3. Analysis Framework

The lane repurposing analysis framework is based on two fundamental screening metrics that focus on the impacts of lane repurposing on auto and transit passengers in the project area. These screening metrics balance the transportation-related impacts of lane repurposing on auto and transit passengers to help provide guidance for decision makers. These fundamental screening metrics are supported by a set of secondary measures, recommended for information purposes, to provide a deeper understanding of the impacts of lane repurposing for technical staff and final decision makers.

The fundamental screening metrics were developed to account for the two major types of evaluation measures found in the literature: efficient use of roadway space and the travel time effects of repurposing on auto drivers/passengers and transit users. The analysis framework does not result in a pass/fail result; thresholds are not provided for the metrics. Instead, this analysis framework presents "ideal" targets for the metrics. The performance of a lane repurposing project should be considered based on how well it compares to these ideals, in addition to information highlighted by the secondary metrics, and considerations in a number of other important areas including the County's overall transportation goals, pedestrian and bicycle related impacts, land use and real estate considerations, and stakeholder input.

This analysis framework will provide useful technical information about the transportation-related impacts of potential lane repurposing projects, but they will need to be considered along with a range of other policy considerations and decision makers will make the final determination as to the best overall balance. The Montgomery County Department of Transportation will ultimately have the responsibility to adopt person throughput/lane repurposing metrics and thresholds for use in the RTS planning and design.

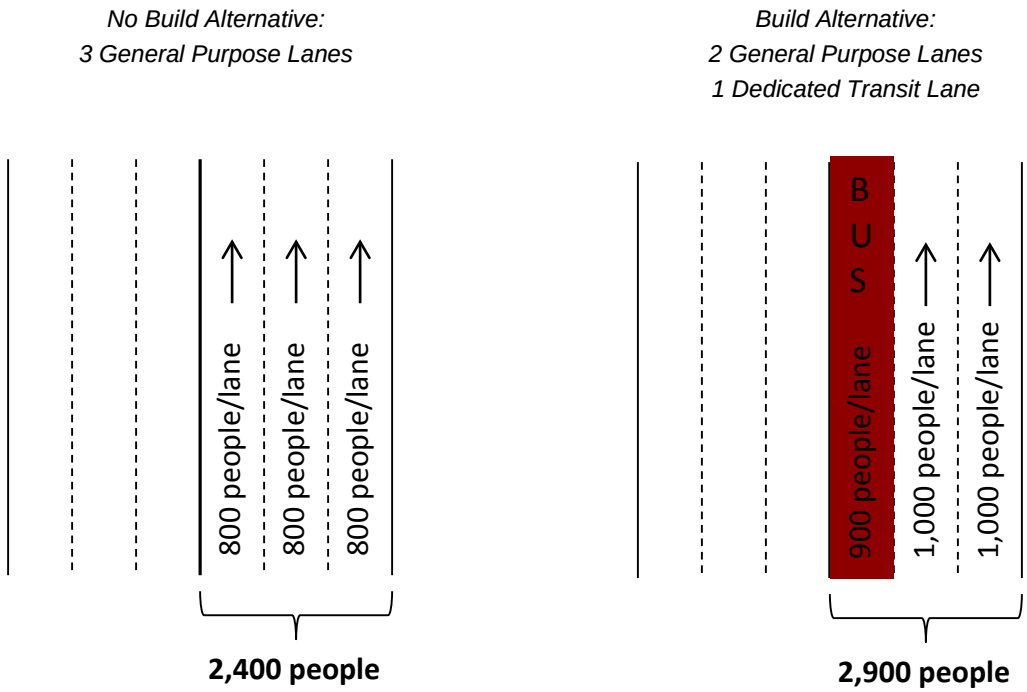
3.1 Fundamental Screening Metrics

Two fundamental screening metrics were developed based on the County's stated goals and the results of the literature review. The fundamental screening metrics were developed with ideal goals for any lane repurposing project which encourages the efficient use of roadway space and where overall travel time for all roadway users (transit riders and auto users) improves. These conditions represent the ideal situation for transit lane repurposing from a transportation perspective, but other factors should also be considered.

3.1.1 Fundamental Screening Metric #1 – Person Throughput

This metric is a measure of the efficient use of roadway space in the corridor, and simply compares the total number of people using the roadways in the peak direction in the No-Build Alternative (without lane repurposing) and the Build Alternative (with lane repurposing). An example of this person throughput calculation is shown in Figure 1. In this example, the Build Alternative represents a more efficient and productive use of roadway space than the No-Build Alternative, as it carries 500 more people per hour in the peak direction on the same facility.

Figure 1: Sample Person Throughput Comparison



The theoretical ideal for this measure under this example would indicate that the roadway being studied was more efficient (i.e. carrying more people) in the Build condition than in the No-Build condition:

Ideal Target: Build Peak Direction Person Throughput > No-Build Peak Direction Person Throughput

A detailed description of how this measure can be calculated is provided in Section 4 of this document.

3.1.2 Screening Metric #2 – Person Travel Time Benefits

This metric looks at the effects of lane repurposing on traffic and transit users, as measured by changes in travel times (both increases and savings). This metric includes two parts that are compared in order to understand the balance between the costs and benefits of lane repurposing. The first component is travel time savings for transit passengers who experience less delay due to the dedicated transit lane (line 1 in Table 1). The second component is the additional delay to auto users caused by the decrease in vehicle capacity in the corridor (line 2). As shown in Table 1, both components are dependent on the change in travel times as well as the number of people experiencing those travel time changes (please note that the data in the table is hypothetical, for the purpose of providing an example of how this metric would be measured – the data does not represent a specific roadway segment or proposal).

Table 1: Hypothetical Person Travel Time Benefits Calculations

		No-Build Alternative	Build Alternative	Difference in Travel Time	Cost or Benefit
1	Transit Travel Time Component	100 people * 30 mins = 3,000 mins	120 people * 20 mins = 2,400 mins	600 minutes travel time savings	BENEFIT
2	Auto Travel Time Component	200 people * 15 mins = 3,000 mins	180 people * 18 mins = 3,240 mins	240 minutes added travel delay	COST
3	Net Person Travel Time Benefits	6,000 total minutes of person-travel time	5,640 total minutes of person-travel time	360 minutes travel time savings	BENEFIT

The final Person Travel Time Benefit calculation compares the total transit passenger travel time savings against the total auto passenger travel time increase, as shown in Line 3 of Table 1. As a theoretical ideal, the total person-time saved by transit passengers should be greater than the person-time increase for auto passengers, for a Net Person Travel Time Benefit greater than zero.

Net Person Travel Time Benefit =
Total Project Area *Transit Passenger Travel Time Savings* -
Total Project Area *Auto Passenger Travel Time Increase*

Ideal Target = Net Person Travel Time Benefit > 0

The ideal target as described above describes a situation in which transit and auto travel times are weighted equally and there is a decrease in the total amount of time spent traveling. The appropriateness of this ideal as a target may be dependent on other County goals, as a certain amount of inconvenience to auto users may be deemed acceptable in order to encourage increased transit use.

Section 4 provides details about how this metric should be calculated, including the modeling tools required. The most important methodology concern for this metric is the necessity of measuring travel time savings and delay for a wider study area (not just specific to the corridor), as traffic deviation from the study corridor resulting from the lane repurposing may effect traffic operations on parallel roadways.

3.2 Secondary Metrics

The repurposing analysis framework also includes a range of secondary measures that would not be utilized as fundamental metrics but would provide decision makers with important additional information and insight regarding lane repurposing. These secondary measures were developed based on the results of the literature review and discussions with project stakeholders to account for a broad set of goals and interests. More details about the methodology for calculating each of these secondary measures can be found in Section 4.

3.2.1 Bus Frequency on Repurposed Lane

This secondary measure serves as a "reality check" regarding the repurposing of a general traffic lane and dedicating it to transit, and states simply that bus frequency on the repurposed lane should be high

enough to justify the dedicated lane. This is important both from the perspective of public perception and enforcement, as drivers who don't see frequent and active use of the lane by transit vehicles are more likely to violate the lane restriction.

Different sources from the literature review identified a range of guidance regarding bus frequency, from 25 buses per hour in a curbside lane to 90 buses per hour for a median lane. Another approach developed by the project team based on traffic conditions in Montgomery County would be to consider the signal cycles in a corridor and ensure that there is one bus per signal cycle. For example, a signal cycle of 180 seconds (found in many corridors in the County) implies a threshold of a bus every three minutes, or 20 buses per hour.

As with the fundamental metrics, this metric does not provide a hard and fast rule, but can provide initial insight into the efficacy of lane repurposing based on the planned operating plan. Some flexibility may be needed in applying this metric since the overall concept is intended to ensure that this dedicated space is being used productively. As such, the desirable minimum number of buses may be lower if right-turning vehicles, taxis, or other vehicles are permitted in curbside lanes.

3.2.2 Bus Reliability: On-Time Performance

Improved reliability is one of the major benefits of dedicated transit lanes in congested corridors, because it reduces the 90th percentile running time, which is often used to determine fleet size, reduces passenger waiting time, and limits overcrowding, in particular for high frequency bus routes. This secondary measure evaluates the improvement in transit reliability associated with the dedicated transit lane by calculating the number of buses arriving on-time at points along the study corridor, with a comparison of the Build Alternative (with repurposed lane) and the No-Build Alternative (without repurposed lane). While no target has been developed for this metric, this measure will provide important information regarding benefits to transit riders and transit agencies that are not accounted for in the fundamental screening metrics, and may encourage additional transit use.

3.2.3 Peak Direction Transit Vehicle Travel Time Savings

This secondary measure is a complement to the person travel time screening metric, but is not tied to the number of people using the transit lane. Specifically, it compares bus travel times in the No-Build Alternative (no dedicated transit lane) and Build Alternative (with a dedicated transit lane). Highly congested corridors are likely to result in greater impacts for this metric, although no specific threshold was identified. While this measure can provide useful information about transit travel time improvements, the Person Travel Time Benefit is a more comprehensive metric that more accurately accounts for the number of people who will experience those benefits. The most useful ways to report this measure include:

- Total time saved on the whole route: i.e. lane repurposing in this corridor allows the bus to save 10 minutes on its total runtime. This can also be used to determine if these savings are sufficient to allow for a decrease in the number of vehicles required to provide service, thus reducing capital needs and operating cost.

- Savings per mile: i.e. lane repurposing in this corridor saves the bus 2 minutes per mile. This format allows for more direct comparisons between corridors or analysis alternatives.

3.2.4 Peak Direction Auto Travel Time Increase

This secondary measure is similar to the transit vehicle travel time savings measure in Section 3.2.3, but is calculated for autos instead of transit vehicles. This measure compares auto travel times in the Build and No-Build Alternatives to calculate the increase in travel time for autos traveling on the corridor. While this measure is related to the Person Travel Time Benefits screening metric, it does not consider the number of people experiencing these delays, and also does not account for delays on parallel roadways caused by traffic diversion. While a small travel time increase is most desirable for this metric, the level of additional travel time that is acceptable depends highly on the impacts on adjacent and parallel streets as well as the transportation goals and policies in the County.

3.2.5 New Transit Trips

This measure calculates the number of new transit trips produced based on the creation of a dedicated transit lane. This shift from auto to transit, as calculated by a travel demand model, considers many of the other secondary measures including bus frequency, transit vehicle travel time savings, and increases in auto travel time to quantify whether these changes are significant enough to encourage the use of transit in the corridor. This measure should be calculated for the Project Area, as this represents the full area likely to be affected by the lane repurposing. (See Section 4.1 for more details about the Project Area definition.)