CHAPTER 7.
Disparity Analysis

The disparity analysis compared the participation of minority- and woman-owned businesses on transportation contracts that the Los Angeles County Metropolitan Transportation Authority (Metro) awarded between January 1, 2011 and December 31, 2015 (i.e., the study period) to what those businesses might be expected to receive based on their availability for that work. The analysis focused on transportation-related construction, professional services, and goods and other services contracts. Chapter 7 presents the disparity analysis in five parts:

A. Overview of disparity analysis;

B. Overall disparity analysis results;

C. Disparity analysis results by DBE goal status; and

D. Statistical significance of disparity analysis results.

A. Overview of Disparity Analysis

As part of the disparity analysis, BBC Research & Consulting (BBC) compared the actual participation of minority- and woman-owned businesses in Metro prime contracts and subcontracts with the percentage of contract dollars that minority- and woman-owned businesses might be expected to receive based on their availability for that work. BBC made those comparisons for each relevant racial/ethnic and gender group. BBC reports disparity analysis results for all Metro contracts considered together and separately for different sets of contracts (e.g., prime contracts and subcontracts).

BBC expressed both actual participation and availability as percentages of the total dollars associated with a particular set of contracts, making them directly comparable (e.g., 5% participation compared with 4% availability). BBC then calculated a *disparity index* to help compare participation and availability results across relevant racial/ethnic and gender groups and across different sets of contracts. A disparity index of 100 indicates a match between actual participation and availability (referred to as *parity*). A disparity index of less than 100 indicates a disparity between participation and availability, and a disparity index of less than 80 is often considered *substantial*.[1] Figure 7-1 describes how BBC calculates disparity indices.

[1] Many courts have deemed disparity indices below 80 as being "substantial" and have accepted them as evidence of adverse conditions for minority- and woman-owned businesses (e.g., see *Rothe Development Corp v. U.S. Dept of Defense*, 545 F.3d 1023, 1041; *Eng'g Contractors Ass'n of South Florida, Inc. v. Metropolitan Dade County*, 122 F.3d at 914, 923 (11th Circuit 1997); and *Concrete Works of Colo., Inc. v. City and County of Denver*, 36 F.3d 1513, 1524 (10th Cir. 1994). See Appendix B for additional discussion of those and other cases.

The disparity analysis results that BBC presents in Chapter 7 summarize detailed results tables provided in Appendix F. Each table in Appendix F presents disparity analysis results for a different set of Metro contracts. For example, Figure 7-2, which is identical to Figure F-2 in Appendix F, presents disparity analysis results for *all* Metro contracts that the study team examined as part of the study—that is, transportation-related construction, professional services, and goods and other services prime contracts and subcontracts that Metro awarded during the study period. Appendix F includes analogous tables for different subsets of contracts including those that present results separately for:

- Construction, professional services, and goods and other services contracts;
- Prime contracts and subcontracts;
- USDOT- and locally-funded contracts; and
- Large and small prime contracts.

The heading of each table in Appendix F provides a description of the subset of contracts that the study team analyzed for that particular disparity analysis table.

Figure 7-1.
Calculation of disparity indices

The disparity index provides a way of assessing how closely the actual participation of minority- and woman-owned businesses matches the percentage of contract dollars that those businesses might be expected to receive based on their availability for specific sets of contracts. One can directly compare a disparity index for one racial/ethnic or gender group to that of another group and compare disparity indices across different sets of contracts. BBC calculates disparity indices using the following formula:

$$\frac{\text{\% actual participation}}{\text{\% availability}} \times 100$$

For example, if actual participation of white woman-owned businesses on a set of contracts was 2 percent and the availability of white woman-owned businesses for those contracts was 10 percent, then the disparity index would be 2 percent divided by 10 percent, which would then be multiplied by 100 to equal 20. In this example, white woman-owned businesses would have actually received 20 cents of every dollar that they might be expected to receive based on their availability.

A review of Figure 7-2 helps to introduce the calculations and format of all of the disparity analysis tables in Appendix F. As illustrated in Figure 7-2, the disparity analysis tables present information about each relevant racial/ethnic and gender group (as well as about all businesses) in separate rows:

- "All businesses" in row (1) pertains to information about all businesses owned by non-Hispanic white men (i.e., majority-owned businesses) and all minority- and woman-owned businesses considered together.
- Row (2) provides results for all minority- and woman-owned businesses, regardless of whether they were certified as Disadvantaged Business Enterprises (DBEs).
- Row (3) provides results for all non-Hispanic white woman-owned businesses, regardless of whether they were certified as DBEs.
- Row (4) provides results for all minority-owned businesses, regardless of whether they were certified as DBEs.
- Rows (5) through (10) provide results for businesses of each individual minority group, regardless of whether they were certified as DBEs.

Figure 7-2.
Example of a disparity analysis table from Appendix F (same as Figure F-2 in Appendix F)

Business Group	(a) Number of contract elements	(b) Total dollars (thousands)	(c) Estimated total dollars (thousands)*	(d) Utilization percentage	(e) Availability percentage	(f) Utilization - Availability	(g) Disparity index
(1) All firms	12,149	$3,028,625	$3,028,625				
(2) MBE/WBE	3,411	$703,237	$703,237	23.2	31.3	-8.1	74.1
(3) WBE	574	$79,021	$79,021	2.6	4.4	-1.8	59.2
(4) MBE	2,837	$624,216	$624,216	20.6	26.9	-6.3	76.6
(5) Black American-owned	195	$101,992	$104,362	3.4	6.8	-3.3	50.9
(6) Asian Pacific American-owned	461	$75,213	$76,961	2.5	2.5	0.0	101.8
(7) Subcontinent Asian American-owned	139	$28,486	$29,148	1.0	0.6	0.4	159.1
(8) Hispanic American-owned	1,744	$383,074	$391,976	12.9	16.3	-3.4	79.2
(9) Native American-owned	17	$21,273	$21,768	0.7	0.7	0.1	110.2
(10) Unknown MBE	281	$14,177					
(11) DBE-certified	1,723	$445,672	$445,672	14.7			
(12) Woman-owned DBE	110	$27,825	$27,825	0.9			
(13) Minority-owned DBE	1,602	$412,759	$412,759	13.6			
(14) Black American-owned DBE	156	$96,279	$96,283	3.2			
(15) Asian Pacific American-owned DBE	361	$54,275	$54,277	1.8			
(16) Subcontinent Asian American-owned DBE	27	$22,247	$22,248	0.7			
(17) Hispanic American-owned DBE	1,049	$223,754	$223,764	7.4			
(18) Native American-owned DBE	17	$21,273	$21,274	0.7			
(19) Unknown DBE-MBE	3	$18					
(20) White male-owned DBE	0	$0	$0	0.0			

Note: Numbers are rounded to the nearest thousand dollars or tenth of one percent. "White woman-owned" refers to non-Hispanic white woman-owned businesses.

* Unknown minority-owned businesses and unknown DBEs were allocated to minority and DBE subgroups proportional to the known total dollars of those groups. For example, if total dollars of Black American-owned businesses (column b, row 5) accounted for 25 percent of total minority-owned business dollars (column b, row 4), then 25 percent of column b, row 10 would be added to column b, row 5 and the sum would be shown in column c, row 5.

Source: BBC Research & Consulting disparity analysis.

The bottom half of Figure 7-2 presents utilization results for businesses that were certified as DBEs. BBC does not report availability or disparity analysis results separately for DBE-certified businesses.

Utilization results. Each disparity analysis table includes the same columns and rows:

- Column (a) presents the total number of prime contracts and subcontracts (i.e., contract elements) that the study team analyzed as part of the contract set. As shown in row (1) of column (a) of Figure 7-2, the study team analyzed 12,149 contract elements. The value presented in column (a) for each individual racial/ethnic and gender group represents the number of contract elements in which businesses of that particular group participated (e.g., as shown in row (6) of column (a), Black American-owned businesses participated in 195 prime contracts and subcontracts).
- Column (b) presents the dollars (in thousands) that were associated with the set of contract elements. As shown in row (1) of column (b) of Figure 7-2, the study team examined approximately $3 billion for the entire set of contract elements. The dollar totals include both prime contract and subcontract dollars. The value presented in column (b) for each individual racial/ethnic and gender group represents the dollars that the businesses of that particular group received on the set of contract elements (e.g., as shown in row (6) of column (b), Black American-owned businesses received approximately $104 million).
- Column (c) presents the dollars (in thousands) that were associated with the set of contract elements after adjusting those dollars for businesses that the study team identified as minority-owned or as DBEs, but for which specific race/ethnicity information was not available. The dollar totals include both prime contract and subcontract dollars.
- Column (d) presents the utilization percentage of each racial/ethnic and gender group as a percentage of total dollars associated with the set of contract elements. The study team calculated each percentage in column (d) by dividing the dollars going to a particular group in column (c) by the total dollars associated with the set of contract elements shown in row (1) of column (c), and then expressing the result as a percentage (e.g., for Black American-owned businesses, the study team divided $104 million by $3billion and multiplied by 100 for a result of 3.4%, as shown in row (6) of column (d)).

Availability results. Column (e) of Figure 7-2 presents the availability of each relevant racial/ethnic and gender group for all contract elements that the study team analyzed as part of the contract set. Availability estimates, which are represented as a percentage of the total contracting dollars associated with the set of contracts, serve as benchmarks against which to compare utilization results for specific groups for specific sets of contracts (e.g., as shown in row (6) of column (e), the availability of Black American-owned businesses is 6.8%).

Differences between utilization and availability. The next step in analyzing whether there was a disparity between the participation and availability of minority- and woman-owned businesses is to subtract the utilization percentage from the availability percentage. Column (f) of Figure 7-2 presents the percentage point difference between utilization and availability for each relevant racial/ethnic and gender group. For example, as presented in row (6) of column (f)

of Figure 7-2, the participation of Black American-owned businesses in Metro contracts was 3.3 percentage points less than their availability.

Disparity indices. It is sometimes difficult to interpret absolute percentage differences between participation and availability. Therefore, BBC also calculated a disparity index for each relevant racial/ethnic and gender group, which measured actual participation relative to availability and served as a metric to compare any disparities across different groups and different sets of contracts. BBC calculated disparity indices by dividing the utilization percentage for each group by the availability percentage for each group and multiplying by 100. Smaller disparity indices indicate greater disparities (i.e., a greater degree of underutilization).

Column (g) of Figure 7-2 presents the disparity index for each relevant racial/ethnic and gender group. For example, as reported in row (6) of column (g), the disparity index for Black American-owned businesses was approximately 51, indicating that Black American-owned businesses actually received only $0.51 for every dollar that they might be expected to receive based on their availability for prime contracts and subcontracts that Metro awarded during the study period.

BBC applied the following rules when disparity indices were exceedingly large or could not be calculated because the study team did not identify any businesses of a particular group as available for a particular set of contract elements:

- When BBC's calculations showed a disparity index exceeding 200, BBC reported an index of "200+." A disparity index of 200+ means that participation was more than twice as much as availability for a particular group for a particular set of contracts.
- When there was no participation and no availability for a particular group for a particular set of contracts, BBC reported a disparity index of "100," indicating parity.
- When participation for a particular group for a particular set of contracts was greater than 0 percent but availability was 0 percent, BBC reported a disparity index of "200+."[2]

B. Overall Disparity Analysis Results

BBC used the disparity analysis results from Figure 7-2 to assess any disparities between the participation of minority- and woman-owned businesses in prime contracts and subcontracts that Metro awarded during the study period as well as their availability for that work. Figure 7-3 presents disparity indices for all relevant racial/ethnic and gender groups considered together and separately for each group. The line down the center of the graph shows a disparity index level of 100, which indicates parity between participation and availability. Disparity indices less than 100 indicate disparities between participation and availability (i.e., underutilization). For reference, a line is also drawn at a disparity index level of 80, because courts typically use 80 as a threshold for what indicates a substantial disparity.

[2] A particular racial/ethnic or gender group could show a utilization percentage greater than 0 percent but an availability percentage of 0 percent for many reasons including the fact that one or more businesses that participated in Metro contracts during the study period were out of business at the time that BBC conducted availability surveys.

Figure 7-3.
Disparity indices by group

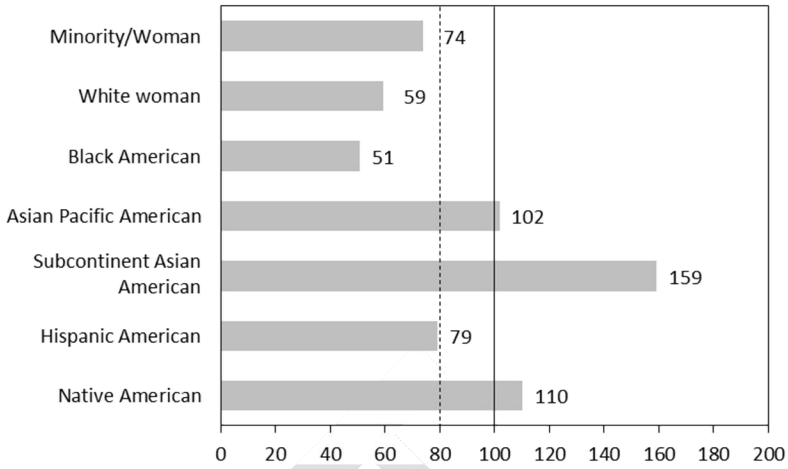
Note:

The study team analyzed 12,149 prime contracts/subcontracts.

For more detail, see Figure F-2 in Appendix F.

Source:

BBC Research & Consulting disparity analysis.



As shown in Figure 7-3, overall, the participation of minority- and woman-owned businesses in contracts that Metro awarded during the study period was lower than what one might expect based on the availability of those businesses for that work. The disparity index of 74 indicates that minority- and woman-owned businesses considered together received approximately $0.74 for every dollar that they might be expected to receive based on their availability for the relevant prime contracts and subcontracts that Metro awarded during the study period. Disparity analysis results by individual group showed that:

- Three groups exhibited disparity indices substantially below parity—Black American-owned businesses (disparity index of 51), Hispanic American-owned businesses (disparity index of 79), and white woman-owned businesses (disparity index of 59).
- Three groups did not exhibit disparities—Asian Pacific American-owned businesses (disparity index of 102), Subcontinent Asian American-owned businesses (disparity index of 159), and Native American-owned businesses (disparity index of 110)

Note that Metro applied DBE contract goals to many of the contracts that it awarded during the study period so the disparity analysis results shown in Figure 7-3 are reflective of the use of those measures.

C. Disparity Analysis Results by DBE Goal Status

Metro used race- and gender-conscious DBE subcontracting goals on many contracts during the study period to encourage the participation of disadvantaged business enterprises. It is useful to compare disparity analysis results between contracts that Metro awarded with the use of DBE subcontracting goals (*goals contracts*) and contracts that Metro awarded without the use of DBE subcontracting goals (*no-goals contracts*). Examining participation in no-goals contracts provides useful information about outcomes for minority-owned businesses and woman-owned businesses on contracts that Metro awarded in a race-neutral and gender-neutral environment

and whether there is evidence that certain groups face any discrimination or barriers as part of Metro's contracting.[3, 4, 5]

Figure 7-4 presents disparity analysis results separately for goals contracts and no-goals contracts. Note that the results presented in Figure 7-4 include both prime contracts and subcontracts associated with projects that Metro awarded with and without the use of goals. As shown in Figure 7-4, overall, minority-owned businesses and woman-owned businesses showed better outcomes on goals contracts than on no-goals contracts. Whereas minority-owned businesses and woman-owned businesses showed a substantial disparity on no-goals contracts (disparity index of 56), they did not show a substantial disparity on goals contracts (disparity index of 96). Results for individual groups indicated that:

- Only Black American-owned business (disparity index of 64) showed substantial disparities on goals contracts.
- All groups except Subcontinent Asian American-owned businesses showed substantial disparities on no-goals contracts.

Figure 7-4.
Disparity indices for goals and no-goals contracts

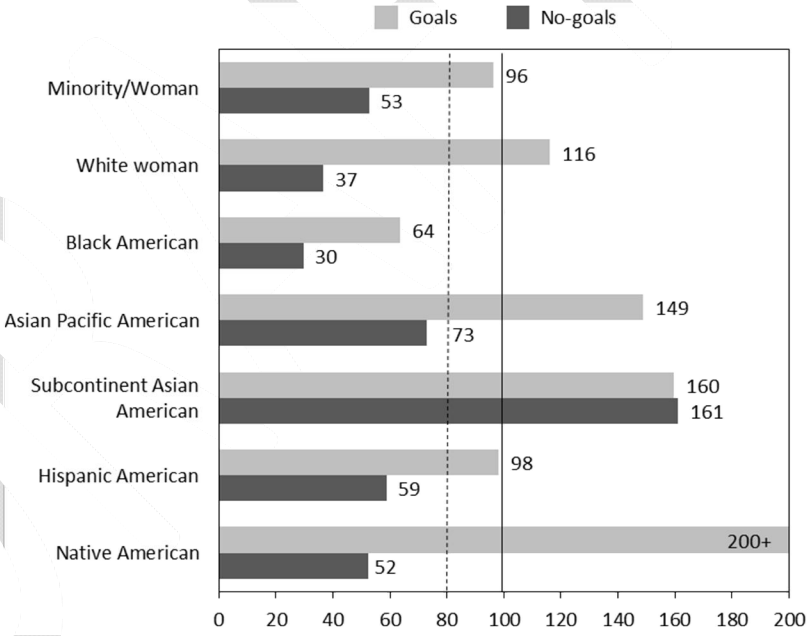
Note:

The study team analyzed 5,293 contract elements to which subcontracting goals applied. The study team analyzed 6,896 contract elements to which no subcontracting goals applied.

For more detail, see Figures F-14 and F-15 in Appendix F.

Source:

BBC Research & Consulting disparity analysis.



Taken together, the results presented in Figure 7-4 show that Metro's use of DBE goals is effective in encouraging the participation of minority-owned businesses and woman-owned businesses in its contracts. Moreover, those results indicate that when Metro does not use race-

[3] Associated General Contractors of America, San Diego Chapter, Inc. v. California Department of Transportation, et al., 713 F.3d 1187, 1192, 1196 (9th Cir. 2013).

[4] *Concrete Works of Colorado, Inc. v. City and County of Denver*, 321 F.3d 950, 985, 987-88 (10th Cir. 2003), *cert. denied*, 540 U.S. 1027, 124 S. Ct. 556 (2003).

[5] *H. B. Rowe Co., Inc. v. W. Lyndo Tippett, NCDOT, et al.*, 615 F.3d 233,246 (4th Cir. 2010).

conscious and gender-conscious measures, most relevant business groups suffer from substantial underutilization in Metro contracting.

D. Statistical Significance of Disparity Analysis Results

Statistical significance tests allow researchers to test the degree to which they can reject random chance as an explanation for any observed quantitative differences. In other words, a statistically significant difference is one that one can consider to be reliable or *real*. Random chance is the factor that researchers consider most in determining the statistical significance of results that are based on population samples.

Monte Carlo analysis. BBC used a computational algorithm that relies on repeated, random simulations to examine the statistical significance of disparity analysis results. That approach is referred to as a *Monte Carlo* method. The analyses that the study team completed as part of the disparity study were well-suited for using Monte Carlo analysis to test statistical significance. Monte Carlo analysis was appropriate for that purpose, because, among the contracts that Metro awarded during the study period, there were many individual chances for businesses to win prime contracts and subcontracts, each with a different payoff (i.e., each with a different dollar value). Figure 7-5 provides additional information about how the study team used a Monte Carlo method to test the statistical significance of disparity analysis results. It is important to note that Monte Carlo simulations may not be appropriate to use with very small populations of contracts.

Results. The study team identified substantial disparities for various racial/ethnic and gender groups on all contracts without race- or gender-conscious DBE subcontracting goals (see Table F-15 in Appendix F). BBC used Monte Carlo analysis to test whether the disparities that the study team observed were statistically significant.

As shown in Figure 7-6, results from the Monte Carlo analysis indicated that the disparities for all minority- and woman-owned businesses, non-Hispanic white woman-owned businesses, all minority-owned businesses, Black American-owned businesses and Hispanic American-owned businesses were statistically significant at the 95 percent confidence level.

Figure 7-5.
Monte Carlo Analysis

The study team began the Monte Carlo analysis by examining individual contract elements. For each contract element, BBC's availability database provided information on individual businesses that are available for that contract element based on type of work, contractor role, contract size, and location of the work. The study team assumed that each available business had an equal chance of winning that contract element. For example, the odds of a non-Hispanic white woman-owned business receiving that contract element were equal to the number of non-Hispanic white woman-owned businesses available for the contract element divided by the total number of businesses available for the contract element. The Monte Carlo simulation then randomly chose a business from the pool of available businesses to win the contract element.

The Monte Carlo simulation repeated the above process for all other elements in a particular set of contracts. The output of a single Monte Carlo simulation for all contract elements in the set represented simulated utilization of minority- and woman-owned businesses, by group, for that set of contract elements. The entire Monte Carlo simulation was then repeated one million times for each set of contracts. The combined output from all one million simulations represented a probability distribution of the overall utilization of minority- and woman-owned businesses if contracts were awarded randomly based on the availability of relevant businesses working in the local marketplace.

The output of the Monte Carlo simulations represents the number of simulations out of one million that produced a utilization result that was equal or below the actual observed utilization result for each racial/ethnic and group and for each set of contracts. If that number was less than or equal to 25,000 (i.e., 2.5% of the total number of simulations), then the study team considered that disparity index to be statistically significant at the 95 percent confidence level. If that number was less than or equal to 50,000 (i.e., 5.0% of the total number of simulations), then the study team considered that disparity index to be statistically significant at the 90 percent confidence level.

Figure 7-6.
Monte Carlo simulation results for disparity analysis results

Race/Ethnicity and Gender	Disparity Index	Number of simulation runs out of one million that replicated observed utilization	Probability of observed disparity occurring due to "chance"
Total minority-/woman-owned	53	0	<0.1 %
White woman-owned	37	200	<0.1 %
Total minority-owned	57	0	<0.1 %
Black American-owned	30	0	<0.1 %
Asian Pacific American-owned	73	134,743	13.5 %
Subcontinent Asian American-owned	161	N/A	N/A
Hispanic American-owned	59	88	<0.1 %
Native American-owned	52	403,619	40.4 %

Note: Numbers rounded to nearest tenth of 1 percent.
Numbers may not add to totals due to rounding.

Source: BBC Research & Consulting disparity analysis.