise noted, all trip statistics are for trips beginning or ending in the Transportation Analysis Zone (TAZ).

b. Discussion of performance measures

The regional analysis results paint a picture of three site types.

The *first site type* can be described as regionally accessible and transit oriented on a macro level. Atlantic Steel and Sandy Springs fit this profile. Both have good regional accessibility as demonstrated by the measures of accessibility and trip length. In addition, at 27% and 12% transit share for work, they each have good transit access relative to the other sites. In combination, the regional and transit accessibility lead to significantly lower VMT associated with these sites, from 128,000 to 180,000 fewer miles of travel per day than Henry County. This accessibility also means these sites fare well compared to typical regional travel behavior. They have lower, and in Atlantic Steel's case significantly lower, per capita, per household and per employee VMT. In addition, each site significantly exceeds the regional average transit mode share.

However, Atlantic Steel and Sandy Springs each have significant congestion on local road networks. Therefore, speeds in their vicinity are slower than for the other sites. Importantly, speeds are slower not only for the traffic associated with the site but also for traffic passing the site. Small speed changes can have large effects if they affect a large volume of travel. NO_x is relatively insensitive to speed changes in the speed ranges relevant to this discussion. However, VOCs can be significantly affected by speed changes. Over the relevant range of speeds, VOC emissions per mile generally rise with decreasing speeds. Speed-based differences show up strongly in the VOC comparison between Cobb/Fulton, Sandy Springs and Atlantic Steel. However, in the case of Atlantic Steel, the reductions in VMT are sufficient to overcome the higher VOC emissions per mile, producing the least net emissions. Finally, it is important to recall the fact that MOBILE 5 uses a standard emission adjustment for cold starts. The adjustment in this case undercounts emissions reductions from the fewer vehicle starts associated with Atlantic Steel and Sandy Springs.

The *second site type* is represented by Cobb/Fulton. This site has the least congested road network and bus transit access; it is on the edge of the region's center and brings a large number of jobs to a job-poor area. This last factor allows the site to capture more local travel as some current residents shift their destinations to closer opportunities. Despite this shift, it lacks the high accessibility to multiple services and destinations that characterize Atlantic Steel and Sandy Springs. It also lacks direct rail transit, so auto travel at this site is much higher than at Atlantic Steel or Sandy Springs. In fact, travel here is very similar to Henry County. Somewhat higher speeds at this site drive VOC emissions down, but do not reduce NO_x, which tracks VMT closely.

Henry County is the *third site type*. It is isolated from regional activity centers, urban or suburban. The results here may appear somewhat counter-intuitive. Per capita and per household VMT are much lower than any of the other sites or the regional average. On the other hand, daily VMT per employee is much higher than at other sites, or the regional average. These characteristics are explained by the site's isolation. It is far from regional activity centers, urban or suburban. It has no transit. Henry County's road network is relatively uncongested but, being somewhat rural in character, is also low in total capacity. Less than 3% of the region's population, and 2% of the region's jobs are within a 45-minute drive during peak traffic hours.

Trips from this site are either very short or very long. As a result, the model designates roughly 90% of the site's trips as local. Hence per capita VMT, driving by people who live there, is very low. And, per-employee-VMT, driving by people who have to travel to get there, is very high. The net result is that the long trips still push the VMT up — over 50% higher than at Atlantic Steel. Speeds do not keep VOCs down as much as Cobb/Fulton because the more rural road network (design and capacity) cannot accommodate the high speeds that Cobb/Fulton can. South Henry's capture rate — at roughly 90% — is striking when compared to the other sites: Cobb/Fulton under 15%, and Atlantic Steel and Perimeter/Sandy Springs under 10%.

4. Local hotspot impacts

Atlantic Steel achieves lower emissions through shorter trips and higher transit share. Traffic volumes and congestion remain at significant levels, raising the possibility of CO "hot spots." Unlike VOCs and NO_x, CO is pollutant of local, rather than regional, concern. As the term suggests, CO can concentrate in small areas.

To address the possibility that the Atlantic Steel development could produce CO hotspots, EPA performed a micro-scale traffic and CO analysis, supported by a team from the Georgia Institute of Technology.

The micro-scale traffic and CO analysis determined that the project is extremely unlikely to create a violation of ambient air quality standards for carbon monoxide. Analyses were developed for worst case morning and evening January conditions when traffic volumes are high, temperatures are cold, and meteorological conditions limit pollutant dispersion. All predicted peak one-hour carbon monoxide concentrations were less than 12 ppm under worst-case conditions. The one-hour carbon monoxide standard is 35 ppm. Analyses were conservative, with assumptions designed to over-predict pollutant concentrations. Given the temporal distribution of vehicle activity, decreased traffic volumes, increased travel speeds, lower emission rates, and increased pollutant dispersion after the peak hour, it is also extremely unlikely that the project will create a violation of the 8-hour standard for carbon monoxide (9 ppm).

Generally speaking, CO emissions rates along links in the most congested corridors — $10^{th}/14^{th}$ Street — would moderately decrease in the build scenario, with the exception of certain links on 16^{th} Street. Lightly traveled links in the baseline — State Street, Northside Drive — would see CO emissions rates increase to moderate levels.

This analysis used the residential and employment projections of the original Jacoby site design. The significant difference between the highest projected concentration and the EPA standard suggest that increases in final residence and/or employment of the magnitude in the Jacoby redesign would not put the project at risk of violating the standard.

In sum, additional access provided by proposed construction appears to mitigate CO emissions rates on the existing worst links, while increasing CO emissions rates on underutilized links to moderate levels.

The full analysis is available from EPA.[6]

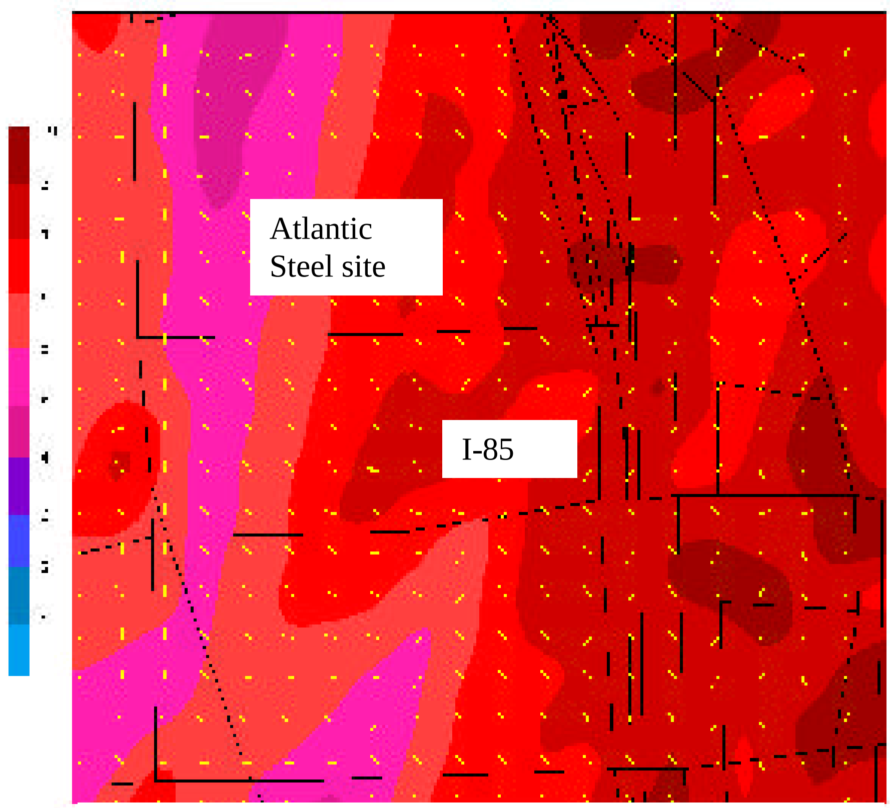


Figure 9: Year 2005 CO concentrations (ppm), with worst-case wind directions

[6] Randall Guensler, Michael O. Rodgers, William H. Bachman, John D. Leonard II, “Microscale Carbon Monoxide Impact Assessment for the Atlantic Steel Development Project,” March 18, 1999

IV. SITE DESIGN PERFORMANCE

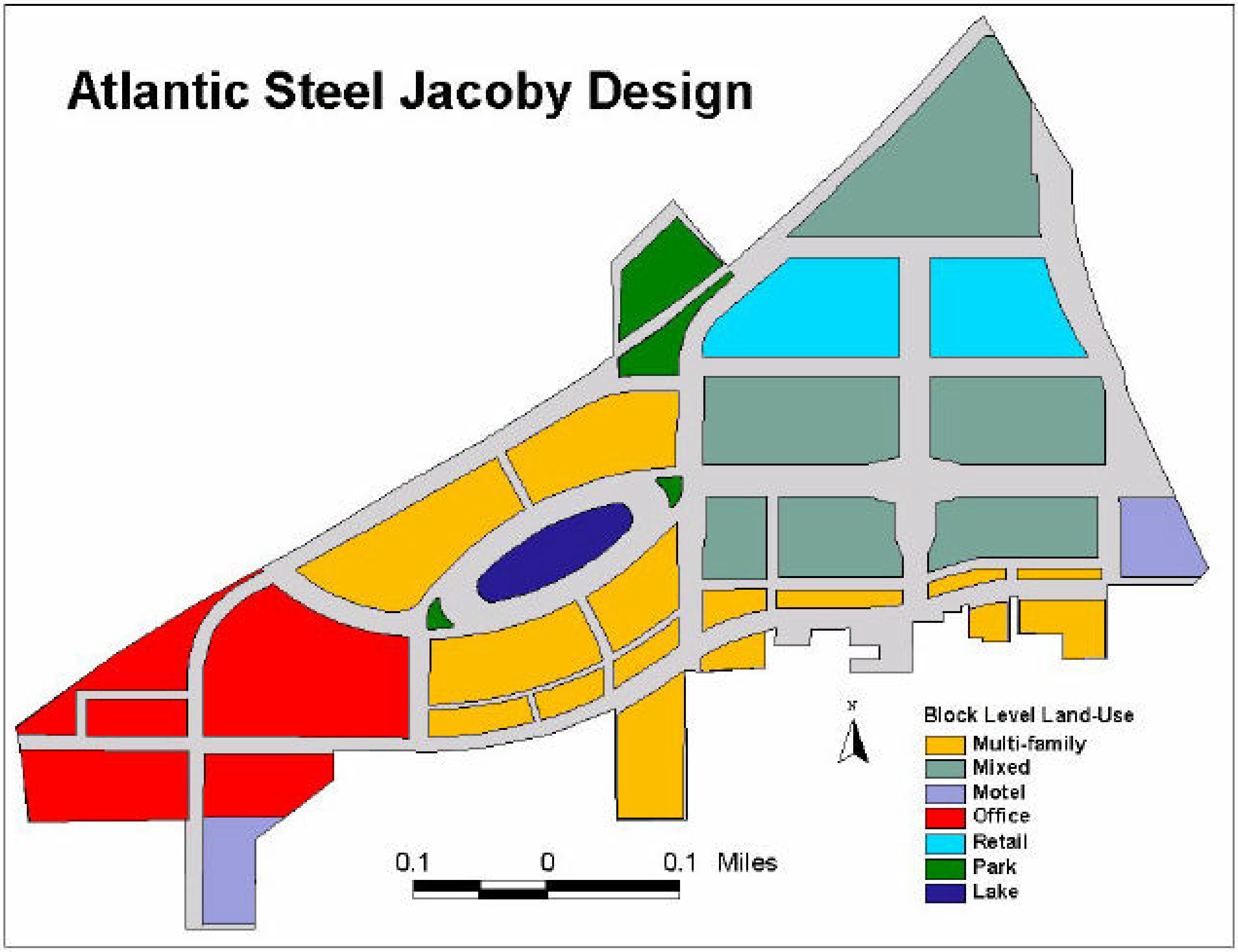
In addition to the site's *location* in the Atlanta region, site *design* is also an important factor in travel behavior. Thus, in addition to analyzing the performance of the site from a regional location perspective, EPA also analyzed the performance of the site design using INDEX®, a GIS-based tool that measures land use and site design characteristics. EPA was supported by Criterion Planners/Engineers, developers of INDEX®. Where the regional analysis asked if the site's *location* produced performance improvements relative to alternatives, the site design analysis asks if the *design* of the site produces improvements relative to alternatives.

A. WHAT ALTERNATIVES TO COMPARE?

EPA made several comparisons. The developer's proposed design for the Atlantic Steel site was compared to each of the three greenfield alternatives. In addition, because Project XL projects must evidence excellence and leadership, the site was compared to two other designs. First, EPA commissioned a design that it believed more fully incorporated design features that increase travel choice and reduce private vehicle trip use, producing environmental improvements. Next, the developer revised the original site design to incorporate additional design features that increase travel choice and reduce private vehicle trip use. Comparing the originally proposed design to likely greenfield designs helped EPA understand "How does the site design compared with the likely alternative?" Comparing the developer's revised design to the originally proposed design and to the commissioned design helped EPA understand "To what degree does the revised design reinforce the VMT and emissions reductions benefits predicted by the regional travel modeling?"

1. The applicant's site design

Jacoby originally submitted the following site design.



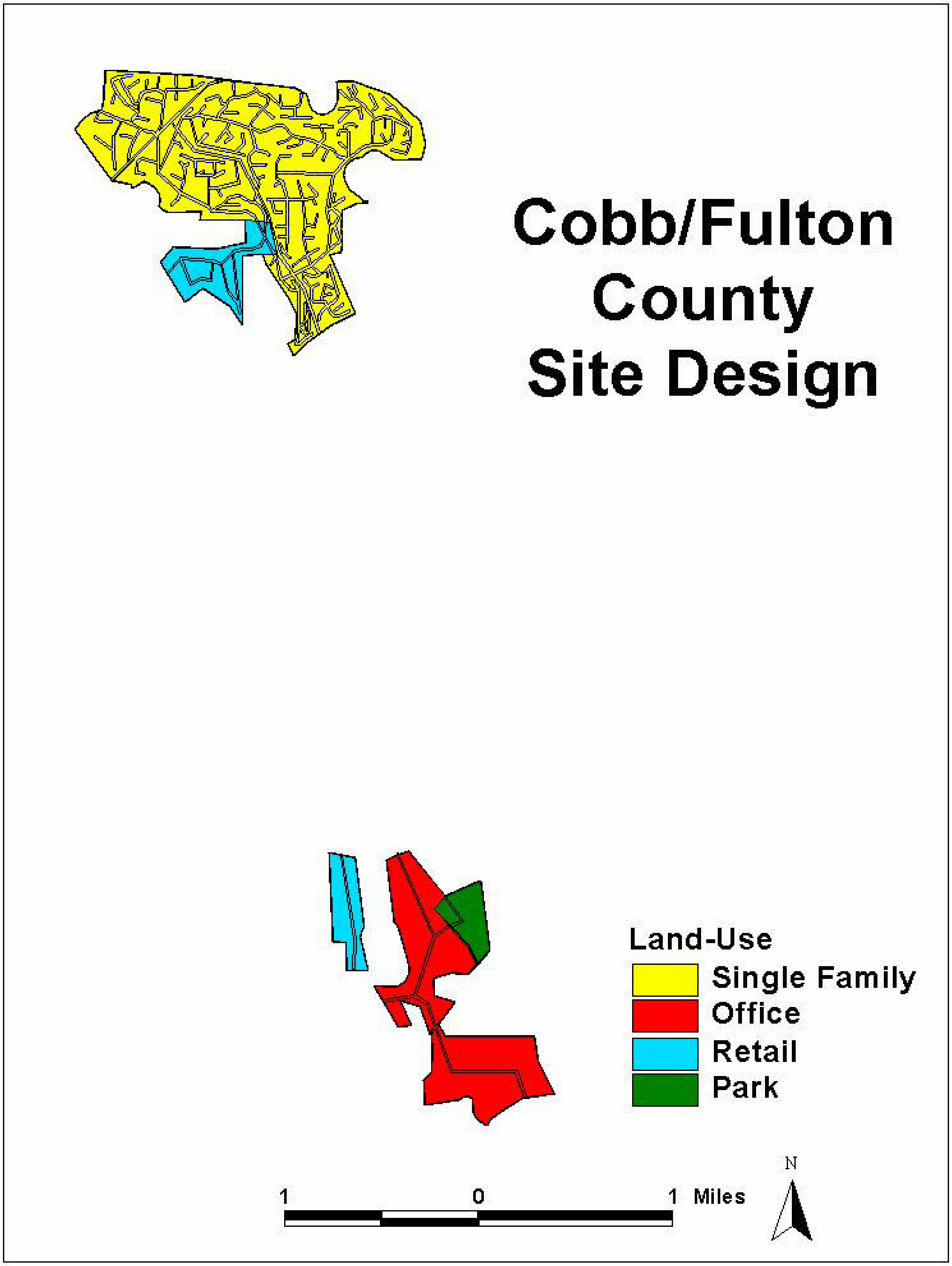
Map 3: Atlantic Steel site, Jacoby original design

The design is for a moderate-density development with hotel, retail, office, and residential uses. (See Figure 5, left-hand column.) Some areas of the site, and some buildings, have mixed uses. Uses are mixed primarily on the site's east side, near the 17th Street bridge, and nearest to the MARTA Arts Center station. On the west side the applicant proposed a single-use office park with buildings set back from the street and stretches of undeveloped green areas and parking separating them. Residences, in some cases mixed with offices, are located in between the office park and the retail/hotel. The street system is an adaptation of the site's existing grid system and includes some points of connection to neighborhood roads.

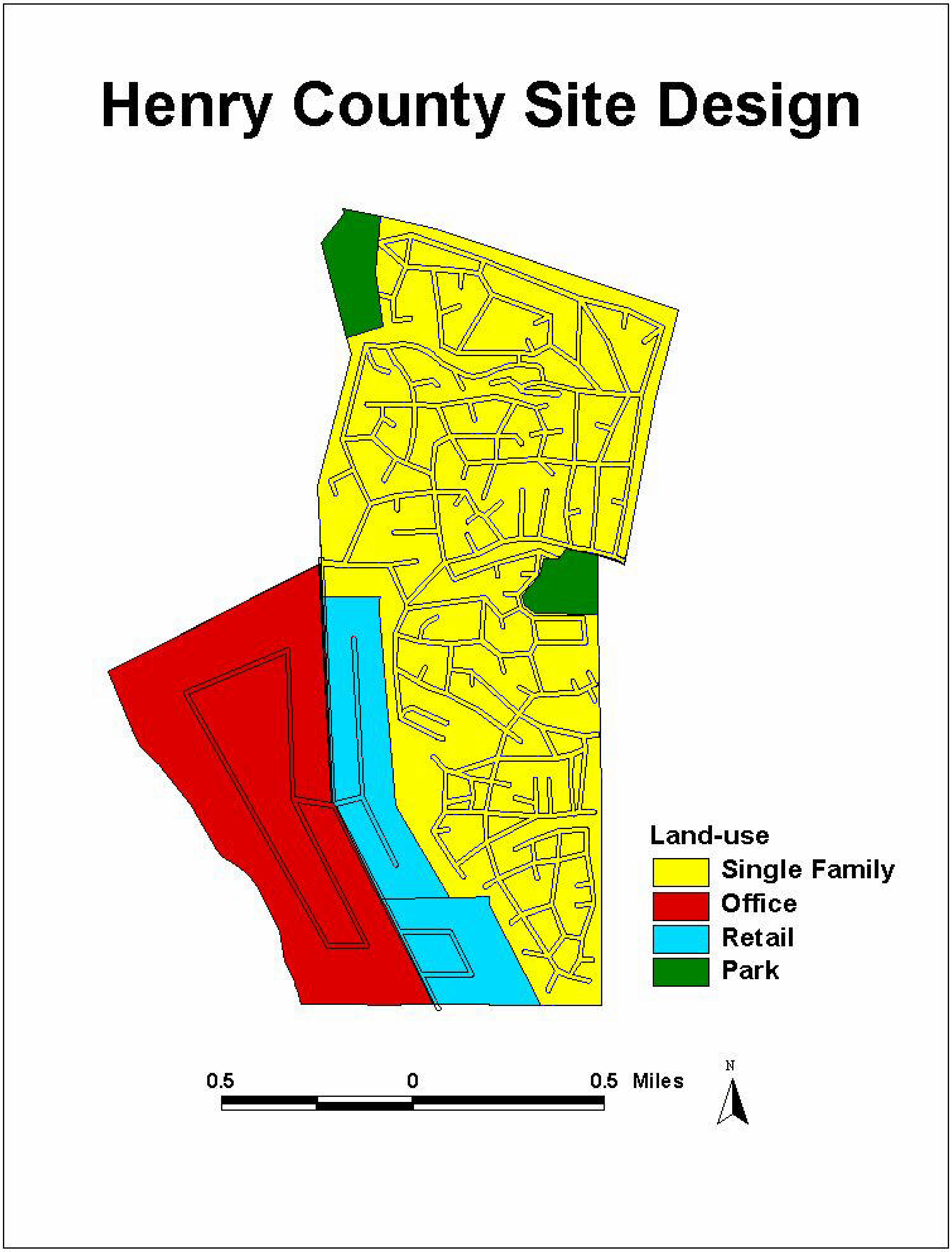
2. The greenfield site designs

In order to allow analysis of the likely transportation and environmental performance of the greenfields, EPA (supported by Criterion Planners/Engineers, Inc.) prepared block-level site designs based on platting patterns established in the immediate vicinity of each greenfield site. The

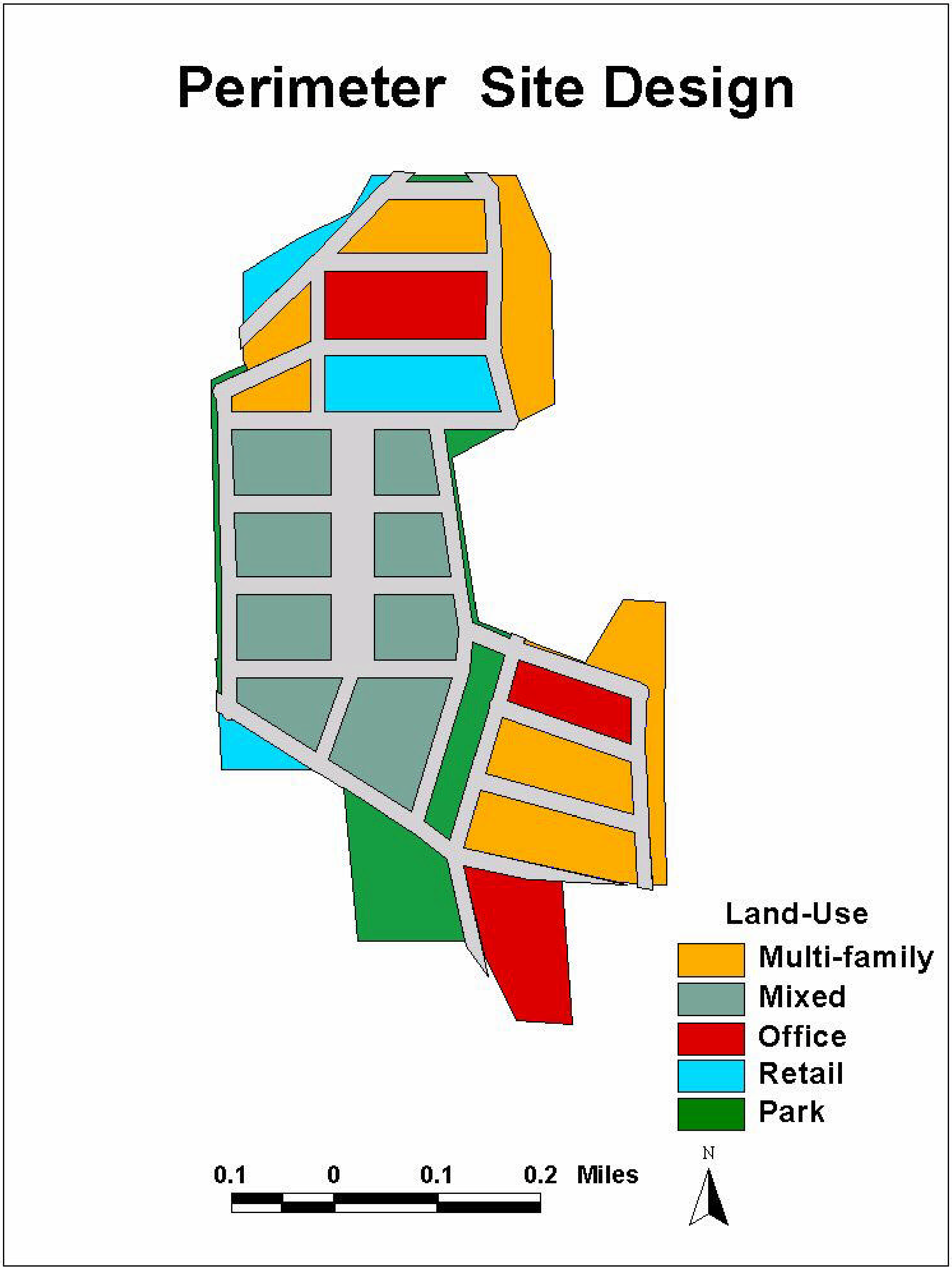
Cobb/Fulton and South Henry designs follow a low-density suburban design, locating as they do the applicant's proposed amount of development on sites almost ten times as large. The Perimeter/ Sandy Springs site has essentially the same density as the Atlantic Steel site. Its design also reflects that of its neighbors, which are characterized by large building setbacks and auto-orientation. The site designs are shown in Maps 4, 5, and 6.



Map 4: Cobb/Fulton site design



Map 5: South Henry County site design



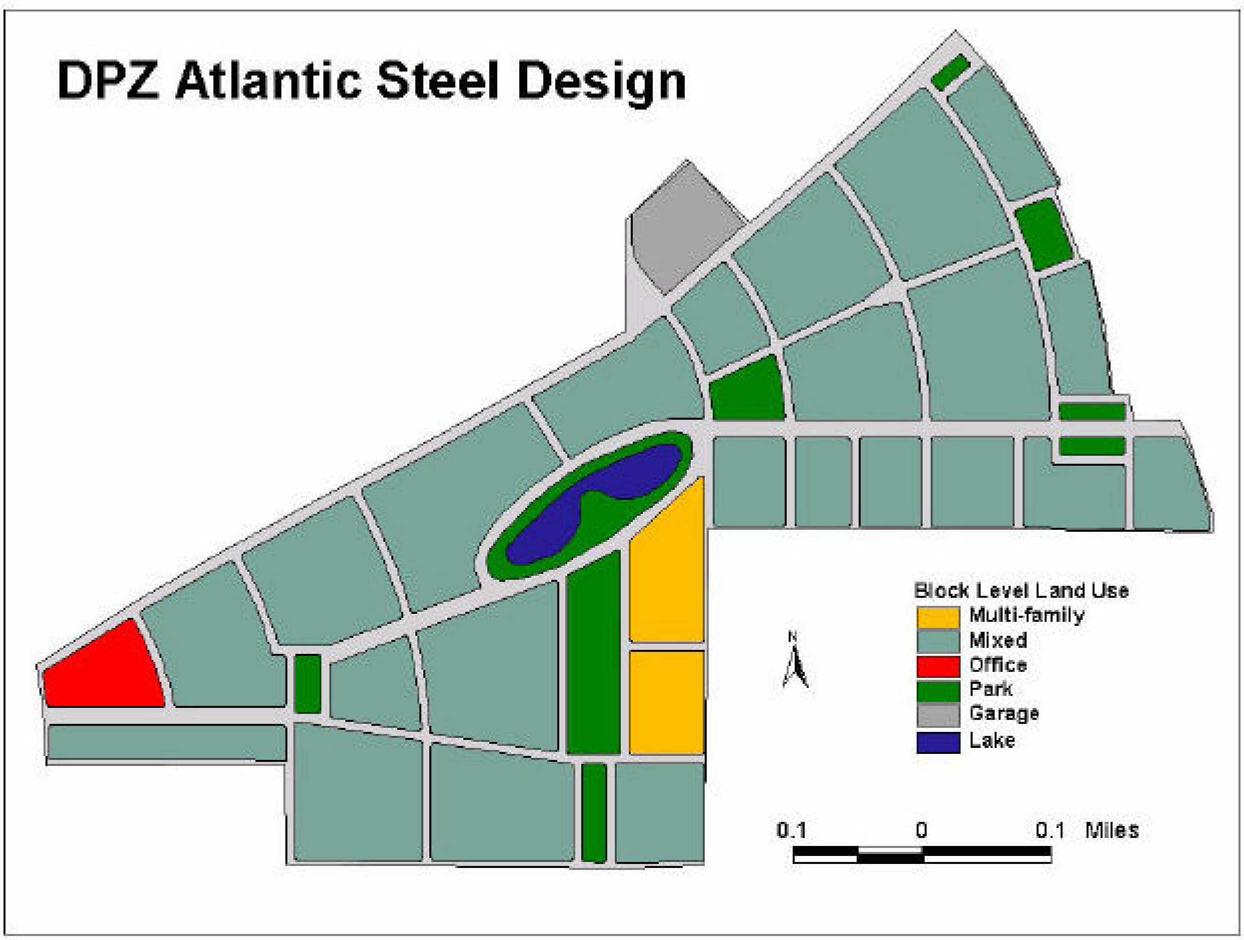
Map 6: Perimeter Center/Sandy Springs site design

3. The DPZ site design

EPA hired one of the nation's leading town planning firms, Duany Plater-Zyberk and Company (DPZ), to identify, based on their expertise, areas where the Atlantic Steel site design could be made more conducive to pedestrian, bicycle and other non-motorized modes of transportation.

To accomplish this task DPZ, led by principal Andres Duany, held a three-day design charette, in Atlanta December 7-9, 1998.

Through the charette DPZ received input from community residents, Jacoby Development and its consultants, local and state government, and others. Project XL emphasizes stakeholder and community participation. The charette was a significant opportunity for such participation, and numerous members of the community participated and contributed. Different stakeholders emphasized environmental, community, marketability and other factors. DPZ presented its recommendations and final design on the third day.



Map 7: Atlantic Steel site, DPZ design

The DPZ design mixes uses at a fine level throughout the site. The neighborhood street grid is continued as much as possible through the site. The DPZ design also included a slightly larger land area than the original design because there is reason to believe that the additional land will be co-developed.

4. Principal differences between site designs

The site design differences of greatest interest to EPA were those affecting travel behavior and subsequent emissions. Many urban land use and transportation planning issues that drive transportation behavior and thus affect environmental performance are captured by what have become known in the planning field as the three Ds: diversity, design, and density.[7] Improvements in each have been observed to produce reduced auto travel, an important contributor to reduced emissions.

“Diversity,” for example, means mixing land uses. Mixing uses has been observed to reduce auto trips by allowing trips to be made, chained, or combined without the use of the auto. For diversity of uses to be effective, however, the different uses must be within easy walking distances from each other. “Design” includes a range of choices that affect the physical and aesthetic experience of being in an area. For example, physically, how far are most people from transit stops? How direct is the route? Aesthetically, do sidewalks pass by parking lots, or are store and office-fronts continuous along a sidewalk? “Density” is a fairly straightforward measure, although the arrangement of the density on the site is important. For instance, concentrating density around transit stops can increase ridership.

From these perspectives, the Jacoby-proposed design had both design merits and shortcomings. Compared to the Perimeter Center/Sandy Springs site, the Jacoby-proposed design is very similar to the suburban infill site — with similar densities, use mixes, etc. The Jacoby design compares favorably with the Cobb/Fulton and South Henry greenfield sites. Versus these true greenfields the Jacoby-proposed design offers the following advantages:

- mix of uses at a scale relevant to non-auto forms of travel,
- proximity to high quality transit,
- and much higher density.

Although the Jacoby design improved upon the greenfield alternatives, opportunities to improve the travel and environmental performance in the Jacoby design were available, including the following.

[7] The phrase is Robert Cervero’s.

a. Some streets have high-speed geometries, and are auto-oriented (centerline radii, lane widths, and curb radii) reducing the pedestrian-friendliness of the environment. Strategic reductions in travel speeds, reductions in building setbacks, and impediments to alternative transportation are opportunities to reduce auto trips and improve the environmental performance of the site.

b. The best pedestrian environments consist of well-defined spaces, continuous uses and a variety of streetscaping amenities. From this perspective, the site design, particularly the west side, can be improved by better framing pedestrian areas and creating clear progressions of pedestrian-oriented uses — such as a clear line of pedestrian oriented retail along key pedestrian routes. The current retail is discontinuous in places and, in these places, does not promote a defined pedestrian route or set of routes. Other pedestrian-friendly improvements can also be made such as avoiding uses incompatible with pedestrian activity, such as surface parking lots along pedestrian routes. Increased attention to these important details of the site design will enhance the attractiveness of pedestrian travel as a viable mode of transportation.

c. The west side of the site — the tech-focused office park, and its associated hotel — can be better integrated with other uses. The proposed configuration leaves these offices removed from the majority of on-site retail, restaurants, and residences. Studies have shown that pedestrian mode share substantially increases when trip lengths are a quarter mile or less. Increasing the west side offices' proximity to on-site destinations can increase pedestrian mode share.

d. Parking has a major effect on travel behavior. Recent work cited by DPZ suggests that co-locating hotels and offices allows for shared parking and reductions in needed capacity as high as 25%. By locating the two hotels next to one and other this opportunity is precluded. Preserving these and other opportunities for innovative parking arrangements makes sense for future traffic management.

The DPZ site design attempted to capitalize upon as many of these opportunities as possible. The DPZ design retains the fundamental features of the applicant's design, with the following changes. The DPZ design:

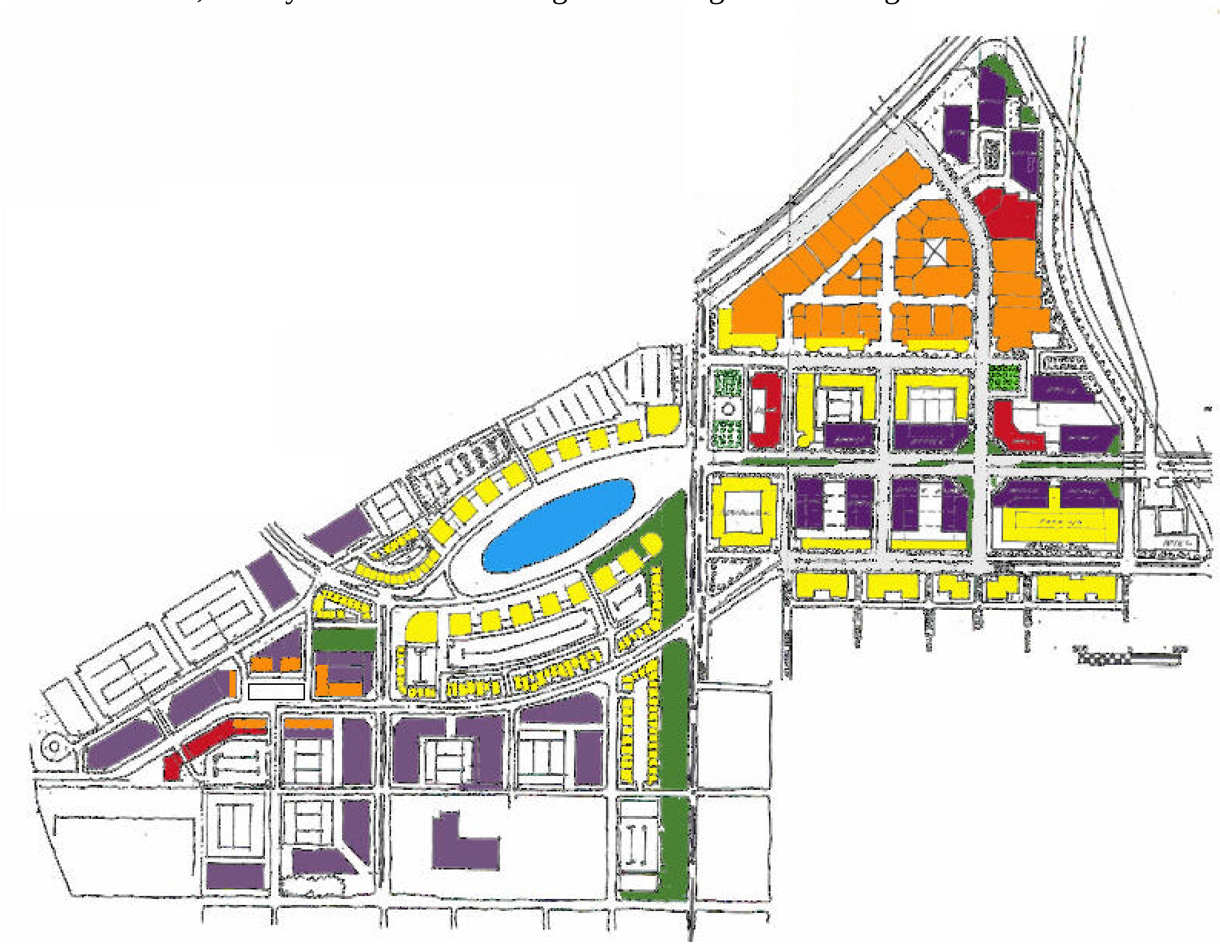
- Increases the amount of mixed use on the west side of the property while still keeping significant amounts of office space there.
- Improves land use mix on the site in general.
- Improves street frontages and creates clear pedestrian trajectories.
- Controls auto speeds for better pedestrian environment.
- Increases densities near transit stops.
- Continues the street grid of the existing, surrounding neighborhood into the site.

- Moves land uses to enable shared parking.

DPZ's site design and recommendations were well received by most of the participants in the charette. Jacoby indicated its intent to incorporate many concepts from the charette into its final site design.

5. The developer's site redesign

Drawing on the results of the design charette, and responding to recommendations in the literature on the three Ds, Jacoby submitted a re-design of the original site design.



Map 8: Jacoby site redesign

B. METHODOLOGIES FOR COMPARING THE ALTERNATIVES

1. Quantify the design variables

As with the locational analysis, EPA needed to quantitatively analyze the performance differences between site designs. To judge the effect of site design, EPA used a two-step analysis. First, the GIS-based tool INDEX® was used (by EPA contractor Criterion Engineers/Planners, Inc.) to quantify the differences among the designs.

INDEX® evaluates a detailed GIS map of each development project to produce information about the spatial characteristics of a site. In doing so, it allows a quantitative comparison of design differences. Measures of site design include, for example, the number of residential dwellings within ¼ mile of a transit route.

Many of these measures suggest the extent to which non-auto transportation choices are available. They also provide information on a few of the parameters that are often included in the elusive concept of a “livable” community, such as how easy it is to walk around that community, and whether there are destinations to which to walk. The quality of life in each hypothetical community is not a central issue examined by this study. But where the model makes that information available, EPA makes that information available to the stakeholders.

2. Vary travel behavior in response to design variables

Data from around the country show that travel behavior varies in response to design. For example, transit ridership increases with proximity of residential development to the nearest transit station. The second step of the analysis used empirical data on travelers’ response associated with aspects of site design to adjust travel behavior for each site design. Adjustments were made for the three Atlantic Steel site designs. The adjustments were made from the travel behavior predicted by TRANPLAN for the Atlantic Steel site if it were designed like an average Atlanta development.

The adjustments described in this section were recommended by EPA consultants Fehr & Peers Associates, Inc., and implemented as part of the general modeling by contractor Hagler Bailly.[8]

In this step, EPA:

a. Examined Atlanta’s TRANPLAN model for whether it was sensitive to each design variable.

b. If it was determined that the ARC model formulation was incapable of responding to key design-related factors, and therefore did not capture traveler response to a design variable,

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[8] Fehr & Peers report available from EPA: Fehr & Peers Associates, “Recommended Refinements to Travel Demand Forecasts for Atlantic Steel Site Project, Atlanta,” March 16, 1999.

adjusted the TRANPLAN model output based on the literature and the quantified value of the design variable in each design.

Adjustments were made to the ARC model to reflect the following site design variables:

a. the dynamic interaction of employment, commercial, and housing within concentrated mixed-use developments;

b. the effects of urban design characteristics and the degree of pedestrian friendliness

Together, these affected both the selection of travel mode and total VMT, and these produced an adjusted VMT for each site design.[9]

Process

When one loads the Atlantic Steel TAZs with the proposed new jobs and activities, TRANPLAN explicitly recognizes jobs and households associated with each site design (macro-scale land use inputs). TRANPLAN thus recognizes the balance of jobs and housing at a very coarse level, and evaluates travel patterns based on the general balance of employment and population in the site and the region as a whole. However, no model input captures the functional integration of jobs and households at a micro-scale level. In order to capture the effects of that integration, post-processing adjustment factors were applied to TRANPLAN model output.

In order to establish a 'baseline site design' to which specific site designs could be compared, existing (1990) TAZs roughly similar to the Atlantic Steel site were sought based on the following criteria: 1) distance from downtown, 2) proximity to MARTA, 3) proximity to freeways, 4) employment density, and 5) residential density. A set of representative zones was found in midtown Atlanta, and these served as the baseline development scenario. The original Jacoby design, DPZ design, and Jacoby redesign were compared with the baseline condition.

Research by Cervero and Kockelman, and Lawton, has established relationships between micro-scale urban design features and travel behavior.[10] These relationships are expressed through equations that relate the quantified design features (independent variables) to elasticities of travel

[9] EPA modeled the performance of the site using performance factors from an integrated transportation and land use model now under development for EPA. This model, an enhanced version of INDEX® known as Smart Growth Index, will model travel behavior on the basis of empirical travel behavior responses to individual land use and design variables. To EPA's knowledge, no such comprehensive application of empirical responses to site- and micro-scale design variables has yet been done in the United States.

[10] See Robert Cervero and Kara Kockelman, "Travel Demand and the 3 Ds: Density, Diversity, and Design," *Transportation Research D: Transportation and Environment*, 1997, and Keith Lawton, "Travel Behavior, Urban Environment Effects and Travel Time Budgets", Portland Metro, 1998.

demand (dependent variable). Travel response to the design aspects of each of the three site designs was calculated using this research.

- **Intensity Factor**, based on an empirically-defined weight of the following independent variables:

  Activity Center Density: Number of activity centers per developed area, where an activity center is defined as any collection of retail or service land uses that either comprise a land area over 10,000 square feet, or consists of 3 or more stores that either adjoin or lie within 200 feet of each other along the same main street.

  Retail Intensity: Proportion of block faces with retail land uses, wherein a block face is the frontage of a block that is bounded on all sides by an intersecting street.

  Walking Accessibility: Relative proximity to sales and service jobs (reflecting activities within a neighborhood that are likely to attract foot travel), measured as a function of average walk travel time.

  Park Intensity: Number of local and regional parks per developed area (in acres), including open space of more than 20 areas.

  Population Density: Population per developed areas (in acres).

- **Pedestrian Environment Factor**, based on the following variables:

  Ease of street crossings: (scale of 4 to 12): Based on key intersections and their width, extent of signalization and traffic volumes.

  Sidewalk Continuity (scale of 4 to 12): Based on the extensiveness of sidewalks on principal arterials served or likely to be served in the future by transit. Secondary attention was paid to the extent of sidewalks on neighborhood collector streets.

  Local street characteristics (grid vs. cul de sac, scale of 4 to 12): Based on the extent of grid street patterns in each zone, and the fineness of the grid, measured as a function of distance between intersections.

  Topography (scale of 4 to 12): Based on the extensiveness of sloping terrain and the steepness of these slopes.

- **Urban Index,** based on an empirically-defined weight of the following independent variables:

  Local intersections within ½ mile of site centroid

  Retail employees within 1 mile radius of site centroid

- **Proximity to commercial-retail uses**

  Proportion of developed acres within ¼ mile of a convenience store, retail-service use

  Proportion of residential acres within ¼ mile of a convenience store, retail-service use

- **Walking Quality Factor**, based on an empirically-defined weight of the following independent variables:

  Sidewalk Provisions: Factor based on proportion of block faces with paved sidewalks

  Street Light Provisions: Proportion of block faces with overhead street lights

  Planted Strips : Proportion of block faces with planted strips between the street curb and sidewalk

  Block Length: Mean distance of block faces

  Lighting Distance: Mean distance between overhead street lights along block faces

  Flat Terrain: Proportion of block faces with "flat" terrain (<5% slope)

Each of the independent variables listed above was calculated for the four site designs. The calculation in some cases required subjective judgment. The percentage difference in the independent variables relative to the baseline was calculated. These 'adjustment factors' were then applied to the elasticities for the dependent variables (non-work and work trips) to establish a revised set of elasticities. Revised elasticities were applied to model output (work trips, non-work trips) to determine the reduction in travel as a function of site design, relative to the baseline scenario.

For example, the calculated 'intensity factor' for the original Jacoby design was 24% greater than the baseline, while the DPZ 'intensity factor' exceeded the baseline by 60%. Cervero and Kockelman found the elasticity of vehicle work trip production with regard to the intensity factor to be 0.119. The reduction in work vehicle trips associated with each site was calculated by multiplying the independent variable adjustment factors (24% and 60%) by the elasticity of travel demand (11.9%) to yield revised elasticities (2.5% for the Jacoby site, and 6% for the DPZ site design); revised elasticities were then multiplied by model data to produce the estimated reduction in non-work vehicle trips for each site design.

3. Run emissions model

Finally, EPA estimated emissions for each site/design combination's adjusted travel behavior using the MOBILE emissions model as described above.

C. RESULTS

1. Basic travel results, and the emissions that travel would produce

Changes in trip generation result in a 3.7% reduction in VMT for the original Jacoby site design, and 5.8% for the DPZ site design. The Jacoby redesign would outperform the assumed average site and the original Jacoby design, and come close to matching the performance of the DPZ design. As described in the regional location analysis above, the assumed average site design would outperform the three greenfield sites.

The VMT percentage changes do not track trip reduction changes one to one because the majority of affected trips are non-work trips. Given the subjective nature of some of the design variable scores it would be inadvisable to place significant weight on the implied precision of these results. However, the performance ranking of the four site designs closely reflects their general performance as objectively quantified by INDEX®.

The following Figures (10 and 11) compare each site design performance not in comparison to the site assumed by TRANPLAN, but to the best-performing site design.

Emissions results track the VMT results.

Regional Vehicle Miles Traveled

Site, design	Regional total (VMT/day)	Associated with site (VMT/day)	Site VMT difference from AS, DPZ
AS, assumed by TRANPLAN	139,172,200	340,300	6.2%
AS, DPZ	**139,152,340**	**320,440**	
AS, Jacoby	139,159,289	327,389	2.2%
AS, Jacoby redesign	139,154,690	322,790	0.7%

Using Mobile 5, vehicle miles traveled drive…

Regional Emissions

	NOx			VOC		
Site	Regional total (tons/day)	Associated with site (tons/day)	Site NOx difference from AS, DPZ	Regional total (tons/day)	Associated with site (tons/day)	Site VOC difference from AS, DPZ
AS, assumed by TRANPLAN	191.95	0.400	6.38%	153.230	-0.390	5.80%
AS, DPZ	**191.93**	**0.376**		**153.206**	**-0.414**	
AS, Jacoby	191.94	0.386	2.66%	153.216	-0.404	2.42%
AS, Jacoby redesign	191.93	0.381	1.33%	153.208	-0.412	0.48%

Figure 10: Travel and emissions impacts of four Atlantic Steel site designs

2. Trips based emissions

As discussed in the regional impacts analysis above, the MOBILE approach does not explicitly take into account trip ends. Rather, trip-end emissions (cold start, hot soak, etc.) are incorporated into the per-mile emissions rates used to convert VMT to emissions. While this works well for many purposes, it has limitations in a comparison between alternatives where vehicle trip generation varies substantially. To shed light on the change in emissions produced by the different number of trips produced by each site, EPA conducted a trip-based analysis of VOC and NO_x emissions.

Vehicle Starts

Site, design	Regional total	Associated with site	Difference from AS, DPZ
AS, assumed by TRANPLAN	11,242,685	16,498	10.8%
AS, DPZ	**11,241,080**	**14,893**	
AS, Jacoby	11,241,641	15,454	3.8%
AS, Jacoby redesign	11,241,270	15,083	1.3%

Vehicle starts drive…

Cold Start Emissions

	NOx			**VOC**		
Site	Regional total (tons/day)	Associated with site (tons/day)	Difference from AS, DPZ	Regional total (tons/day)	Associated with site (tons/day)	Difference from AS, DPZ
AS, assumed by TRANPLAN	32.06	0.061	8.3%	32.83	0.062	8.3%
AS, DPZ	**32.06**	**0.056**		**32.83**	**0.058**	
AS, Jacoby	32.06	0.058	2.9%	32.83	0.059	2.9%
AS, Jacoby redesign	32.06	0.057	1.4%	32.83	0.058	1.4%

Figure 11: Vehicle starts impacts of three Atlantic Steel site designs

These site-specific results were driven by the site design variables quantified in the next section.

3. Results of quantifying the design variables

The results in this section quantify the design variables that:

- help determine accessibility and that drove the comparison of travel behavior changes in response to design,
- determine multi-media impacts such as open space loss and impervious surface, and
- determine other aspects of site design of concern to stakeholders.

Element	*Indicator*	*Definition*	*Sites*					
			Cobb/ Fulton	*South Henry*	*Sandy Springs*	*Jacoby*	*DPZ*	*Jacoby redesign*
Population	Resident population	Total number of residents	6,000	6,000	6,000	6,000	6,000	7,500
	Household population	Total number of dwelling units	2,400	2,400	2,400	2,400	2,400	3,100
	Employment population	Total number of jobs	17,483	17,483	17,483	17,483	17,483	21,173
	Total population		23,483	23,483	23,483	23,483	23,483	28,923
Land use	Development area	Total land area in acres	1,255	1,218	143	148	157	137
	Use mix	Dissimilarity between predominant uses in one-acre grid cells.	.01	.04	.29	0.29	0.39	.39
	Activity diversity	Percent of blocks with mixed uses.	18%	64%	35%	18%	64%	39%
	Block texture	Ratio of one acre per block versus actual acres per block.	.06	.05	.24	0.29	0.21	.24

Housing	Average residential density	Dwelling units per net acre of land designated for residential uses.	4.1	4.2	72	81	83	78
	On-site transit proximity[11]	Average travel distance from all dwellings to closest on-site transit stop.	n.a (no on-site transit)	n.a	n.a	368 ft.	377 ft.	413 ft.
	MARTA rail transit proximity	Average travel distance from all dwellings to closest MARTA rail stop.	7.7 mi.	35 mi.	1.3 mi.	4,715 ft.	5,075 ft.	3,612 ft.
Employment	Nonresidential building size – total	Total nonresidential building area in million square feet.	7	7	7	7	7	8.2
	Nonresidential building size – average	Average size of nonresidential buildings in square feet.	n.a	n.a	n.a	259,000	93,000	206,000
	Jobs/housing balance	Ratio of jobs to dwelling units.	7.3	7.3	7.3	7.3	7.3	6.8
	Employment density	Employees per net acre of land designated for employment uses.	41	39	278	286	221	315
	Nonresidential building density	Average nonresidential building floor area ratio (per block).	0.4	0.4	2.5	2.6	2.0	2.8
	On-site transit proximity	Average travel distance from all businesses to closest on-site transit stop	n.a	n.a	n.a	588 ft.	778 ft.	587 ft.
	MARTA rail transit proximity	Average travel distance from all businesses to closest MARTA rail stop.	8.0 mi.	36 mi.	1.4 mi.	4,366 ft.	5,308	3,537 ft.

[11] On-site transit for Atlantic Steel assumes a mix of trolley and bus.

Parks & Recreation	Park space availability	On-site acres of park per 1,000 residents (includes lake and other open space).	n.a	n.a	n.a	3.6	2.2	1.7
	Recreation proximity	Average travel distance from all dwellings to closest park (includes lake and other open space).	3 mi.	4,193 ft.	1,501 ft.	830 ft.	284 ft.	315 ft.
Environment	Open space	Percent of total land area dedicated to open space (including lake)	4%	4%	13%	22%	11%	9.5%
	Open space loss	Development site area	1,255 acres	1,218 acres	143 acres	148 acres	157 acres	137 acres
	Imperviousness	Percent of total land area covered by impervious surfaces	53%	53%	71%	78%	55%	90%
	Total impervious surface	Total land area covered by impervious surfaces.	665 acres	645 acres	101 acres	107 acres	76 acres	124 acres
Transportation and Travel	Internal street connectivity	Ratio of street intersections versus intersections and cul-de-sacs.	.76	.6	1.0	0.93	1.0	1.0
	External street connectivity	Average distance between ingress/ egress streets on site boundary in ft.	6,404	8,221	1,701	1,181	725	899
	Pedestrian route directness	Average ratio of shortest walking distance from outlying nodes in 1/8, 1/4 and ½ mile increments to central nodes, to straight-line distance between the same points.	2.6	4.3	1.5	1.4	1.6	1.7

	Effective walking area	Ratio of land area reachable in 1/4-mile walk from designated nodes versus land area of 1/4-mile radius walking shed.	0.6	0.3	0.8	0.8	0.8	.8
	On-site transit-oriented residential density	Average number of dwellings per net acre within 1/4-mile walk of on-site transit stops.	n.a	n.a	n.a	52	83	78
	On-site transit-oriented employment density	Average number of employees per net acre within 1/4-mile walk of on-site transit stops.	n.a	n.a	n.a	286	221	315
	Off-site transit-oriented residential density	Average number of dwellings per net acre within a 1/4-mile walk of an off-site MARTA bus stop.	n.a	n.a	n.a	8	63	50
	Off-site transit-oriented employment density	Average number of employees per net acre within a 1/4-mile walk of an off-site MARTA bus stop.	n.a	n.a	n.a	157	260	198

4. Discussion of design variable quantification

a. Design goals

In general, the INDEX® evaluation demonstrates that the improvements sought by DPZ's recommendations — improved walkability and transit orientation — were achieved in the DPZ design and the subsequent Jacoby redesign. The land use mix improves, as measured by the indicators "Use mix" and "Activity diversity." This mix provides more walk-accessible destinations, through better mixing of office and retail (more lunchtime walking destinations) and of office and housing (more walk commute trips possible). The two new designs improve the pedestrian environment for walk trips in ways both quantified ("Internal street connectivity," "External street connectivity") and unquantified (building frontage along sidewalks increases; no surface parking along sidewalks). Pedestrian access to transit is also generally improved ("On-site transit-oriented residential density," "Off-site transit-oriented residential density," "Off-site transit-oriented employment density"). The designs locate dense uses closer to transit stops not only in the site, but also respond to the location of stops off-site. This is in keeping with the designs' generally greater integration of the site transportation network with the surrounding network.

Some of the design changes produce measures of site design that suggest decreased pedestrian and transit friendliness. For example, the average travel distance from all dwellings to an on-site transit stop are slightly higher in both later designs. This is in part a result of the improved land use mix. In particular, the western portion of the site, the furthest from the MARTA rail station, was redesigned from exclusively offices in the original Jacoby design, to mixed use. DPZ believes that in a pedestrian friendly environment, small differences in transit access distance below a ¼-mile are not important, and that the improved land use mix more than offsets the effects of the small change in transit access distance. Also offsetting is the significant improvement in the Jacoby redesign of proximity to the MARTA rail station for both housing and employment.

Taken as a whole, both the DPZ site design and the Jacoby redesign are more walkable and transit accessible.

b. Multi-media impacts

In addition to air pollutant emissions, and the transportation behavior that produces them, EPA is concerned with performance across other environmental media. The table above rates the alternatives on several environmental performance measures relevant to Atlanta.

i. Open space

The sites at Perimeter/Sandy Springs and Atlantic Steel have substantially smaller areas than the sites at Cobb/Fulton and South Henry. Especially compared to the latter two cases, development at Atlantic Steel would preserve substantial amounts of regional open space.

ii. Stormwater runoff

The sites at Perimeter/Sandy Springs and Atlantic Steel would have substantially smaller total impervious surface areas than the sites at Cobb/Fulton and South Henry. Assuming that all sites receive the same amount of rain, all three Atlantic Steel designs would produce far less stormwater runoff than the other site/design options, and of the Atlantic Steel designs, the DPZ design, the least.

iii. Brownfield redevelopment

Not reflected in the table above, but an important consideration, is that all three Atlantic Steel designs would clean up a brownfield. EPA has not analyzed the specific benefits of brownfield cleanup in this location. However, the federal government, and numerous states and cities have made brownfield cleanup a priority because such cleanups and redevelopments bring economic, health, and aesthetic benefits.

iv. Noise/traffic

EPA is not performing a specific noise analysis for the Atlantic Steel site's neighborhood, Home Park. The neighborhood has endorsed redevelopment of the Atlantic Steel site, for a combination of reasons suggested in the brownfield section above. Although some roads in the vicinity will see increased traffic, others will see decreases.

v. CO_2 emissions

EPA also evaluated the production of CO_2, a greenhouse gas, from transportation associated with each site. Vehicles emit a fixed amount of CO_2 for each gallon of gasoline used. EPA assumed that the Atlanta light duty vehicle fleet composition matched the national average, and applied the national average fuel economy to the VMT for each site/design combination. Results:

Site/design	**CO_2 emissions/year**
Atlantic Steel, DPZ	13,943
Atlantic Steel, Jacoby	14,245
Atlantic Steel, Jacoby redesign	14,045
Sandy Springs	16,955
Cobb/Fulton	22,082
Henry County	22,548

V. CONCLUSION

Analyses of the proposed Atlantic Steel development and of alternative locations and designs tell a consistent story. At the regional level, the results demonstrate that absorbing a portion of Atlanta's growth through development at the Atlantic Steel site provides lower vehicle miles of travel and lower NO_x and VOC emissions in comparison to sites that represent other likely development locations. Emissions reductions result from Atlantic Steel's regionally central location and transit access. Combined, these factors reduce total VMT associated with the site, and reduce the number of auto trips associated with the site.

At the site level, analysis indicates that, despite increases in traffic, CO hot spots do not occur. Areas where CO increases tend to be those that currently enjoy a low CO concentration. Some areas that currently have higher concentrations of CO actually register slight declines in CO. Additional analysis is not expected to significantly alter these results.

With respect to the site design, the analysis is clear. All of the three Atlantic Steel site designs are superior to that which would likely occupy the Cobb/Fulton site or the Henry County site. The Atlantic Steel site also offers superior transit access compared to the Perimeter Center/Sandy Springs location. The DPZ site design and the Jacoby redesign are superior to the site design originally proposed by the developer in three respects. First, the later designs provide better connectivity on and off site. Second, they greatly improve the mix of uses on site by integrating them at a finer scale. Third, the pedestrian environment is improved through better street design, more direct routing and slower traffic speeds. Each of these improvements contributes to create an atmosphere conducive to non-SOV travel, both for residents of the site and site visitors. This environment is crucial to achieving the environmental benefits made possible by the site's location and transit accessibility. The changes in the two later designs are reflected in lower VMT, emissions, and other environmental impacts.