

Response Report in Support of Governor Evers’s Proposed District Plans

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1 Introduction

My qualifications were described in my first report [2].

I have been retained to evaluate the Governor’s proposed district plans for the Wisconsin State Assembly, the Wisconsin State Senate, and the U.S. House of Representatives (a.k.a. “Congress”), regarding their statistical properties. This report will focus on comparisons between the Governor’s plans and the plans recently passed by the Wisconsin State Legislature in Legislative Bills SB 621 and SB 622 (referred to throughout this report as the SB 621 and SB 622 plans) on some aspects not covered in the first report [2]. The Governor’s plans will also be compared to the Black Leaders Organizing for Communities (BLOC) plans for the State Assembly and State Senate regarding majority-minority districts. For some measures, comparisons to the 2011 enacted districts will also be presented.

2 Executive Summary

My analysis in this report includes the following comparisons:

- In Section 3, I explore discrepancies between the U.S. Census Bureau’s and the LTSB’s descriptions of the 2011 enacted districts in terms of 2020 Census blocks. These discrepancies are significant for the analysis in subsequent sections.
- In Section 4, I compare the Governor’s plans to the SB 621/622 plans with regard to core population movement, including a detailed analysis by district.
- In Section 5, I compare the Governor’s plans to the BLOC plans with regard to majority-minority districts, including majority Non-White, majority Black, and majority Hispanic districts.
- In Section 6, I compare the Governor’s plans to the 2011 enacted plans (Census Bureau version) with regard to all municipal splits and town splits in particular, including detailed lists

of exactly which towns are split in each plan and the percentages of each town's population that are contained in each district.

- In Section 7, I compare the Governor's plans to the BLOC plans with regard to various compactness measures.

This Executive Summary provides summaries of the analyses contained in the remainder of the report.

2.1 The 2011 Enacted Districts – LTSB vs. U.S. Census Bureau

Comparisons between proposed plans and the 2011 enacted plans are complicated by the fact that the 2011 enacted districts were based on 2010 Census geographies, while proposed plans for new districts are based on 2020 Census geographies. Specifically, all proposed new plans are constructed by assigning each 2020 Census block to a unique district in the plan. Direct comparisons require that the 2011 enacted plans also be described in terms of 2020 Census blocks, but unfortunately, 2020 Census blocks do not line up neatly with 2011 enacted districts. In cases where a 2020 Census block intersects more than one 2011 district, a choice must be made about which 2011 district to assign that block to in order to best approximate the “true” 2011 enacted districts.

Both the U.S. Census Bureau and the Legislative Technology Services Bureau (LTSB) of the State of Wisconsin have published assignments of 2020 Census blocks to 2011 enacted districts, and there are discrepancies between them. These discrepancies have minimal impact on the computation of some measures (e.g., core population movement between the 2011 enacted plans and proposed new district plans) and a substantial impact on others (e.g., municipal splits in the 2011 enacted plans).

In order to explore the accuracy of both sets of 2011 enacted district approximations, I compared them to the official Census Bureau shapefiles for Wisconsin's State Legislative and Congressional districts as of 2018. Details of this analysis may be found in Section 3.

Based on this analysis, it is evident that the Census Bureau's approximation of the 2011 enacted districts is substantially more accurate at all levels (Assembly, Senate, and Congress) than the LTSB's approximation. This finding is taken into account in subsequent sections where appropriate, most notably regarding municipal splits in Section 6.

2.2 Core Population Movement

Core population movement measures the number of persons who are moved to a different district when redistricting takes place, i.e., persons whose district number in the 2011 enacted plan is different from their district number in the new plan.

In my first report [2], I reported total core population movement for the Governor's plans and the SB 621/622 plans, with respect to both the Census Bureau's and the LTSB's versions of the 2011 enacted plans. The differences between the two versions were minimal, with discrepancies of

0.05% or less in all cases. In keeping with other submitted reports, here I will focus only on core population movement with respect to the LTSB's version of the 2011 enacted plans.

Based on the initial expert reports submitted to the Court, the Governor's plans had the highest core population retention—or equivalently, the lowest core population movement—of all submitted plans for the Assembly and Congress. This remains the case regardless of which version of the 2011 enacted plans is used for the computation; in fact, as Tables 4 and 5 in my first report indicate, the Governor's plans compare **more** favorably overall to the SB 621/622 plans by this measure with respect to the Census Bureau's version than with respect to the LTSB's version. (For the Senate, the Governor's plan has slightly higher core population retention than the SB 621 plan with respect to the Census Bureau's version and slightly lower core population retention than the SB 621 plan with respect to the LTSB's version.)

In Section 4, I give a detailed analysis of core population movement by district at all levels (Assembly, Senate, and Congress) for both the Governor's plans and the SB 621/622 plans. These analyses show that the comparisons showing that the Governor's plans have lower overall core population movement remain largely true at the district level as well:

- For the Assembly plan, while the districts with the greatest core population movement in the Governor's plan have higher core population movement than the districts with the greatest core population movement in the corresponding SB 621 plan, the core population movement in most districts is slightly lower in the Governor's plan than in the SB 621 plan, resulting in lower total core population movement in the Governor's plan.
- For the Senate plan, while the districts with the greatest core population movement in the Governor's plan have higher core population movement than the districts with the greatest core population movement in the corresponding SB 621 plan, the core population movement in most districts is slightly lower in the Governor's plan than in the SB 621 plan, resulting in similar total core population movement in the Governor's plan. (The total core population movement in the Senate plans is slightly higher than in the SB 621 plan with respect to the LTSB's version of the 2011 enacted plan and slightly lower than in the SB 621 plan with respect to the Census Bureau's version of the 2011 enacted plan.)
- For the Congressional plans, the core population movement in the majority of districts is lower in the Governor's plan than in the SB 622 plan, resulting in lower total core population movement in the Governor's plan.

2.3 Majority-Minority Districts

In this section I will compare the districts in the Governor's plans for the State Assembly and State Senate with majority total minority (i.e., Non-White) Voting Age Population (NWVAP), majority Black Voting Age Population (BVAP), and majority Hispanic Voting Age Population (HVAP) with the analogous districts in the BLOC plans for the State Assembly and State Senate.

In this report, Black Voting Age Population (BVAP) will refer to the population that I called “BVAP1” in my first report [2]; this is the more inclusive version that includes all Census categories involving Black alone or in combination with any number of other races, including Hispanic.

2.3.1 Majority-Minority Assembly Districts

Majority NWVAP Assembly Districts: In both the Governor’s and the BLOC Assembly plans, there are 10 majority NWVAP districts: Districts 8, 9, 10, 11, 12, 14, 16, 17, 18, and 66. District 66 is geographically separate from the other 9 districts, which are concentrated in the Milwaukee area. Here I will focus on the regions consisting of the 9 Milwaukee area districts in each plan.

While the internal lines between districts vary between the two plans, the regions spanned by these districts are similar in both plans.

- The combined Non-White Voting Age Population of these 9 districts is 254,230 in the Governor’s plan and 255,533 in the BLOC plan.
- 3.59% of the Non-White Voting Age Population contained in these districts in the Governor’s plan is not contained in these districts in the BLOC plan.
- 4.09% of the Non-White Voting Age Population contained in these districts in the BLOC plan is not contained in these districts in the Governor’s plan.

Majority BVAP Assembly Districts: In both the Governor’s and the BLOC Assembly plans, there are 7 majority BVAP districts: Districts 10, 11, 12, 14, 16, 17, and 18. While the internal lines between districts vary between the two plans, the regions spanned by these districts are similar in both plans.

- The combined Black Voting Age Population of these 7 districts is 156,580 in the Governor’s plan and 157,592 in the BLOC plan.
- 1.60% of the Black Voting Age Population contained in these districts in the Governor’s plan is not contained in these districts in the BLOC plan.
- 2.24% of the Black Voting Age Population contained in these districts in the BLOC plan is not contained in these districts in the Governor’s plan.

Majority HVAP Assembly Districts: In both the Governor’s and the BLOC Assembly plans, there are 2 majority HVAP districts: Districts 8 and 9. While the internal lines between districts vary between the two plans, the regions spanned by these districts are similar in both plans.

- The combined Hispanic Voting Age Population of these 2 districts is 48,769 in the Governor’s plan and 49,033 in the BLOC plan.
- 1.03% of the Hispanic Voting Age Population contained in these districts in the Governor’s plan is not contained in these districts in the BLOC plan.

- 1.56% of the Hispanic Voting Age Population contained in these districts in the BLOC plan is not contained in these districts in the Governor’s plan.

2.3.2 Majority-Minority Senate Districts

Majority NWVAP Assembly Districts: In both the Governor’s and the BLOC Senate plans, there are 3 majority NWVAP districts: Districts 3, 4, and 6. While the internal lines between districts vary between the two plans, the regions spanned by these districts are similar in both plans.

- The combined Non-White Voting Age Population of these 3 districts is 243,242 in the Governor’s plan and 244,954 in the BLOC plan.
- 4.68% of the Non-White Voting Age Population contained in these districts in the Governor’s plan is not contained in these districts in the BLOC plan.
- 5.35% of the Non-White Voting Age Population contained in these districts in the BLOC plan is not contained in these districts in the Governor’s plan.

Majority BVAP Assembly Districts: In both the Governor’s and the BLOC Senate plans, there are 2 majority BVAP districts: Districts 4 and 6. While the internal lines between districts vary between the two plans, the regions spanned by these districts are similar in both plans.

- The combined Black Voting Age Population of these 2 districts is 134,423 in the Governor’s plan and 135,618 in the BLOC plan.
- 3.82% of the Black Voting Age Population contained in these districts in the Governor’s plan is not contained in these districts in the BLOC plan.
- 4.67% of the Black Voting Age Population contained in these districts in the BLOC plan is not contained in these districts in the Governor’s plan.

2.4 Municipal Splits

Municipal splits measure the number of municipalities (cities, towns, or villages) that are split between two or more districts. Section 6 contains a detailed comparison of the Governor’s plans to the 2011 enacted plans regarding municipal splits, with a particular focus on town splits. According to the classification provided by the LTSB, Wisconsin contains 1,850 municipalities (cities, towns, and villages), of which 1,248 are towns.

The Census Bureau’s and the LTSB’s approximations of the 2011 enacted plans are strikingly different regarding the numbers of municipal splits in general and town splits in particular. Based on the analysis described in Section 3, I believe that comparison with the Census Bureau’s approximation is more appropriate here.

The numbers of both town splits and total municipal splits in the Governor’s plans at all levels (Assembly, Senate, and Congress) are either equal to or less than the corresponding numbers of

splits in the Census Bureau’s versions of the 2011 enacted plans. Detailed lists of exactly which towns are split in each plan, including the percentages of each town’s population that is contained in each district, may be found in Appendix B.

2.5 Compactness

District **compactness** refers to the idea that a district should not be too “spread out.” There is no single measure that adequately defines this concept, but the two most commonly reported measures are the **Polsby-Popper** score and the **Reock** score. It should be emphasized that both of these scores are very sensitive to differences in map projections and resolutions; see Section 7 for a fuller discussion of these issues.

A discrete alternative proposed by Duchin and Tenner in [3] is the **cut edges** score, which counts the number of adjacent pairs of Census blocks that lie in different districts. This number may be thought of as a discrete analog of the total perimeter of all district boundaries. Unlike the other two scores, it is not sensitive to map projections. It also has the additional feature that, since Census blocks tend to have shorter perimeter in more densely populated areas, it more closely models the number of **persons** who live near district boundaries rather than the physical lengths of the district boundaries.

In Section 7, I report the mean, maximum, and minimum of the Polsby-Popper and Reock scores for each of the Governor’s plans and the SB 621/622 plans, along with the cut edges score. Additionally, the full ranges of Polsby-Popper and Reock scores for each plan are depicted graphically in Figures 12, 13, and 14.

Overall, I do not detect any substantial meaningful differences between the Governor’s and the SB 621/622 plans with respect to compactness.

3 The 2011 Enacted Districts – LTSB vs. U.S. Census Bureau

Comparisons between proposed plans and the 2011 enacted plans are complicated by the fact that the 2011 enacted districts were based on 2010 Census geographies, while proposed plans for new districts are based on 2020 Census geographies. Specifically, all proposed new plans are constructed by assigning each 2020 Census block to a unique district in the plan. Direct comparisons require that the 2011 enacted plans also be described in terms of 2020 Census blocks, but unfortunately, 2020 Census blocks do not line up neatly with 2011 enacted districts. In cases where a 2020 Census block intersects more than one 2011 district, a choice must be made about which 2011 district to assign that block to in order to best approximate the “true” 2011 enacted districts.

Both the U.S. Census Bureau and the Legislative Technology Services Bureau (LTSB) of the State of Wisconsin have published assignments of 2020 Census blocks to 2011 enacted districts, and there are discrepancies between them. These discrepancies have minimal impact on the computation of some measures (e.g., core population movement between the 2011 enacted plans and proposed new

district plans) and a substantial impact on others (e.g., municipal splits in the 2011 enacted plans). For this reason, it seems worth exploring the differences between the Census Bureau’s and the LTSB’s assignments of 2020 Census blocks to 2011 enacted districts.

The Census Bureau’s 2020 Census block assignments are based on its “crosswalk” that is used to compare 2010 geographies to 2020 geographies. This crosswalk is available at <https://www.census.gov/geographies/reference-files/time-series/geo/relationship-files.html>. Since the 2011 enacted districts are based on 2010 Census blocks, this crosswalk provides a way to approximate 2011 enacted districts using 2020 Census blocks, and this is the method used by the Census Bureau to assign 2020 Census blocks to 2011 enacted districts.

Meanwhile, the LTSB’s 2020 Census block assignments to districts appear to have been created by assigning whole wards—which have been updated to reflect 2020 Census geography—to districts. I do not know what algorithm was used to create these assignments, but the assignments of 2020 Census blocks to 2011 districts in the LTSB block shapefiles available at <https://legis.wisconsin.gov/ltsb/gis/data/> create districts at all levels (Assembly, Senate, and Congress) that do not split any (updated) wards.

In order to explore the accuracy of both sets of 2011 enacted district approximations, I compared them to the official Census Bureau shapefiles for Wisconsin’s State Legislative and Congressional districts as of 2018, available from the Census Bureau at <https://www.census.gov/cgi-bin/geo/shapefiles/index.php>. I reprojected all shapefiles to the coordinate reference system (CRS) NAD_1983_Wisconsin_TM_US_Ft (WKID 102219), which is the base CRS in the shapefiles provided by the LTSB at <https://legis.wisconsin.gov/ltsb/gis/data/>. (Units of measurement in this CRS are given in U.S. feet.) For both approximations of 2011 enacted districts by 2020 Census blocks, I merged the blocks assigned to each district to create a single geometry for each district that could be compared to the geometry for official district.

Then for each district, I computed the area of the symmetric difference of the official district geometry and each of its approximations by 2020 Census blocks. (The **symmetric difference** of two regions consists of all points contained in one region but not the other.) The mean, maximum, and minimum values of the areas of the symmetric differences for each of the Census Bureau and LTSB approximations of the 2011 enacted districts are shown in Table 1.

	Census Bureau Approx.			LTSB Approx.		
	Mean	Max	Min	Mean	Max	Min
State Assembly	3,160,547	29,711,727	43	9,218,264	150,110,674	17,549
State Senate	6,261,393	33,288,602	312	20,372,917	166,227,032	422,901
Congress	6,721,120	32,634,400	56,570	243,586,551	926,971,192	87,438

Table 1: Areas (Sq. Ft.) of Symmetric Differences Between Official 2011 Enacted Districts and Approximations By 2020 Census Blocks

Additionally, the full ranges of the areas of the symmetric differences for each plan are depicted graphically in Figures 1, 2, and 3 as follows: Districts in the Census Bureau's and the LTSB's approximations were each sorted from lowest to highest area, and the resulting sorted lists of areas for each district are plotted. (Note that the sorted ordering of the districts is not the same in both plans.)

Based on this analysis, it is evident that the Census Bureau's approximation of the 2011 enacted districts is substantially more accurate at all levels (Assembly, Senate, and Congress) than the LTSB's approximation.

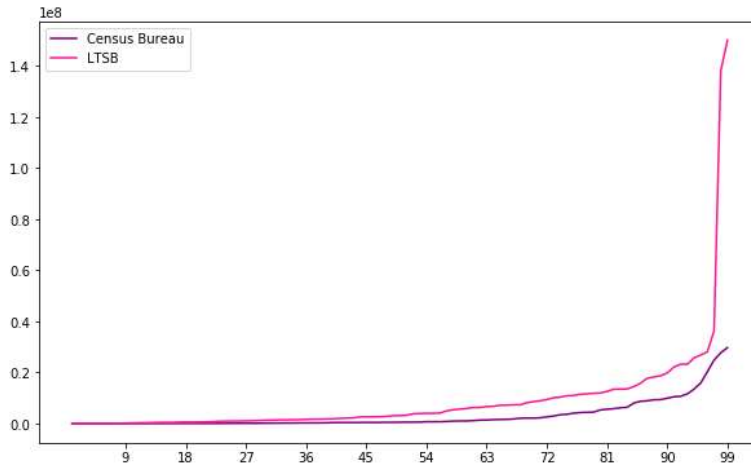


Figure 1: Areas of Symmetric Differences by District, State Assembly

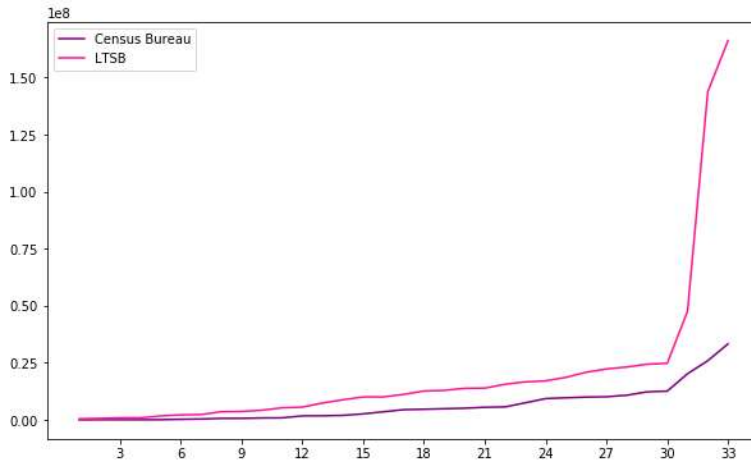


Figure 2: Areas of Symmetric Differences by District, State Senate

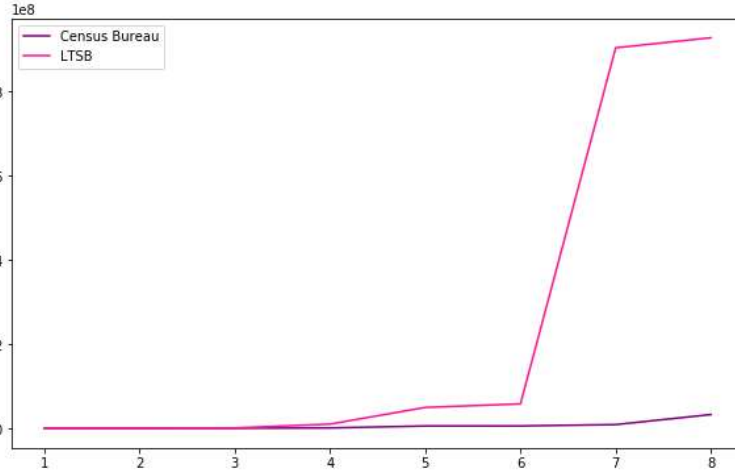


Figure 3: Areas of Symmetric Differences by District, Congress

4 Core Population Movement

Core population movement measures the number of persons who are moved to a different district when redistricting takes place, i.e., persons whose district number in the 2011 enacted plan is different from their district number in the new plan.

In my first report [2], I reported total core population movement for the Governor’s plans and the SB 621/622 plans, with respect to both the Census Bureau’s and the LTSB’s versions of the 2011 enacted plans. The differences between the two versions were minimal, with discrepancies of 0.05% or less in all cases. In keeping with other submitted reports, here I will focus only on core population movement with respect to the LTSB’s version of the 2011 enacted plans.

Based on the initial expert reports submitted to the Court, the Governor’s plans had the highest core population retention—or equivalently, the lowest core population movement—of all submitted plans for the Assembly and Congress. This remains the case regardless of which version of the 2011 enacted plans is used for the computation; in fact, as Tables 4 and 5 in my first report indicate, the Governor’s plans compare **more** favorably overall to the SB 621/622 plans by this measure with respect to the Census Bureau’s version than with respect to the LTSB’s version. (For the Senate, the Governor’s plan has slightly higher core population retention than the SB 621 plan with respect to the Census Bureau’s version and slightly lower core population retention than the SB 621 plan with respect to the LTSB’s version.)

Table 2 (repeated from Table 5 in my first report) shows the total core population movement for the Governor’s plans and the SB 621/622 plans for the State Assembly, State Senate, and Congress with respect to the LTSB’s version of the 2011 enacted plans. In this section, I will give a more detailed analysis by district.

Core Population Movement	Governor's Plan		SB 621/622 Plans	
	Persons	Percentage	Persons	Percentage
State Assembly Plans	837,659	14.21%	933,604	15.84%
State Senate Plans	461,228	7.83%	459,061	7.79%
Congressional Plans	324,415	5.50%	384,456	6.52%

Table 2: Core Population Movement for Governor's and SB 621/622 District Plans

4.1 Assembly plans

Tables 12, 13, and 14 in Appendix A show, for each Assembly district, how many persons were moved out of or into that district between the 2011 enacted plan and either the Governor's or the SB 621 plan. This data is also depicted graphically in Figure 4, as follows: Districts in the Governor's and the SB 621 plans were each sorted from lowest to highest movement either out of or into the district, and the resulting sorted lists of numbers of persons moved in each district are plotted. (Note that the sorted ordering of the districts is not the same in both plans.)

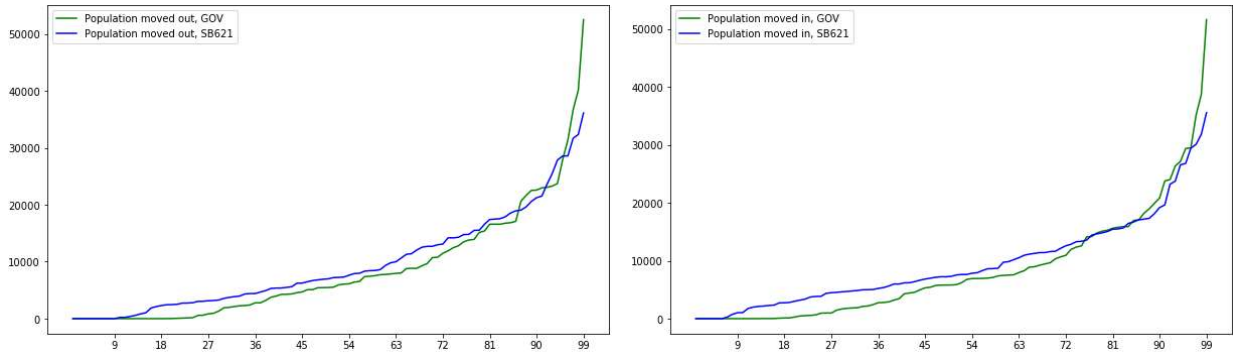


Figure 4: Sorted core population movement by district, State Assembly

These plots illustrate that, while the districts with the greatest movement in the Governor's plan have higher movement than the districts with the greatest movement in the SB 621 plan, the movement in most districts is slightly lower in the Governor's plan than in the SB 621 plan, resulting in lower total core population movement in the Governor's plan.

4.2 Senate plans

Table 15 in Appendix A shows, for each Senate district, how many persons were moved out of or into that district between the 2011 enacted plan and either the Governor's or the SB 621 plan. This data is also depicted graphically in Figure 5, as follows: Districts in the Governor's and the SB 621 plans were each sorted from lowest to highest movement either out of or into the district, and the resulting sorted lists of numbers of persons moved in each district are plotted. (Note that the sorted ordering of the districts is not the same in both plans.)

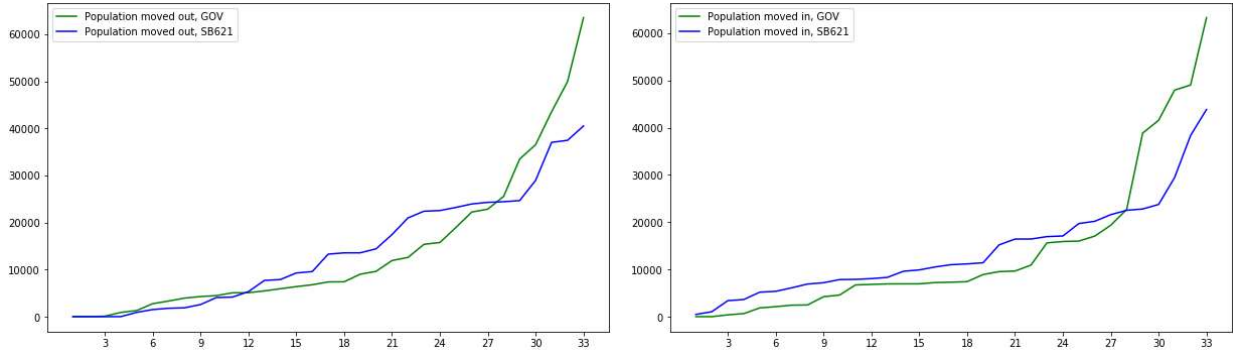


Figure 5: Sorted core population movement by district, State Senate

These plots illustrate that, while the districts with the greatest movement in the Governor’s plan have higher movement than the districts with the greatest movement in the SB 621 plan, the movement in most districts is slightly lower in the Governor’s plan than in the SB 621 plan, resulting in lower total core population movement in the Governor’s plan.

4.3 Congressional plans

Table 16 in Appendix A shows, for each Congressional district, how many persons were moved out of or into that district between the 2011 enacted plan and either the Governor’s or the SB 622 plan. This data is also depicted graphically in Figure 6, as follows: Districts in the Governor’s and the SB 622 plans were each sorted from lowest to highest movement either out of or into the district, and the resulting sorted lists of numbers of persons moved in each district are plotted. (Note that the sorted ordering of the districts is not the same in both plans.)

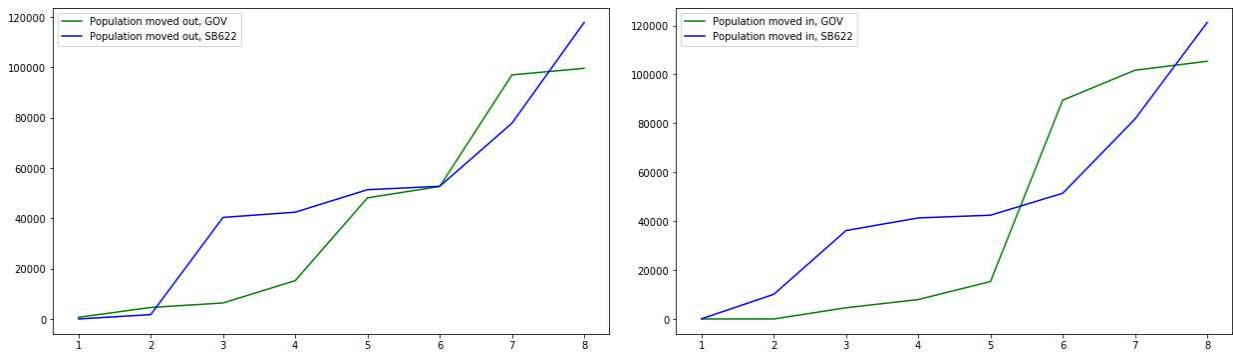


Figure 6: Sorted core population movement by district, Congress

These plots illustrate that the movement in the majority of districts is lower in the Governor’s plan than in the SB 622 plan, resulting in lower total core population movement in the Governor’s plan.

5 Majority-Minority Districts

In this section, I will compare the districts in the Governor’s plans for the State Assembly and State Senate with majority total minority (i.e., Non-White) Voting Age Population (N WVAP), majority Black Voting Age Population (BVAP), and majority Hispanic Voting Age Population (HVAP) with the analogous districts in the BLOC plans for the State Assembly and State Senate.

In this report, Black Voting Age Population (BVAP) will refer to the population that I called “BVAP1” in my first report [2]; this is the more inclusive version that includes all Census categories involving Black alone or in combination with any number of other races, including Hispanic.

5.1 Majority-Minority Assembly Districts

5.1.1 Majority N WVAP Assembly Districts

In both the Governor’s and the BLOC Assembly plans, there are 10 majority N WVAP districts: Districts 8, 9, 10, 11, 12, 14, 16, 17, 18, and 66. District 66 is geographically separate from the other 9 districts, which are concentrated in the Milwaukee area. Here I will focus on the regions consisting of the 9 Milwaukee area districts in each plan.

Maps of these regions are shown in Figure 7; while the internal lines between districts vary between the two plans, the regions spanned by these districts are similar in both plans.

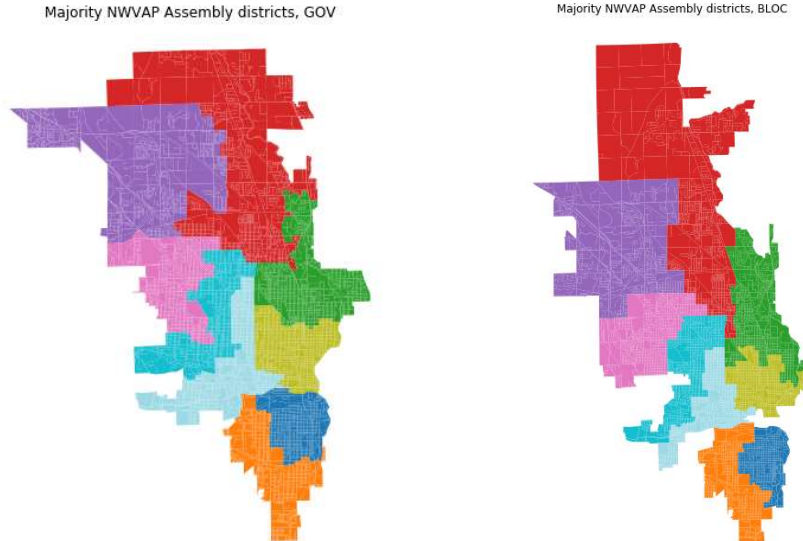


Figure 7: Majority N WVAP Assembly districts in GOV and BLOC plans

The combined Non-White Voting Age Population of these 9 districts is 254,230 in the Governor’s plan and 255,533 in the BLOC plan. Table 3 shows the Non-White Voting Age Population (both total persons and percentage) contained in the region spanned by these districts in the Governor’s plan but not in the BLOC plan, and vice-versa.

NWVAP Assembly Movement	Persons moved out	Percentage moved out
In GOV plan, not in BLOC plan	9,139	3.59%
In BLOC plan, not in GOV plan	10,442	4.09%

Table 3: NWVAP movement between Governor’s and BLOC majority NWVAP Assembly districts

5.1.2 Majority BVAP Assembly Districts

In both the Governor’s and the BLOC Assembly plans, there are 7 majority BVAP districts: Districts 10, 11, 12, 14, 16, 17, and 18. Maps of these regions are shown in Figure 8; while the internal lines between districts vary between the two plans, the regions spanned by these districts are similar in both plans.

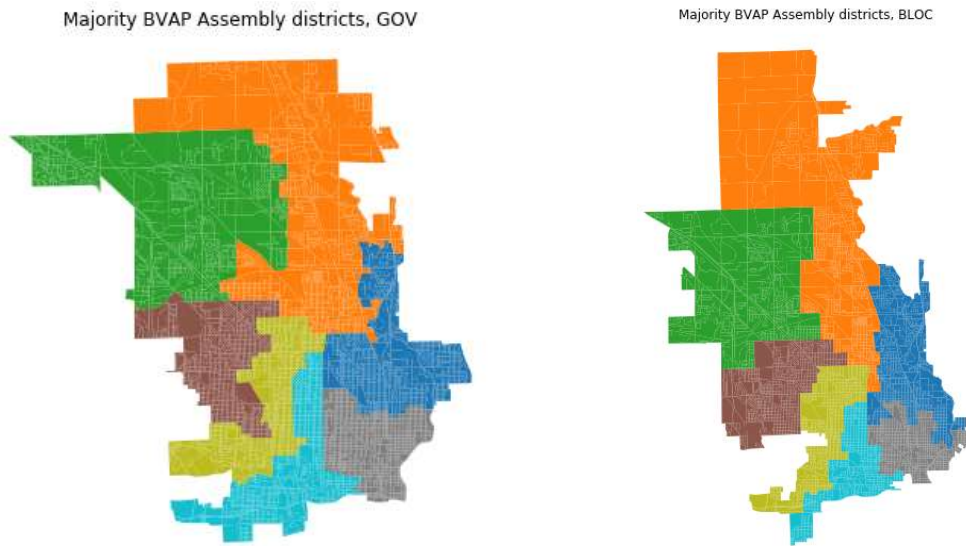


Figure 8: Majority BVAP Assembly districts in GOV and BLOC plans

The combined Black Voting Age Population of these 7 districts is 156,580 in the Governor’s plan and 157,592 in the BLOC plan. Table 4 shows the Black Voting Age Population (both total persons and percentage) contained in the region spanned by these districts in the Governor’s plan but not in the BLOC plan, and vice-versa.

BVAP Assembly Movement	Persons moved out	Percentage moved out
In GOV plan, not in BLOC plan	2,511	1.60%
In BLOC plan, not in GOV plan	3,523	2.24%

Table 4: BVAP movement between Governor’s and BLOC majority BVAP Assembly districts

5.1.3 Majority HVAP Assembly Districts

In both the Governor’s and the BLOC Assembly plans, there are 2 majority HVAP districts: Districts 8 and 9. Maps of these regions are shown in Figure 9; while the internal lines between districts vary between the two plans, the regions spanned by these districts are similar in both plans.

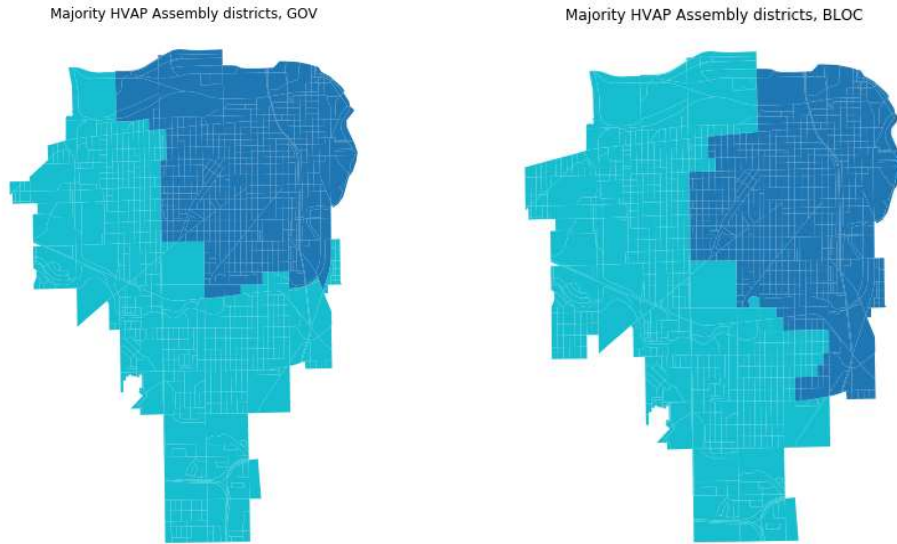


Figure 9: Majority HVAP Assembly districts in GOV and BLOC plans

The combined Hispanic Age Population of these 2 districts is 48,769 in the Governor’s plan and 49,033 in the BLOC plan. Table 5 shows the Hispanic Voting Age Population (both total persons and percentage) contained in the region spanned by these districts in the Governor’s plan but not in the BLOC plan, and vice-versa.

HVAP Assembly Movement	Persons moved out	Percentage moved out
In GOV plan, not in BLOC plan	500	1.03%
In BLOC plan, not in GOV plan	764	1.56%

Table 5: HVAP movement between Governor’s and BLOC majority HVAP Assembly districts

5.2 Majority-Minority Senate Districts

5.2.1 Majority NWWAP Senate Districts

In both the Governor’s and the BLOC Senate plans, there are 3 majority NWWAP districts: Districts 3, 4, and 6. Maps of these regions are shown in Figure 10; while the internal lines between districts vary between the two plans, the regions spanned by these districts are similar in both plans.

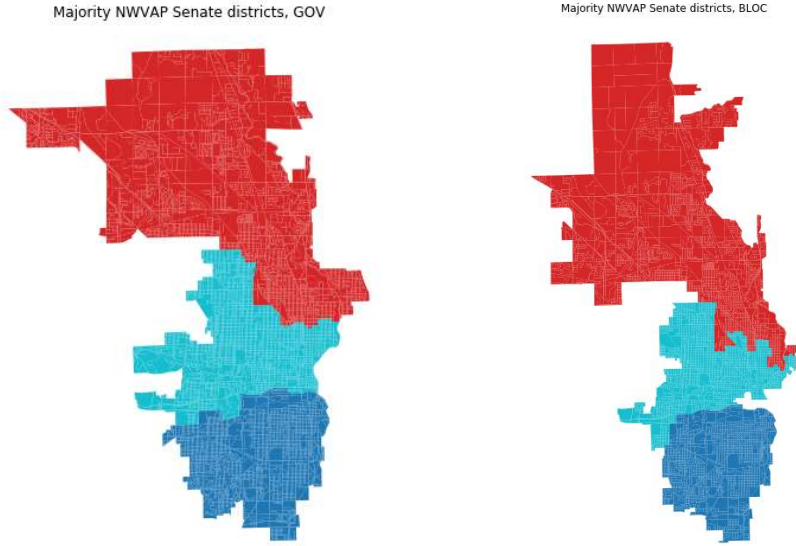


Figure 10: Majority NNVAP Senate districts in GOV and BLOC plans

The combined Non-White Voting Age Population of these 3 districts is 243,242 in the Governor’s plan and 244,954 in the BLOC plan. Table 6 shows the Non-White Voting Age Population (both total persons and percentage) contained in the region spanned by these districts in the Governor’s plan but not in the BLOC plan, and vice-versa.

NNVAP Senate Movement	Persons moved out	Percentage moved out
In GOV plan, not in BLOC plan	11,382	4.68%
In BLOC plan, not in GOV plan	13,094	5.35%

Table 6: NNVAP movement between Governor’s and BLOC majority NNVAP Senate districts

5.2.2 Majority BVAP Senate Districts

In both the Governor’s and the BLOC Senate plans, there are 2 majority BVAP districts: Districts 4 and 6. Maps of these regions are shown in Figure 11; while the internal lines between districts vary between the two plans, the regions spanned by these districts are similar in both plans.

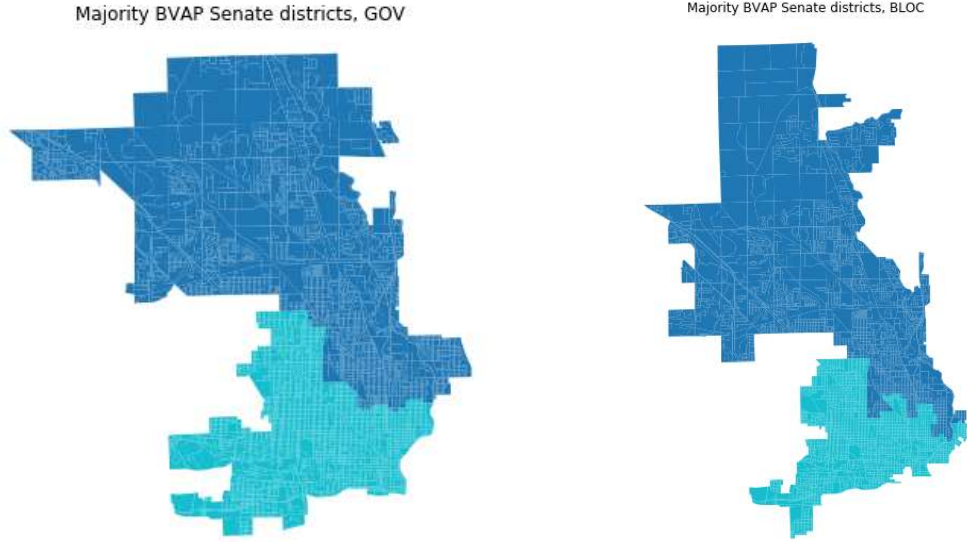


Figure 11: Majority BVAP Senate districts in GOV and BLOC plans

The combined Black Voting Age Population of these 2 districts is 134,423 in the Governor’s plan and 135,618 in the BLOC plan. Table 7 shows the Black Voting Age Population (both total persons and percentage) contained in the region spanned by these districts in the Governor’s plan but not in the BLOC plan, and vice-versa.

BVAP Senate Movement	Persons moved out	Percentage moved out
In GOV plan, not in BLOC plan	5,135	3.82%
In BLOC plan, not in GOV plan	6,330	4.67%

Table 7: BVAP movement between Governor’s and BLOC majority BVAP Senate districts

6 Municipal Splits

Municipal splits measure the number of municipalities (cities, towns, or villages) that are split between two or more districts. In this section I will give a detailed comparison of the Governor’s plans to the 2011 enacted plans regarding municipal splits, with a particular focus on town splits. According to the classification provided by the LTSB, Wisconsin contains 1,850 municipalities (cities, towns, and villages), of which 1,248 are towns.

The Census Bureau’s and the LTSB’s approximations of the 2011 enacted plans are strikingly different regarding the numbers of municipal splits in general and town splits in particular. Based on the analysis described above in Section 3, I believe that comparison with the Census Bureau’s approximation is more appropriate here, and it will be used throughout this section.

The numbers of towns split and all municipalities split for each of the Governor’s plans and the 2011 enacted plans are shown in Table 8. Detailed lists of exactly which towns are split in each

plan, including the percentages of each town’s population that are contained in each district, may be found in Appendix B.

Town/Municipal Splits	Town Splits		All Municipal Splits	
	Governor’s Plan	2011 Plan	Governor’s Plan	2011 Plan
State Assembly	80	89	174	188
State Senate	55	55	118	123
U.S. Congress	22	29	47	57

Table 8: Town and Municipal Splits

7 Compactness

District **compactness** refers to the idea that a district should not be too “spread out.” There is no single measure that adequately defines this concept, but the two most commonly reported measures are the **Polsby-Popper** score and the **Reock** score.

The Polsby-Popper score measures the ratio of a district’s area to the square of its perimeter, multiplied by 4π . The possible values for this score range from 0 to 1, with a “perfect” compactness score of 1 achieved exactly when the district’s boundary is a perfect circle.

The Reock score measures the ratio of a district’s area to the area of the smallest circle that completely contains the district. As for Polsby-Popper, the possible values for this score range from 0 to 1, with a “perfect” compactness score of 1 achieved exactly when a district’s boundary is a perfect circle.

It should be emphasized that both of these scores are extremely sensitive to differences in map projections and resolutions. This issue is explored at some length in [1], where it is shown that not only can these scores vary significantly based on the choice of map projection, but the relative ordering of districts with respect to these scores (i.e., which districts appear more compact than others) may not even be consistent across different map projections.

For these reasons, one must interpret these scores cautiously. The raw score for any particular district is of limited value, and is impossible to verify without additional information such as the map projection used for the computation. **Relative** scores—provided that they are computed with respect to the same map projection—may be useful for comparisons across districts and district plans, but small differences between district scores still may not be particularly meaningful.

The scores that I report here for the SB 621/622 plans are somewhat different than those reported by the Legislature, but without additional information, such as the map projection used to perform the computation, I cannot determine the source of the discrepancies. For my computations, I have used the map projection NAD_1983_Wisconsin_TM_US_Ft (WKID 102219), which is the base projection in the shapefiles provided by the LTSB at <https://legis.wisconsin.gov/ltsb/gis/data/>.

A discrete alternative to these scores, proposed by Duchin and Tenner in [3], is the **cut edges** score, which counts the number of adjacent pairs of Census blocks that lie in different districts. This number may be thought of as a discrete analog of the total perimeter of all district boundaries. Unlike the other two scores, it is not sensitive to map projections. It also has the additional feature that, since Census blocks tend to have shorter perimeter in more densely populated areas, it more closely models the number of **persons** who live near district boundaries rather than the physical lengths of the district boundaries.

The mean, maximum, and minimum of the Polsby-Popper and Reock scores for each of the Governor’s plans and the SB 621/622 plans are shown in Tables 9, 10, and 11, along with the cut edges score. (Note that Polsby-Popper and Reock scores are computed for each individual district, while the cut edges score is a single score for an entire district plan.)

State Assembly	Governor’s Plan			SB 621 Plan		
Compactness Scores	Mean	Max	Min	Mean	Max	Min
Polsby-Popper	0.251	0.523	0.056	0.243	0.566	0.050
Reock	0.397	0.652	0.147	0.379	0.651	0.148
Cut Edges	18,441			19,196		

Table 9: Compactness Scores for State Assembly District Plans

State Senate	Governor’s Plan			SB 621 Plan		
Compactness Scores	Mean	Max	Min	Mean	Max	Min
Polsby-Popper	0.217	0.433	0.053	0.224	0.392	0.048
Reock	0.392	0.607	0.135	0.395	0.593	0.133
Cut Edges	11,147			10,785		

Table 10: Compactness Scores for State Senate District Plans

Congress	Governor’s Plan			SB 621 Plan		
Compactness Scores	Mean	Max	Min	Mean	Max	Min
Polsby-Popper	0.243	0.397	0.127	0.280	0.498	0.125
Reock	0.458	0.599	0.334	0.458	0.635	0.337
Cut Edges	3,774			3,410		

Table 11: Compactness Scores for Congressional District Plans

Additionally, the full ranges of Polsby-Popper and Reock scores for each plan are depicted graphically in Figures 12, 13, and 14 as follows: Districts in the Governor’s and the SB 621/622 plans were each sorted from lowest to highest score, and the resulting lists of scores for each district are plotted. (Note that the sorted ordering of the districts is not the same in both plans.) Overall, I do not detect any substantial meaningful differences between the Governor’s and the SB 621/622 plans with respect to compactness.

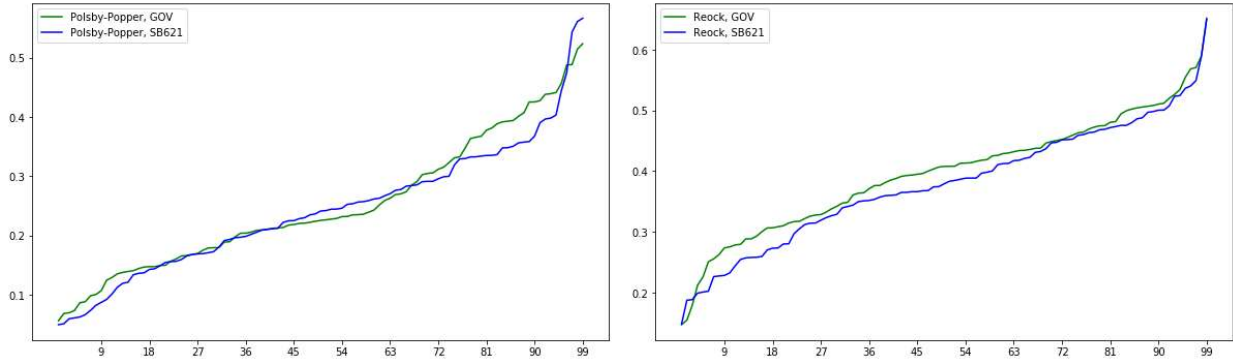


Figure 12: Compactness measures by district, State Assembly

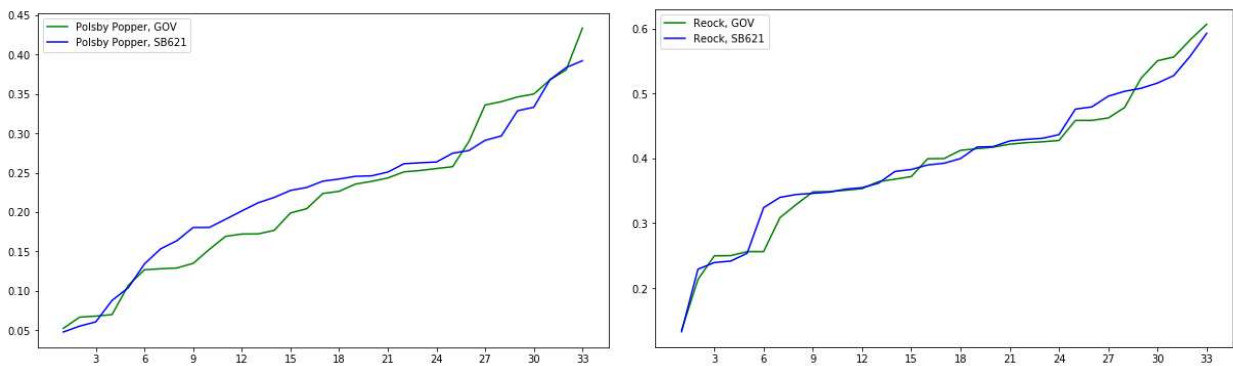


Figure 13: Compactness measures by district, State Senate

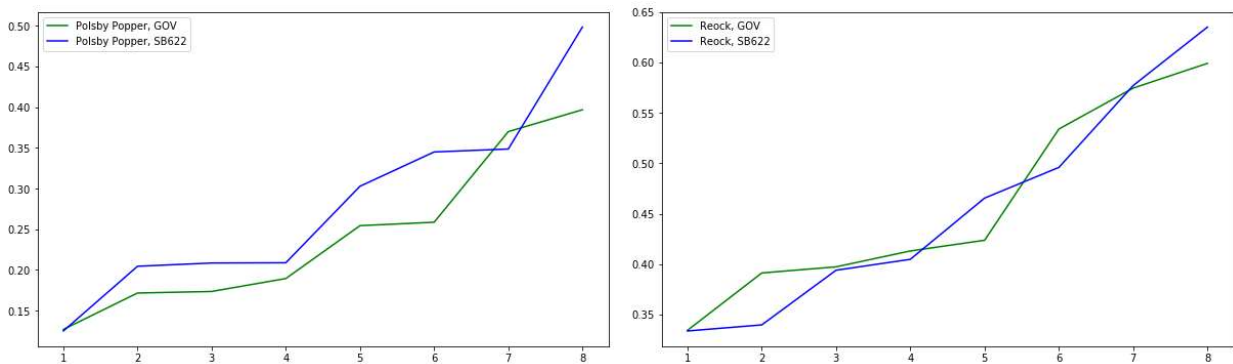


Figure 14: Compactness measures by district, Congress

8 Previous Expert Testimony and Compensation

This information remains the same as in my initial report [2]. I have not served as an expert witness in any other case in the past 4 years. I am being compensated at the rate of \$250 per hour for my work on this case.

References

- [1] Assaf Bar-Natan, Lorenzo Najt, and Zachary Schutzman, *The gerrymandering jumble: Map projections permute districts' compactness scores*, Cartography and Geographic Information Science **47** (2021), 321–335.
- [2] Jeanne Clelland, *Expert Report in Support of Governor Evers's Proposed District Plans*, Expert report to Wisconsin Supreme Court for Johnson v. Wisconsin Election Commission, 2021, available at <https://www.wicourts.gov/courts/supreme/origact/2021ap1450.htm>.
- [3] Moon Duchin and Bridget Tenner, *Discrete geometry for electoral geography*, arXiv e-prints (2018), arXiv:1808.05860.

A Core Population Movement by District

This Appendix contains tables that describe the core population movement by district in the Governor's and SB 621/622 plans.

- Tables 12, 13, and 14 show the core population movement by district in the Governor's and SB 621 Assembly plans.
- Table 15 shows the core population movement by district in the Governor's and SB 621 Senate plans.
- Table 16 shows the core population movement by district in the Governor's and SB 622 Congressional plans.

District	Governor's Plan			SB 621 Plan		
	Moved out	Moved in	Total moved	Moved out	Moved in	Total moved
1	0	0	0	390	0	390
2	6,522	2,754	9,276	14,189	11,145	25,334
3	8,836	6,774	15,610	8,340	6,184	14,524
4	0	946	946	6,227	7,147	13,374
5	7,717	287	8,004	19,051	11,270	30,321
6	0	2,185	2,185	9,348	11,405	20,753
7	16,578	17,053	33,631	7,622	7,843	15,465
8	0	5,425	5,425	0	5,363	5,363
9	5,425	7,572	12,997	5,363	7,622	12,985
10	7,447	14,134	21,581	6,482	13,357	19,839
11	23,724	29,495	53,219	7,911	13,291	21,202
12	23,267	26,356	49,623	6,809	9,741	16,550
13	22,512	20,848	43,360	32,334	30,106	62,440
14	52,488	51,636	10,4124	36,104	35,577	71,681
15	13,483	15,781	29,264	21,514	23,745	45,259
16	4,694	10,333	15,027	0	5,975	5,975
17	22,960	27,151	50,111	3,139	7,231	10,370
18	12,794	18,967	31,761	7,208	13,567	20,775
19	5,462	2,422	7,884	2,736	0	2,736
20	20,626	23,773	44,399	0	2,736	2,736
21	16,843	18,204	35,047	0	1,045	1,045
22	21,632	19,914	41,546	18,544	17,070	35,614
23	1,983	506	2,489	20,580	19,187	39,767
24	36,628	35,150	71,778	27,839	26,805	54,644
25	4,267	5,874	10,141	4,921	6,395	11,316
26	0	973	973	1,864	2,811	4,675
27	17	0	17	2,306	2,722	5,028
28	0	0	0	14,182	14,651	288,33
29	5,086	3,203	8,289	18,933	16,691	35,624
30	3,203	0	3,203	14,761	11,589	26,350
31	610	9	619	23,583	23,222	46,805
32	0	0	0	12,685	12,844	25,529
33	15,138	15,892	31,030	25,488	26,570	52,058

Table 12: Persons Moved in State Assembly Districts (Districts 1-33)

District	Governor's Plan			SB 621 Plan		
	Moved out	Moved in	Total moved	Moved out	Moved in	Total moved
34	4,558	3,448	8,006	6,911	5,628	12,539
35	4,343	7,002	11,345	3,859	6,986	10,845
36	2,778	4,558	7,336	6,986	8,714	15,700
37	40,112	38,715	78,827	8,612	6,843	15,455
38	31,354	29,390	60,744	10,639	8,612	19,251
39	7,851	9,229	17,080	6,683	7,930	14,613
40	2,296	4,977	7,273	5,377	7,545	12,922
41	3,756	5,806	9,562	15,493	17,186	32,679
42	10,713	11,967	22,680	14,283	15,493	29,776
43	129	117	246	31,642	31,823	63,465
44	91	658	749	3,561	4,697	8,258
45	0	1,466	1,466	5,605	7,633	13,238
46	23,057	16,967	40,024	17,403	11,636	29,039
47	3,958	128	4,086	6,237	2,175	8,412
48	27,918	24,013	51,931	11,292	7,231	18,523
49	2,779	4,429	7,208	0	1,756	1,756
50	5,445	6,203	11,648	3,738	4,481	8,219
51	8,795	10,924	19,719	1,037	3,835	4,872
52	0	0	0	5,305	5,036	10,341
53	6,117	7,118	13,235	5,487	6,643	12,130
54	172	2,796	2,968	220	2,335	2,555
55	9,676	7,517	17,193	7,236	4,781	12,017
56	11,895	6,928	18,823	14,794	9,846	24,640
57	7,546	9,458	17,004	3,179	4,630	7,809
58	0	1	1	4,673	5,227	9,900
59	5,929	6,929	12,858	9,817	11,406	21,223
60	1	15	16	10	0	10
61	15	0	15	578	0	578
62	7,390	8,898	16,288	7,304	8,307	15,611
63	0	16	16	3,273	3,015	6,288
64	2,133	4,297	6,430	3,027	4,543	7,570
65	0	2,117	2,117	0	2,117	2,117
66	4,282	7,390	11,672	3,965	7,304	11,269

Table 13: Persons Moved in State Assembly Districts (Districts 34-66)

District	Governor's Plan			SB 621 Plan		
	Moved out	Moved in	Total moved	Moved out	Moved in	Total moved
67	16,580	15,618	32,198	16,578	15,657	32,235
68	16,756	14,813	31,569	17,886	15,445	33,331
69	5,522	8,276	13,798	7,970	10,184	18,154
70	8,017	9,654	17,671	2,730	3,853	6,583
71	0	1,673	1,673	2,123	3,743	5,866
72	0	1,874	1,874	2,516	4,371	6,887
73	0	566	566	9,984	10,944	20,928
74	0	0	0	4,408	4,985	9,393
75	566	1,849	2,415	4,335	4,999	9,334
76	22,565	10,676	33,241	12,052	0	12,052
77	10,778	7,963	18,741	8,420	4,863	13,283
78	7,947	464	8,411	13,094	5,980	19,074
79	15,395	5,323	20,718	28,556	18,132	46,688
80	12,448	5,800	18,248	21,238	15,058	36,296
81	1,907	976	2,883	17,546	17,320	34,866
82	2,256	1,782	4,038	12,966	12,581	25,547
83	13,912	15,112	29,024	28,567	29,434	58,001
84	7,772	7,465	15,237	19,634	19,641	39,275
85	11,478	12,355	23,833	0	1,027	1,027
86	16,579	15,878	32,457	3,056	2,276	5,332
87	840	2,890	3,730	841	3,200	4,041
88	17,084	14,185	31,269	15,524	12,150	27,674
89	939	0	939	2,803	1,988	4,791
90	13,803	15,269	29,072	4,400	6,201	10,601
91	60	83	143	216	255	471
92	2	0	2	8,452	8,640	17,092
93	1,333	16	1,349	17,478	16,448	33,926
94	8,832	5,793	14,625	2,466	0	2,466
95	6,062	6,950	13,012	0	755	755
96	5,081	5,727	10,808	2,443	3,383	5,826
97	9,287	12,561	21,848	11,403	14,441	25,844
98	2,407	0	2,407	12,541	10,524	23,065
99	6,420	8,974	15,394	12,699	14,825	27,524

Table 14: Persons Moved in State Assembly Districts (Districts 67-99)

District	Governor's Plan			SB 621 Plan		
	Moved out	Moved in	Total moved	Moved out	Moved in	Total moved
1	15,358	9,528	24,886	22,529	16,939	39,468
2	6,771	2,472	9,243	14,402	9,598	24,000
3	9,006	17,053	26,059	0	7,843	7,843
4	33,474	49,021	82,495	0	15,187	15,187
5	63,501	63,283	126,784	24,269	23,745	48,014
6	25,558	41,561	67,119	0	16,426	16,426
7	5,462	6,930	12,392	0	1,045	1,045
8	43,517	38,844	82,361	20,971	17,070	38,041
9	4,267	6,830	11,097	4,064	6,901	10,965
10	5,086	0	5,086	24,652	19,707	44,359
11	15,748	15,901	31,649	37,447	38,327	75,774
12	895	4,224	5,119	1,783	5,355	7,138
13	49,927	47,944	97,871	13,550	11,001	24,551
14	9,627	15,612	25,239	17,438	22,509	39,947
15	90	2,111	2,201	40,498	43,843	84,341
16	36,530	22,705	59,235	24,410	10,520	34,930
17	6,376	10,913	17,289	1,880	7,177	9,057
18	3,321	6,946	10,267	5,305	8,307	13,612
19	11,924	6,710	18,634	9,574	3,622	13,196
20	5,929	6,944	12,873	9,273	11,406	20,679
21	7,405	8,914	16,319	7,882	8,049	15,931
22	16	7,405	7,421	910	7,882	8,792
23	7,371	7,220	14,591	23,937	22,789	46,726
24	4,470	9,654	14,124	1,503	6,101	7,604
25	0	1,849	1,849	7,690	9,891	17,581
26	22,827	640	23,467	23,194	471	23,665
27	22,219	4,568	26,787	37,013	20,183	57,196
28	18,926	19,345	38,271	28,945	29,434	58,379
29	5,064	7,290	12,354	2,572	5,178	7,750
30	2,754	382	3,136	13,547	11,159	24,706
31	1,296	0	1,296	22,393	21,590	43,983
32	3,937	2,432	6,369	4,154	3,383	7,537
33	12,576	15,997	28,573	13,276	16,423	29,699

Table 15: Persons Moved in State Senate Districts

District	Governor's Plan			SB 622 Plan		
	Moved out	Moved in	Total moved	Moved out	Moved in	Total moved
1	97,047	105,387	202,434	1,743	10,082	11,825
2	52,681	0	52,681	52,751	70	52,821
3	4,579	7,940	12,519	117,891	121,251	239,142
4	48,160	89,479	137,639	0	41,319	41,319
5	99,659	101,716	201,375	40,378	42,435	82,813
6	6,361	15,314	21,675	42,454	51,408	93,862
7	675	4,579	5,254	77,835	81,739	159,574
8	15,253	0	15,253	51,404	36,152	87,556

Table 16: Persons Moved in Congressional Districts

B Town Splits

This Appendix contains tables that list the towns split between districts in the Governor's plans and in the 2011 enacted plans (Census Bureau version), along with the percentages of each town's population contained in each district. Note that in some cases, 100% of the town's population is contained in a single district even though the town is technically split.

- Tables 17, 18, and 19 contain a list of all towns that are split between Assembly districts in the Governor's plan.
- Tables 20, 21, and 22 contain a list of all towns that are split between Assembly districts in the 2011 enacted plan.
- Tables 23 and 24 contain a list of all towns that are split between Senate districts in the Governor's plan.
- Tables 25 and 26 contain a list of all towns that are split between Senate districts in the 2011 enacted plan.
- Table 27 contains a list of all towns that are split between Congressional districts in the Governor's plan.
- Table 28 contains a list of all towns that are split between Congressional districts in the 2011 enacted plan.

Town Name	County	Districts With % Town Population
Algoma	Winnebago	(53, 93.39%), (54, 6.61%)
Aztalan	Jefferson	(33, 38.42%), (38, 61.58%)
Beloit	Rock	(31, 34.17%), (45, 65.83%)
Berry	Dane	(79, 100.0%), (80, 0.0%)
Black Wolf	Winnebago	(53, 98.72%), (54, 1.28%)
Blooming Grove	Dane	(46, 16.58%), (47, 35.2%), (48, 48.21%), (77, 0.0%)
Brockway	Jackson	(70, 0.07%), (92, 99.93%)
Brookfield	Waukesha	(13, 69.6%), (15, 23.56%), (98, 0.0%), (22, 6.84%)
Buchanan	Outagamie	(3, 100.0%), (57, 0.0%)
Burke	Dane	(37, 99.63%), (48, 0.37%)
Burlington	Racine	(32, 32.56%), (63, 67.44%)
Calumet	Fond du Lac	(52, 53.19%), (59, 46.81%)
Cameron	Wood	(69, 100.0%), (86, 0.0%)
Columbus	Columbia	(37, 1.44%), (42, 98.56%)
Cottage Grove	Dane	(46, 64.55%), (47, 35.45%)
Dale	Outagamie	(40, 25.06%), (56, 74.94%)
Delton	Sauk	(41, 1.02%), (81, 98.98%)
Dunkirk	Dane	(43, 35.94%), (46, 64.06%)
Dunn	Dane	(46, 41.17%), (47, 58.83%), (80, 0.0%)
East Troy	Walworth	(32, 43.36%), (83, 56.64%)
Emmet	Dodge	(33, 74.96%), (38, 25.04%)
Fond du Lac	Fond du Lac	(52, 99.84%), (53, 0.16%)
Fort Winnebago	Columbia	(42, 99.51%), (81, 0.49%)
Franklin	Sauk	(50, 72.75%), (81, 27.25%)
Freedom	Outagamie	(5, 99.58%), (56, 0.42%)

Table 17: Towns Split, Governor's Assembly Plan, A-F

Town Name	County	Districts With % Town Population
Genesee	Waukesha	(97, 54.72%), (99, 45.28%)
Germantown	Washington	(24, 100.0%), (58, 0.0%)
Grafton	Ozaukee	(23, 100.0%), (60, 0.0%),
Grand Chute	Outagamie	(55, 41.23%), (56, 51.23%), (57, 7.54%)
Grant	Portage	(71, 20.36%), (72, 79.64%)
Harmony	Rock	(31, 99.53%), (44, 0.47%)
Hartford	Washington	(24, 46.74%), (58, 0.0%), (59, 53.26%)
Hull	Portage	(70, 69.4%), (71, 30.6%)
Hustisford	Dodge	(33, 32.79%), (39, 67.21%)
Irving	Jackson	(70, 0.0%), (92, 100.0%)
Janesville	Rock	(43, 99.29%), (44, 0.71%)
Koshkonong	Jefferson	(33, 11.29%), (43, 88.71%)
La Prairie	Rock	(31, 27.68%), (44, 72.32%)
Ledgeview	Brown	(2, 64.4%), (88, 35.6%)
Lisbon	Waukesha	(22, 70.22%), (24, 18.37%), (98, 10.78%), (99, 0.63%)
Lowell	Dodge	(37, 37.99%), (38, 62.01%)
Lyndon	Sheboygan	(26, 32.04%), (59, 67.96%)
Madison	Dane	(47, 88.23%), (48, 10.49%), (77, 1.28%), (78, 0.0%)
Manitowish Waters	Vilas	(34, 100.0%), (74, 0.0%)
Medary	La Crosse	(94, 25.31%), (95, 74.69%)
Meeme	Manitowoc	(25, 59.51%), (27, 40.49%)
Merton	Waukesha	(22, 0.0%), (24, 10.37%), (99, 89.63%)
Middleton	Dane	(78, 0.06%), (79, 99.94%)
Mukwonago	Waukesha	(83, 69.34%), (97, 30.66%)
Nashville	Forest	(35, 26.75%), (36, 73.25%)
New Holstein	Calumet	(27, 0.0%), (59, 100.0%)
Newport	Columbia	(41, 0.0%), (81, 100.0%)

Table 18: Towns Split, Governor's Assembly Plan, G-N

Town Name	County	Districts With % Town Population
Oconomowoc	Waukesha	(24, 48.7%), (99, 51.3%)
Oregon	Dane	(43, 0.0%), (80, 100.0%)
Oshkosh	Winnebago	(53, 98.03%), (54, 1.97%)
Ottawa	Waukesha	(97, 58.34%), (99, 41.66%)
Packwaukeee	Marquette	(41, 22.74%), (42, 77.26%)
Plymouth	Rock	(43, 100.0%), (45, 0.0%)
Randall	Kenosha	(32, 0.0%), (61, 100.0%)
Rib Mountain	Marathon	(85, 0.0%), (86, 100.0%)
Rock	Rock	(43, 99.63%), (44, 0.37%)
Rubicon	Dodge	(33, 41.99%), (39, 58.01%)
Rutland	Dane	(43, 99.85%), (80, 0.15%)
Seymour	Eau Claire	(68, 100.0%), (91, 0.0%)
Sheboygan	Sheboygan	(26, 0.0%), (27, 100.0%)
Somers	Kenosha	(61, 17.54%), (64, 82.46%)
St. Joseph	St. Croix	(29, 17.98%), (30, 82.02%)
Stettin	Marathon	(85, 22.29%), (86, 77.71%)
Sun Prairie	Dane	(37, 0.0%), (46, 100.0%)
Sylvester	Green	(45, 100.0%), (51, 0.0%)
Trenton	Washington	(58, 22.81%), (60, 77.19%)
Union	Eau Claire	(67, 43.69%), (91, 0.56%), (93, 55.75%)
Verona	Dane	(47, 0.26%), (78, 0.36%), (80, 99.38%)
Vienna	Dane	(42, 0.0%), (79, 100.0%)
Warren	St. Croix	(29, 29.2%), (30, 70.8%)
Washington	Eau Claire	(68, 0.05%), (91, 0.03%), (93, 99.92%)
Waterford	Racine	(62, 51.52%), (83, 48.48%)
Waukesha	Waukesha	(15, 9.08%), (84, 38.58%), (97, 52.34%)
Wheaton	Chippewa	(67, 100.0%), (91, 0.0%)
Whitewater	Walworth	(31, 0.0%), (43, 100.0%)

Table 19: Towns Split, Governor's Assembly Plan, O-W

Town Name	County	Districts With % Town Population
Algoma	Winnebago	(53, 100.0%), (54, 0.0%)
Alto	Fond du Lac	(42, 100.0%), (53, 0.0%)
Beaver Brook	Washburn	(73, 0.0%), (75, 100.0%)
Beloit	Rock	(31, 34.17%), (45, 65.83%)
Benton	Lafayette	(49, 100.0%), (51, 0.0%)
Blooming Grove	Dane	(47, 99.45%), (48, 0.55%), (77, 0.0%)
Brockway	Jackson	(70, 0.07%), (92, 99.93%)
Brookfield	Waukesha	(13, 93.16%), (14, 6.84%)
Buchanan	Outagamie	(3, 100.0%), (57, 0.0%)
Burke	Dane	(46, 0.0%), (48, 1.75%), (79, 98.25%)
Burlington	Racine	(32, 32.56%), (63, 67.44%)
Calumet	Fond du Lac	(52, 53.19%), (59, 46.81%)
Cameron	Wood	(69, 100.0%), (86, 0.0%)
Columbus	Columbia	(37, 1.44%), (42, 98.56%)
Cottage Grove	Dane	(46, 64.55%), (47, 35.45%), (48, 0.0%)
Cross Plains	Dane	(79, 0.74%), (80, 99.26%)
Crystal	Washburn	(73, 0.0%), (75, 100.0%)
Delton	Sauk	(41, 1.42%), (81, 98.58%)
Dunkirk	Dane	(43, 35.94%), (46, 64.06%)
Dunn	Dane	(47, 100.0%), (80, 0.0%)
Eagle Point	Chippewa	(67, 100.0%), (68, 0.0%)
East Troy	Walworth	(32, 43.36%), (33, 36.45%), (83, 20.19%)
Fond du Lac	Fond du Lac	(52, 99.84%), (53, 0.16%)
Fort Winnebago	Columbia	(42, 99.51%), (81, 0.49%)
Genesee	Waukesha	(97, 37.94%), (99, 62.06%)
Germantown	Washington	(24, 100.0%), (58, 0.0%)
Glenmore	Brown	(2, 0.0%), (88, 100.0%)
Goetz	Chippewa	(67, 100.0%), (68, 0.0%)
Grafton	Ozaukee	(23, 100.0%), (60, 0.0%)
Grand Chute	Outagamie	(55, 48.77%), (56, 51.23%)

Table 20: Towns Split, 2011 Assembly Plan, A-Grand

Town Name	County	Districts With % Town Population
Grant	Shawano	(6, 100.0%), (40, 0.0%)
Grant	Portage	(71, 20.36%), (72, 79.64%)
Greenville	Outagamie	(55, 20.28%), (56, 79.72%)
Grover	Marinette	(36, 0.0%), (89, 100.0%)
Harmony	Rock	(31, 99.53%), (44, 0.47%)
Hartford	Washington	(58, 0.0%), (59, 100.0%)
Hull	Portage	(70, 99.87%), (71, 0.13%)
Irving	Jackson	(70, 0.0%), (92, 100.0%)
Janesville	Rock	(43, 99.29%), (44, 0.71%)
Koshkonong	Jefferson	(33, 11.29%), (43, 88.71%)
La Prairie	Rock	(31, 100.0%), (44, 0.0%)
Larrabee	Waupaca	(6, 0.0%), (40, 100.0%)
Ledgeview	Brown	(2, 45.27%), (88, 54.73%)
Lisbon	Waukesha	(22, 88.59%), (98, 10.78%), (99, 0.63%)
Little Rice	Oneida	(34, 0.0%), (35, 100.0%)
Lowell	Dodge	(37, 55.23%), (39, 44.77%)
Madison	Dane	(47, 98.38%), (76, 0.34%), (77, 1.28%), (78, 0.0%)
Manitowish Waters	Vilas	(34, 100.0%), (74, 0.0%)
Martell	Pierce	(30, 0.0%), (93, 100.0%)
Meeme	Manitowoc	(25, 59.51%), (27, 40.49%)
Merton	Waukesha	(22, 0.0%), (99, 100.0%)
Middleton	Dane	(78, 0.06%), (79, 99.94%)
Mount Pleasant	Green	(45, 55.74%), (80, 44.26%)
Mukwonago	Waukesha	(33, 69.3%), (97, 30.6%), (99, 0.1%)
Nashville	Forest	(34, 0.0%), (36, 100.0%)
New Holstein	Calumet	(27, 0.0%), (59, 100.0%)
Newport	Columbia	(41, 0.0%), (81, 100.0%)
Oconomowoc	Waukesha	(38, 99.2%), (99, 0.8%)
Oregon	Dane	(43, 0.0%), (80, 100.0%)
Oshkosh	Winnebago	(53, 100.0%), (54, 0.0%)

Table 21: Towns Split, 2011 Assembly Plan, Grant-O

Town Name	County	Districts With % Town Population
Plymouth	Rock	(43, 100.0%), (45, 0.0%)
Port Edwards	Wood	(70, 100.0%), (72, 0.0%)
Randall	Kenosha	(32, 0.0%), (61, 100.0%)
Richfield	Adams	(41, 0.0%), (72, 100.0%)
Richmond	St. Croix	(29, 52.23%), (30, 47.77%)
Rock	Rock	(43, 99.63%), (44, 0.37%)
Rudolph	Wood	(70, 100.0%), (72, 0.0%)
Rutland	Dane	(43, 99.85%), (80, 0.15%)
Seymour	Eau Claire	(68, 100.0%), (91, 0.0%)
Sheboygan	Sheboygan	(26, 0.0%), (27, 100.0%)
Shelby	La Crosse	(94, 62.99%), (95, 37.01%)
Somers	Kenosha	(61, 17.54%), (64, 82.46%)
Stettin	Marathon	(85, 0.35%), (86, 99.65%)
Tomah	Monroe	(70, 0.0%), (96, 100.0%)
Trenton	Washington	(58, 22.81%), (60, 77.19%)
Union	Eau Claire	(91, 0.56%), (93, 99.44%)
Verona	Dane	(47, 0.26%), (78, 0.36%), (79, 32.51%), (80, 66.87%)
Vienna	Dane	(37, 0.0%), (79, 100.0%)
Washington	Eau Claire	(68, 0.05%), (91, 0.03%), (93, 99.92%)
Washington	Green	(45, 0.0%), (80, 100.0%)
Waterloo	Jefferson	(37, 0.0%), (38, 100.0%)
Watertown	Jefferson	(37, 0.0%), (38, 100.0%)
Waukesha	Waukesha	(83, 38.58%), (97, 61.42%)
Wellington	Monroe	(50, 0.0%), (96, 100.0%)
Westford	Dodge	(39, 1.37%), (42, 98.63%)
Westport	Dane	(48, 0.0%), (79, 100.0%)
Wheaton	Chippewa	(67, 100.0%), (91, 0.0%)
Whitewater	Walworth	(31, 0.0%), (43, 100.0%)
Woodville	Calumet	(3, 100.0%), (25, 0.0%)

Table 22: Towns Split, 2011 Assembly Plan, P-W

Town Name	County	Districts With % Town Population
Aztalan	Jefferson	(11, 38.42%), (13, 61.58%)
Beloit	Rock	(11, 34.17%), (15, 65.83%)
Blooming Grove	Dane	(16, 100.0%), (26, 0.0%)
Brockway	Jackson	(24, 0.07%), (31, 99.93%)
Brookfield	Waukesha	(5, 93.16%), (8, 6.84%), (33, 0.0%)
Buchanan	Outagamie	(1, 100.0%), (19, 0.0%)
Burke	Dane	(13, 99.63%), (16, 0.37%)
Burlington	Racine	(11, 32.56%), (21, 67.44%)
Calumet	Fond du Lac	(18, 53.19%), (20, 46.81%)
Cameron	Wood	(23, 100.0%), (29, 0.0%)
Columbus	Columbia	(13, 1.44%), (14, 98.56%)
Dale	Outagamie	(14, 25.06%), (19, 74.94%)
Delton	Sauk	(14, 1.02%), (27, 98.98%)
Dunkirk	Dane	(15, 35.94%), (16, 64.06%)
Dunn	Dane	(16, 100.0%), (27, 0.0%)
East Troy	Walworth	(11, 43.36%), (28, 56.64%)
Emmet	Dodge	(11, 74.96%), (13, 25.04%)
Fort Winnebago	Columbia	(14, 99.51%), (27, 0.49%)
Franklin	Sauk	(17, 72.75%), (27, 27.25%)
Freedom	Outagamie	(2, 99.58%), (19, 0.42%)
Germantown	Washington	(8, 100.0%), (20, 0.0%)
Grafton	Ozaukee	(8, 100.0%), (20, 0.0%)
Harmony	Rock	(11, 99.53%), (15, 0.47%)
Hartford	Washington	(8, 46.74%), (20, 53.26%)
Hustisford	Dodge	(11, 32.79%), (13, 67.21%)
Irving	Jackson	(24, 0.0%), (31, 100.0%)
Koshkonong	Jefferson	(11, 11.29%), (15, 88.71%)

Table 23: Towns Split, Governor's Senate Plan, A-K

Town Name	County	Districts With % Town Population
La Prairie	Rock	(11, 27.68%), (15, 72.32%)
Ledgeview	Brown	(1, 64.4%), (30, 35.6%)
Lisbon	Waukesha	(8, 88.59%), (33, 11.41%)
Lyndon	Sheboygan	(9, 32.04%), (20, 67.96%)
Madison	Dane	(16, 98.72%), (26, 1.28%)
Manitowish Waters	Vilas	(12, 100.0%), (25, 0.0%)
Merton	Waukesha	(8, 10.37%), (33, 89.63%)
Middleton	Dane	(26, 0.06%), (27, 99.94%)
Mukwonago	Waukesha	(28, 69.34%), (33, 30.66%)
New Holstein	Calumet	(9, 0.0%), (20, 100.0%)
Newport	Columbia	(14, 0.0%), (27, 100.0%)
Oconomowoc	Waukesha	(8, 48.7%), (33, 51.3%)
Oregon	Dane	(15, 0.0%), (27, 100.0%)
Randall	Kenosha	(11, 0.0%), (21, 100.0%)
Rubicon	Dodge	(11, 41.99%), (13, 58.01%)
Rutland	Dane	(15, 99.85%), (27, 0.15%)
Seymour	Eau Claire	(23, 100.0%), (31, 0.0%)
Somers	Kenosha	(21, 17.54%), (22, 82.46%)
Sun Prairie	Dane	(13, 0.0%), (16, 100.0%)
Sylvester	Green	(15, 100.0%), (17, 0.0%)
Union	Eau Claire	(23, 43.69%), (31, 56.31%)
Verona	Dane	(16, 0.26%), (26, 0.36%), (27, 99.38%)
Vienna	Dane	(14, 0.0%), (27, 100.0%)
Washington	Eau Claire	(23, 0.05%), (31, 99.95%)
Waterford	Racine	(21, 51.52%), (28, 48.48%)
Waukesha	Waukesha	(5, 9.08%), (28, 38.58%), (33, 52.34%)
Wheaton	Chippewa	(23, 100.0%), (31, 0.0%)
Whitewater	Walworth	(11, 0.0%), (15, 100.0%)

Table 24: Towns Split, Governor's Senate Plan, L-W

Town Name	County	Districts With % Town Population
Alto	Fond du Lac	(14, 100.0%), (18, 0.0%)
Beloit	Rock	(11, 34.17%), (15, 65.83%)
Blooming Grove	Dane	(16, 100.0%), (26, 0.0%)
Brockway	Jackson	(24, 0.07%), (31, 99.93%)
Buchanan	Outagamie	(1, 100.0%), (19, 0.0%)
Burke	Dane	(16, 1.75%), (27, 98.25%)
Burlington	Racine	(11, 32.56%), (21, 67.44%)
Calumet	Fond du Lac	(18, 53.19%), (20, 46.81%)
Cameron	Wood	(23, 100.0%), (29, 0.0%)
Columbus	Columbia	(13, 1.44%), (14, 98.56%)
Delton	Sauk	(14, 1.42%), (27, 98.58%)
Dunkirk	Dane	(15, 35.94%), (16, 64.06%)
Dunn	Dane	(16, 100.0%), (27, 0.0%)
East Troy	Walworth	(11, 79.81%), (28, 20.19%)
Fort Winnebago	Columbia	(14, 99.51%), (27, 0.49%)
Germantown	Washington	(8, 100.0%), (20, 0.0%)
Glenmore	Brown	(1, 0.0%), (30, 100.0%)
Grafton	Ozaukee	(8, 100.0%), (20, 0.0%)
Grant	Shawano	(2, 100.0%), (14, 0.0%)
Grover	Marinette	(12, 0.0%), (30, 100.0%)
Harmony	Rock	(11, 99.53%), (15, 0.47%)
Irving	Jackson	(24, 0.0%), (31, 100.0%)
Koshkonong	Jefferson	(11, 11.29%), (15, 88.71%)
La Prairie	Rock	(11, 100.0%), (15, 0.0%)
Larrabee	Waupaca	(2, 0.0%), (14, 100.0%)
Ledgeview	Brown	(1, 45.27%), (30, 54.73%)
Lisbon	Waukesha	(8, 88.59%), (33, 11.41%)

Table 25: Towns Split, 2011 Senate Plan, A-L

Town Name	County	Districts With % Town Population
Madison	Dane	(16, 98.38%), (26, 1.62%)
Manitowish Waters	Vilas	(12, 100.0%), (25, 0.0%)
Martell	Pierce	(10, 0.0%), (31, 100.0%)
Merton	Waukesha	(8, 0.0%), (33, 100.0%)
Middleton	Dane	(26, 0.06%), (27, 99.94%)
Mount Pleasant	Green	(15, 55.74%), (27, 44.26%)
Mukwonago	Waukesha	(11, 69.3%), (33, 30.7%)
New Holstein	Calumet	(9, 0.0%), (20, 100.0%)
Newport	Columbia	(14, 0.0%), (27, 100.0%)
Oconomowoc	Waukesha	(13, 99.2%), (33, 0.8%)
Oregon	Dane	(15, 0.0%), (27, 100.0%)
Randall	Kenosha	(11, 0.0%), (21, 100.0%)
Richfield	Adams	(14, 0.0%), (24, 100.0%)
Rutland	Dane	(15, 99.85%), (27, 0.15%)
Seymour	Eau Claire	(23, 100.0%), (31, 0.0%)
Somers	Kenosha	(21, 17.54%), (22, 82.46%)
Tomah	Monroe	(24, 0.0%), (32, 100.0%)
Verona	Dane	(16, 0.26%), (26, 0.36%), (27, 99.38%)
Vienna	Dane	(13, 0.0%), (27, 100.0%)
Washington	Eau Claire	(23, 0.05%), (31, 99.95%)
Washington	Green	(15, 0.0%), (27, 100.0%)
Waukesha	Waukesha	(28, 38.58%), (33, 61.42%)
Wellington	Monroe	(17, 0.0%), (32, 100.0%)
Westford	Dodge	(13, 1.37%), (14, 98.63%)
Westport	Dane	(16, 0.0%), (27, 100.0%)
Wheaton	Chippewa	(23, 100.0%), (31, 0.0%)
Whitewater	Walworth	(11, 0.0%), (15, 100.0%)
Woodville	Calumet	(1, 100.0%), (9, 0.0%)

Table 26: Towns Split, 2011 Senate Plan, M-W

Town Name	County	Districts With % Town Population
Alma	Jackson	(3, 60.31%), (7, 39.69%)
Beaver Dam	Dodge	(5, 66.74%), (6, 33.26%)
Beloit	Rock	(1, 31.67%), (2, 68.33%)
Clayton	Winnebago	(6, 73.83%), (8, 26.17%)
Clearfield	Juneau	(3, 22.08%), (7, 77.92%)
Eagle Point	Chippewa	(3, 0.0%), (7, 100.0%)
East Troy	Walworth	(1, 0.08%), (5, 99.92%)
Garfield	Jackson	(3, 100.0%), (7, 0.0%)
Germantown	Juneau	(3, 49.02%), (7, 50.98%)
Ironton	Sauk	(2, 15.11%), (3, 84.89%)
Janesville	Rock	(1, 82.89%), (2, 17.11%)
Knapp	Jackson	(3, 0.0%), (7, 100.0%)
La Grange	Monroe	(3, 6.26%), (7, 93.74%)
La Prairie	Rock	(1, 72.32%), (2, 27.68%)
Lisbon	Juneau	(3, 99.26%), (7, 0.74%)
Lomira	Dodge	(5, 0.36%), (6, 99.64%)
Rock	Rock	(1, 12.68%), (2, 87.32%)
Theresa	Dodge	(5, 60.61%), (6, 39.39%)
Turtle	Rock	(1, 73.67%), (2, 26.33%)
Westford	Dodge	(5, 1.37%), (6, 98.63%)
Winchester	Winnebago	(6, 6.63%), (8, 93.37%)
Wolf River	Winnebago	(6, 99.25%), (8, 0.75%)

Table 27: Towns Split, Governor's Congressional Plan

Town Name	County	Districts With % Town Population
Alma	Jackson	(3, 60.21%), (7, 39.79%)
Anson	Chippewa	(3, 0.74%), (7, 99.26%)
Beaver Dam	Dodge	(5, 46.04%), (6, 53.96%)
Buena Vista	Richland	(2, 99.56%), (3, 0.44%)
Clearfield	Juneau	(3, 22.08%), (7, 77.92%)
Eagle Point	Chippewa	(3, 0.0%), (7, 100.0%)
Garfield	Jackson	(3, 100.0%), (7, 0.0%)
Germantown	Juneau	(3, 49.02%), (7, 50.98%)
Goetz	Chippewa	(3, 97.79%), (7, 2.21%)
Harmony	Rock	(1, 69.13%), (2, 30.87%)
Hubbard	Dodge	(5, 99.89%), (6, 0.11%)
Janesville	Rock	(1, 9.25%), (2, 90.75%)
Knapp	Jackson	(3, 0.0%), (7, 100.0%)
La Grange	Monroe	(3, 6.26%), (7, 93.74%)
La Prairie	Rock	(1, 72.32%), (2, 27.68%)
Lisbon	Juneau	(3, 99.26%), (7, 0.74%)
Lomira	Dodge	(5, 0.36%), (6, 99.64%)
Milton	Rock	(1, 23.06%), (2, 76.94%)
Oak Grove	Dodge	(5, 98.93%), (6, 1.07%)
Oshkosh	Winnebago	(6, 98.15%), (8, 1.85%)
Rock	Rock	(1, 12.68%), (2, 87.32%)
Theresa	Dodge	(5, 60.61%), (6, 39.39%)
Turtle	Rock	(1, 55.16%), (2, 44.84%)
Vinland	Winnebago	(6, 98.59%), (8, 1.41%)
Waukesha	Waukesha	(1, 81.55%), (5, 18.45%)
Westford	Dodge	(5, 1.37%), (6, 98.63%)
Whitewater	Walworth	(1, 93.72%), (5, 6.28%)
Winneconne	Winnebago	(6, 0.19%), (8, 99.81%)
Wolf River	Winnebago	(6, 71.74%), (8, 28.26%)

Table 28: Towns Split, 2011 Congressional Plan