CEE 123 Transport Systems 3: Planning & Forecasting

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The Miasma Beach Transportation Model

Task 3. DEMAND FORECASTING: TRIP GENERATION

The first two tasks have focused on the development of a network that represents the transportation system of Miasma Beach. Task 3 develops the specifications for the **activity system** of the region. Recall that the area has been divided into six Traffic Analysis Zones (1 through 6), with two external stations (7 and 8) that serve as control points with areas not directly part of the study area. The modeling approach is to calibrate and validate trip generation and trip distribution models for the **six internal zones only**. Interactions with the external area (via the external stations) have been modeled independently and these results will be provided in Task 5.

3.1 Description of the Zoning System

Figure 2 depicts the defined TAZs superimposed on the corrected Miasma Beach 2020 base transportation network (*verify that all network edits (Tasks 1 and 2) have been made before proceeding*).

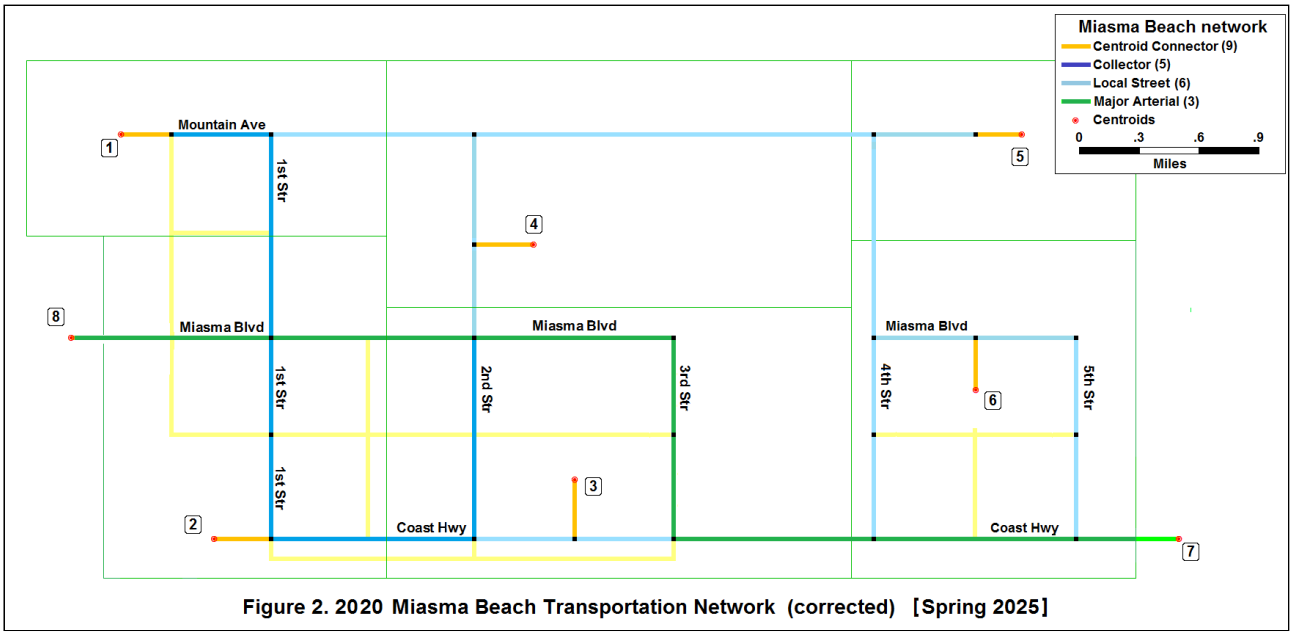

Figure 2. 2020 Miasma Beach Transportation Network (corrected) [Spring 2025]

Zone 1 forms the "Old Town" Central Business District (CBD) and urban residential areas, reflecting the historic employment center in the City. Zones 2 and 3 form a beachside community, a residential area with some retail activity along Coast Highway. Zone 4 is an agricultural area, with packing and processing industries, east of the CBD and north of Zone 3. Zones 5 and 6 are developing residential zones located east of the Miasma wetlands. Zones 7 and 8 are External Stations: Zone 7 is at the east end of Coast Highway where SR-1 heads toward the City of Miasma; Zone 8 is at the west end of Miasma Blvd where SR-1 heads into the Miasma Mountains toward Port Miasma. A variety of demographic characteristics have been assembled for the six TAZs (data are provided in Table 2).

Table 2. 2020 Miasma Beach Demographic Data

ZONE	POP	LABF	CARS	HINC	HH	EIND	ERET	EOTH	ETOT	AREA

1	3000	1100	900	29850	700	400	150	1000	1550	1.56
2	1550	1300	600	44850	800	300	225	1300	1825	2.53
3	3500	1200	2500	83100	1000	0	350	250	600	3.10
4	0	0	0	0	0	1400	150	200	1750	2.83
5	2450	1400	2000	49500	950	0	100	50	150	1.27
6	5000	1800	2250	57000	1550	0	425	500	925	3.09
Tot	15500	6800	8250		5000	2100	1400	3300	6800	14.38
Mean	2583	1133	1375	55050	833	350	233	550	1133	2.40

Note: Weighted mean used for income.

Definition of Variables in Table 3

POP = zone population	EIND = basic employment
LABF = labor force (by residence)	ERET = retail employment
CARS = total cars in zone	EOTH = other employment
HINC = median zone household income	ETOT = total zone employment
HH = number of households in zone	Area = zone area (sq.mi.)

Note: basic employment includes agricultural and industrial

3.2 Development of Trip Production and Attraction Models

As part of the development of the Miasma Beach Transportation Model, a formal home interview survey was conducted. Travel diaries were collected for all members of approximately 1000 households in the six internal zones. An extensive Cordon Survey also was conducted to develop estimates of traffic entering and exiting the area at the defined external stations (see Task 5). Preliminary analysis of survey data produced **population-level** estimates of trip productions and attractions for the study area. Total trips were segmented into Home Based Work (**HBW**), Home Based Other (**HBO**), and Non-Home Based (**NHB**) trips.

Table 3. 2020 Miasma Beach Productions and Attractions

ZONE	TOT/P	TOT/A	HBW/P	HBW/A	HBO/P	HBO/A	NHB/P	NHB/A
1	11550	10300	1800	3200	5500	4800	4250	2300
2	11800	11800	1800	2800	5500	6000	4500	3000
3	12050	12300	2700	1100	6600	6900	2750	4300
4	1500	5600	0	3100	0	1800	1500	700
5	8850	4800	2200	300	5400	1800	1250	2700
6	14250	15200	3500	1500	7000	8700	3750	5000
Tot	60000	60000	12000	12000	30000	30000	18000	18000
Mean	10000	10000	2000	2000	5000	5000	3000	3000

An estimate of 60,000 daily person trips were generated by Miasma Beach residents in the base year (2020); Table 3 presents base year trip productions and attractions. The estimated trips are split 20 percent HBW, 50 percent HBO, and 30 percent NHB. These trip types are fundamentally different based on such attributes as time-of-day, mean trip length, and vehicle occupancy.

The tabulated demographic and trip end data provided may be used to **develop** and/or **apply** zonal production and attraction trip generation models for Home-Based Work (**HBW**), Home-Based Other (**HBO**), and Non home-Based (**NHB**) trips.

3.2.1 Model Specification for Trip Generation

Production and attraction models have been estimated for some of the trip types (these are summarized in Table 4a and 4b) but teams must estimate some models.

> **Spring 2025 Instructions**:
> Each project Consulting Team will estimate and/or apply different combinations of the HBW, HBO, and NHB trip production models. Click HERE for instructions!

It is **recommended** that you either verify the models provided using TransCAD or attempt to estimate alternative (perhaps better) production and attraction models. Provide a **summary table** of estimation results for all specified models as well as for any proposed alternative models. Be sure to **include** all model summary statistics.

Table 4a. Estimated Trip Production Models [coef (t)]

Variable	HBW#1	HBW#2	HBW#3	NHB#1	NHB#2
DU	2.30 (12.92)	-	-	-	-
POP	-	0.66 (5.51)	-	0.32 (3.29)	0.17 (1.56)
LABF	-	-	1.24 (3.81)	-	-
CARS	-	-	0.47 (2.40)	-	-
ERET	-	-	-	-	2.41 (1.76)
EOTH	-	-	-	2.50 (7.68)	2.47 (9.86)
ETOT	-	-	-	-	-
Const.	84.76	349.51	-51.50	823.46	663.92
Obser.	6	6	6	6	6
R-sq	0.98	0.88	0.96	0.96	0.98
F-ratio	167.00	30.33	37.28	35.78	41.65

Table 4b. Estimated Attraction Models [coef (t)]

Variable	HBW	NHB trips
DU	-	2.09 (4.91)
ERET	-	4.40 (3.15)
EOTH	-	-
ETOT	1.71 (8.19)	-
Const.	39.37	233.22
Obser.	6	6
R-sq	0.94	0.97
F-ratio	67.09	46.48

Team Assignments for TG Models (CEE123 and CEE223): Table 4c

3.2.2 Preparation of Input Data

The Miasma Beach trip production and attraction models will be estimated using regression analysis, with the dependent variables being zonal productions and attractions, respectively (from Table 3). Independent variables are demographic variables (from Table 2). The demographic variables for each TAZ are included in the TAZ Geographic file. Open the **TAZ** Geographic file and click the **New Dataview** button to open the **TAZ** dataview. **Sort** by ascending order of ID to compare the dataview with **Table 2**.

TAZ 4 Issue: Since TAZ has no households, it should not be used in the estimation of HB trip generation models. Check with TA.

> **HELP**:
> Productions and attractions are not included in the original TAZ file so these fields from Table 3 must be **appended** to the TAZ dataview. Click HERE for assistance!.

3.2.3 Estimating HBO Trip Generation Models

Using 2010 Miasma Beach activity system data and the expanded trip data in Tables 2 and 3, develop trip generation models for **HBO** productions and attractions. Display these dependent and independent variables in the TAZ dataview to begin the model estimation process. If previously estimated models are being applied, then go to section 3.2.4.

> **HELP**:
> If you are estimating new models, utilize TransCAD's **Model Estimation** procedure. Click HERE for TransCAD assistance!. You may also use Excel.

Follow the same procedure to estimate at least two potential models for **HBO** productions. *You must **estimate** the production model identified in Table 4c; you must **estimate** the attraction model in Table 4c.* Compare all estimated **HBO** models and determine which one is "best". As a rough guide, the final R-squared value should be 0.70 or better for the selected model. Tabulate ALL estimated **HBO** models and supporting statistics.

3.2.4 Create Model Files of HBW and NHB Productions and Attractions
Previously estimated trip generation models are summarized in Table 4a and 4b and may be used to create TransCAD production and attraction model files (*.mod). The task report should provide a table summarizing all models utilized, including all summary statistics, whether new models or previously estimated models are utilized.

> **HELP**:
> A **Model File** stores the variables and parameters of a TransCAD model. To create a file for an existing model, Click HERE for TransCAD assistance!.

3.2.5 Applying Model Files of All Three Trip Purposes
Once model files are created for productions and attractions of all three trip purposes, apply them to estimate trip ends for Miasma Beach.

> **HELP**:
> To **Apply** a model file, select **Planning / Trip Production / Apply a Model**.
> Click HERE for TransCAD assistance!

3.3 Trip Balancing

In trip generation, trip productions and trip attractions are estimated separately. The total number of trip productions, therefore, will typically not equal the total number of attractions. Any difference will violate the requirements for trip distribution analysis (and subsequent stages). The trip ends must be "balanced" so that the total number of productions equals the total number of attractions for each trip purpose (HBW, HBO, and NHB).

In practice, it is standard practice to hold trip productions constant, rather than attractions, when balancing trip ends. Trip productions are usually strongly related to zonal demographics, thus, the resulting production models are usually effective in replicating actual productions. On the other hand, there can be many factors that affect the number of trips attracted to a TAZ, thus, estimated attraction models often do not replicate attractions that well. For this reason, trip production estimates are typically considered more valid and thus are held constant. Conventionally, internal and external trip ends are combined prior to balancing. For Miasma Beach, external trips are already balanced, thus, only internal trips need be balanced at this point.

3.3.1 Balance (Normalize) Trip Attractions
Normalize zonal trip ends for HBW, HBO, and NHB trips for Miasma Beach, holding productions constant (or providing justification for not doing so). Tabulate productions with both initial and normalized attaractions

> **HELP**:
> TransCAD provides a built-in procedure for trip balancing. With TAZ as the working layer, go to **Planning / Balance**. Click HERE for TransCAD assistance!

3.3.2 Re-Allocate NHB Trip Attractions
While total NHB trip productions provide a reasonable estimate of total trips, and thus serves as the normalization factor for total trip attractions, the actual zone by zone distribution of (normalized) trip attractions provides a better estimate of the zone-by-zone distribution of trip productions for NHB trips. **Re-allocate** zonal NHB trip productions to be equal to zonal NHB trip attractions.

3.3.3 Summary of Trip Production and Attraction Models
Provide a summary table comparing the estimated values of all three trip purposes. **Compute a "goodness-of-fit" measure** to show how close the *estimated* trip ends are to the "*observed*" values in Table 3.

3.4 Prepare Task 3 Documentation

Include all relevant layouts, outputs, and model files. Since each consultant uses a different set of generation models, final results will vary from those of other consultants. Include regression analysis results for **all** attempted models in an appendix. Follow Project Format Guidelines in the preparation of this report. This report will be submitted as part of Interim Report 2 with the results of Tasks 4 and 5.

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