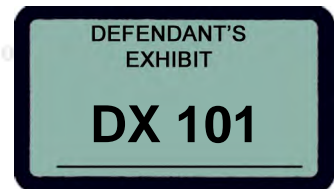


Expert Report of Sean P. Trende, Ph.D.

Wise v. State, 2516-CV29597 (Circuit Court of Jackson County, Missouri)

January 7, 2026

Not an Official Court Document



I. Introduction.

My name is Sean P. Trende. I am over 18 years of age and I hold a Ph.D. in Political Science. I have been retained by the Attorney General of Missouri on behalf of their clients in the above-captioned matter. I am being compensated at a rate of \$500/hr. My compensation is in no way dependent upon the conclusions I reach. All opinions are offered to a reasonable degree of scientific certainty.

II. Qualifications

A. Professional Experience

I serve as Senior Elections Analyst for Real Clear Politics. I joined Real Clear Politics in January of 2009 and assumed a fulltime position in March of 2010. Real Clear Politics is a company of approximately 50 employees, with its main offices in Washington D.C. It produces one of the most heavily trafficked political websites in the world, which serves as a one-stop shop for political analysis from all sides of the political spectrum and is recognized as a pioneer in the field of poll aggregation. Real Clear Politics produces original content, including both data analysis and traditional reporting.

My main responsibilities with Real Clear Politics consist of tracking, analyzing, and writing about elections. I collaborate in rating the competitiveness of Presidential, Senate, House, and gubernatorial races. As a part of carrying out these responsibilities, I have studied and written extensively about demographic trends in the country, exit poll data at the state and federal level, public opinion polling, and voter turnout and voting behavior. In particular, understanding the way that districts are drawn and how geography and demographics interact is crucial to predicting United States House of Representatives races, so much of my time is dedicated to that task.

I am currently a Visiting Scholar at the American Enterprise Institute, where my publications focus on the demographic and coalitional aspects of American Politics.

I am also a Lecturer at The Ohio State University. My course load is detailed in my c.v., attached as Exhibit 1.

B. Publications and Speaking Engagements

I am the author of the 2012 book *The Lost Majority: Why the Future of Government is up For Grabs and Who Will Take It*. In this book, I explore realignment theory. It argues that realignments are a poor concept that should be abandoned. As part of this analysis, I conducted a thorough analysis of demographic and political trends beginning in the 1920s and continuing through modern times, noting the fluidity and fragility of the coalitions built by the major political parties and their candidates.

I also co-authored the 2014 *Almanac of American Politics*. The *Almanac* is considered the foundational text for understanding congressional districts and the representatives of those districts, as well as the dynamics in play behind the elections. My focus was researching the history of and writing descriptions for many of the 2012 districts, including tracing the history of how and why they were drawn the way that they were drawn. Because the 2014 *Almanac* covers the 2012 elections, analyzing how redistricting was done was crucial to my work. I have also authored a chapter in Dr. Larry Sabato's post-election compendium after every election dating back to 2012.

I have spoken on these subjects before audiences from across the political spectrum, including at the Heritage Foundation, the American Enterprise Institute, the CATO Institute, the Bipartisan Policy Center, and the Brookings Institution. In 2012, I was invited to Brussels to speak about American elections to the European External Action Service, which is the European Union's diplomatic corps. I was selected by the United States Embassy in Sweden to discuss the 2016

elections to a series of audiences there and was selected by the United States Embassy in Spain to fulfill a similar mission in 2018. I was invited to present by the United States Embassy in Italy, but was unable to do so because of my teaching schedule.

C. Education

I received my Ph.D. in political science at The Ohio State University in 2023. I passed comprehensive examinations in both Methodology and American Politics. My dissertation applied historical and spatial statistical approaches to analyzing American political institutions, including (1) an analysis of Supreme Court voting patterns from 1900 to 1945; (2) methodological development in the use of integrated nested LaPlace approximations (INLA) to incorporate spatial statistics into election analysis; and (3) simulation-based evaluation of “communities of interest” in redistricting. In pursuit of this degree, I also earned a Master’s Degree in Applied Statistics. My coursework for my Ph.D. and M.A.S. included, among other things, classes on G.I.S., spatial statistics, issues in contemporary redistricting, machine learning, non-parametric hypothesis tests and probability theory. I also earned a B.A. from Yale University in history and political science in 1995, a Juris Doctor from Duke University in 2001, and a Master’s Degree in political science from Duke University in 2001.

In the winter of 2018, I taught American Politics and the Mass Media at Ohio Wesleyan University. I taught Introduction to American Politics at The Ohio State University for three semesters from Fall of 2018 to Fall of 2019, and again in Fall of 2021. In the Spring semesters of 2020, 2021, 2022 and 2023, I taught Political Participation and Voting Behavior at The Ohio State University. This course spent several weeks covering all facets of redistricting: how maps are drawn, debates over what constitutes a fair map, measures of redistricting quality, and similar topics. It also covers the Voting Rights Act and racial gerrymandering claims. I also taught survey

methodology in Fall of 2022 and Spring of 2024. In Spring of 2025 I taught Introduction to the Policy Process. In Spring of 2026 I will teach American Government Culture and Behavior.

D. Prior Expert Engagements

A full copy of all cases in which I have testified or been deposed is included on my C.V., attached as Exhibit 1. In 2021, I served as one of two special masters appointed by the Supreme Court of Virginia to redraw the districts that will elect the Commonwealth's representatives to the House of Delegates, state Senate, and U.S. Congress in the following decade. The Supreme Court of Virginia accepted those maps, which were praised by observers from across the political spectrum. *See, e.g., New Voting Maps, and a New Day, for Virginia*, The Washington Post (Jan. 2, 2022), available at <https://www.washingtonpost.com/opinions/2022/01/02/virginia-redistricting-voting-maps-gerrymander/>; Henry Olsen, *Maryland Shows How to do Redistricting Wrong. Virginia Shows How to Do it Right*, The Washington Post (Dec. 9, 2021), available at <https://www.washingtonpost.com/opinions/2021/12/09/maryland-virginia-redistricting/>; Richard Pildes, *Has VA Created a New Model for a Reasonably Non-Partisan Redistricting Process*, Election Law Blog (Dec. 9, 2021), available at <https://electionlawblog.org/?p=126216>.

In 2019, I was appointed as the court's expert by the Supreme Court of Belize. In that case I was asked to identify international standards of democracy as they relate to malapportionment claims, to determine whether Belize's electoral divisions (similar to our congressional districts) conformed with those standards, and to draw alternative maps that would remedy any existing malapportionment.

I served as a Voting Rights Act expert to counsel for the Arizona Independent Redistricting Commission in 2021 and 2022.

I also served as an expert in *Faatz v. Ashcroft*, a Missouri redistricting case involving a compactness challenge to the Missouri State Senate boundaries.

III. Overview of Terms

Academics often casually deploy jargon in a way that can confuse readers who do not typically employ such jargon. Such is potentially the case with the discussion of compactness measures and census geographies in this case. To help avoid this, I open with an explanation of compactness measures and of census geographies.

A. Compactness

Plaintiffs' experts discuss two commonly used compactness measures in their reports: Reock and Polsby-Popper. I add two more: Convex Hull and "IKIWIST" scores. These are probably the most commonly used compactness measures. But importantly, they are but a sample of dozens of metrics that have been proposed over the years. *See, e.g.*, <https://alarm-redist.org/redistmetrics/articles/compactness.html> (listing various measures). In other words, there is no one "compactness" measure. Rather, different measures emphasize different aspects of what we might consider "compact." It is also important to understand that these scores can vary somewhat based upon the projection employed and the amount of detail in the shapefile employed.

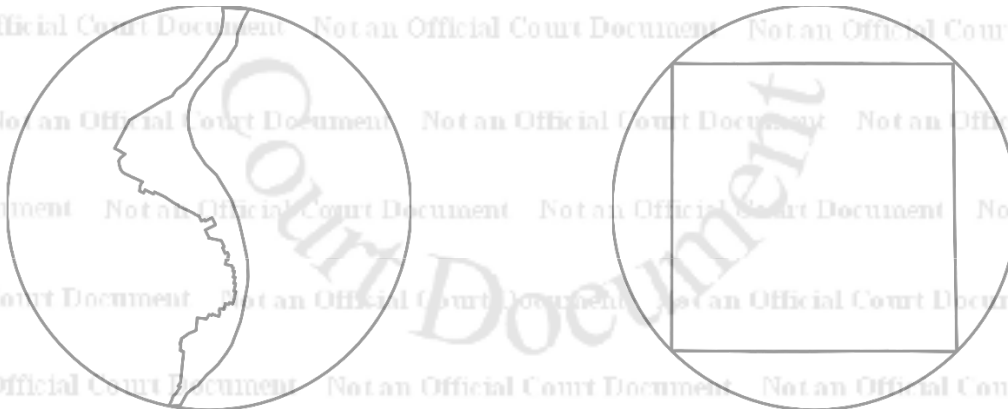
1. Reock Score

The first measure is the Reock score. It is the first measure discussed here, but it was also among the first numeric measures of compactness developed. Ernest C. Reock, Jr., *A Note: Measuring Compactness as a Requirement of Legislative Apportionment*, 5 *Midwest J. Pol. Sci.* 70 (1961). In lay terms, we might imagine the smallest circle that wholly encloses the district without cutting it, called the "minimum bounding circle." The Reock score is the percentage of that circle that the district would fill, expressed as a decimal. Were a district perfectly circular, it

would fill 100% of that minimum bounding circle, and the Reock score would be 1. Were a district somehow a line segment, it would fill 0% of that district, and the Reock score would be 0.

In practical terms, Reock scores measure how distended a district is. Elongated districts tend to have low Reock scores, while districts with high Reock scores tend to be, for lack of a better word, “stocky.” To help illustrate this (and other measures) I examine districts in the 2022 Missouri House plan, and compare the least compact district according to Reock among the various districts (District 76, with a score of 0.1419) as well as the most compact (District 157, with a score of 0.6181). I select the Missouri House plan because it has a large number of districts, and therefore offers a wider range of potential contrasts to illustrate the various measures.

Fig. 1: Districts with Minimum Bounding Circles



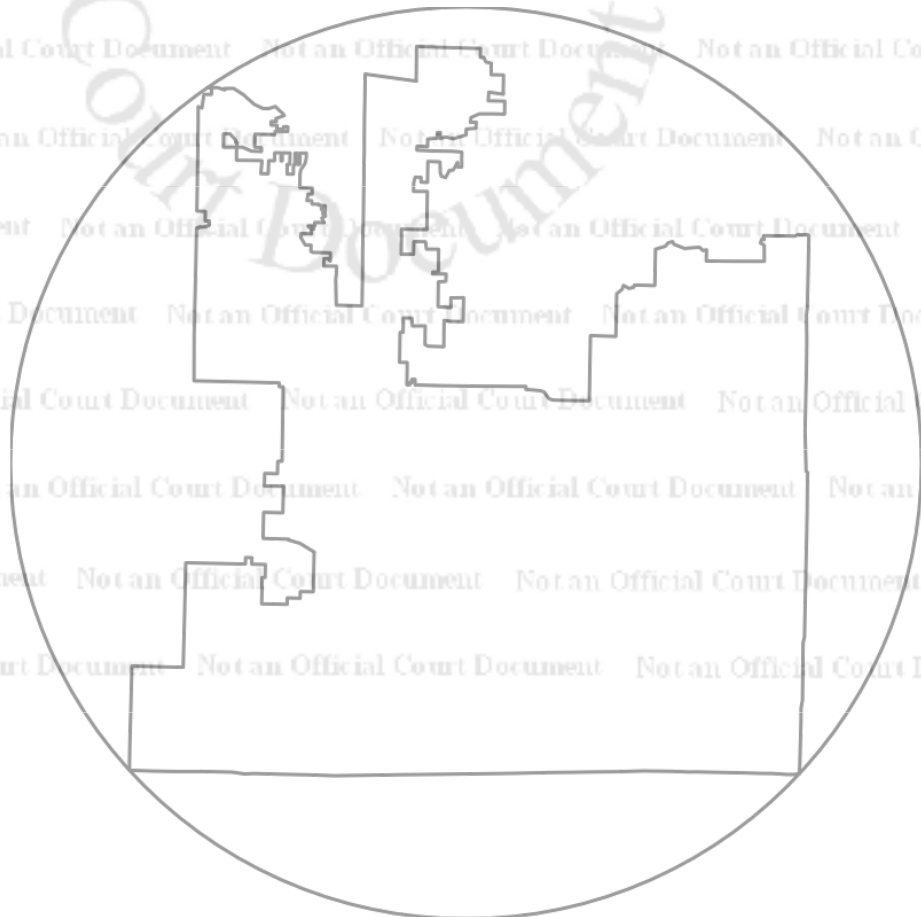
The district on the left has a Reock score of 0.1419, which means that it fills 14.9% of the circle that surrounds it. The district on the right has a Reock score of 0.6181, meaning that it fills 61.8% of the circle that surrounds it. One can readily see that the district on the right “fills” a higher percentage of its minimum bounding circle than the district on the left. This is what a Reock score measures; an opinion that relies upon a Reock score is relying upon the percentage of a particular circle that a district would fill.

In practice, Reock scores measure how “stocky” a district is.

2. Polsby-Popper Score

Reock scores do have real limitations for redistricting purposes. One can imagine a circular district, which would have a Reock score of 1. Now imagine a map maker carves out a narrow, serpentine channel running into the center of the district. The district would still fill a large portion of the Minimum Bounding Circle, and thus would score well on the compactness score. Likewise, a district covered with small protrusions, like potato eyes, could nevertheless score well on Reock scores, even though such inlets and protrusions might signify a gerrymander or be identified by laypeople as not compact. As an illustration of this, consider State House District 33, which is not terribly visually pleasing. Yet it would fill its minimum bounding circle nicely, giving it a respectable Reock score of 0.4795.

Fig. 2: State House District 33, With Minimum Bounding Circle

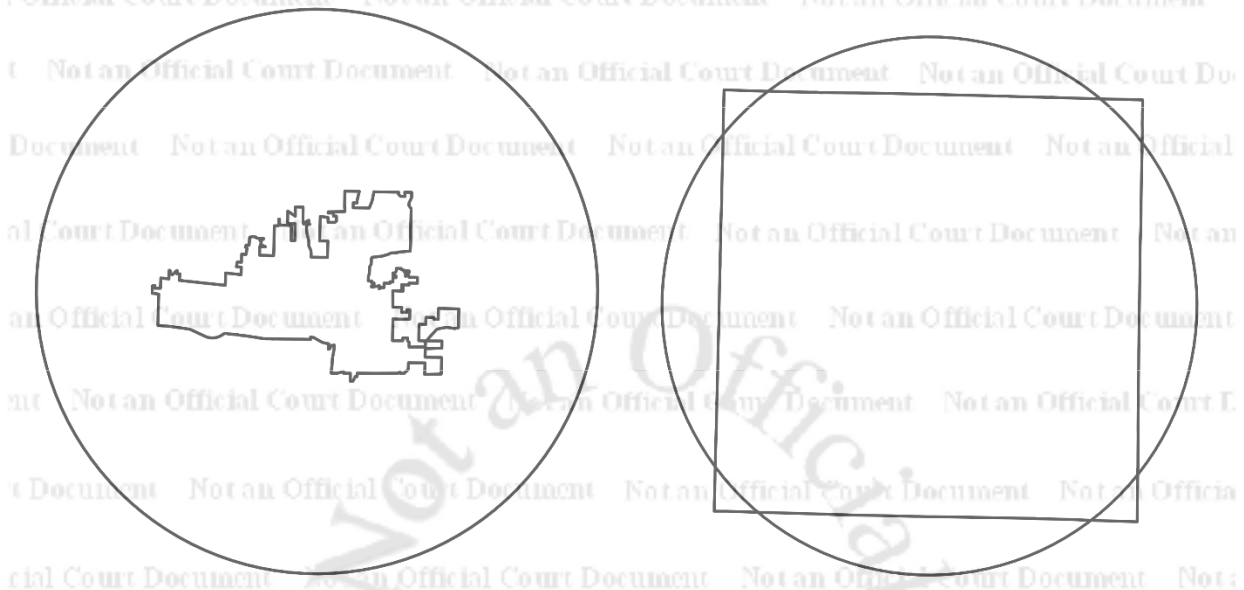


Polsby-Popper scores help to address this. In lay terms, imagine taking a circle and then “unfolding” it without breaking it, until it is shaped into a circle. That circle would have the same perimeter as the district. The Polsby-Popper score is the percentage of such a circle (i.e. a circle with the same perimeter as the district) that such a district would fill. Daniel D. Polsby & Robert D. Popper, The Third Criterion: Compactness as a Procedural Safeguard Against Partisan Gerrymandering, 9 Yale L. & Pol’y Rev. 301 (1991).

Practically speaking, a “smoother” district will have a higher Polsby-Popper score, while a district with many “arms and inlets” will have lower Polsby-Popper scores. Once again, a perfectly circular district would have no arms and inlets, so its area would be the same as that of a circle with the same perimeter; it would fill 100% of the circle and would receive a Polsby-Popper score of one. As more and more “bends” are added to the district, its perimeter will increase, and it will fill less and less of the circle with the same perimeter as the district.

To help illustrate this, compare the least compact contiguous district using Polsby-Popper among the various districts here (District 46, 0.105, below left) with the most compact (District 157, 0.7742, below right). Thus, District 46 fills 10.5% of the circle with the same perimeter; this makes sense because it is fairly irregular. District 157, on the other hand, fills 77.42%.

Fig. 3: State House Districts, with Circle of Same Perimeter



Again, the basic intuition of what would be the more compact district holds here, with the district on the right looking considerably more compact than the district on the left. What makes it so in this test is the many folds in the district on the left inflate its perimeter, creating a larger circle that it is less able to fill.

Thus, we can see that the Polsby-Popper score measures the “arms and inlets” in a district. Note that this too can generate counterintuitive results: An oval running down the Florida Peninsula might have poor compactness under Reock, but score quite well under Polsby-Popper.

This approach has limitations as well. Polsby-Popper scores can be sensitive to features that mapmakers are directed to follow. For example, river boundaries tend to meander, which can increase the perimeter of a district if they are followed. At the same time, mapmakers are often instructed to follow natural features, such as river boundaries. Thus, a mapmaker who forms a district boundary out of precincts drawn by straight lines and who avoids precincts that follow river boundaries would be rewarded with a higher Polsby-Popper score.

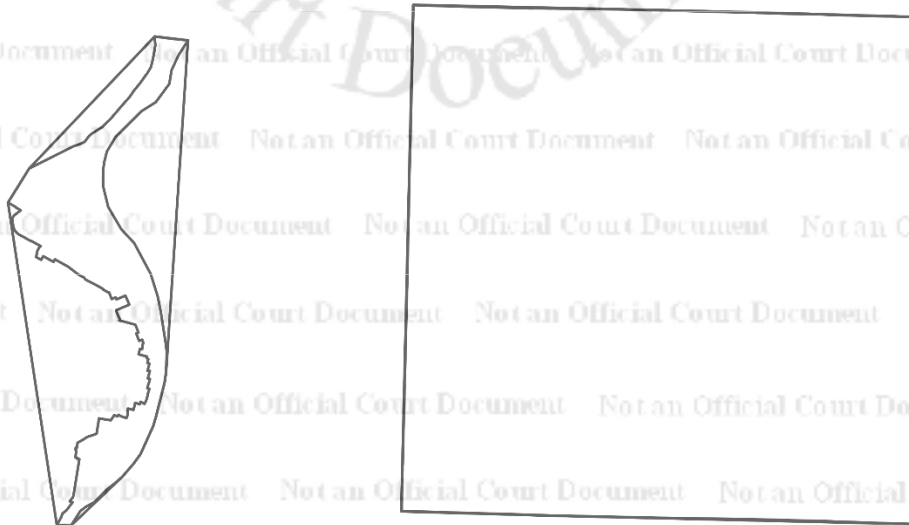
Likewise, some states have very regular edges – think Colorado – while other states have irregular coastlines – think Maine. Districts that respect those shorelines will have more “arms and inlets” and therefore higher perimeters simply by virtue of state geography, and their Polsby-Popper scores will suffer.

3. Convex Hull Score

A researcher may also reasonably wonder “what is so great about circles?” Convex Hull scores seek to dispense with circles altogether and instead look at the area of a convex polygon that would enclose a district. A more straightforward way to think of this is to imagine a rubber band snapped around a district. The Convex Hull score would ask what percentage of that rubber band the district would fill.

We once again illustrate this by comparing the least compact district in our dataset – again District 76 with a score of 0.405, with District 157, which has a Convex Hull score of 0.997.

Fig. 4: State House Districts with Convex Polygon



Once again we can see how the more compact district fills a much larger percentage of the shape “rubber-banded” around the district – in this case it is a square, and the rubber band would almost perfectly encompass it, when compared to the percentage of the less-compact district using Convex Hull.

As with all of these attempts to quantify the notion of “compactness,” the Convex Hull score has its plusses and minuses. As a plus, it is likely impossible to ever draw a perfectly circular district (although circular cities do exist throughout the South), but square counties, townships and precincts do exist. It is therefore at least possible to draw a district with a Convex Hull score of 1 while adhering to traditional redistricting principles. At the same time, as is the case with Polsby-Popper scores, a badly distended district can score well on Convex Hull scores; imagine a largely rectangular district that spanned the entire Colorado/Wyoming border.

4. IKIWISI Scores

The final metric we examine is a newer one, developed by political scientists Aaron Kaufman, Gary King and Maya Komisarchik. Rather than directly developing a mathematical formula for measuring compactness, they instead interviewed judges, redistricting experts, public officials, lawyers and ordinary citizens by showing them various districts, in order to get a sense of what they would consider “valid.” Kaufman, Aaron, et al., “How to Measure Legislative Compactness if You Only Know it When You See it,” 65 *Am. Jrnl. Pol. Sci.* 533, 534 (2021). They find that the groups effectively define compactness in the same way, which they summarize as “squarish, with minimal arms, pockets, islands, or jagged edges.” *Id.* at 544. They turn these into what they (unfortunately) call “I Know it When I See It” scores. These scores run from 1 to 100. Because they are whole numbers, there can be multiple districts with identical IKIWISI scores. The least compact district is again District 76, while a number of districts score a perfect IKIWISI

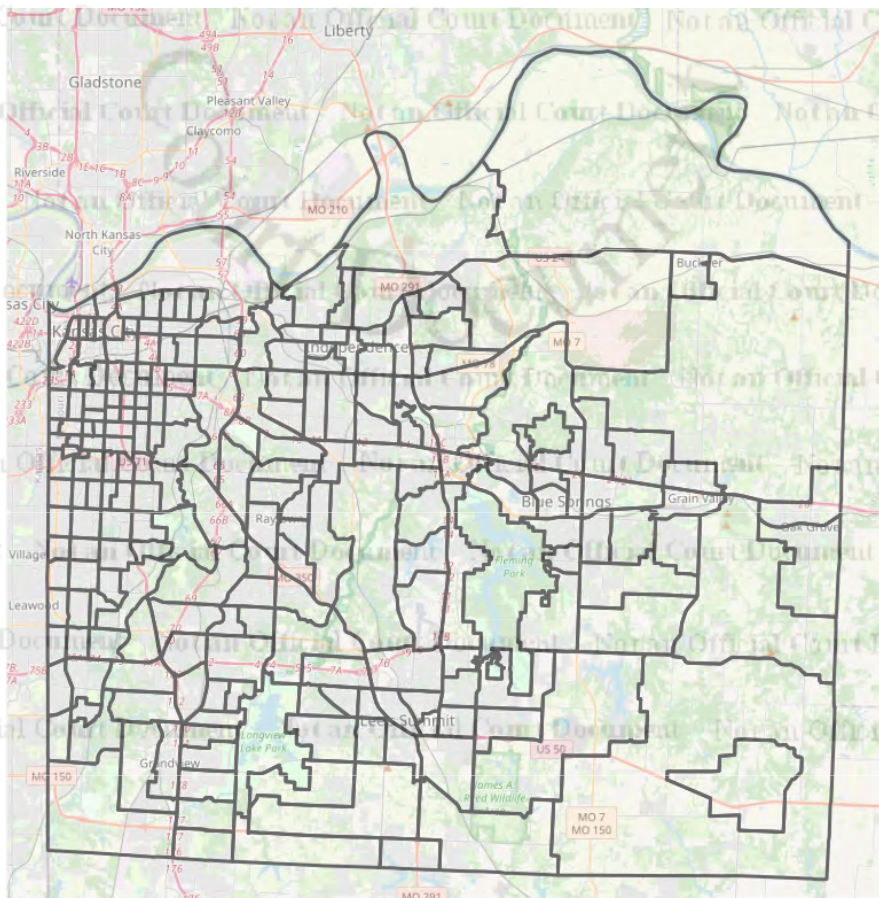
score, including District 157.

B. Census Geographies

As with compactness scores, it may be helpful to have a brief refresher on census geographies. The US Census Bureau reports data at multiple levels of data collection. The largest grouping is obviously at the national level, but the data are further broken down at the state level, and then to the county level.

Counties are then further broken down into census tracts. Jackson County, MO has 227 census tracts with a mean population of around 3,200 residents. We can see these in the following illustration:

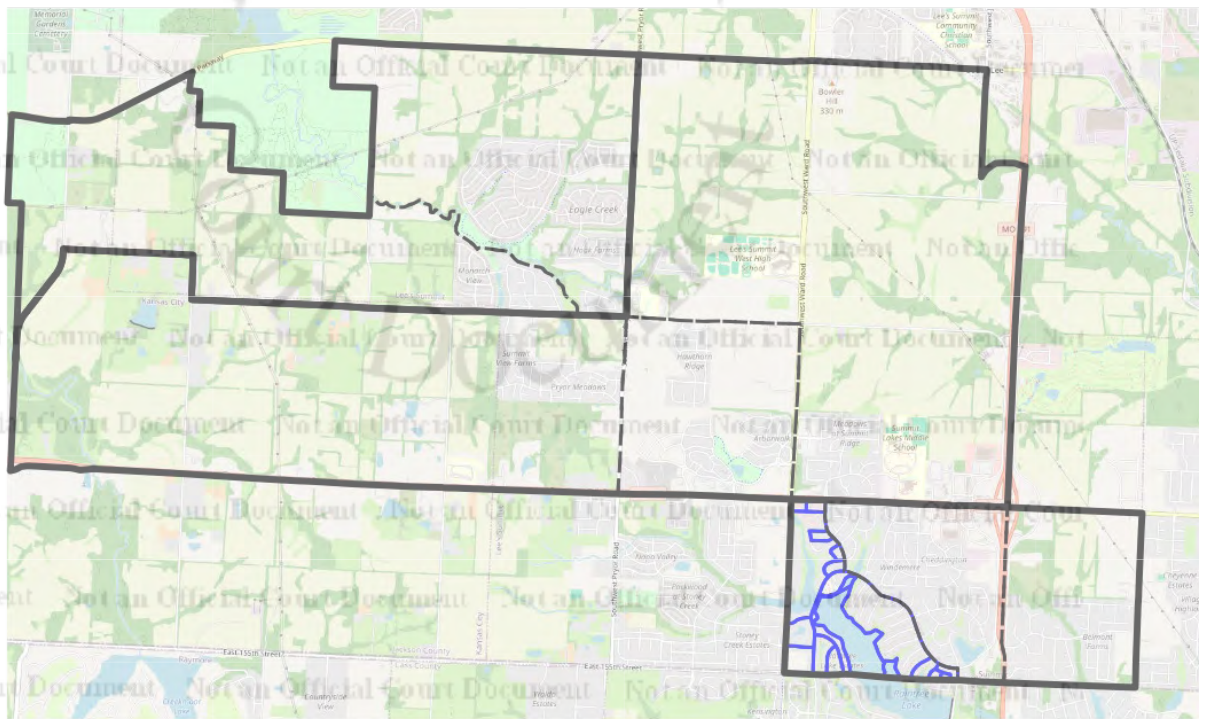
Fig. 5: Census Tracts in Jackson County, MO.



Census tracts are then divided into block groups; there are 640 in Jackson County. The average block group in Jackson County contained 1,200 residents. Finally, block groups are divided into census blocks, of which there are around 15,000 in DeSoto County.

To help illustrate this better, the following map is Tracts 013504, 018102, and 018200 in southern Jackson County. The tracts are broken up into their block groups, denoted by dashed lines. Block group 3 of Tract 018101 is broken up into its constituent blocks, denoted by blue lines.

Fig. 6: Tracts 013504, 018102, and 018200, with further subdivisions.



Blocks are something of the “quarks” of the census world. They will usually line up with the boundaries of cities, towns, and the census version of precincts: Voting Tabulation Districts, or

VTDs. They will often line up with precincts lines as well. Precincts and VTDs will not, however, always line up with block groups, tracts, or even cities.

Each of these units comes with its own unique identifier, known as a GEOID. These GEOIDs are typically a combination of other census identifiers. So, for example, the GEOID for Tract 013707 is 29095013707, which means that it is in state 29 (the identifier for Missouri) in county 095 (the identifier for Jackson County), and is tract 013707. These units will also sometimes have census names; the name for this tract is Census Tract 137.07.

IV. Contiguity Analysis

First, I have been asked to respond to Dr. Cervas' conclusions about H.R. 1's Legislative Text. Dr. Cervas concludes that "[i]n this circumstance, H.B. 1 should have either uniquely identified the VTDs or specified which census blocks comprising the VTDs belong in CD 4 and which belong in CD 5" and that it is left "to election officials' discretion where the voters who live in these VTDs will ultimately be assigned." Cervas Report at 25-26. He also notes that a double assignment of VTDs leaves districts 4 and 5 overpopulated and non-contiguous.

I do not know what best bill drafting practices in Missouri are, nor do I know whether the bill as drafted leaves it to election officials' discretion where voters who live in these VTDs will be assigned, nor do I know what Missouri canons of statutory construction would apply under these circumstances. This seems like classic legal analysis that lawyers would fight about and courts should decide.

What Dr. Cervas and I do agree about, though, is that these are two separate VTDs within Jackson County that (unfortunately, in my view) share a label. One of these has a GEOID from the 2020 census of 29095K16811 and is bounded by a portion of Rockhill Road, by a portion of East 89th St., and by a portion of Oak Street. It has a population of 32. The second VTD has a GEOID

from the 2020 census of 29095000484 and is bounded by a portion of East 70th St., by a portion of Troost St., by a portion of East 75th St., and by a portion of Holmes Rd. It has a population of 843.

Dr. Cervas notes that if both VTDs are assigned to CD4, it would have 843 too many people, and if both VTDs are assigned to CD5, it would have 32 people too many. We also agree that in both of these circumstances, the district would be non-contiguous.

What Dr. Cervas does not discuss is the following scenario: If the VTD with the GEOID of 29095K16811 is assigned to District 4, District 4 would be rendered contiguous and equipopulous with other Missouri districts. Likewise, if the VTD with the GEOID of 29095000484 is assigned to District 5, the district would be contiguous and equipopulous with other Missouri districts.

Again, whether election officials would actually have discretion to prescribe a different outcome given this possibility is legal argumentation that falls well beyond the scope of what I am comfortable testifying to. Likewise, whether Missouri canons of statutory construction exist to avoid assigning these VTDs to two districts is not something I can opine on to any reasonable degree of scientific certainty.

V. Analysis of Enacted Map.

Plaintiffs' experts offer up a dizzying array of maps and various potential considerations for a map drawer (some of which are fairly novel) suggesting that a more compact version of the existing map could potentially be drawn. That it can be done is not particularly surprising. There exist an incomprehensible number of potential maps. Even a simple 10x10 grid features 8 quintillion potential arrangements of 10 districts; the number of arrangements for 4,604 VTDs in Missouri is much larger, even with a constraint for contiguity added. Jamie Tucker-Foltz, *How*

Millions of Simulated Maps Can Help Us Make Electoral Districts That Feel Fair, Yale Insights (Nov. 17, 2025), <https://insights.som.yale.edu/insights/how-millions-of-simulated-maps-can-help-us-make-electoral-districts-that-feel-fair>.

In other words, in a world of increased computing power where millions or even billions of maps can be produced in a relatively short time, it is unsurprising that more compact maps can be produced. Indeed, if *that* is the standard for what “compact and as nearly equal in population as may be” is, then it’s unclear whether a stable map can ever be achieved; more simulations and exploration will eventually discover a more compact map. That was one of the core points to which I testified in the *Faatz* litigation.

Regardless, I have been asked to determine whether other recent Missouri districts fall within the range of districts drawn in Missouri maps. To do this, I first examined the 2012, 2022, and Enacted maps to determine whether they feature districts with compactness scores that are lower, or within a point of the scores of the Enacted Map. For Reock, Polsby-Popper and IKIWISI scores, I employ the calculations from Dave’s Redistricting. For Convex Hull, I calculate the compactness in R. Using Reock scores, there are four districts in these maps that have been less compact than District 5 in the Enacted Map (0.292): District 6 in the 2012 Map (0.234), District 6 in the 2022 map (0.247), District 5 in the 2012 Map (0.261), and District 6 in the Enacted Map (0.281). In addition, District 3 in the 2012 Map (0.295) and District 3 in the 2022 map (0.3) are within a point of the Enacted Map District 5.

Using Polsby-Popper scores, District 3 in the 2022 Map (0.151), and District 4 in the 2012 Map (0.188), have lower scores than the Enacted Map District 5 (0.199). District 2 in the 2012 Map has a Polsby-Popper score within a point of the Enacted Map District 5 (0.203).

Using Convex Hull scores, District 3 in the 2022 Map (0.637), District 4 in the 2012 Map (0.677) and District 5 in the 2012 Map (0.69) have lower Convex Hull scores than District 5 in the Enacted Map (0.702).

Using IKIWISI scores, District 3 in the 2022 map (24) and District 5 in the 2012 Map (33) have lower scores than the Enacted Map District 5 (34).

In the state House map, 30 districts have Reock scores lower than or within a point of District 5 in the Enacted Map District 5. In the State Senate map, seven districts have Reock scores lower than or within a point of the Enacted Map District 5. In the State House map, 24 districts have Polsby-Popper scores lower than or within a point of District 5 in the Enacted Map District 5. In the State Senate map, that number is six. In the State House map, 49 districts have Convex Hull scores within a point of that of District 5 in the Enacted Map, while 12 state Senate districts have scores within a point. The Convex Hull Scores may be of particular interest given that legislative districts in particular are ideally shaped as certain polygons, which is captured by Convex Hull scores. Finally, in the State House map, 29 districts have IKIWISI scores lower than the Enacted Map District 5, while in the State Senate, that number is seven.

I have also been asked to provide the average compactness scores for those maps.

Table 1: Average Compactness Measures for various Missouri Maps

Score	2011	2022	Enacted	House	Senate
Reock	0.396	0.417	0.413	0.397	0.396
Polsby-Popper	0.263	0.31	0.353	0.323	0.327
Convex Hull	0.752	0.786	0.802	0.755	0.757
IKIWISI	48.8	57.2	63	54.1	54

In short, this does not suggest that Enacted Map District 5 or the Enacted Map as a whole are unusually non-compact compared to what has previously been employed in Missouri.

I was also asked to calculate the average Reock, Polsby-Popper, and Convex Hull scores for Missouri Congressional Districts going back to 1972. Because these maps are not provided by Dave's Redistricting, but rather are accessed from Jeffrey B. Lewis, Brandon DeVine, Lincoln Pitcher, and Kenneth C. Martis. (2013) *Digital Boundary Definitions of United States Congressional Districts, 1789-2012*, I calculated these values using R. Again, scores may vary slightly based upon projections and the level of granularity in the shapefile.

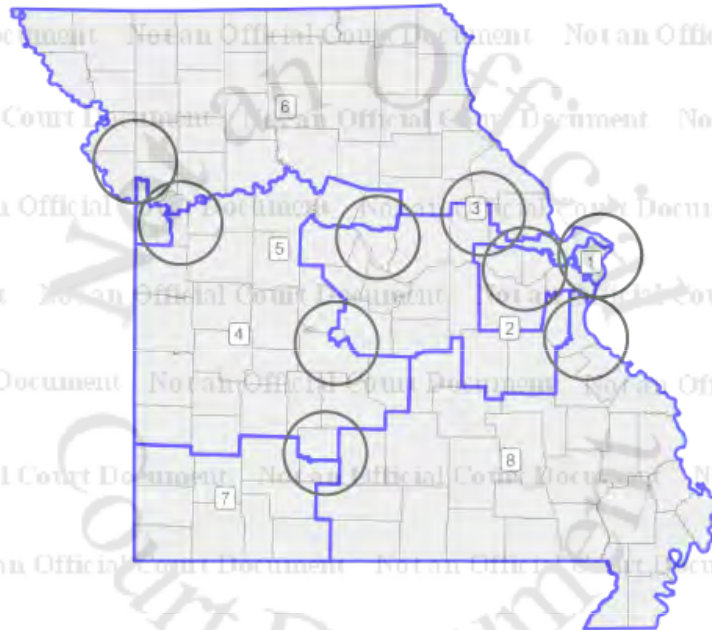
Table 2: Various Average Compactness Scores, Various Missouri Maps

Map	Reock	Polsby-Popper	Convex Hull
1972	0.406	0.337	0.763
1982	0.457	0.392	0.786
1992	0.428	0.326	0.752
2002	0.445	0.276	0.724
2012	0.396	0.27	0.752
2022	0.417	0.319	0.786
Enacted	0.413	0.366	0.802

I have also been asked to compare the number of county splits, and counties split, to the 2011 and 2022 maps, as well as municipalities split. The 2012 Map splits eight counties a total of nine times. The 2022 map splits nine counties a total of ten times. The Enacted map splits five counties a total of seven times.

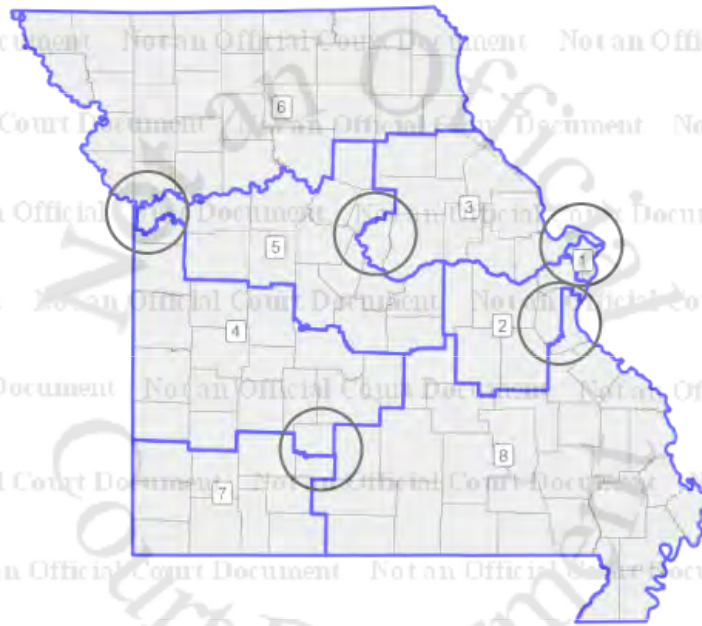
I was asked to produce a map of the 2022 map, highlighting the county splits. It follows:

Figure 7: 2022 Map, with County Splits highlighted



I was asked to do the same for the Enacted Map. It follows:

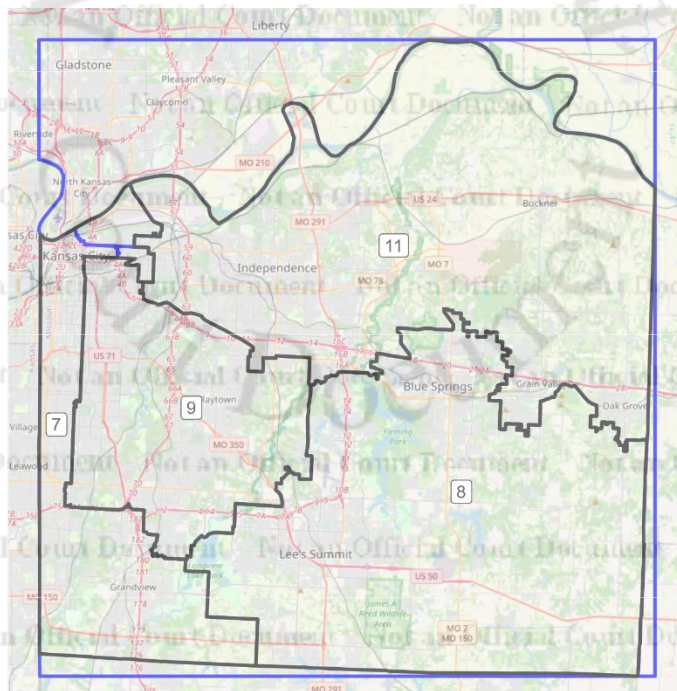
Figure 8: Enacted Map, with County Splits highlighted



The split of Jackson County is also not entirely *sui generis*. It was split three ways in the 2022 map. As Dr. Rodden's maps show on pages 8 and 9, it was also split three ways in 1992 and 2002. As to the specific split, it mostly follows senate district lines. The following map takes the Missouri State Senate map and lays it over the congressional map. Where one sees blue lines, it

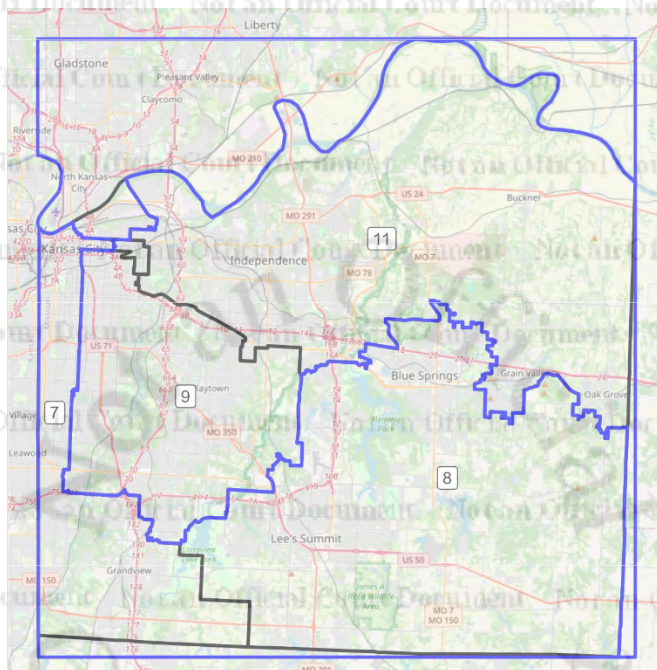
means that the Enacted Map splits Jackson County in a way that the senate map does not. There is very little blue. This is because the Enacted Map follows the State Senate map through Jackson County almost perfectly, placing districts 9 and 11 in Congressional District 5 and District 8 in District 4. It largely places District 7 in Congressional District 4, with around 8,261 residents in District 5 and 16,037 in District 6. While that split is avoidable, it would add an additional hook to District 4 reducing some compactness measures, and would necessitate a different county split for the districts.

Figure 9: Jackson County State Senate Districts (Black) and Congressional Districts (Blue)



The following map reverses this image, layering the state senate districts on top. Thus, here, any black that shows up reflects a state senate line not mimicked in the Enacted Map.

Figure 10: Jackson County State Senate Districts (Black) and Congressional Districts (Blue)



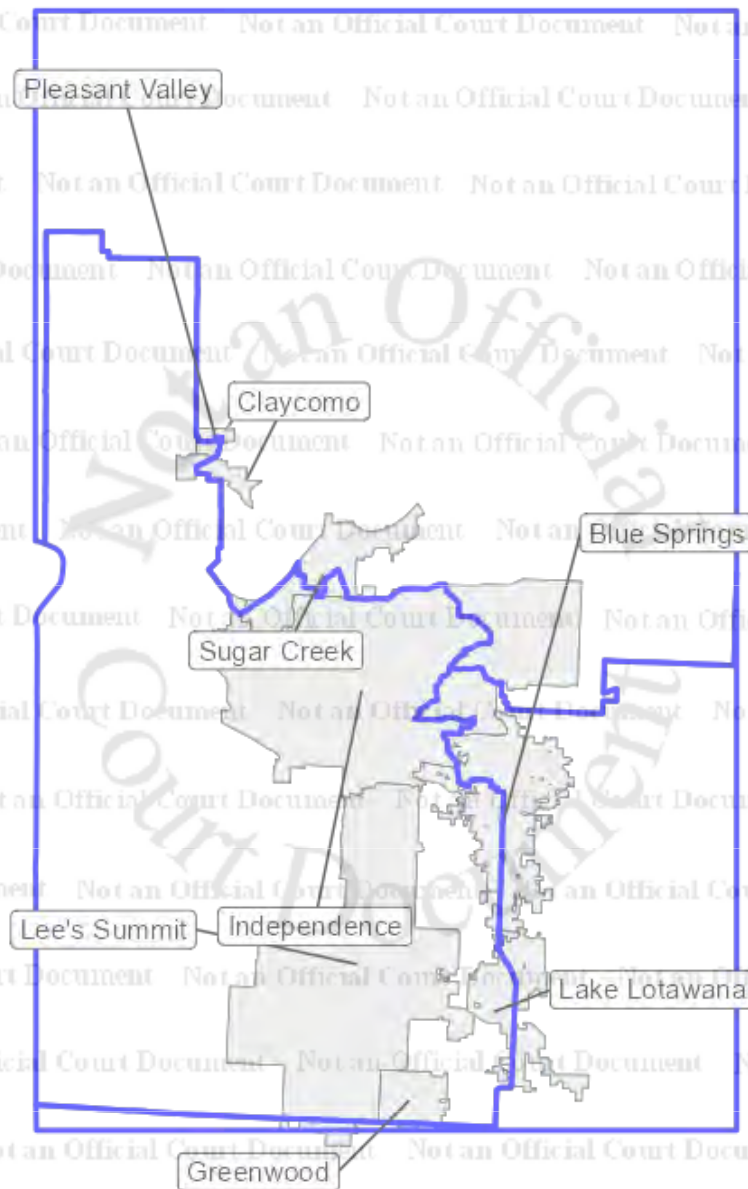
Note that Dr. Rodden places much emphasis on keeping the central business district together. Although he provides no source against which I can check this, he defines it as the area “bounded by 31st Avenue to the south, the Missouri River to the north, the Kansas border to the west, and Woodland Avenue to the east.” This is a bit vague, given that Woodland Avenue is no longer a continuous street and does not extend to the Missouri River, but regardless, it appears to have a population of around 29,000 residents. It could be placed in a single state Senate district. However, the state Senate map divides the central business district as well, in much the same way that the Enacted Map does (it is difficult to tell north of I-70, because Woodland Ave terminates shortly to the north of I-70). The state House map, for that matter, splits it between three districts, even though it could be placed within a single district.

Fig. 11: Split of “Central Business District” in State House Map.



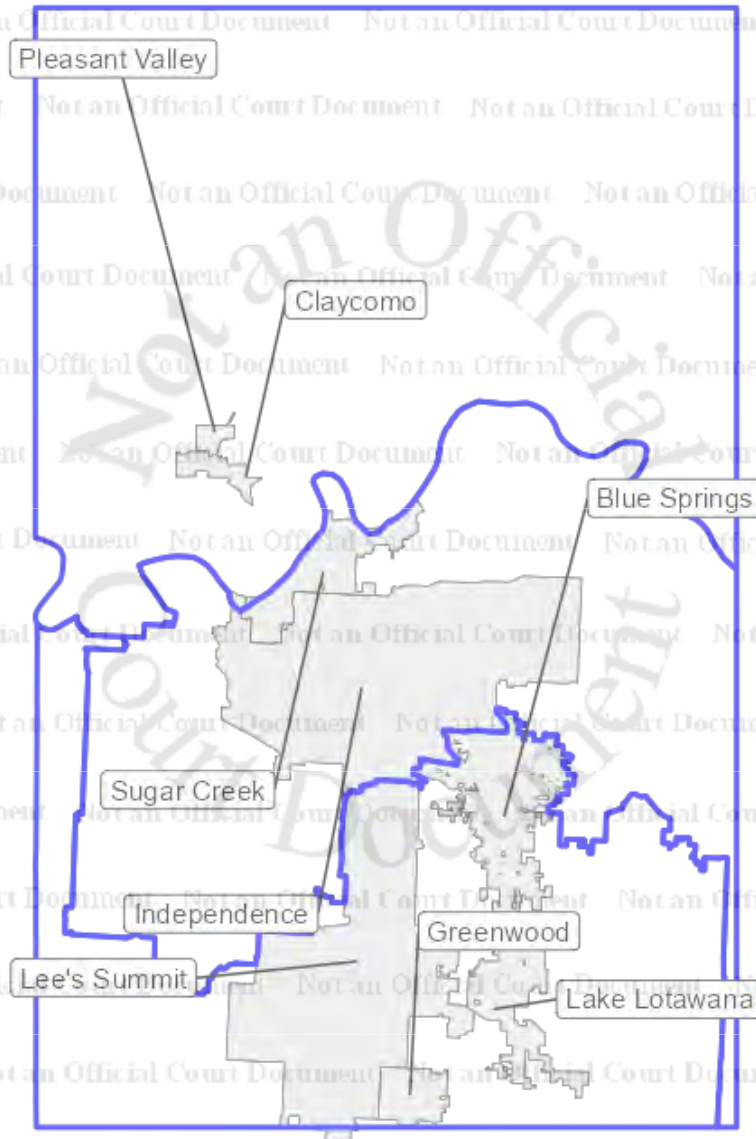
I was also asked to examine how the 2022 Map and Enacted Map split municipalities in Jackson and Clay counties. Both maps split Kansas City between three districts, although the splits in the 2022 Map occur outside of Jackson County. As to the additional municipalities, the 2022 map splits numerous municipalities, including some major Kansas City suburbs: Blue Springs, Claycomo, Greenwood, Independence, Lake Lotwana, Lee's Summit, Pleasant Valley, and Sugar Creek.

Fig. 12: Municipalities in Jackson and Clay counties split in 2022 Map



The Enacted Map fixes most of these splits (indeed as Dr. Cervas' report indicates, the Enacted Map fixes quite a few split municipalities).

Fig. 13: Municipalities in Jackson and Clay counties split in 2022 Map, as treated by Enacted Map



There are cross-county splits for Sugar Creek and Independence, but these are unpopulated.

As a final note, the split places the downtown airport, (Charles B. Wheeler MKC), in the Sixth District. The current Representative from the Sixth is Sam Graves, who chairs the Transportation Committee.

VI. Responses to specific experts.

I have also been asked to review the expert reports of Drs. Jonathan Rodden, Ari J. Stern, Jonathan Cervas and John Cromartie. Despite their considerable lengths, most of these reports make a few discrete points, and for the most part “are what they are.” Their significance is more legal than the sort of things that experts typically comment upon. Nevertheless, there are some important facets worth pointing out.

Dr. Cervas’ report mostly serves to demonstrate that districts 4 and 5 could have been redrawn in such a way as to improve compactness scores. He does so while achieving certain goals: keeping core retention, compactness scores, and political subdivision splits within rough range of the Enacted Map. If the “as may be” portion of the Missouri Constitution requires the *most* compact map to be selected, then the results may be useful for such analysis. If that is the case, however, he would seem to have produced only one map: either Cervas 1—which is the most compact of the three maps—or Cervas 3, which is the most compact of the three maps with only five split counties. Whether that is what the law requires, however, is a legal conclusion that I do not opine about.

Dr. Stern is similar to Dr. Cervas, in that he produces a large number of computer generated maps whose features are purportedly similar to those of the Enacted Map (it is obviously impossible to examine all 100,000 maps). Again, if the point is to demonstrate that it is possible to generate a map that is even *more* compact than the Enacted Map, these maps may be relevant. There are a few points that may be of interest, however. First, 100,000 maps does not necessarily

mean 100,000 conceptually different maps. The differences between Map 12,064 on page 53 and Map 26,709 on page 54, for example, appear relatively minor, with different slight inlets into southern Jackson County; the same is true for Map 58,210.

Second, to the extent that Dr. Stern is engaged in an outlier analysis here—that is, attempting to draw some type of conclusion that the map is particularly non-compact compared to what the ensemble drew—it would be a weaker conclusion than typical. First, because the Enacted Map is similar in compactness to Congressional Maps drawn in Missouri over the past 56 years, this analysis would suggest that those maps were problematic as well. Second, when you perform an outlier analysis for partisanship or race, you instruct the computer to mimic what the map drawer was doing to the best of your abilities, while excluding partisan or racial data. The idea is to sample from the universe of maps that the map drawer could have sampled from if he or she were ignoring political and/or racial data. If the map ensemble fairly reflects the map drawers non-political/non-racial goals but appears to be an outlier with respect to political or racial data from the resulting ensemble maps, then we might conclude that the map maker did not, in fact, ignore political or racial data.

Compactness, however, is different. First, and perhaps most obviously, very few people draw with specific compactness numbers in mind. While experienced mappers may be able to look at a district and estimate roughly what the Polsby-Popper or Reock score would be, it would be truly extraordinary if one could do so consistently with any degree of precision. This is usually accounted for by fine-tuning a specified compactness parameter in the Ensemble Code to match roughly the scores of the Enacted Map.

Herein lies the rub. While Dr. Stern claims that he did not impose any compactness parameters, the truth is that the GerryChain methodology by its nature will do so. This is because

spanning trees – the method used by ReCom in GerryChain to identify potential splits – by its nature creates compact maps. Spanning-tree-based recombination does not *enforce* compactness, but it tends to avoid extreme or pathological district shapes. As Dr. Moon Duchin, one of the leads on the GerryChain project explained: “So it’s worth saying the basic method creates plans that take into account population balance that ensure contiguity and that prioritize compactness, upweight compactness. But they do that without having to set -- dial a knob [sic] to the preferred level of compactness. It’s kind of baked into the mathematical calculation.”). PI Tr., Direct Exam of Moon Duchin, Ph.D., 10/06/2025 AM, at 58:3-21 ([58:16-21]). *See also* D. DeFord, M. Duchin & J. Solomon, *Recombination: A Family of Markov Chains for Redistricting*, 3 Harv. Data Sci. Rev. (2021), available at <https://hdr.mitpress.mit.edu/pub/1ds8ptxu/release/5> (“In shifting to spanning tree-based sampling methods to overcome the limitations of *Flip*-based chains, we were led to a new point of view on compactness that has significant independent value. Recombination implements compactness in a soft stochastic fashion, rather than selecting and manually weighting or thresholding a score. We make the case that this spanning tree count favored by recombination amounts to a new kind of compactness, better suited to the needs of redistricting: it draws on latent cluster structure in geographical networks rather than treating redistricting as a Euclidean geometry problem where ideal districts are circles and squares.”) (“In Section 5.1, we explain why this favors plans that look plump and compact to the eye.”)(discussing ReCom’s “natural relationship to compactness”).

In other words, ReCom won’t naturally select from the universe of plans that are available to the map drawer. Instead, left to its own devices it will naturally draw districts with a high degree of compactness. This isn’t like political or racial data where leaving out a parameter means the computer will ignore it; it means that left to its own devices ReCom by its nature reverts to a *de*

facto level of compactness by its very nature. Here, if you choose not to decide you still have made a choice.

Additionally, this *de facto* level of compactness isn't necessarily an ideal one. To my knowledge, left to its own devices ReCom does not claim to optimize compactness (nor, for that matter, does it claim to optimize any other considerations such as county or municipal splits without further instructions). Moreover, one *may* adjust the compactness parameter in ReCom upward or downward, so as to favor more- or less- compact districts. Had Dr. Stern done this, he likely would have produced more maps that look like the Enacted Map. Overall, the best one can conclude here is that the Enacted Map does not – at least by some measures – resemble the compactness of maps that ReCom produces. The legal significance of this is unclear. At most this suggests that the map drawer had a somewhat different view of what constitutes “compact” than the ReCom algorithm natural produces.

Finally, note that Dr. Cromartie appears to draw some type of conclusion by the fact that the Enacted Map includes districts combining very different types of counties and extending into different metropolitan areas.¹ But Dr. Stern demonstrates that even a computer drawing blindly to such considerations can make similar choices. Map 88,159 on page 57 includes a District 5 that includes Jackson County, Lafayette County, Saline County, Howard County, Randolph County and portions of Boone County. Dr. Cromartie identifies these as Metro Core, Metro Outlying, Nonmetro, Metro Outlying, and Nonmetro, respectively, on page 10 of his report. It is unclear how Boone County would be classified, but one assumes it is Metro Core.

Much of Dr. Rodden's report is dealt with at other points in this report; much of the rest consists of a smorgasbord of census data and regional information that Missouri map drawers may

¹ It may be useful to observe that District 6 is pulled out of the St. Louis metro area by removing Lincoln County; the district no longer joins portions of the two major metropolitan areas in Missouri.

or may not have relied upon when drawing maps, either this cycle or in the past, that happened to be united in 2022 but were not in the Enacted Map (and may or may not have been in earlier maps he displays). He notes, however, at the end of his report that “[i]t does not appear that the 2025 Map’s deviation from the principle of closely united territory arose from an effort to preserve boundaries of Missouri Senate districts.” Rodden Report, at 37. It is unclear exactly why he comes to this conclusion. His own map illustrates that the split of Jackson County barely deviates from state senate boundaries. It splits one state senate district, leaving around 85% of that district’s population intact. Given that there are no other county splits in districts 5 or 6, it would be an exceeding stroke of luck to not have to deviate from *some* state senate boundary in the map, since state Senate districts are not required to be equipopulous, or to have to do so within the one county that is split. While the 2022 Map might split fewer districts *outside* of Jackson County, rural Missouri has large state senate districts that sprawl multiple counties; keeping counties whole will often be at odds with avoiding senate district splits.

As to the other boundary splits that Dr. Rodden examines, given that the map closely follows state senate boundaries in Jackson County, it is unsurprising that it is less attentive to state Assembly district or school district boundaries within Jackson County. It would only follow these boundary lines to the extent that state Senate districts follow these boundary lines. The one exception here – which Dr. Rodden does not examine – is municipal splits where, partially by virtue of following state Senate boundaries, the Enacted Map improves upon the 2022 Map.

This also addresses one of Dr. Rodden’s more incendiary claims: That there is a potential racial gerrymandering claim at work here. To my knowledge, such a claim has not been brought. Dr. Rodden emphasizes Troost Ave. as a racial dividing line. But the Enacted Map also follows closely the State Senate boundary here, which also divides along Troost Ave.

Dr. Rodden suggests that there is something unusual about crossing the Missouri River. He writes “As demonstrated in the historical maps in Part III, the Missouri River has long been part of the dividing line between Districts 5 and 6 in the Kansas City area. In the 2025 Plan, District 6 dips down across the Missouri River and extracts part of Kansas City south of the river for the first time in history.” Rodden Report at 35.

But it is only unusual – at best – (a) to cross the Missouri River (b) into Kansas City and to do so (c) in a District that is numbered six. That is a highly specific complaint. As his own maps demonstrate, the Sixth District has crossed the Missouri River into Jackson County in every map since 1982. And this misses another seemingly crucial observation: The *Fifth District* crosses the Missouri River into Kansas City in both the 2012 and 2022 maps. If anything, this map is the first map since 2002 that doesn’t cross the Missouri River twice in Jackson County.

Dr. Rodden also criticizes the splitting off of Morgan County from other recreation-dependent counties in the Lake of the Ozarks region. But the 2012 map did so as well, splitting off a portion of Camden County, in the same region. In fact, that map used the middle of Lake of the Ozarks as part of its boundary when splitting Camden County; the Enacted Map at least follows a county boundary when doing so.

I declare under penalty of perjury that the foregoing is true and correct to the best of my knowledge. I reserve the right to revise, update, or supplement my opinions as new information becomes available to me.

 1/13/2024