Quello Center Report

Indicators and Methods for the Assessment of BEAD Implementation and Broadband Policy

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July 8, 2026

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Methodological note

Due to the extended timeline of final plan approvals and additional wait for the release of official data, some of the information in this report is incomplete. We included data released by the National Telecommunication and Information Administration (NTIA) through May 18, 2026. As of that date, all eligible entities had submitted final proposals to the NTIA. Except for the proposals submitted by California and Illinois, NTIA had approved all plans. Final data for California, Illinois, the District of Columbia, Puerto Rico, and Virgin Islands were not yet accessible in the public domain. For now, we are using available preliminary data for these two states and the District of Columbia. No NTIA-approved data is currently available for Puerto Rico and the Virgin Islands. Some of the numbers in this report, for example, national averages or medians, will likely change marginally once official final numbers are available. Numbers that will likely be affected are shown in double brackets ([[xx]]) and must be considered preliminary. The results of the statistical analyses in Appendix B are also affected by the preliminary nature of a few data points, although we do not expect major changes to these analyses. We will update this report with final numbers once they are available.

Acknowledgements

We gratefully acknowledge support by the Broadband Access Initiative (BAI) of The Pew Charitable Trusts. Dr. Sharon Strover, University of Texas at Austin and Dr. Mark Jamison, University of Florida, reviewed an earlier version of the draft report. Their constructive comments and suggestions helped improve substance and clarity. Detailed feedback by Dr. Colby Humphrey and Lexi West from the Broadband Access Initiative further improved the organization and details of the report. The views expressed do not necessarily reflect those of the Broadband Access Initiative.

Executive summary

It is promising that the BEAD program is advancing into its implementation phase. Since the passing of the Infrastructure Act in 2021, both the magnitude of the connectivity problem and the proposed solutions have changed. Preliminary data indicate that the number of BEAD-eligible locations has declined by more than 50% since 2022. The BEAD Restructuring Public Notice of June 6, 2025, made broad changes to the program. The required additional state planning efforts pushed the rollout to 2026, but the restructuring also included provisions that might speed up the completion of the program.

In most states, the number of BEAD-eligible locations is lower than when awards were made in June 2023. This is the result of several factors. Private sector investment and other broadband support programs (e.g., the Capital Projects Fund) facilitated connecting locations, thus lowering the count. In addition, the restructured BEAD program broadened the scope of eligible technologies to include unlicensed fixed wireless (ULFW) as an eligible technology. As a result, areas currently covered by ULFW were reclassified as being served, thus removing them from the unserved count. Although new housing construction and more accurate maps added BEAD-eligible locations in some states, the overall national count declined by more than 50%.

Despite these improvements in connectivity, monitoring and assessment of BEAD and of the broader policy efforts to advance access to high-speed Internet remain vitally important. They are an integral part of the good stewardship of public funds and contribute to accountability and democratic legitimacy. During the implementation phase, assessment helps identify program improvements. It helps distinguish outcomes caused by BEAD and developments that are caused by other factors, such as supply chain issues. Regular assessment can detect unintended consequences early and adopt measures to mitigate them. Finally, periodic assessment contributes to the formation of forward-looking broadband infrastructure policies.

This report proposes a multi-layer approach for the assessment of BEAD implementation, starting narrowly with network deployment. Early assessments can build on the compliance requirements established by NTIA. However, the Infrastructure Investment and Jobs Act (IIJA) of 2021 envisioned broadband as an essential infrastructure for participation in the society and economy of the United States. We therefore recommend that states go beyond narrow compliance requirements and assess the BEAD program more broadly. To this end, the report recommends collecting selected additional data points related to adoption and pricing that are needed in a comprehensive assessment. It also provides guidance for the assessment of broader community outcomes.

It is important that BEAD-related data are collected at the location level. This will preserve the ability to aggregate information to larger geographies and to integrate it with data from other sources. The indicators proposed in the report are flexible and can be calculated at different levels of granularity, including project areas, sub-grantees that may serve multiple project areas, census geographies, and entire states. Which level is the most appropriate depends on the purpose of a specific assessment. The report recommends three related phases of assessment, from an initial focus on network deployment, to an assessment of eligible entity-wide effects of BEAD, and an assessment of broader community outcomes of better connectivity.

The indicators and empirical assessment methods outlined in this document are designed to serve as initial steps toward a broadband policy learning system. This would be achieved best if states made information collected from subgrantees available to the public in a standardized, comparable form (or if the federal government supported unified reporting). Such information would provide important data to facilitate learning from experience and knowledge sharing that would benefit all states and territories.

Contents

1. Introduction

It is promising to see the Broadband, Equity, Access, and Deployment (BEAD) program move to its implementation stage. Extending connectivity to all currently served and underserved locations supports the broader goal of generating direct and indirect benefits to individuals and communities. The monitoring of progress toward serving all eligible Broadband Serviceable Locations (BSLs) and assessment of the overarching goals of BEAD are integral parts of this next phase of the program. As of May 18, 2026, NTIA had approved the final plans of all 56 eligible entities, giving them the green light to negotiate subawards with Internet Service Providers (ISPs).[1]

This report seeks to provide guidance to eligible entities on how to monitor progress toward BEAD goals and how to assess the broader impacts of public investment. The Infrastructure Investment and Jobs Act of 2021 and NTIA's guidelines for the semi-annual reports by providers and states to NTIA contain detailed instructions on indicators related to network deployment, technical attributes of the connections, the use of subsidies, and progress toward program goals.[2] Monitoring and assessment have diagnostic and evaluative functions. They help identify areas that may impede achievement of program goals, and they help to assess more broadly whether the overarching program goals are reached (see also Bauer et al., 2025, for a detailed discussion).

The information collected by states for the semi-annual reports to NTIA is a starting point for periodic monitoring of the advances toward universal broadband connectivity. While due diligence and compliance with federal rules will create a focus on individual projects and project areas, good stewardship will benefit from monitoring developments across larger geographies, such as census tracts, counties, and the entire state. Until newly connected locations show up in other statistics, such as the FCC broadband map, it will be important to keep track of deployment in project areas. Additional insights can be gained by comparing individual project areas with other areas in the state and possibly with developments in other states.

In most states, BEAD must close connectivity gaps across widely dispersed locations, not in contiguous unserved areas. Program assessment therefore encompasses multiple components. The first task is to monitor progress toward connecting these locations. The Semi-Annual Reports to NTIA (SARs) will generate most of this information, including the type of connection, capacity (download and upload speeds), and reliability. Secondly, a more comprehensive assessment of state-wide connectivity policy will require additional data that goes beyond SARs, such as the

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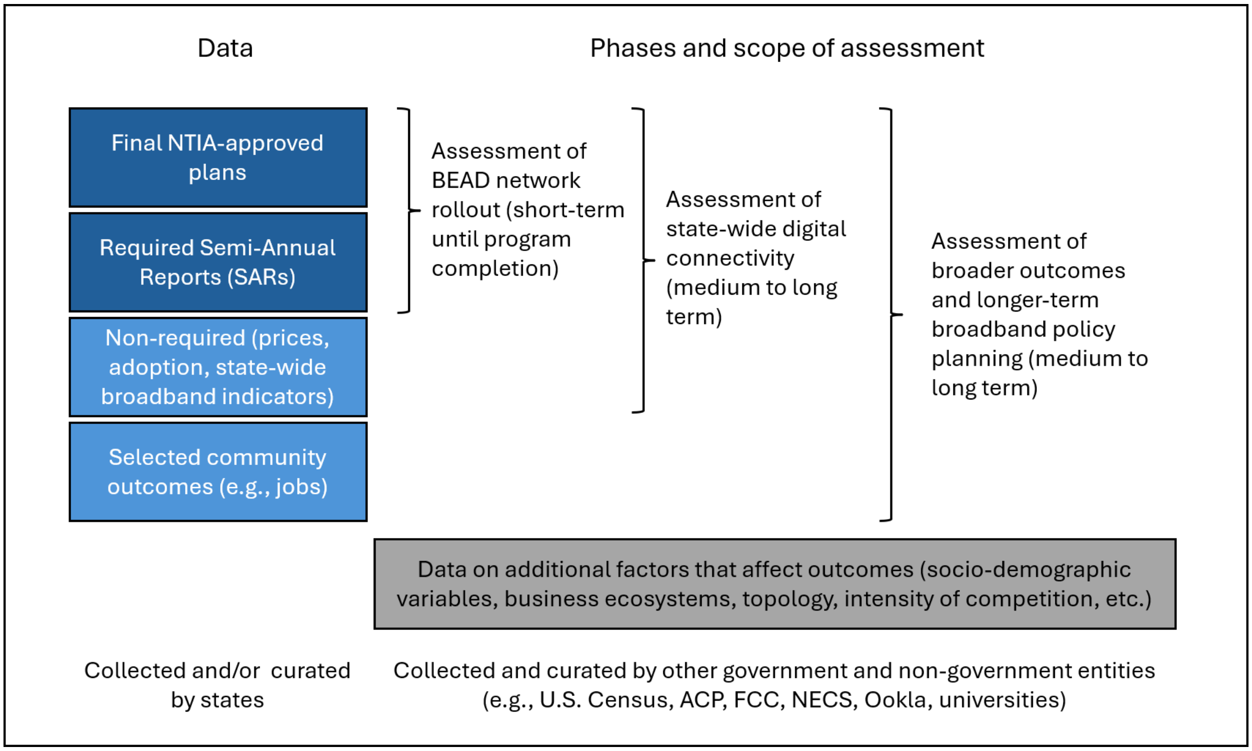
[1] As of April 19, 2026, the plans of California, Illinois, and Oklahoma had not received NTIA approval (see https://www.ntia.gov/funding-programs/internet-all/broadband-equity-access-and-deployment-bead-program/progress-dashboard, retrieved on April 18, 2926). On February 16, Louisiana announced that it had started to distribute infrastructure funds to providers (see https://mailchi.mp/la.gov/connectla-emails-10606570?e=44a6e40294).

[2] NTIA issued the BEAD Semi-Annual Performance (Technical) V 2.0 Report Form October 25, 2025 (see https://broadbandusa.ntia.gov/sites/default/files/2025-10/NTIA_BEAD_Semi-Annual_Technical_Report_v2.0_Form.pdf, retrieved on April 18, 2926). At the same time, the agency released answers to BEAD-related Frequently Asked Questions (last updated on April 2, 2026, see https://broadbandusa.ntia.gov/technical-assistance/BEAD_FAQs, retrieved on April 18, 2026).

prices at which services are offered and the adoption of service. However, such data can be collected with innovative methods and incremental effort.

Fig. 1.1: From data to assessment



A third task of assessment is an analysis of the broader effects of improved broadband connectivity on individuals and communities. This task is critically important, but it is more difficult than the assessment of network deployment. Effects of improved connectivity will only become visible over time so that a longitudinal measurement approach is needed. Public data that allows assessing program impacts, such as information from the U.S. Census and the American Community Survey (ACS) is not immediately available. Moreover, other factors that influence outcomes on jobs, education, and health must be considered. However, policy evaluation and empirical research offer appropriate tools, such as interviews, focus groups, surveys, and statistical analyses that can be brought to these tasks.

For these levels of evaluation, appropriate baselines must be established against which progress can be assessed. In addition to a meaningful starting point, effective metrics and indicators to track progress over time, and methods to make comparisons between areas will be needed. Comparisons between geographic areas may provide additional insights. However, to do this well, the effects of confounding factors that affect the cost and speed of deployment must be considered. For example, the ruggedness and topology of the terrain or the dispersion of the locations to be served will have an impact and must be accounted for in comparisons. During the early network rollout phase, SBO's monitoring efforts will pragmatically focus on BEAD-eligible locations, but it is important to develop more comprehensive perspectives early.

In addition to assuring compliance with pertinent federal and state regulations, monitoring and assessment of network deployment is essential for effective BEAD program management. This will help to diagnose potential roadblocks, such as permitting or supply chain issues, early and to ensure the prudent use of public funds. It is therefore important that State Broadband Offices (SBOs) develop appropriate reporting mechanisms, as part of the sub-awards and in addition to them. Because data collection is costly, such requirements should be designed to generate necessary information at the lowest possible administrative burden for subgrantees and SBOs.

From a state and national perspective, standardized reporting by states would be desirable, as it allows generating more robust knowledge about the effects of variations in approaches. The reporting requirements established in the Infrastructure Act and detailed by NTIA go a long way to achieve that goal. However, as of now it is not expected that NTIA will make the data reported by the eligible entities publicly available. Therefore, this report encourages eligible entities to release the reported data publicly. Moreover, important performance metrics, such as the adoption rates and the prices of service, are not part of the required semi-annual reports. To close this gap, this report encourages eligible entities to collect selected additional data that will allow a comprehensive assessment of the program and better planning for the future.

This report is organized as follows. The next section documents the NTIA-approved baseline data for eligible entities, including information on BEAD-eligible locations and funding. Section three focuses on the assessment of BEAD-funded network deployment. It presents metrics that should be documented and calculated as part of the semi-annual reporting process and metrics that measure the success toward BEAD goals over time. Moreover, it proposes indicators that would greatly improve program assessment beyond infrastructure investment goals. Section four discusses how SBOs can examine the effects of BEAD investment on digital equity and broader community outcomes. Section five provides a brief outlook and concluding thoughts.

2. NTIA-approved baselines for eligible entities

2.1 Number of BEAD-eligible locations

The number of unserved and underserved locations that need to be connected or upgraded to at least 100/20 Mbps is an important initial baseline for BEAD.

Table 2.1: Unserved and underserved locations by state

	Number of unserved and underserved locations (FCC 2022 Broadband Map data, base for BEAD allocation)			NTIA approved (2025-2026)	Change from 2022 FCC data			
State, Territory	Unserved locations	Under-served	Unserved and under-served	Total	Change from 2022 unserved	Change in %	Change from 2022 total	Change in %
AL	331,206	96,640	427,846	94,555	-236,651	-71.5	-333,291	-77.9
AK	88,182	17,381	105,563	46,508	-41,674	-47.3	-59,055	-55.9
AR	215,621	93,920	309,541	79,293	-136,328	-63.2	-230,248	-74.4
AZ	177,325	141,416	318,741	161,648	-15,677	-8.8	-157,093	-49.3
CA	306,910	154,689	461,599	339,822	32,912	10.7	-121,777	-26.4
CO	147,484	89,025	236,509	96,065	-51,419	-34.9	-140,444	-59.4
CT	11,693	4,065	15,758	1,782	-9,911	-84.8	-13,976	-88.7
DC	184	30	214	101	-83	-45.1	-113	-52.8
DE	2,052	12,904	14,956	4,739	2,687	130.9	-10,217	-68.3
FL	272,961	135,371	408,332	73,944	-199,017	-72.9	-334,388	-81.9
GA	315,780	95,845	411,625	119,814	-195,966	-62.1	-291,811	-70.9
HI	11,671	1,071	12,742	7,033	-4,638	-39.7	-5,709	-44.8
IA	83,509	70,506	154,015	37,634	-45,875	-54.9	-116,381	-75.6
ID	85,902	52,094	137,996	91,341	5,439	6.3	-46,655	-33.8
IL	239,687	128,388	368,075	159,085	-80,602	-33.6	-208,990	-56.8
IN	202,020	106,583	308,603	122,847	-79,173	-39.2	-185,756	-60.2
KS	87,489	57,313	144,802	26,613	-60,876	-69.6	-118,189	-81.6
KY	259,258	60,955	320,213	87,160	-172,098	-66.4	-233,053	-72.8
LA	296,777	78,938	375,715	127,108	-169,669	-57.2	-248,607	-66.2
MA	12,522	7,602	20,124	3,808	-8,714	-69.6	-16,316	-81.1
MD	44,411	23,032	67,443	9,771	-34,640	-78.0	-57,672	-85.5
ME	42,264	50,289	92,553	22,513	-19,751	-46.7	-70,040	-75.7

MI	368,388	123,935	492,323	197,964	-170,424	-46.3	-294,359	-59.8
MN	135,984	76,778	212,762	74,739	-61,245	-45.0	-138,023	-64.9
MO	337,484	107,211	444,695	204,366	-133,118	-39.4	-240,329	-54.0
MS	268,365	39,397	307,762	93283	-175,082	-65.2	-214,479	-69.7
MT	104,534	49,499	154,033	68,498	-36,036	-34.5	-85,535	-55.5
NC	376,037	127,391	503,428	93,437	-282,600	-75.2	-409,991	-81.4
ND	7,988	1,858	9,846	279	-7,709	-96.5	-9,567	-97.2
NE	70,478	38,123	108,601	14,064	-56,414	-80.0	-94,537	-87.0
NH	25,572	10,704	36,276	5,135	-20,437	-79.9	-31,141	-85.8
NJ	43,324	29,212	72,536	11,479	-31,845	-73.5	-61,057	-84.2
NM	114,997	76,705	191,702	42651	-72,346	-62.9	-149,051	-77.8
NV	51,689	8,985	60,674	26,236	-25,453	-49.2	-34,438	-56.8
NY	149,368	36,659	186,027	52,982	-96,386	-64.5	-133,045	-71.5
OH	183,709	108,611	292,320	83,992	-99,717	-54.3	-208,328	-71.3
OK	150,718	147,042	297,760	40,509	-110,209	-73.1	-257,251	-86.4
OR	122,382	62,188	184,570	104654	-17,728	-14.5	-79,916	-43.3
PA	278,535	51,154	329,689	129356	-149,179	-53.6	-200,333	-60.8
RI	2,309	586	2,895	2,622	313	13.6	-273	-9.4
SC	119,580	78,733	198,313	20,480	-99,100	-82.9	-177,833	-89.7
SD	28,397	14,196	42,593	7,060	-21,337	-75.1	-35,533	-83.4
TN	186,394	57,323	243,717	43871	-142,523	-76.5	-199,846	-82.0
TX	779,377	362,878	1,142,255	242,903	-536,474	-68.8	-899,352	-78.7
UT	41,535	28,107	69,642	30,215	-11,320	-27.3	-39,427	-56.6
VA	364,155	59,718	423,873	85,069	-279,086	-76.6	-338,804	-79.9
VT	33,646	27,953	61,599	15299	-18,347	-54.5	-46,300	-75.2
WA	236,535	85,029	321,564	166,564	-69,971	-29.6	-155,000	-48.2
WI	253,097	210,952	464,049	175,464	-77,633	-30.7	-288,585	-62.2
WV	271,623	40,428	312,051	73,091	-198,532	-73.1	-238,960	-76.6
WY	39,215	20,403	59,618	38,558	-657	-1.7	-21,060	-35.3
AS	1,782	--	1,782	6,962	5,180	290.7	5,180	290.7
GU	34,251	--	34,251	1,542	-32,709	-95.5	-32,709	-95.5
NMI	10,088	--	10,088	9,568	-520	-5.2	-520	-5.2
PR	61,871	--	61,871	N/R	N/R	N/R	N/R	N/R
VI	557	--	557	N/R	N/R	N/R	N/R	N/R
US	8,488,872	3,559,815	12,048,687	3,876,076	-4,440,159	-52.3	-7,852,932	-65.2

Notes: The initial allocation of BEAD funds was based on unserved locations as documented in the December 2022 version of the FCC Broadband Map. The total number of locations approved by NTIA in 2025 included both unserved and underserved locations. We show both the change from unserved (as this gives an indication of the changes from the number on which fund allocation was based) and from the total number of unserved and underserved lines in December 2022 (to show the change based on the definition used by NTIA in 2025). N/A … not available at the time this report was revised because state plan is not yet approved. N/R … not reported at the time this report was revised even though NTIA approved the plan. -- … data not available.

Sources: NTIA, state final plans, own calculations.

Table 2.1 above and Table A.2.1 in Appendix A depict the number of unserved and underserved locations for December 2022, the first version of the new FCC Broadband Map that was used to determine BEAD allocations. Congress established a three-part formula in the Bipartisan Infrastructure Bill. According to this formula, the funds allocated to each state consisted of a flat award and funding tied to the number of high-cost locations as a share of the total number of high-cost locations across the United States. The third component was linked to the share of an eligible entity's unserved locations in the total number of unserved locations across the United States. The allocations were announced by the Biden Administration in June 2023.

Table 2.1 also includes the numbers established in the final state plans that were approved by the NTIA. That latter number includes unserved and underserved locations. The table also includes the difference between those two points in time. Because the final NTIA approved number includes unserved and underserved locations, we show the change from the number of unserved locations used for the allocation and from the total number of (unserved plus underserved) locations. Nationwide, the number of BEAD eligible locations at the time of final plan approvals was [[52.3%]] lower than the number of unserved locations in 2022. Although the initial BEAD allocation was based on unserved locations only, the final NTIA-approved numbers for BEAD-eligibility also include underserved locations. Thus, a comparison of the final approved number with the total of unserved and unserved locations at the time of funds allocation is also informative. The final number was [[65.2%]] lower than the total number of unserved and underserved locations in the FCC Broadband Map data as of December 2022.

Several factors contributed to the much lower numbers of locations without or with insufficient connectivity. Most importantly, they include network deployment supported by other federal and state programs, such as the $10B Capital Projects Fund (CPF), various pandemic relief programs that facilitated network investment, continued private sector investment, changes in the BEAD program rules such as the inclusion of ULFW, and socio-economic changes.[3] Moreover, the December 2022 data were based on a preliminary broadband map developed by the FCC, which was expected to be corrected. The restructured BEAD program required states to consider locations where unlicensed wireless service at 100/20 threshold or better was available as served

[3] A detailed and rigorous analysis of these changes will be conducted separately.

and excluded from BEAD eligibility. Finally, several of the NTIA-approved final plans may fall short of serving all BEAD-eligible locations.[4]

At the level of individual states, there is considerable variation, with both reductions in the number of eligible locations and increases in a few cases. Relative to the number of unserved locations in 2022, the number of BEAD eligible locations has declined in 49 of the 54 states and territories for which official numbers are available. The declines range from 1.7% in Wyoming to 96.5% in North Dakota. The number of BEAD eligible locations is higher in five eligible entities, with the increase ranging from 6.3% in Idaho to 290.7% in American Samoa (the latter from a small base). The change in BEAD-eligible locations due to the factors discussed above is higher in comparison with the total number of unserved and underserved locations in 2022. Relative to that starting point, BEAD-eligible locations were lower in 53 of the 54 eligible entities for which official data is available. The decline ranges from 5.2% in Northern Mariana Islands to 97.2% in North Dakota. The count has increased only in American Samoa. In some eligible entities, such as Delaware, Washington, D.C. or Rhode Island, the absolute number of eligible locations is low, so the changes should be interpreted jointly with the total number of locations that are affected.

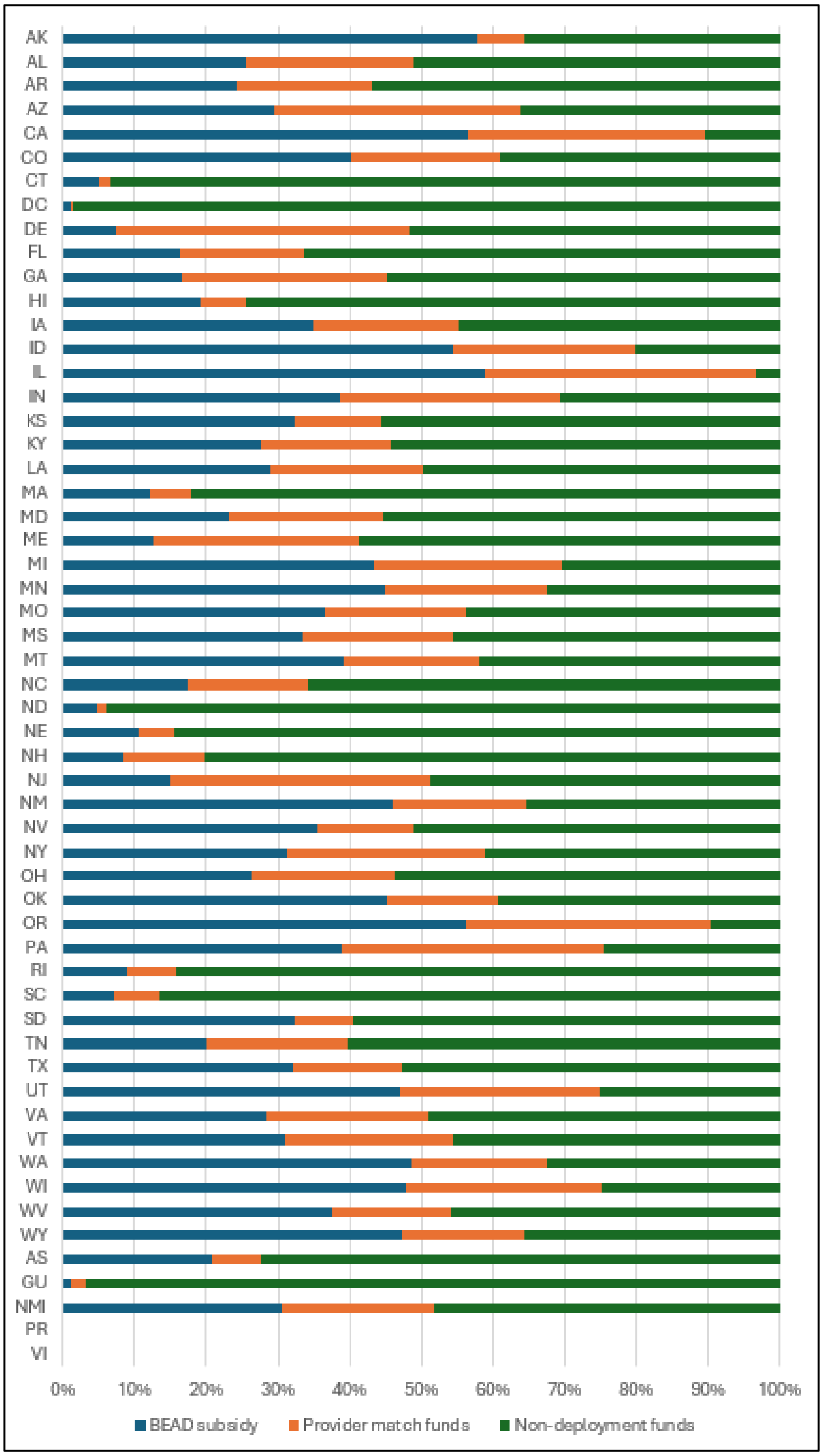
Continued private sector investment in broadband contributed to the reduced number of unserved and underserved locations. Studies of the drivers of broadband investment show that it is influenced by economic and social factors, such as cost conditions and household income (e.g., (Prado & Bauer 2022). Because these factors differ across states, broadband connections were added at varying rates. Data from state planning efforts show that the cost of serving the remaining locations increases rapidly for the most difficult to reach locations. Empirical data is difficult to come by, but the economic logic of broadband investment suggests that the additional investment most likely went to locations that were relatively cheaper to serve. Consequently, the remaining locations will likely be increasingly costly to connect.

One consequence of this uneven pattern of investment across the country is that the initial BEAD allocations are increasingly misaligned with remaining state needs. Our statistical analysis of the BEAD funding revealed that the three-part formula adopted by Congress to determine state allocations resulted in an outcome that was not well aligned with the cost conditions in states (see Appendix B; (Mack et al., 2025). The differential investment pattern since the BEAD allocation was made has aggravated this misalignment in many cases. One mitigating factor is that the overall lower number of eligible locations helps states whose BEAD funding fell short of actual needs, such as Colorado.

[4] Accurate data on the number of locations that may remain unserved are not available. Preliminary estimates have to be uses with caution but suggest that up to 1 million locations might be affected (see https://broadbandexpanded.com/posts/unservedafterbeadfeb2026, retrieved on April 18, 2026).

2.2 BEAD subsidies, provider matches, and non-deployment funding

Figure 2.1: BEAD subsidy, provider match, and non-deployment funds by state (% of initial BEAD allocation) (Source: NTIA, state final plans, own calculations)



The restructured BEAD program required states to minimize subsidy costs when selecting subgrantees.[5] The data depicted in Figure 2.3 and in Table A.2.4 in Appendix A reflects a higher share of wireless and satellite technologies than preliminary data available from the original BEAD program.

However, the substitution of wireless and satellite unfolded unevenly across states. This contributed to widely varying shares of non-deployment funds (BEAD allocation from June 2023 minus required subsidies).[6] How these funds may be used awaits clarification from the Department of Commerce. Several states would likely have realized significant non-deployment savings under the original BEAD rules because the number of BEAD eligible locations in most states and territories in 2025 was lower than the number upon which the 2023 BEAD allocation was based.[7]

2.3 Average funding per location

Figure 2.2 and Table A.2.2 in Appendix A show the average BEAD subsidy required per location across the states and territories, and the average provider matches committed during the benefit-of-the-bargain round. Across all eligible entities for which data is available, the median BEAD subsidy per location is [[$4,632]], and the median match contributed by providers is [[$2,932]] (see Table A.2.3 in the appendix). With [[$4,775]] the national average BEAD subsidy is slightly above the median, and the national average provider match of [[$3,081]] is slightly above the median provider match. The median of total funding per location across the eligible entities for which data is available is [[$7,433]] and the national average total funding is [[$7,856]].

As Figure 2.2 shows, in most states the average providers' match is lower than the average BEAD subsidy, but the numbers are often close. In several states, including Alaska, the District of Columbia, North Dakota, New Mexico, Nevada, South Dakota, West Virginia, and Wyoming the average BEAD subsidy is more than twice the average providers' match. In Delaware and New Jersey, the average subgrantee match is substantially higher than the average BEAD subsidy. These numbers illustrate the diversity of conditions and the varying willingness of providers to match public funds.

The differences reflect several interacting factors. Cost conditions for serving the remaining locations vary greatly across states. For example, population density in Delaware is about 520 people per square mile, but only 12 in North Dakota. Population dispersion as well as topological

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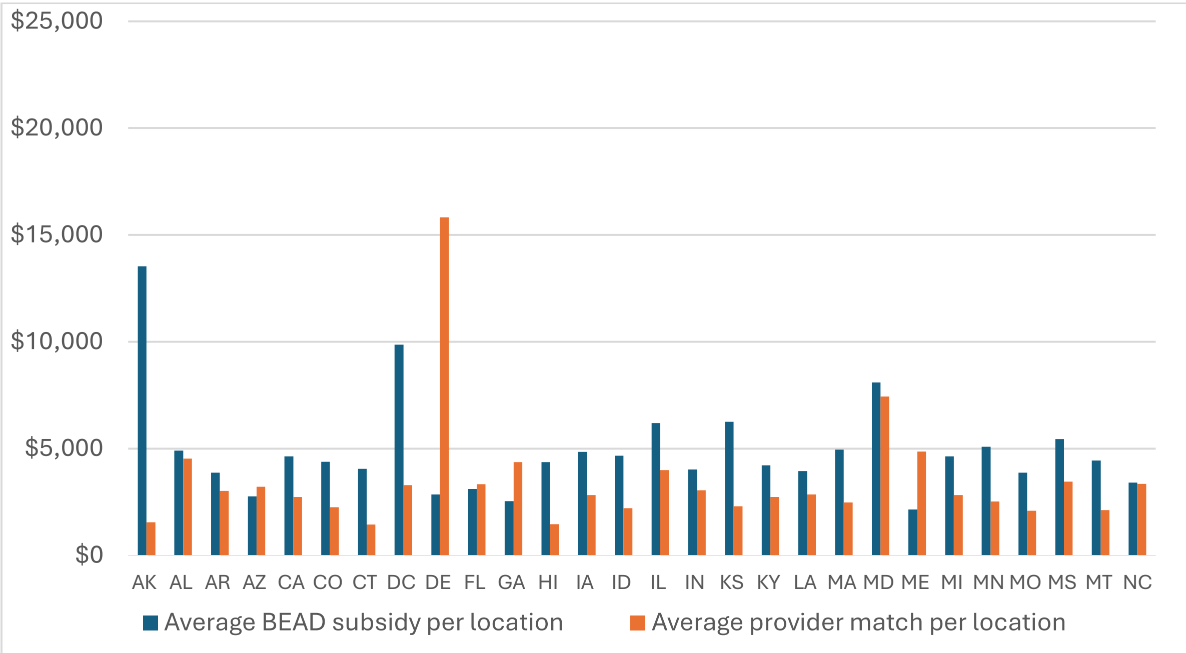
[5] Because the program left open whether or how funds that were not used could be used, it created ambiguous incentives for the states. Trying to minimize costs could result in less robust connectivity with uncertainty about non-deployment funds. Pushing fiber further out to more expensive locations, as was the original BEAD plan, could increase subsidy costs and result in top-down cuts by NTIA.

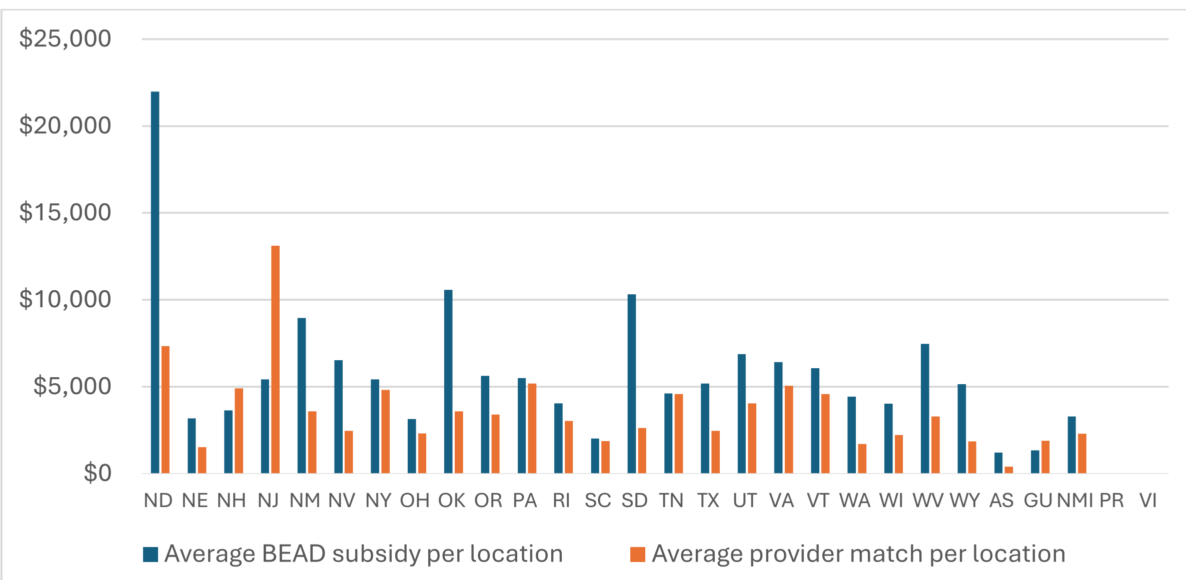
[6] The non-deployment funds presented here are NTIA-based numbers. The actual amounts received by the states may vary from this number and will be known once the Department of Commerce releases its guidance.

[7] For example, Louisiana's original BEAD plan filed in 2024 (but never approved by NTIA) anticipated $450M in non-deployment funds. The final, NTIA approved plan in 2025 shows anticipated non-deployment funds of $856M,

conditions vary greatly between these states. There are also demand-side differences in state median incomes that affect how far the network will be extended without a need for a subsidy. Finally, the market structure of service providers varies between states.

Figure 2.2: Average BEAD subsidy and provider match, per location in US $ (Source: NTIA, state final plans, own calculations)





Using a ranking of national median and average values to classify states from the "most efficient" to the "least efficient" may be tempting but it has important caveats.[8] It does not correct for confounding factors, such as varying cost conditions that are often in play, and therefore can easily be misleading.

2.4 Planned technology mix

The original BEAD program envisioned deploying fiber to as many locations as possible within the funding constraints imposed by the available subsidies and the willingness and ability of providers to generate the required matching funds. The restructured BEAD program changed this goal to serving the remaining locations with the minimum required subsidy. This constrained the ability of states to choose a technology mix. Both the original and the restructured approach have strengths and weaknesses. Restructuring may affect the likelihood that access gaps will be closed in a sustainable way, the scalability of the deployed infrastructure, the intensity of competition in future local broadband markets, and the quality and prices of service.

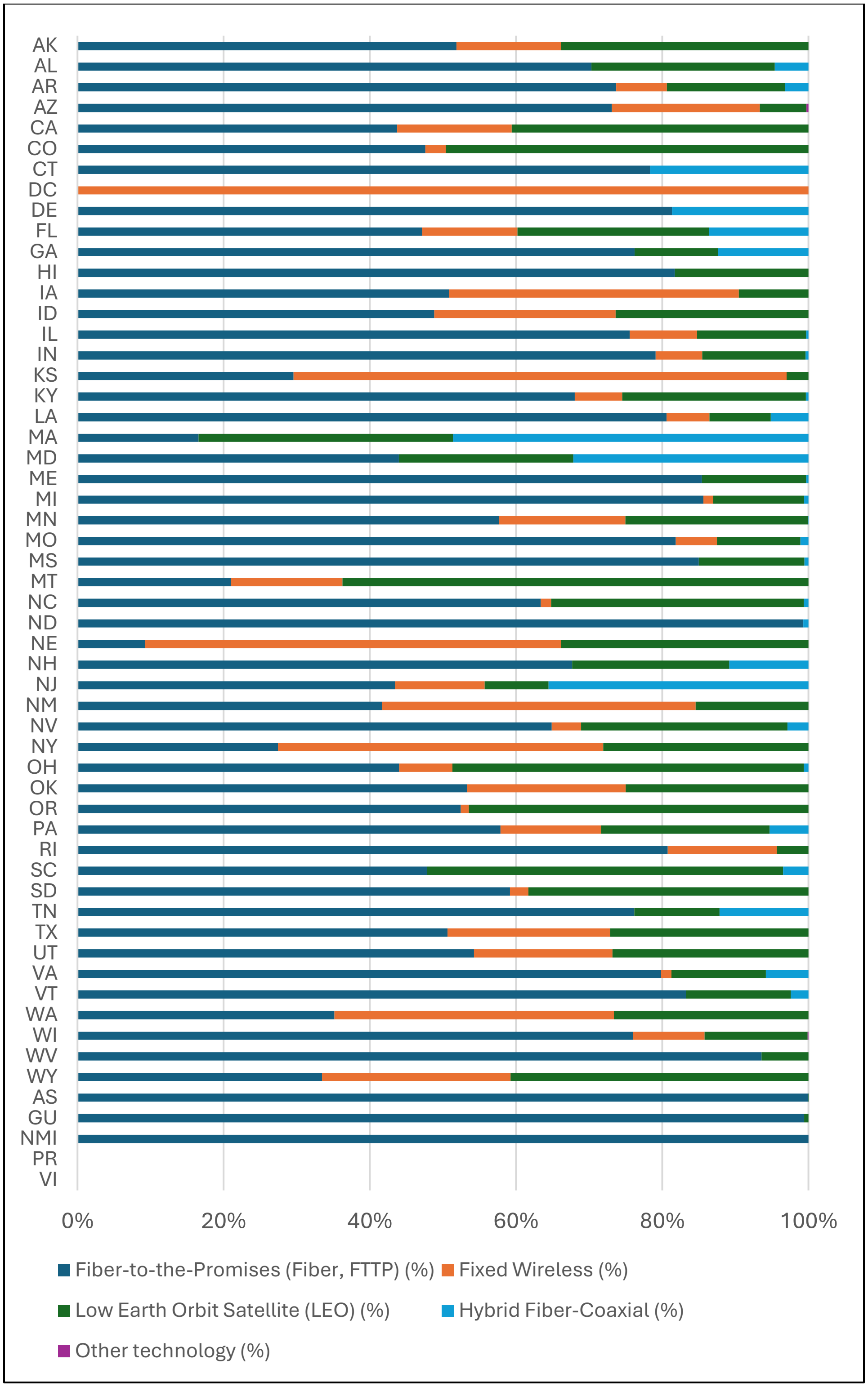
The share of satellite broadband increased significantly in the revised technology mix. Satellite broadband has the potential to provide resilient service to remote locations. At the same time, foliage, topology, and whether conditions can interfere with the quality of the connectivity. There is a shorter record to assess whether satellite broadband can deliver the required minimum service quality of 100/20 Mbps on a sustained basis and whether it can scale to meet future demands. Moreover, Amazon's Kuiper has faced several setbacks in launch technology. It will be important to assess the quality of satellite connections as locations go online.

Prioritizing fiber would have provided stronger confidence that the network could be scaled to meet increasing capacity needs. Although unlicensed wireless and satellite technology might allow comparable scalability, they are less tested. They are also dependent on other policy choices, such as spectrum allocation. Thus, they are afflicted with a higher risk that locations may again suffer from subpar connectivity in the future. Some experts also are concerned that the lifecycle cost of terrestrial wireless and satellite technologies is higher (Afflerbach, 2022).

Scalability, an important feature retained in the restructured BEAD program, is a critical feature when looking forward to AI-enabled services and applications, but it is not the only one. The technical requirements of a next-generation information infrastructure are evolving. Ubiquitous availability, not just at fixed locations, will likely be more important. If 6G wireless services are introduced and gain traction, new demands on the backhaul and middle-mile infrastructure will arise. Moreover, if quantum computing is successful, existing middle mile and access technologies, including fiber, may require significant upgrades to support the transmission of quantum information based on photons.

[8] See, for example, the well-intended analysis by Joe Kane, BEAD's Benefit of the Bargain Round So Far: The Good, the Bad, and the Uncertain, September 9, 2025, Information Technology and Innovation Foundation, retrieved on April 29, 2026, from https://itif.org/publications/2025/09/09/beads-benefit-of-the-bargain-round-so-far/.

Figure 2.3: Planned technology mix for BEAD-eligible locations by state (in % of all BEAD-eligible locations). Source: NTIA, state final plans, own calculations.



Of the [[3,876,076]] BEAD eligible locations nationwide, NTIA-approved plans show that subgrantees plan to extend fiber to [[62.3%]], hybrid fiber-coaxial to [[1.9%]], fixed wireless to [[12.4%]], satellite to [[23.4%]]. This is a considerable change from the initial goals of BEAD to deploy fiber deep to the edges of the network. One of the immediate benefits may be a shortening of the wait time of users to be connected, given that non-wired technologies can be deployed faster in many locations. Given cost differences between technologies, the restructured BEAD program contributed to a reduction in the required short-term subsidies. Although the details are heavily dependent on local conditions, in general fiber has the highest initial investment cost, and FWA and ULFW are cheaper to deploy but have higher maintenance and upgrade cost. Costs for LEO satellites are difficult to compare, given their unique cost structure. LEOs have very high fixed costs of providing capacity but low incremental costs of adding an additional location within capacity limits (Calabrese et al., 2025).

Figure 2.3 and Table A.2.3 in Appendix A show the considerable variation between states. Among the states, the share of BEAD eligible locations for which fiber to the home service is planned ranges from [[0%]] in the District of Columbia to [[99.3%]] in the continental U.S. (and 100% in the New Mariana Islands). The share of hybrid-fiber coaxial cable ranges from [[0%] to [[48.6%]] in Massachusetts. Fixed wireless access ranges from [[0%]] to [[100%]] in the District of Columbia. The share of satellite broadband service ranges from [[0%]] in Connecticut, Delaware, the District of Columbia, and North Dakota to [[63.7%]] in Montana.

Whether the added locations will experience robust and sustained service exceeding the 100/20 Mbps threshold remains to be seen. In principle, fiber is best positioned to meet this expectation but, like other technologies, fiber is subject to interruptions. For unlicensed wireless and satellite, concerns about the scalability to meet growing demand are also relevant. It will therefore be important to build robust measurement frameworks to assess the quality of the future, heterogeneous access infrastructure.

3. Assessment of network deployment

In addition to establishing a baseline, program monitoring and assessment requires indicators that are periodically updated to document progress toward program goals. This includes two types of information: (1) indicators that can be measured at a point in time (e.g., the number of BEAD-eligible locations) (also called "stocks") and (2) variables that are measured over time (e.g., the number of connections added during an observation period) (also called "flows"). In many cases, flows measure the change in the value of stocks between two reporting dates.

The starting point at the time of NTIA approval and before BEAD network rollout starts can serve as a pragmatic baseline for the subsequent assessment of progress toward the goal of connecting all locations and the broader community outcome goals envisioned in the Infrastructure Act. This includes investment data (e.g., the number of locations connected), financial data (e.g., the amount of funds spent), technical specifications of the connections (e.g., supported speed, latency), and information on project timelines (e.g., progress toward milestones).

3.1 Indicators documenting BEAD rollout

3.1.1 Essential indicators

A logical starting point for documenting network deployment is the data reported as part of compliance requirements. From this information, a first set of indicators can be generated to gain insights into progress toward closing access gaps. However, comprehensive assessment of the effects of the investment will require curation and possibly collection of additional data, as will be discussed in section 4.1.2 below.

Given the focus of the restructured BEAD program on network deployment, this will yield initial indicators focusing on the number of BEAD-eligible unserved and underserved locations. States should also collect data on the technologies envisioned to serve locations, financial information such as the use of the subsidies and matching funds that were committed, and the timeline for completion, all essential for the assessment of progress. Data should be curated in ways that allow calculating essential network deployment indicators for subgrantees, project areas, and for the entire state or territory.

Good stewardship and public policy require that data be made available in the public domain after they are approved by the eligible entities and NTIA. Failure to do so would greatly complicate any assessment and deviate from best practices that have evolved during the past few years among SBOs. The data should be collected at the lowest level of granularity, ideally the location level, and in ways that allows aggregating to higher levels, such as project areas, subgrantees, and census geographies. A prudent set of indicators to document network deployment should contain the following information:

- The number of unserved locations as approved by NTIA
- Number of locations that will not be connected by BEAD

- BEAD funds and matching funds committed to connect these locations
- Technologies planned to serve the BEAD-eligible locations
- Technical capabilities of the connections
- Financial performance metrics
- The anticipated time to completion

Table 3.1: Indicators for the assessment of BEAD network rollout

	Priority	Indicator	Measurement, data sources	Timing of data collection
Number of unserved, underserved locations				
☐	High	Unserved locations	Number of unserved BSLs as approved by NTIA	Sub-award, semi-annual thereafter
☐	High	Number of locations that will remain unserved	Benefit-of-the bargain round data	N/A
☐	High	Community anchor institutions (CAIs)	Number of CAIs	Sub-award, semi-annual thereafter
BEAD funds and matching funds				
☐	High	BEAD allocation	NTIA announcement, June 3, 2023	BEAD announcement, June 2022
☐	High	BEAD subsidy	NTIA approved state final plans	Approval date of state final plans
☐	High	Provider matching funds	NTIA approved state final plans	Approval date of state final plans
☐	High	Non-deployment funds	NTIA approved state final plans	Approval date of state final plans
Technologies planned to connect BEAD-eligible locations				
☐	High	Number and share of fiber	NTIA	BEAD announcement, June 2022
☐	High	Number and share of coaxial cable	NTIA approved state final plans	Approval date of state final plans
☐	High	Number and share of fixed wireless	NTIA approved state final plans	Approval date of state final plans
☐	High	Number and share of satellite	NTIA approved state final plans	Approval date of state final plans
Technical capabilities of the connections				
☐	High	Type of connection	Sub-grantee agreements and reports	Signing of agreement, semi-annual reports
☐	High	Upload/download capacity	Sub-grantee agreements and reports	Signing of agreement, semi-annual reports

☐	High	Latency	Sub-grantee agreements and reports	Signing of agreement, semi-annual reports
☐	High	Scalability	Sub-grantee agreements and reports	Signing of agreement, semi-annual reports
☐	High	Resilience	Sub-grantee agreements and reports	Signing of agreement, semi-annual reports
Timeline to completion				
☐	High	Initial time to completion	Sub-grantee agreement	Signing of agreement, semi-annually
☐	High	Remaining time to completion	Sub-grantee semi-annual reports	Semi-annually
☐	High	Completion data	Sub-grantee semi-annual reports	Semi-annually

Given that Community Anchor Institutions (CAIs) are identified separately in NTIA guidance and given their role to facilitate digital access (Strover et al., 2020), states should consider documenting them separately. Following the same format, a prudent set of indicators would include:

- The number of unserved and underserved CAIs
- BEAD funds and matching funds committed to connect these locations
- Technologies planned to serve the locations (fiber, hybrid fiber-coax, fixed wireless, satellite)
- Technical capabilities of the connections (as required by NTIA)
- The anticipated time to completion

3.1.2 Additional indicators not required in SARs

The essential indicators discussed in subsection 4.1 will allow a robust assessment of network rollout. However, they are insufficient for a more comprehensive assessment of the immediate impacts of BEAD investment on individuals and businesses. Because participation in the society and economy of the United States is an important goal, we highly recommend that states collect information on adoption as well as the prices and service conditions of low-cost broadband service options (LCSO). Both adoption and prices are influenced by other factors and are not a narrow metric for BEAD implementation in a narrow sense. However, like the broader community outcomes discussed in the next section, they reflect the overall goals of network rollout in a broader sense. Price and adoption data could be collected as part of the subgrantee reporting process or it could be collected via a separate mechanism:

- Adoption of broadband across BEAD-supported locations
- Prices and service conditions for low-cost broadband service options (LCSO) at BEAD-supported locations

Data collection from subgrantees will eventually be replaced by and integration of the information into broader reporting systems, such as data from the ACS, the U.S. Census, and the FCC broadband maps. Continued monitoring of the broader connectivity landscape of the state will assist in forward-looking broadband policy development and facilitate the assessment of broader community impacts. To monitor the state of broadband beyond BEAD, states should develop reliable inventories of the state of connectivity to document the status of broadband across areas that are considered served and new locations that may or may not be served.[9]

Many states already have developed accurate broadband maps. These or other publicly available sources (each with their own advantages and disadvantages) are natural building blocks of state-wide documentation of digital connectivity. However, additional data points that are critical for an assessment of broadband connectivity are missing and will require additional effort. Broadband prices are currently not comprehensively documented. A limited set of broadband prices is collected by the FCC for urban areas, but information for non-urban areas is missing or patchy. Adoption data is available with delays from the ACS and from the NTIA Internet use surveys, even though connecting broadband data with socio-economic variables such as income can only be done indirectly from these sources.

In support of comprehensive assessment of the state of broadband connectivity, states should document and assess the following indicators on a state-wide basis (the list of suggested metrics includes fewer indicators than Table 3.1 as the purpose is slightly different):[10]

- Total number of locations served in the state (if possible synchronized with the annual BEAD reporting requirements)
- Technologies used to serve these locations (fiber, hybrid fiber-coax, fixed wireless, satellite)
- Technical capabilities/metrics for served locations (if available, by technology)
- Adoption of broadband across the state
- Broadband prices and service conditions

3.1.3 Granularity of reporting and analysis

BEAD aims to overcome a complicated problem: connecting dispersed and often remote locations to broadband. Whereas states have to follow federal guidelines, there is flexibility in how to establish project areas. Some states use pre-existing area boundaries, such as census blocks, census block groups, or ZIP codes. Other states have created custom maps that applicants for

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[9] The number of Broadband Serviceable Locations (BSL) changes continuously as existing locations may be retired, and new construction may generate additional locations. For example, CostQuest Associates reported in February 2026 that the number of 12.3% of counties experienced an increase in the number of unserved BSLs between Version 6 and Version 7 of CostQuest's Location Fabric. See Broadband in America Report: Analysis of Broadband Coverage Changes—February 2026 Edition, https://www.costquest.com/resources/articles/broadband-in-america/broadband-in-america-report-analysis-broadband-coverage-changes-2026-02/, retrieved on April 20, 2026.

[10]

BEAD funding have to adhere to. Ideally, information for monitoring and assessment purposes would be publicly available at a high level of granularity and for areas that can be compared across states.

The achievable level of granularity is likely constrained by concerns about proprietary information that SBOs must navigate. It would be desirable to have crosswalks from project areas to census geographies, which then would allow more systematic comparisons across areas within a state and across states. It would also facilitate linking BEAD observations with the broader connectivity ecosystem that is documented in already existing broadband statistics (e.g., the American Community Survey) and socio-demographic data.

All the indicators discussed in the following sections can be generated for various geographic areas, including project areas, census block groups, counties, and states (provided there are crosswalks between these geographic areas that allow attributing the information appropriately). They can also be generated for subgrantees. For the purposes of this report, we present information at the state level. Adapting the indicators to other levels of granularity would be straightforward if the data is collected with appropriate spatial and provider identifiers, which we highly recommend.

The appropriate level of analysis will depend on the type of assessment. Initially, as the focus is on BEAD-eligible locations, data documenting progress at that level would be desirable. For financial analyses, such as the amount of funds expended, such granularity would not be needed, and either project areas or subgrantees would be appropriate. Later in the development of BEAD, states may be interested in broader community outcomes. This requires linking network rollout data with socio-demographic and other variables, which may only be available at the level of census tracts or even the county level. To allow assessments at these levels of granularity, states should document BEAD progress at the highest level of granularity possible so that subsequent work can aggregate data to the appropriate level. If states only document highly aggregated data, such as the entire state or large regions in the state, program assessment will be jeopardized.

3.2. Assessing progress over time

3.2.1 Progress to universal connectivity

BEAD program guidelines require that State Broadband Offices (SBOs) regularly engage with subgrantees to discuss progress toward the established goals. The required semi-annual reports allow systematic comparisons of progress over time for project areas, subgrantees, and states. If subgrantee data are mapped to census geographies, progress can also be monitored for other geographic areas (e.g., census tracts, counties). BEAD rules do not require states to make detailed information public, nor do they require the release of data documenting progress over time. However, good stewardship and transparency imply that the data is made available. A semi-annual release of data would allow tracking changes better than an annual release.

- Progress in connecting eligible BSLs

    - Number (or percentage) of eligible BSLs added during the past reporting period (since the start of BEAD implementation)
    - Number (or percentage) of eligible BSLs that remain to be served
- Technical performance characteristics of newly connected locations
- Financial indicators (funds uses, funds remaining, comparisons between planned expenses and actual expenses)
- Adoption of broadband at newly served locations
- Pricing of low-cost service options at the newly served locations

Given that the BEAD locations are the final remaining locations in a state, a simple before-and-after comparison is an acceptable starting point. Data points at half-year intervals can easily be compared to the baseline at the beginning of the implementation to assess the rate of progress. Alternatively, they can be assessed against the state's BEAD goals, in which case they would document progress in reducing the gap.

The starting point at the beginning of the program is not the only yardstick for comparison. An SBO might be interested in how the network rollout compares relative to the growth in the number of connections in prior years. To do this, SBOs could simply calculate the average growth rate of broadband connections that meet the 100/20 Mbps standard. This would provide initial insights into the acceleration (or deceleration) associated with the BEAD program relative to a multi-year network rollout trend.

3.2.2 Comparisons of areas within states and across states

States have historically shared information about policies that worked and their experiences of initiatives that did not meet the expectations. Broadband connectivity is no different. The indicators generated by single states as part of their monitoring and assessment efforts can also be used for comparisons of areas within a state and for comparisons of entire states. In principle, all indicators discussed in Section 3 can be used in comparisons and can provide additional insights into the efficiency of program implementation.

However, comparisons must adjust for factors, such as varying supply, demand, and demographic conditions, which affect BEAD implementations. For example, cost conditions such as the ruggedness of terrain and distance to locations influence how quickly locations can be connected and the cost of doing so. One method to avoid these problems is to make comparisons only between similarly situated areas or states. Another method is to use statistical tools to control such confounding factors. Both approaches are discussed in the following two sections and illustrated using comparisons between states.

3.2.2.1 Comparison with similar areas

Several options exist to compare progress indicators for a specific geographic area with other areas. It may often be useful to compare project areas within one state. Another option may be to compare indicators with neighboring states or territories. If the conditions affecting cost drivers are similar, it might be appropriate to compare areas without correcting differences and confounding factors. Another more reliable option is to use clustering techniques to identify areas with similar conditions. Clustering could be done at the level of states, but if more granular data is available, it could also be accomplished for smaller areas down to individual project areas or subgrantees. We illustrate a simple clustering approach that could be adapted for areas within states in Appendix C.

For the example discussed here, we employed clustering analysis to identify groups of states that are similar in important conditions relevant for broadband costs. Specifically, we used a technique called K-means clustering, employing five indicators that represent potential barriers to broadband deployment: the percentage of rural areas in a state, the percentage of low-income populations, the percentage of extremely rugged terrain (Area Ruggedness Scale ARS 6 level), highly rugged roads (Road Ruggedness Scale, RRS 5 level) [11], and the log-transformed number of unserved and underserved locations. These variables were selected based on their documented relevance to broadband deployment costs and logistical complexity, especially within the context of the BEAD program's infrastructure deployment objectives. To determine the optimal number of clusters, multiple K-means models were estimated and compared using silhouette scores, a standard metric for evaluating clustering quality (Shahapure & Nicholas, 2020).[12]

Figure 3.1: Clusters of states with comparable conditions (Source: Mack et al., 2025)

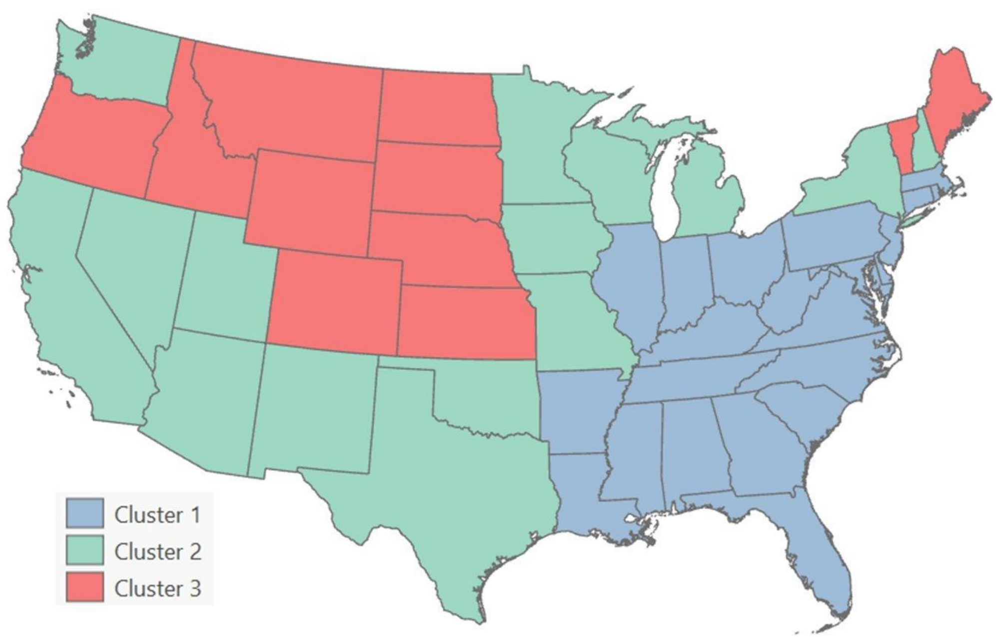


Table 3.2: List of states by cluster (50 states plus DC) (Source: Mack et al. (2025).

[11] See U.S. Department of Agriculture, Economic Research Service, Area and Ruggedness Scales, https://www.ers.usda.gov/data-products/area-and-road-ruggedness-scales (last visited February 17, 2026).
[12] Silhouette scores range from -1 to +1; scores closer to +1 indicate better clustering results.

Cluster 1 – Lower challenges (23 states)	**Cluster 2 – Medium challenges** (16 states)	**Cluster 3 - High challenges** (12 states)
AL	AZ	AK
AR	CA	CO
CT	HI	ID
DE	IA	KS
DC	MI	ME
FL	MN	MT
GA	MO	NE
IL	NV	ND
IN	NH	OR
KY	NM	SD
LA	NY	VT
MD	OK	WY
MA	TX	
MS	UT	
NJ	WA	
NC	WI	
OH		
PA		
RI		
SC		
TN		
VA		
WV		

States in Cluster 1 are not very rural (M=11.06) and have minimal terrain-related challenges (ARS 6: M = 0.52, RRS5: M = 1.62). These states also report a moderate number of unserved and underserved locations (M = 10.89, log-transformed), suggesting relatively favorable conditions for broadband infrastructure expansion. As such, states in Cluster 1 are likely to experience fewer logistical and financial constraints in deploying broadband infrastructure using BEAD funds.

States in Cluster 2 tend to be more rural than states in cluster one (M = 37.57) with moderate terrain ruggedness (ARS 6: M = 1.26, RRS 5: M = 1.76). These characteristics mean that high-speed internet service provision presents a unique challenge. Effective deployment in these states will likely depend on strategic resource allocation, streamlined permitting processes, and potentially phased rollouts of infrastructure.

States in Cluster 3 are some of the most rural states in the country (M=65.08) that also have substantial terrain-related barriers (ARS 6: M = 2.53, RRS 5: M = 1.92). Thus, although the states in this cluster have a lower average number of unserved and underserved locations compared to Cluster 2 (M = 10.85), the geographic dispersion and topographic difficulty create substantial obstacles to conventional broadband deployment. States categorized as Cluster 3 pose the highest challenges to achieve the BEAD-defined service goals, assuming all other factors are equal.

Table A.2.5 in the appendix depicts average and median costs per connection within clusters, which are a more meaningful comparison standard for how well states did. Clusters are a first, high-level step of controlling for similar circumstances. One would expect that the subsidy costs increase as conditions in the states belonging to different clusters make deployment more challenging. One would also expect provider matches to decrease as cost conditions become more challenging and the conditions to earn a return more difficult. At the same time, there is significant heterogeneity of conditions within the clusters and within states. Both effects are visible in Table A.2.5. Average and median subsidy costs are higher for more challenging clusters, and provider matches lower, but the pattern is uneven.

3.2.2.2 Statistical benchmarking

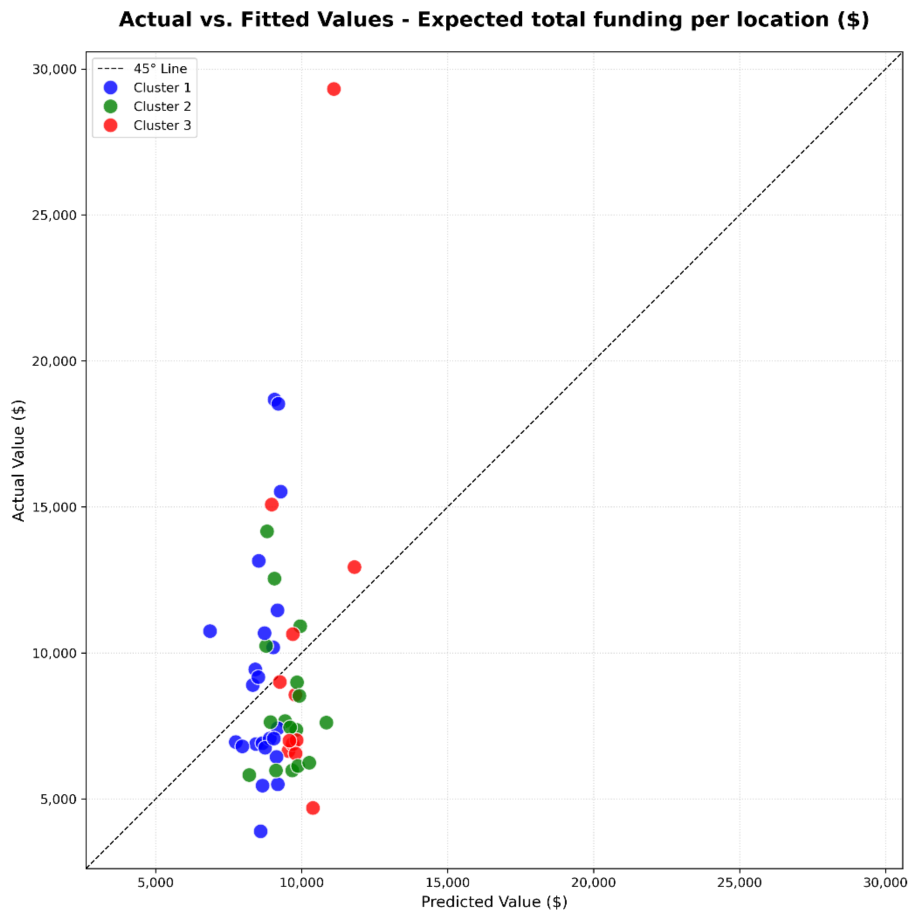
Benchmarking compares the outcomes of one geographic area of interest with one or more other areas, possibly considered "best practice" models. Such comparisons may use statistical analysis or qualitative assessment methods. Given the complexity of factors in play in broadband development, detailed case studies that build on ethnographic work, perhaps complemented with quantitative comparisons, may be especially useful. This approach allows us to gain deeper insights into which policy designs might be particularly effective. It also facilitates additional forms of learning from the experience of others.

The analysis of the residuals reveals that the cost drivers included in the statistical analysis only explain part of the variation. Moreover, states from each of the clusters are above and below the hypothetical benchmark constituted by the regression line. This shows that local conditions vary greatly and that future observations will have to be analyzed at a higher level of granularity. It also could indicate varying efficiency of the benefit of the bargain process, but there is insufficient information available to make such a judgment with confidence.

Statistical benchmarking can use parametric or non-parametric techniques to assess the effectiveness of a policy measure in a geography relative to other geographies that are considered "best practice" performers. These methods allow us to consider variations in the conditions of broadband deployment. For example, they consider the effects of the ruggedness of terrain on deployment costs. In addition to geographic areas, statistical benchmarking may be applied to comparing subgrantees with "best practice" operators. These methods can help develop a deeper understanding of the effectiveness of implementation measures in a wide range of circumstances, but their data requirements may be difficult to meet (Grubesic, 2010).

We applied multiple methods to assess how well individual states did. Here we present findings from multivariate regression analysis used to estimate how the cost per location and the provider match per location are related to cost drivers, such as terrain ruggedness and population density. We then analyzed the deviations between the cost predicted by the regression model and cost per location that resulted from the benefit-of-the bargain round in each state with the regression line.

Figure 3.2: Variation of expected total funding per location from predicted values (own calculations, see Appendix B for more details).



Observations above the 45˚-line indicate higher cost than would be expected from the factors included in the statistical analysis. This does not necessarily suggest a less efficient process, as it could be caused by factors that were not included in the statistical model. Likewise, states whose cost per location is below the 45˚-line have costs below the value predicted by the model. This does not necessarily signal higher efficiency, as they may have benefited from unique conditions that are not reflected in the model. Thus, it does not necessarily suggest that these states were particularly effective in conducting the bidding process.

Figure 2.2 and the more detailed discussion in Appendix B depict deviations of actual total funding per location from a predicted value based on cost drivers. It shows the tremendous diversity of conditions and outcomes of the benefit for the bargain process. This is reflected in the low explanatory power of multivariate regression models. Additional analyses will be necessary once more detailed data is available.

3.2.3 Integrating BEAD data with other reporting systems

BEAD eligible locations typically are dispersed across the entire state. Documenting progress for these locations is particularly useful during program implementation and assessment. Eventually, the information will be reflected in other state- and nation-wide reporting frameworks, such as ACS and Census data, the FCC broadband map, and other statistics.

Despite this gradual integration, BEAD-specific reporting could remain meaningful for some time beyond the completion of the program. For example, the experience with other programs, such as CAF II, indicates that providers adjust the quality of service offered to locations after program requirements end. For example, Manda et al. (2024) document that a significant share of locations funded by the Connect America Fund II did not receive the download speeds stipulated in the program after the program ended. A large part of this may be a flaw in program design, which did not include provisions beyond the program's end date. Part of it may be the outcome of confounding factors and/or corporate strategy. However, it suggests that BEAD may suffer from a similar vulnerability, and that continued monitoring of the developments affecting BEAD-supported locations may be worthwhile.

Apart from these concerns, states will be well advised to develop frameworks to monitor the heterogeneous access infrastructure that will emerge from the BEAD program and how well it is suited to meet emerging uses and needs. As AI-enabled services and applications go online, the current threshold of 100/20 Mbps may not be sufficient, and new and old locations may require initiatives to improve the level and quality of connectivity. AI-enabled services will require adjustments in the data center infrastructure and in the associated middle mile and end-user network infrastructures. Should quantum computing become a reality, some of the existing and currently rolled out infrastructures will likely become obsolete.

The timelines of these developments are difficult to predict. Unless federal support programs are reformed, states may have to devise their own sustainable mechanisms to address these emerging challenges. One important component of such longer-term plans will be systematic horizon scanning to identify needs with some lead time. Such forward-looking perspectives will also facilitate the design of appropriate programs at the state level. These range from broad-based universal service programs modeled after the federal Universal Service Fund to innovative solutions such as credit guarantees to enable smaller businesses to get access to external funding. Well-designed credit guarantees would have a low risk to the public sector and can accelerate rural entrepreneurship and continued network improvements.

4. Broader effects of BEAD investment

The restructured BEAD program is primarily an infrastructure access program. Of course, infrastructure investment and closing the access gap have consequences for digital equity and broader community outcomes. Infrastructure access is a necessary condition for adoption and use, which are preconditions for the full benefits of broadband to materialize. Research and experience in communities with high levels of connectivity suggest that infrastructure benefits can be boosted with complementary initiatives that improve the working of the broadband ecosystem (see, e.g., Bauer et al., 2025; Greene, 2021; Lobo, 2026). The language in the Infrastructure Act suggests that the U.S. Congress envisioned digital equity and broader community benefits are important outcome of the BEAD program. The following two sections discuss how the effects of BEAD on these overarching goals can be assessed.

4.1 Digital equity

The Digital Equity Act, included in the Bipartisan Infrastructure Bill, defines digital equity as "the condition in which individuals and communities have the information technology capacity that is needed for full participation in the society and economy of the United States".[13] Accompanying documentation and guidance explains that this goal is reached when individuals and communities have (1) access to digital tools and skills, including secure affordable, reliable, high-speed broadband, necessary hardware, and the education to use them; (2) are able to access essential services like healthcare, education and government; (3) utilize the Internet to access employment opportunities, career training, and financial services; and (4) are able to participate in civil engagement (e.g., register to vote, stay connected to local communities).[14]

This formulation also implies that digital equity is a moving goal that will change with social, economic, and technological developments. During the original BEAD planning phase, states had considerable leeway to identify selected equity-related key performance indicators (KPIs). Consequently, a range of goals were articulated in state digital equity plans, but no unified national approach emerged. Despite the cancelling of the Digital Equity Act programs in 2025, states and citizen groups continue to work on efforts to improve digital equity with non-federal funds. These efforts build on the knowledge developed as part of the development of the original Digital Equity Plans.

As part of the original planning, states conducted needs assessments or surveys to document the state of digital equity. For example, California conducted a large digital equity public survey in 2023. After 2025, the state pivoted to more focused data collection efforts, such as the Digital Equity

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[13] Infrastructure Investment and Jobs Act, Pub. L. No. 117-58 (2021), Section 60302 (10).
[14] See Congressional Research Service, The Infrastructure Investment and Jobs Act (P.L. 117-58): Summary of the Broadband Provisions in Division F, November 16, 2021. Retrieved on May 2, 2026, from https://www.congress.gov/crs_external_products/R/PDF/R46967/R46967.3.pdf.

Resource Survey,[15] intended to assist residents and organizations in finding digital inclusion programs and services. In some states, specialized surveys provide insights into the state of digital equity for some populations. For example, the Office of Superintendent of Public Instruction of the State of Washington conducts an Annual State Technology Survey.[16] Other states conduct similar specialized services.

However, no nationally standardized framework for the assessment of digital equity was developed as part of the original BEAD planning. Digital equity is a nested phenomenon that can be assessed at various levels, from households to communities to a state, with each level providing unique insights. Several research teams have developed frameworks and guides on how to evaluate digital equity. For example, Gonzales et al. (2024) have developed *A Simple Evaluation Guide for the Digital Equity Community*. A group of researchers and practitioners have developed the *Digital Opportunities Compass* (Rhinesmith et al., 2023). Ogbo-Gebhardt and Grady (2025) examined the effectiveness of a digital navigator program organized by the Digital Empowerment Leadership Program (DELP) at North Carolina Central University. These documents can be used to develop measurement frameworks, should this be desired. Table 4.1 presents key dimensions

Given the current paucity of data, several federal data sources may be used to develop high-level insights or proxy indicators, but the data is typically only available with delays (see Table 4.1). Part of the information gap can be filled with documentation and assessments that are available for specific digital equity projects. For example, Tech Goes Home evaluates its impact on individual learners and communities.[17] Similarly, the STEM Alliance regularly evaluates its Digital Pathways programs.[18] The National Digital Inclusion Alliance (NDIA) has developed the Digital Inclusion Impact Aggregator, an open-source platform to collect data on digital equity ecosystems.[19]

Given that no nationwide standardized assessment of the state of digital equity has been established, a baseline must be constructed from sources that may not have been designed for that purpose. To monitor BEAD-eligible locations, subgrantee reporting could be used to collect relevant data. As all street addresses are known, it would also be possible to design a short, periodic survey that targets BEAD-eligible addresses. If a general baseline for a census geography (e.g., a census block, census tract, or county) or the entire state is sufficient, data from the ACS could be used to construct proxies. Over time, if BEAD is effective, equity-related metrics should improve independently of the measurement approach.

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[15] See State of California, Broadband for All, Digital Equity Resource Survey, retrieved May 2, 2026, from https://broadbandforall.cdt.ca.gov/digital-equity-resource-survey/.

[16] See Office of Superintendent of Public Instruction (OSPI), Annual State Technology Survey, retrieved on May 2, 2026, from https://ospi.k12.wa.us/policy-funding/school-technology/annual-state-technology-survey.

[17] See Tech Goes Home, https://www.techgoeshome.org/impact (last visited February 3, 2026). See also Rhinesmith et al. (2023).

[18] See The STEM Alliance, https://www.thestemalliance.org/ (last visited February 3, 2026).

[19] See National Digital Inclusion Alliance, Digital Inclusion Impact Aggregator, https://www.digitalinclusion.org/aggregator/ (last visited February 3, 2026).

Table 4.1: Available (proxy) equity indicators (own research)

Dimension	Possible indicators	Data sources
Broadband access	See above Section 4	See above Section 4
Proxy indicators	NTIA Internet Use Survey American Community Survey (ACS)	NTIA Data Central, https://www.ntia.gov/topics/data-central; United States Census Bureau, American Community Survey, https://www.census.gov/programs-surveys/acs/data.html

If states envisioned a broad assessment of digital equity, they would have to develop new survey instruments or use data collection (e.g., educational statistics, surveys of veterans) to collect additional observations that can shed light on digital equity. In addition to available information on broadband access, such a comprehensive assessment would have to include information on broadband affordability, a wide range of digital skills and competencies, and indicators documenting the fullness of participation in the American economy and society.

Table 4.2: Components of a comprehensive assessment of digital equity (own research)

Dimension	Possible indicators	Data sources	Available or new
Broadband access	See above Section 3	See above Section 3	Semi-annual reporting
Broadband affordability	Cost of broadband connection	FCC Urban Rate Survey, https://www.fcc.gov/economics-analytics/industry-analysis-division/urban-rate-survey-data-resources (selected urban rates only). Individual studies (Koduru, Alvarado Rojas, et al., 2025)	Partially available, additional collection would be necessary
Digital skills and literacy	Knowledge, competencies of users to perform a range of digital tasks (from search to AI use)	As of May 2026, there is no systematic, granular, national data source available. Researchers have generated robust measurement scales for digital skills (Angel-Urdinola et al., 2025; Hampton et al., 2020; Hampton et al., 2023; Hargittai & Hsieh, 2012; Hargittai & Micheli, 2019).	High-level data available, granular data would have to be collected

		See also the approach by the OECD, https://goingdigital.oecd.org/	
Full participation in the economy and society	Actual labor market participation Actual use of telehealth services Participation in education opportunities Participation in civic activities	Quantitative survey studies or ethnographic studies (Kwak et al., 2004; Whitacre & Manlove, 2016); see also Table 4.4 below	Some limited data available, other information would have to be collected

The prices for broadband are an outcome of supply and demand-side factors and an important observation that can help assess the effectiveness of competition in the marketplace. The restructured BEAD program narrowed provisions related to affordability that were mandated by NTIA in the original BEAD Notice of Funding Opportunity (NTIA, 2022). It dropped the middle income and low-income plans but retained an obligation that subgrantees must offer at least one low-cost service option. Eligibility criteria for consumers correspond to the FCC's Lifeline program (NTIA, 2025, pp. 5-6). No systematic data is yet available to assess the types of plans offered under this obligation. Earlier voluntary plans by broadband providers had desirable effects on adoption and use (see, e.g., Rosston & Wallsten, 2020).

Broadband prices are currently not documented at a granular geographic level. Prices for communication services are collected as part of the Consumer Price Index and show a steady decline relative to other prices (see, e.g., FCC, 2024; Ford, 2026; Menko, 2025). The Urban Rate Survey (URS) conducted by the FCC is based on a robust statistical sampling frame for urban areas, but it relies on data submitted by companies and does not document rural areas.[20] Specialized tools such as the Broadband-Plan Querying Tool (BQT+), allow querying individual addresses to retrieve plan information (see, e.g., Koduru, Beltiukov, et al., 2025).

4.2 Broader community outcomes

4.2.1 Goals and data sources

The goal of bringing broadband to all locations is to generate benefits for individuals and communities that would otherwise not accrue, such as effects on employment, income, property values, education, health, and safety. In the original BEAD planning, states and territories identified a range of broader community outcomes, but several were mentioned repeatedly. The following table lists the goals by the frequency of their appearance in the plans. It is based on a narrative

[20] See FCC, https://www.fcc.gov/economics-analytics/industry-analysis-division/urban-rate-survey-data-resources (last visited February 8, 2026).

analysis of the original reports filed to NTIA by the eligible entities (Five-Year Action plans, Proposal Volumes 1 and 2, and the Digital Equity Plans), conducted by the research team in 2024 and additional analyses using AI tools in 2026.

Table 4.3: Top 10 broader community outcome goals (own research)

Rank	**Community outcome goals**	**# of eligible entities (out of 55)**
1	Workforce development and employment	52
2	Healthcare access & telehealth	46
3	Education (K-12, higher education, adult/e-learning)	41
4	General economic development and business grow	39
5	Improved digital skills and literacy	31
6	Access to online government and civic services	24
7	Equity/targeted inclusion of covered populations	21
8	Public safety and emergency services	14
9	Sector-specific innovation (e.g., agriculture, smart industry)	10
10	Cultural, indigenous, or digital citizenship goals	4

As an important aspect of the original BEAD program, broader community outcomes are implicit in the restructured BEAD program. They are generally not mentioned in the final BEAD plans approved by NTIA after the restructuring. Nonetheless, they must be considered an important indicator for the success of the BEAD program. Their assessment is an important part of current and future state broadband policy. Several data sources from federal agencies, national organizations such as Americorps, and research centers are available that can help in such assessments. As Table 4.4 shows, such general data would, in principle, allow assessing broader community outcomes in the top categories included by states in their plans.

Table 4.4: Federal data sources to assess broader community outcomes (own research)

Indicator	Examples of metrics	Data sources	Granularity
Jobs	• Availability and quality of jobs available in a community	• U.S. Bureau of Labor Statistics (BLS), https://www.bls.gov/emp/	Varies by data. Census regions and divisions, states, counties, metropolitan areas, many cities
Income	• Average or median individual income	• U.S. Census, Income Tables, https://www.census.gov/topics/income-poverty/income/data/tables.html	ACS 1-Year estimates for areas >65,000 population; ACS 5-Year estimates

	• Average or median household income • Income distribution by quartile or decile		for census block groups
Economic growth	• Local economic growth	• Bureau of Economic Analysis (BEA) gross domestic product data, https://www.bea.gov/data/gdp/gross-domestic-product	Quarterly and annual state-level data; annual county level data
Population growth	• Population growth	• U.S. Census Bureau population data, https://www.census.gov/topics/population.html	ACS 1-Year estimates for >65,000 population; ACS 5-Year estimates: block groups; Decennial Census: blocks
Education	• Quality of education system and community education level	• U.S. Department of Education (DoE), https://www2.ed.gov/rschstat/landing.jhtml?src=ft • National Center for Education Statistics (NCES), https://nces.ed.gov/	School districts, Census tracts, blocks, counties, metropolitan, micropolitan areas, congressional districts
Health	• Community health indicators	• University of Wisconsin, Madison, Population Health Institute, https://uwphi.pophealth.wisc.edu/	Census block groups (e.g., Area Deprivation Index); county; state
Property values	• Assessed value of property • Market value of property	• Federal Housing Finance Agency (FHFA), https://www.fhfa.gov/; e.g., the housing price index, https://www.fhfa.gov/data/hpi • American Community Survey (self-reported housing price values)	FHFA offers highly granular data (e.g., census tract, Zip code, county level); 5-Year ACS estimates at the census tract level; 1-Year ACS estimates for areas >65,000 population

Civic participation of citizens	• Share of the sociodemographic groups participating in community discussions	• Pew Research Political & Civic Engagement data, https://www.pewresearch.org/topic/politics-policy/political-civic-engagement/	Urban, suburban, rural; national, sub-national (Census region);
		• AmeriCorps Civic Engagement data, https://data.americorps.gov/stories/s/AmeriCorps-Civic-Engagement-and-Volunteering-CEV-D/62w6-z7xa/	Biannual, state, national-level data, top MSAs
Quality of life	• Multidimensional tools (e.g., WHO, CDC surveys)	• Would have to be generated, depending on the specific questions to be explored	See, e.g., Mosteller and Falotico-Taylor (1989)

In addition to federal sources, states typically collect administrative records on unemployment insurance records, tax data, and other community indicators. These are typically shared with federal agencies to improve their data. They could help with certain assessment tasks. The increasing availability of complementary data could be leveraged to improve the quality and timeliness of assessment as well. For example, some states have begun to use new approaches to measure labor market outcomes, such as “enhanced” wage records (EWRs) (see, e.g., Congdon & Raderman, 2026).

Table 4.4 shows that the geographic granularity of the available federal data varies widely. For example, ACS 1-Year estimates are only available for areas with a population of more than 65,000. ACS 5-Year estimates are available for more granular areas, but only in five-year intervals. Economic growth data are available annually at the county level and quarterly at the state and national levels. Alternative data sources, such as calling records and energy use, which is correlated with economic activity, might allow more continuous monitoring of community outcomes, but they are typically not publicly available.

4.2.2 Measurement challenges

Assessing broader community impacts must overcome several empirical challenges. First, these effects need time to develop. The time lag from the beginning or the completion of investment in a connection to the realization of broader community outcomes is variable and not well understood. It will likely take years until such effects are fully visible and measurable, even if economic and social data are available in real time.

Second, the BEAD-eligible locations are typically widely dispersed across states. This implies that it may be difficult to measure community benefits related to the incremental connectivity provided by BEAD, which initially will primarily benefit the affected household or business. One way to get a clearer understanding of the effects of new connections is to analyze individual household data collected in case studies. Another option is to aggregate information from individual digital inclusion projects and their documented effects, as proposed in the framework developed in the Digital Inclusion Impact Aggregator.

Third, broadband access typically contributes, but it is not a direct cause of these broader community outcomes. Other factors, including other broadband programs, socio-demographic factors, and economic factors, often are also in play and must be considered in empirical assessments. These factors may amplify or weaken the effects of additional connectivity. Furthermore, these effects vary across communities, implying that some communities will get a larger boost than others from a given investment, but the variation is not related to the project but to other factors.

Despite these challenges, the effects even of incremental additions to connectivity can be examined over time with appropriate statistical methods. The complexity of BEAD and the multiplicity of broadband support programs create methodological and empirical challenges. In our first report (Bauer et al., 2025), we developed a general measurement framework to help design robust studies

4.2.3 Toward empirical assessment

The effects of improved connectivity on broader community outcomes can be assessed with a multitude of methods. Each has strengths and weaknesses. Qualitative approaches utilize fieldwork in communities to collect information on how connectivity affects outcomes. Interviews, focus groups, and other forms of observations may be utilized to weave a narrative of how changes in connectivity affect communities. This enables nuanced insights and assessments of experiences (see, e.g., Lobo, 2020, 2026).

Statistical empirical studies assess the effects of connectivity using numerical data. They control confounding factors by using methods such as multiple regression analyses or structural equation modeling. A method that is often used in assessing the effects of a policy intervention is difference-in-differences (DiD) estimation.[21] Although intuitive and useful, this approach is difficult to apply because of the lack of control groups. In some cases, methods using regression discontinuity designs (RDD) might be applicable.[22] This method compares observations immediately above and below a threshold used to determine policy eligibility.

The general structural form of these approaches is that outcomes, such as the number of jobs or income, are statistically related to changes in connectivity and to other, potentially confounding factors.

[21] This method compares changes in outcomes over time between observations for a group affected by a policy (treatment group) and observations from a group that did not have such an intervention (control group). The method requires that the two groups evolved in parallel before the policy intervention (parallel trend assumption).
[22] Regression Discontinuity Design (RDD) estimates the causal effects of an intervention by comparing outcomes above and below thresholds that can be used as natural cutoff points.

$Y_{it} = f(\mathbf{B}_{it}, \mathbf{X}_{it}) + \varepsilon_{it}$

Y_{it} ... dependent variable (e.g., jobs, income, education outcomes, health outcomes)

$\mathbf{B}_{it}$ ... one or more broadband connectivity measures

$\mathbf{X}_{it}$ ... a vector of other factors that influence the relationship between connectivity and outcomes, such as education, income

ε_{it} ... error term, capturing unexplained variation

That is, variations in the outcome variable are explained by variations in connectivity (B) and variations in other contextual factors, such as income and education (X). The subscript (it) indicates that observations are labeled with a location (i) and time (t). If data were available from 2020-2025, subscripts t would reflect these six years. For data available across all 56 eligible entities, the subscript would run from 1 to 56 (i=1, 2. ....., 56) and assign each observation to a geographic marker.[23] Careful studies typically examine numerous factors (X) to make sure a relationship found between connectivity and outcomes is robust and that the observations are not influenced or caused by other factors.

An important difference is whether observations are only available at one point in time or whether several observations are available over multiple periods (e.g., years). Data documenting the situation at one point in time only allows calculation of correlations between broadband access and outcomes. They do not allow establishing a causal relation. To examine whether broadband is a causal factor, longitudinal data of observations from different points in time and ideally across multiple locations are needed.

Here, we briefly discuss a few selected studies to illustrate best practices of researchers in addressing these issues in similar contexts. Each study offers much more detail that is not fully discussed here. For purposes of illustration, we selected studies examining the relationship between broadband and entrepreneurial activity, broadband and growth, and broadband and income.

Qualitative studies that develop comprehensive assessments of the interplay of broadband policy and community outcomes are Lobo (2020, 2026) and Ali (2021). Lobo (2020) assesses the investment of city-owned EBP (Electric Power Board) in Chattanooga, TN on a range of community outcomes. Lobo (2026) expands the assessment with new observations related to investment into emerging technologies, such as quantum computing. Overall, Lobo finds positive impacts on a number of dimensions but cautions against the problem of causally attributing these observations

[23] For data available at lower granularity, the subscript would run from i=1, ..., N, with N the total number of units (e.g., number of counties, number of census tracts, number of census block groups in the geography of interest).

to broadband.[24] Ali (2021) develops several in-depth case studies of rural broadband initiatives. Both studies demonstrate the usefulness of qualitative assessments of broadband investments.

Deller et al. (2022) study the interplay of broadband on business startups in rural counties in 2014. They differentiate four download and download speed tiers from 10-100 Mbps and two upload speed tiers (10, 25 Mbps) and examine whether they are related to startup activity in various economic sectors. The study finds that broadband availability is associated with startup activities across most industries. Download speeds seem to be more important than upload speeds. The study controls numerous other factors, such as lagged economic growth, economic structure, demographic factors, and social capital, to isolate the effects of broadband properly.

A more recent study by Biedny et al. (2024) examines the effects of broadband download speeds on business births. The study uses data for six years (2015-2020) from eight U.S. states to examine whether higher speeds influence business births. The study finds that the introduction of 100+ Mbps service increases business births per capita for at least five years. The authors also find positive effects of speeds exceeding 250 Mbps, but do not detect a statistically significant effect that Gigabit service would increase business births compared to 250 Mbps. Several economic and demographic control variables are used, and additional robustness checks are performed to evaluate the quality of the findings.

Examining the relationship between broadband expansion and local economic growth, Kolko (2012) finds a positive effect that is stronger in industries that rely more heavily on information densities and in areas with lower population density. Whitacre et al. (2014) assess the relationship between broadband availability and adoption on economic growth and income. They find that higher adoption goes hand in hand with higher incomes, but that broadband availability alone has a lesser impact on economic growth. Finally, Zuo (2021) conducts a detailed study of the income effects of the Internet Essentials program. He finds that broadband increased employment rates and earnings of eligible individuals, mainly driven by greater labor force participation and a lower risk of unemployment. All three studies utilize a range of variables to control confounding factors.

Not all studies find positive effects of broadband on broader community outcomes, or they find that broadband is a necessary but not a sufficient condition. For example, Hampton et al. (2021) find that the effects of higher speed broadband on educational outcomes are influenced by other factors, such as the parental limitations on use of the Internet. Several surveys, including Gallardo et al. (2018) and Briglauer et al. (2024), document the state of research on broader community impact and the diversity of findings.

[24] In a recent paper George S. Ford argues that the stated effects disappear if proper statistical techniques are applied. See G.S. Ford, When narratives replace evidence: Employment claims and the EBP municipal broadband network. Phoenix Center Policy Bulletin No. 84, retrieved on May 29, 2026, from https://phoenix-center.org/PolicyBulletin/PCPB84Final.pdf.

5. Conclusion

Monitoring and assessing progress toward serving all eligible Broadband Serviceable Locations (BSLs) are integral parts of implementing the restructured Broadband, Equity, Access, and Deployment (BEAD) program. This report suggests using the NTIA approved numbers for BEAD-eligible locations as the baseline for assessing BEAD implementation. It proposes three layers of assessment, starting from a narrow monitoring of BEAD network rollout to broader assessments.

Most of these indicators can be derived from the semi-annual report (SAR) data. In addition, it suggests collecting a small number of additional indicators that will allow better assessment of the repercussions of BEAD investment. The report offers guidelines for comparisons between geographic areas and for the assessment of broader community impacts of BEAD investment.

Data to enable robust assessment by SBOs and other state agencies should be collected at the level of individual locations and released to the public with appropriate safeguards for proprietary information. It is therefore important that State Broadband Offices (SBOs) develop appropriate reporting mechanisms that can be used for assessment purposes in addition to meeting compliance requirements.

The reporting requirements established in the Infrastructure Act and detailed by NTIA go a long way to achieving narrow BEAD assessment goals. However, states have an interest in also understanding the effects of investment on broader outcomes. To assess these effects, we recommend collecting additional indicators and are offering guidance on how the data can be meaningfully analyzed. Where the collection of additional data is recommended, it should be organized at the lowest possible administrative burden for subgrantees and SBOs.

Regular assessment that is built into the implementation process, and not as add-on at a later stage, serves accountability, transparency, and democratic legitimacy. It helps discern implementation strategies that work and flags obstacles and unanticipated consequences to assist in taking remedial measures. Moreover, it is a necessary ingredient for better broadband planning for the future, enabled by waves of new technologies. To facilitate learning between states, standardized reporting would be desirable.

The indicators and empirical assessment methods outlined in this document could be used most fruitfully if states made information collected from subgrantees available in a standardized, comparable form. Such information would facilitate learning from experience and knowledge sharing that would benefit all states. It would also allow gaining insights that can inform the next generation of digital connectivity infrastructure challenges.

Appendix A: Supplemental data

Please note that an empty cell in a table implies that a datum was not available on May 18, 2026, when we had to lock in available data for the final revisions of this report. Missing information will be included as soon as it is available in a verifiable form.

Table A.2.1: Unserved and underserved locations by state

	FCC broadband map data (December 2022)			NTIA approved[25] (final plan, 2025/2026)		
State/Territory	Unserved	Underserved	Total[26]	Unserved	Underserved	Total[27]
AK	88,182	17,381	105,563	N/A	N/A	46,508
AL	331,206	96,640	427,846	N/A	N/A	94,555
AR	215,621	93,920	309,541	N/A	N/A	79,293
AZ	177,325	141,416	318,741	N/A	N/A	161,648
CA	306,910	154,689	461,599	N/A	N/A	339,822
CO	147,484	89,025	236,509	N/A	N/A	96,065
CT	11,693	4,065	15,758	N/A	N/A	1,782
DC	184	30	214	N/A	N/A	101
DE	2,052	12,904	14,956	N/A	N/A	4,739
FL	272,961	135,371	408,332	N/A	N/A	73,944
GA	315,780	95,845	411,625	N/A	N/A	119,814
HI	11,671	1,071	12,742	N/A	N/A	7,033
IA	83,509	70,506	154,015	N/A	N/A	37,634
ID	85,902	52,094	137,996	N/A	N/A	91,341
IL	239,687	128,388	368,075	N/A	N/A	159,085
IN	202,020	106,583	308,603	N/A	N/A	122,847

[25] Data released by NTIA through May 18, 2026
[26] Sum of unserved and underserved locations
[27] Eligible Broadband Serviceable locations, including unserved and underserved locations and community anchor institutions

KS	87,489	57,313	144,802	N/A	N/A	26,613
KY	259,258	60,955	320,213	N/A	N/A	87,160
LA	296,777	78,938	375,715	N/A	N/A	127,108
MA	12,522	7,602	20,124	N/A	N/A	3,808
MD	44,411	23,032	67,443	N/A	N/A	9,771
ME	42,264	50,289	92,553	N/A	N/A	22,513
MI	368,388	123,935	492,323	N/A	N/A	197,964
MN	135,984	76,778	212,762	N/A	N/A	74,739
MO	337,484	107,211	444,695	N/A	N/A	204,366
MS	268,365	39,397	307,762	N/A	N/A	93,283
MT	104,534	49,499	154,033	N/A	N/A	68,498
NC	376,037	127,391	503,428	N/A	N/A	93,437
ND	7,988	1,858	9,846	N/A	N/A	279
NE	70,478	38,123	108,601	N/A	N/A	14,064
NH	25,572	10,704	36,276	N/A	N/A	5,135
NJ	43,324	29,212	72,536	N/A	N/A	11,479
NM	114,997	76,705	191,702	N/A	N/A	42,651
NV	51,689	8,985	60,674	N/A	N/A	26,236
NY	149,368	36,659	186,027	N/A	N/A	52,982
OH	183,709	108,611	292,320	N/A	N/A	83,992
OK	150,718	147,042	297,760	N/A	N/A	40,509
OR	122,382	62,188	184,570	N/A	N/A	104,654
PA	278,535	51,154	329,689	N/A	N/A	129,356
RI	2,309	586	2,895	N/A	N/A	2,622
SC	119,580	78,733	198,313	N/A	N/A	20,480
SD	28,397	14,196	42,593	N/A	N/A	7,060

TN	186,394	57,323	243,717	N/A	N/A	43,871
TX	779,377	362,878	1,142,255	N/A	N/A	242,903
UT	41,535	28,107	69,642	N/A	N/A	30,215
VA	364,155	59,718	423,873	N/A	N/A	85,069
VT	33,646	27,953	61,599	N/A	N/A	15,299
WA	236,535	85,029	321,564	N/A	N/A	166,564
WI	253,097	210,952	464,049	N/A	N/A	175,464
WV	271,623	40,428	312,051	N/A	N/A	73,091
WY	39,215	20,403	59,618	N/A	N/A	38,558
AS	1,782		1,782	N/A	N/A	6,962
GU	34,251		34,251	N/A	N/A	1,542
NMI	10,088		10,088	N/A	N/A	9,568
PR	61,871		61,871	N/A	N/A	
VI	557		557	N/A	N/A	

Sources: FCC broadband map (https://broadbandmap.fcc.gov/home), NTIA BroadbandUSA Public Resources related to BEAD Plans and Milestones (https://broadbandusa.ntia.gov/funding-programs/broadband-equity-access-and-deployment-bead-program/public-resources-related-bead-plans-and-milestones#N)

Table A.2.2: Deployment and non-deployment funding by state

State/Territory	Total BEAD funds for the state (June 2023)	BEAD Deployment funding (NTIA approved)	Non-deployment BEAD funding	Provider match
AK	$1,017,139,672.42	$629,172,952	$387,966,720	$72,172,671
AL	$1,401,221,901.77	$464,262,346	$936,959,556	$427,638,477
AR	$1,024,303,993.86	$305,491,845	$718,812,149	$239,759,327
AZ	$993,112,231.37	$446,123,359	$546,988,872	$519,178,371
CA	$1,864,136,508.93	$1,574,861,927	$289,274,582	$928,407,665
CO	$826,522,650.41	$420,604,503	$405,918,148	$217,076,250
CT	$144,180,792.71	$7,215,750	$136,965,043	$2,581,270
DC	$100,694,786.93	$996,099	$99,698,688	$332,033
DE	$107,748,384.66	$13,516,741	$94,231,644	$74,988,602
FL	$1,169,947,392.70	$229,662,147	$940,285,246	$246,234,278
GA	$1,307,214,371.30	$304,638,706	$1,002,575,665	$522,912,217
HI	$149,484,493.57	$30,672,750	$118,811,744	$10,224,250
IA	$415,331,313.00	$182,302,422	$233,028,891	$106,097,783
ID	$583,256,249.88	$426,238,563	$157,017,687	$201,929,974
IL	$1,040,420,751.50	$986,254,515	$54,166,237	$634,323,961
IN	$868,109,929.79	$483,242,488	$384,867,442	$384,802,966
KS	$451,725,998.15	$166,605,020	$285,120,978	$61,283,702
KY	$1,086,172,536.86	$367,126,274	$719,046,263	$238,211,875
LA	$1,355,554,552.94	$498,764,087	$856,790,466	$365,105,723
MA	$147,422,464.39	$18,835,466	$128,586,998	$9,408,653
MD	$267,738,400.71	$79,065,513	$188,672,888	$72,591,202
ME	$271,977,723.07	$48,369,286	$223,608,437	$109,412,663

MI	$1,559,362,479.29	$916,605,938	$642,756,541	$557,740,894
MN	$651,839,368.20	$378,864,147	$272,975,221	$189,968,693
MO	$1,736,302,708.39	$790,525,572	$945,777,136	$429,751,895
MS	$1,203,561,563.05	$508,353,205	$695,208,358	$321,575,798
MT	$628,973,798.59	$303,686,528	$325,287,271	$145,190,798
NC	$1,532,999,481.15	$318,737,670	$1,214,261,811	$312,042,555
ND	$130,162,815.12	$6,133,968	$124,028,847	$2,044,657
NE	$405,281,070.41	$44,555,557	$360,725,514	$21,354,151
NH	$196,560,278.97	$18,623,317	$177,936,962	$25,168,184
NJ	$263,689,548.65	$62,184,236	$201,505,313	$150,527,134
NM	$675,372,312.00	$381,968,078	$293,404,234	$153,038,503
NV	$416,666,229.74	$170,650,263	$246,015,967	$65,219,921
NY	$664,618,251.49	$287,240,266	$377,377,986	$255,188,417
OH	$793,688,107.63	$260,629,657	$533,058,450	$197,349,119
OK	$797,435,691.25	$427,589,563	$369,846,128	$146,067,251
OR	$688,914,932.17	$587,851,818	$101,063,114	$354,362,484
PA	$1,161,778,272.41	$711,295,843	$450,482,429	$669,685,114
RI	$108,718,820.75	$10,566,150	$98,152,671	$7,958,118
SC	$551,535,983.05	$41,358,389	$510,177,594	$38,231,550
SD	$207,227,523.92	$72,801,060	$134,426,464	$18,534,860
TN	$813,319,680.22	$201,902,731	$611,416,949	$200,278,727
TX	$3,312,616,455.45	$1,257,675,573	$2,054,940,883	$595,140,965
UT	$317,399,742.00	$207,444,606	$109,955,136	$122,307,747
VA	$1,481,489,573.00	$545,170,411	$936,319,162	$429,474,841
VT	$228,913,019.08	$92,845,749	$136,067,270	$69,946,983

WA	$1,227,742,066.30	$736,319,365	$491,422,701	$283,671,174
WI	$1,055,823,573.71	$696,592,288	$359,231,286	$397,477,946
WV	$1,210,800,970.00	$545,692,254	$665,108,716	$239,597,400
WY	$347,877,921.27	$198,430,561	$149,447,360	$71,131,763
AS	$37,564,827.53	$8,386,766	$29,178,062	$2,796,462
GU	$156,831,733.59	$1,820,958	$155,010,776	$3,137,118
NMI	$80,796,709.02	$31,365,227	$49,431,482	$21,931,951
PR	$334,614,151.70			
VI	$27,103,240.86			

Sources: NTIA BroadbandUSA Public Resources related to BEAD Plans and Milestones (https://broadbandusa.ntia.gov/funding-programs/broadband-equity-access-and-deployment-bead-program/public-resources-related-bead-plans-and-milestones#N)

Table A.2.3: Average funding per location

State, Territory	Total BSLs (NTIA final approved[25], 2025/2026)	Average BEAD subsidy per location	Average provider match per location	Average expected total cost per location
AK	46,508	$13,528	$1,552	$15,080
AL	94,555	$4,910	$4,523	$9,433
AR	79,293	$3,866	$3,010	$6,876
AZ	161,648	$2,760	$3,212	$5,972
CA	339,822	$4,634	$2,732	$7,366
CO	96,065	$4,378	$2,260	$6,638
CT	1,782	$4,049	$1,449	$5,498
DC	101	$9,862	$3,287	$13,150
DE	4,739	$2,852	$15,824	$18,676
FL	73,944	$3,106	$3,330	$6,436
GA	119,814	$2,543	$4,364	$6,907
HI	7,033	$4,361	$1,454	$5,815
IA	37,634	$4,846	$2,817	$7,663
ID	91,341	$4,666	$2,211	$6,877
IL	159,085	$6,200	$3,987	$10,187
IN	122,847	$4,024	$3,042	$7,066
KS	26,613	$6,260	$2,303	$8,563
KY	87,160	$4,212	$2,733	$6,945
LA	127,108	$3,943	$2,853	$6,796
MA	3,808	$4,946	$2,471	$7,417
MD	9,771	$8,092	$7,429	$15,521
ME	22,513	$2,149	$4,859	$7,008

MI	197,964	$4,630	$2,818	$7,448
MN	74,739	$5,082	$2,529	$7,611
MO	204,366	$3,877	$2,094	$5,971
MS	93,283	$5,450	$3,447	$8,897
MT	68,498	$4,434	$2,119	$6,553
NC	93,437	$3,411	$3,340	$6,751
ND	279	$21,986	$7,328	$29,314
NE	14,064	$3,171	$1,515	$4,686
NH	5,135	$3,627	$4,901	$8,528
NJ	11,479	$5,417	$13,113	$18,530
NM	42,651	$8,956	$3,588	$12,544
NV	26,236	$6,529	$2,461	$8,990
NY	52,982	$5,421	$4,817	$10,238
OH	83,992	$3,145	$2,308	$5,453
OK	40,509	$10,574	$3,587	$14,161
OR	104,654	$5,617	$3,386	$9,003
PA	129,356	$5,501	$5,175	$10,676
RI	2,622	$4,030	$3,035	$7,065
SC	20,480	$2,019	$1,867	$3,886
SD	7,060	$10,312	$2,625	$12,937
TN	43,871	$4,602	$4,565	$9,167
TX	242,903	$5,178	$2,450	$7,628
UT	30,215	$6,866	$4,048	$10,914
VA	85,069	$6,409	$5,048	$11,457
VT	15,299	$6,069	$4,572	$10,641
WA	166,564	$4,421	$1,703	$6,124

WI	175,464	$4,019	$2,216	$6,235
WV	73,091	$7,466	$3,278	$10,744
WY	38,558	$5,146	$1,845	$6,991
AS	6,962	$1,205	$401	$1,606
GU	1,542	$1,332	$1,883	$3,215
NMI	9,568	$3,278	$2,292	$5,570
PR				
VI				
National Average[1]		$4,775	$3,081	$5,865
National Median[2]		$4,632	$2,932	$7,433

Notes to Table A.2.3: [1] Calculated as total BEAD subsidy divided by the total number of BEAD-eligible locations across the 54 states and territories for which official data is available. [2] Determined as median subsidy across the 54 states and territories, as no national ranking of the cost of single locations is available.

Data source: NTIA BroadbandUSA Public Resources related to BEAD Plans and Milestones (https://broadbandusa.ntia.gov/funding-programs/broadband-equity-access-and-deployment-bead-program/public-resources-related-bead-plans-and-milestones#N)

Table A.2.4: Planned technology mix for BEAD-eligible locations by state

State, Territory	Total BSLs (NTIA final approved, 2025/2026)	Fiber-to-the-Premises (Fiber, FTTP) (%)	Fixed Wireless[1] (%)	Low Earth Orbit Satellite (LEO) (%)	Hybrid Fiber-Coaxial (%)	Other technology[2] (%)
AK	46,508	51.8%	14.3%	33.9%	0.0%	
AL	94,555	70.3%	0.0%	25.1%	4.6%	
AR	79,293	73.7%	6.9%	16.2%	3.2%	
AZ	161,648	73.1%	20.2%	6.4%	0.0%	0.3%
CA	339,822	43.7%	15.6%	40.6%	0.0%	
CO	96,065	47.6%	2.8%	49.6%	0.0%	
CT	1,782	78.3%	0.0%	0.0%	21.7%	
DC	101	0%	100%	0%	0.0%	
DE	4,739	81.3%	0.0%	0.0%	18.7%	
FL	73,944	47.2%	13.0%	26.2%	13.6%	
GA	119,814	76.2%	0.0%	11.4%	12.4%	
HI	7,033	81.7%	0.0%	18.3%	0.0%	
IA	37,634	50.8%	39.6%	9.5%	0.0%	
ID	91,341	48.8%	24.8%	26.4%	0.0%	
IL	159,085	75.5%	9.2%	14.9%	0.3%	
IN	122,847	79.1%	6.4%	14.1%	0.4%	
KS	26,613	29.5%	67.5%	3.0%	0.0%	
KY	87,160	68.0%	6.5%	25.1%	0.3%	
LA	127,108	80.6%	5.9%	8.4%	5.1%	
MA	3,808	16.5%	0.0%	34.8%	48.6%	

MD	9,771	44.0%	0.0%	23.9%	32.2%	
ME	22,513	85.4%	0.0%	14.2%	0.3%	
MI	197,964	85.6%	1.4%	12.4%	0.6%	
MN	74,739	57.7%	17.3%	25.0%	0.1%	
MO	204,366	81.9%	5.6%	11.4%	1.1%	
MS	93,283	85.0%	0.0%	14.4%	0.6%	
MT	68,498	21.0%	15.3%	63.7%	0.0%	
NC	93,437	63.4%	1.4%	34.6%	0.6%	
ND	279	99.3%	0.0%	0.0%	0.7%	
NE	14,064	9.2%	56.9%	33.9%	0.0%	
NH	5,135	67.7%	0.0%	21.5%	10.8%	
NJ	11,479	43.4%	12.3%	8.7%	35.6%	
NM	42,651	41.7%	42.9%	15.4%	0.0%	
NV	26,236	64.9%	4.0%	28.2%	2.9%	
NY	52,982	27.4%	44.5%	28.1%	0.0%	
OH	83,992	44.0%	7.3%	48.1%	0.6%	
OK	40,509	53.30%	21.70%	25.00%	0.00%	
OR	104,654	52.5%	1.1%	46.5%	0.0%	
PA	129,356	57.9%	13.7%	23.1%	5.3%	
RI	2,622	80.7%	14.9%	4.3%	0.0%	
SC	20,480	47.8%	0.0%	48.7%	3.5%	
SD	7,060	59.2%	2.5%	38.3%	0.0%	
TN	43,871	76.2%	0.0%	11.7%	12.2%	
TX	242,903	50.6%	22.2%	27.1%	0.0%	
UT	30,215	54.3%	18.9%	26.8%	0.0%	
VA	85,069	79.8%	1.4%	12.9%	5.8%	

VT	15,299	83.2%	0.0%	14.4%	2.4%	
WA	166,564	35.2%	38.2%	26.6%	0.0%	
WI	175,464	76.0%	9.8%	14.1%	0.0%	0.1%
WV	73,091	93.6%	0.0%	6.4%	0.0%	
WY	38,558	33.5%	25.8%	40.8%	0.0%	
AS	6,962	99.986%	0.0%	0.014%	0.0%	
GU	1,542	99.4%	0.0%	0.6%	0.0%	
NMI	9,568	100.0%	0.0%	0.0%	0.0%	
PR						
VI						

Notes to Table A.2.4: [1] Types of fixed wireless may be aggregated (Licensed, Unlicensed, and Licensed by-Rule). [2] NTIA has not specified the type of technology.

Sources: NTIA BroadbandUSA Public Resources related to BEAD Plans and Milestones (https://broadbandusa.ntia.gov/funding-programs/broadband-equity-access-and-deployment-bead-program/public-resources-related-bead-plans-and-milestones#N)

Table A.2.5: Within-cluster comparison of state average cost per location

State/Territory	Total BSLs (NTIA final approved[25], 2025/2026)	BEAD Deployment funding (NTIA approved)	Average BEAD subsidy per location	Average provider match per location	Average expected total cost per location
Cluster 1 – Lower challenges (23 states)					
AL	94,555	$464,262,346	$4,910	$4,523	$9,433
AR	79,293	$305,491,845	$3,866	$3,010	$6,876
CT	1,782	$7,215,750	$4,049	$1,449	$5,498
DC	101	$996,099	$9,862	$3,287	$13,150
DE	4,739	$13,516,741	$2,852	$15,824	$18,676
FL	73,944	$229,662,147	$3,106	$3,330	$6,436
GA	119,814	$304,638,706	$2,543	$4,364	$6,907
IL	159,085	$986,254,515	$6,200	$3,987	$10,187
IN	122,847	$483,242,488	$4,024	$3,042	$7,066
KY	87,160	$367,126,274	$4,212	$2,733	$6,945
LA	127,108	$498,764,087	$3,943	$2,853	$6,796
MA	3,808	$18,835,466	$4,946	$2,471	$7,417
MD	9,771	$79,065,513	$8,092	$7,429	$15,521
MS	93,283	$508,353,205	$5,450	$3,447	$8,897
NC	93,437	$318,737,670	$3,411	$3,340	$6,751
NJ	11,479	$62,184,236	$5,417	$13,113	$18,530
OH	83,992	$260,629,657	$3,145	$2,308	$5,453
PA	129,356	$711,295,843	$5,501	$5,175	$10,676

RI	2,622	$10,566,150	$4,030	$3,035	$7,065
SC	20,480	$41,358,389	$2,019	$1,867	$3,886
TN	43,871	$201,902,731	$4,602	$4,565	$9,167
VA	85,069	$545,170,411	$6,409	$5,048	$11,457
WV	73,091	$545,692,254	$7,466	$3,278	$10,744
Cluster 1 Average	--	--	$4,785	$4,499	$17,794
Cluster 1 Median	--	--	$4,212	$3,330	$7,417
Cluster 2 – Medium challenges (16 states)					
AZ	161,648	$446,123,359	$2,760	$3,212	$5,972
CA	339,822	$1,574,861,927	$4,634	$2,732	$7,366
HI	7,033	$30,672,750	$4,361	$1,454	$5,815
IA	37,634	$182,302,422	$4,846	$2,817	$7,663
MI	197,964	$916,605,938	$4,630	$2,818	$7,448
MN	74,739	$378,864,147	$5,082	$2,529	$7,611
MO	204,366	$790,525,572	$3,877	$2,094	$5,971
NH	5,135	$18,623,317	$3,627	$4,901	$8,528
NM	42,651	$381,968,078	$8,956	$3,588	$12,544
NV	26,236	$170,650,263	$6,529	$2,461	$8,990
NY	52,982	$287,240,266	$5,421	$4,817	$10,238
OK	40,509	$427,589,563	$10,574	$3,587	$14,161
TX	242,903	$1,257,675,573	$5,178	$2,450	$7,628
UT	30,215	$207,444,606	$6,866	$4,048	$10,914
WA	166,564	$736,319,365	$4,421	$1,703	$6,124
WI	175,464	$696,592,288	$4,019	$2,216	$6,235
Cluster 2 Average	--	--	$5,361	$2,964	$15,672
Cluster 2 Median	--	--	$4,740	$2,775	$7,620

Cluster 3 – High challenges (12 states)					
AK	46,508	$629,172,952	$13,528	$1,552	$15,080
CO	96,065	$420,604,503	$4,378	$2,260	$6,638
ID	91,341	$426,238,563	$4,666	$2,211	$6,877
KS	26,613	$166,605,020	$6,260	$2,303	$8,563
ME	22,513	$48,369,286	$2,149	$4,859	$7,008
MT	68,498	$303,686,528	$4,434	$2,119	$6,553
ND	279	$6,133,968	$21,986	$7,328	$29,314
NE	14,064	$44,555,557	$3,171	$1,515	$4,686
OR	104,654	$587,851,818	$5,617	$3,386	$9,003
SD	7,060	$72,801,060	$10,312	$2,625	$12,937
VT	15,299	$92,845,749	$6,069	$4,572	$10,641
WY	38,558	$198,430,561	$5,146	$1,845	$6,991
Cluster 3 Average	--	---	$7,310	$3,048	$10,358
Cluster 3 Median	--	--	$5,382	$2,282	$7,786

Sources: NTIA BroadbandUSA Public Resources related to BEAD Plans and Milestones (https://broadbandusa.ntia.gov/funding-programs/broadband-equity-access-and-deployment-bead-program/public-resources-related-bead-plans-and-milestones#N)

Appendix B: Assessing BEAD funds allocations and outcomes

The costs associated with broadband infrastructure deployment vary significantly across states due to multiple contextual and geographic factors, including the proportion of low-income populations, rural and Tribal land coverage, and terrain ruggedness. Given this complexity, understanding the contextual factors is essential for states seeking to allocate BEAD funds effectively and efficiently. Strategic budgeting for broadband infrastructure is pivotal to the success and sustainability of broadband expansion efforts. To investigate this issue, this section presents regression analyses. The unit of analysis are states. Several simple linear regressions were conducted to examine how strongly BEAD subsidies, provider matching funds (private investment), and total deployment funding (the sum of subsidies and private investment) are driven by key cost drivers.

A set of contextual and geographic variables that are known to influence deployment costs were included as independent variables. The dependent variables consisted of four state-level fundings: (1) BEAD subsidy per location (Broadband Serviceable Locations, including underserved and unserved locations and community anchor institutions), (2) provider match funds per location, and (3) total funding per location. Examining these funding measures separately enables an assessment of whether BEAD subsidies, private investment, and overall funding levels are systematically aligned with state-specific contextual conditions. The specifications for the simple linear regression model are as follows:

$$\textit{BEAD subsidy per location (BSLs)}_i = \beta_0 + \beta_1 \cdot \textit{RuralPercent}_i + \beta_2 \cdot \textit{TribalPercent}_i + \beta_3 \cdot \textit{TerrainRuggednessPercent}_i \textit{ (RRS 5 level)} + \beta_4 \cdot \textit{TerrainRuggednessPercent}_i \textit{ (ARS 6 level)} + \beta_5 \cdot \textit{LowIncomePercent}_i + \epsilon_i$$

$$\textit{Provider Match per location (BSLs)}_i = \beta_0 + \beta_1 \cdot \textit{RuralPercent}_i + \beta_2 \cdot \textit{TribalPercent}_i + \beta_3 \cdot \textit{TerrainRuggednessPercent}_i \textit{ (RRS 5 level)} + \beta_4 \cdot \textit{TerrainRuggednessPercent}_i \textit{ (ARS 6 level)} + \beta_5 \cdot \textit{LowIncomePercent}_i + \epsilon_i$$

$$\textit{Expected Total funding per BSL location (BSLs)}_i = \beta_0 + \beta_1 \cdot \textit{RuralPercent}_i + \beta_2 \cdot \textit{TribalPercent}_i + \beta_3 \cdot \textit{TerrainRuggednessPercent}_i \textit{ (RRS 5 level)} + \beta_4 \cdot \textit{TerrainRuggednessPercent}_i \textit{ (ARS 6 level)} + \beta_5 \cdot \textit{LowIncomePercent}_i + \epsilon_i$$

Table B.1: Variables used in analyses

Variable	Definition	Source
BEAD subsidy per location (BSLs)	The average BEAD subsidy per location by state. The definition of location is eligible Broadband Serviceable	BroadbandUSA website (NTIA, 2026)

	Locations (BSLs), including unserved and underserved locations and community anchor institutions.	
Provider match per location (BSLs)	The average provider matches location by state. The definition of location is eligible Broadband Serviceable Locations (BSLs), including unserved and underserved locations and community anchor institutions.	BroadbandUSA website (NTIA, 2026)
Expected total funding per location (BSLs)	The average total funding per location by state. The total funding refers to the sum of the BEAD subsidy and provider match (private investment). The definition of location is eligible Broadband Serviceable Locations (BSLs), including unserved and underserved locations and community anchor institutions.	Own calculation
Percentage of rural areas	The proportion of rural areas	USDA (2025b)
Percentage of tribal areas	The proportion of Tribal land. The definition of tribal land is referred to in Mack et al. (2023).	U.S. Census Bureau, Manson et al., 2024
Percentage of RRS 5 level areas	The proportion of a given geographical area (census tract) where roads are classified as "highly rugged" (RRS = 5) based on the Road Ruggedness Scale (RRS). This scale, with five categories, assesses changes in elevation specifically along roads, with RRS 5 representing the highest level of ruggedness.	USDA (2025a)

Percentage of ARS 6 level areas	The proportion of a given geographical area (census tract) that is classified as "extremely rugged" (ARS = 6) on the Area Ruggedness Scale (ARS). This scale, which has six categories, classifies terrain based on changes in elevation, with ARS 6 representing the highest level of ruggedness.	USDA (2025a)
Percentage of low-income population	The proportion of the low-income population who are below the federal poverty line by state (2023)	U.S. Census Bureau (2024)

The number of Broadband serviceable Locations (BSLs, including Community Anchor Institutions), BEAD subsidy per location, and provider match fund per location data for each state were obtained from publicly released data on the National Telecommunications and Information Administration (NTIA) official BroadbandUSA website (NTIA, 2026). Total funding (the sum of BEAD subsidy and provider match fund) and total funding per location were calculated using NTIA data. The analysis relied on data available as of May 18, 2026. As of that date, the NTIA had approved 54 plans (48 states, 1 federal district, and 5 territories). Additionally, comparable contextual and cost-related variables were unavailable for the five territories. Accordingly, the final analytical sample comprises 48 states with NTIA-approved plans as of May 18, 2026, and 2 states (CA, IL) and the District of Columbia (DC) with preliminary plans before NTIA approval.

The percentage of rural areas (USDA, n.d.-b) and the ruggedness of locations (USDA, n.d.-a) were obtained from the USDA. The percentage of each state that is comprised of tribal lands is based on information from the U.S. Census Bureau that delineates boundaries of tribal tracts in a shapefile (Manson et al., 2021). We use the definition of tribal lands from (Mack et al., 2022), which defines tribal land as pertaining to reservation and off-reservation lands and excludes Oklahoma Tribal Statistical Areas (OTSAs), State Designated Tribal Statistical Areas (SDTSAs), and Tribal Designated Statistical Areas (TDSAs). The percentage of low-income populations of each state was obtained from the 2023 poverty estimates published by the (U.S. Census Bureau, 2024).

We sought to explore whether the BEAD subsidy per location (BSL) was responsive to known cost drivers and other conditions affecting the commercial viability of infrastructure investment. We conducted both bivariate and multivariate analyses of the factors influencing the BEAD subsidy per location (BSL). To assess the robustness of the analysis, a series of bivariate (single-variable) linear regressions was conducted for each independent variable with the dependent variable before estimating a full multivariate model (Table B.2). The results indicated that none of the contextual factors are statistically associated with the BEAD budget allocation per BSL. The absence of associations with rurality, terrain ruggedness, and low-income population implies that the BEAD subsidy per BSL across states is not strongly responsive to key cost drivers of broadband deployment. In other words, current BEAD subsidy distributions do not appear to be systematically aligned with state-specific infrastructure needs or contextual factors that influence deployment costs.

Additionally, the visualizations indicate that BEAD subsidies per BSL do not correspond systematically to the clusters identified clusters in the previous section. The figure does not show a strong association between cluster designation and relative position to the regression line. Although high-challenging states show a greater concentration of structural cost drivers, such as higher rurality, terrain of ruggedness, and other deployment barriers that increase infrastructure deployment costs, this does not automatically translate into higher subsidy requirements. Local heterogeneity in conditions, variable private sector commitments, and adjustments in the technology mix explain these outcomes.

Table B.2: Multivariate regression results predicting BEAD subsidy per location (BSL)

	B	SE	t	*p*-value
Rural areas (%)	45.949	27.801	1.65	0.105
Tribal areas (%)	70.836	74.688	0.95	0.348
RRS 5 areas (%)	-105.121	220.551	-0.48	0.636
ARS 6 areas (%)	127.173	318.494	0.40	0.692
Low-income population (%)	145.859	184.168	0.79	0.433
Intercept	1985.981	2546.171	0.78	0.439
F (5, 45)	2.10			
R^2	0.189			

Following this logic, low-challenging states would be expected to fall below the reference line. However, the deviations reveal substantial heterogeneity within each cluster, with both positive and negative deviations distributed across low-, medium-, and high-challenging states. This pattern implies that the structural comparable conditions captured by the clustering do not systematically predict or align with whether, for each state, the BEAD subsidy per location exceeds or falls below the model-predicted value. Therefore, the regression result and visualization indicate that the BEAD subsidy is not effectively allocated across states.

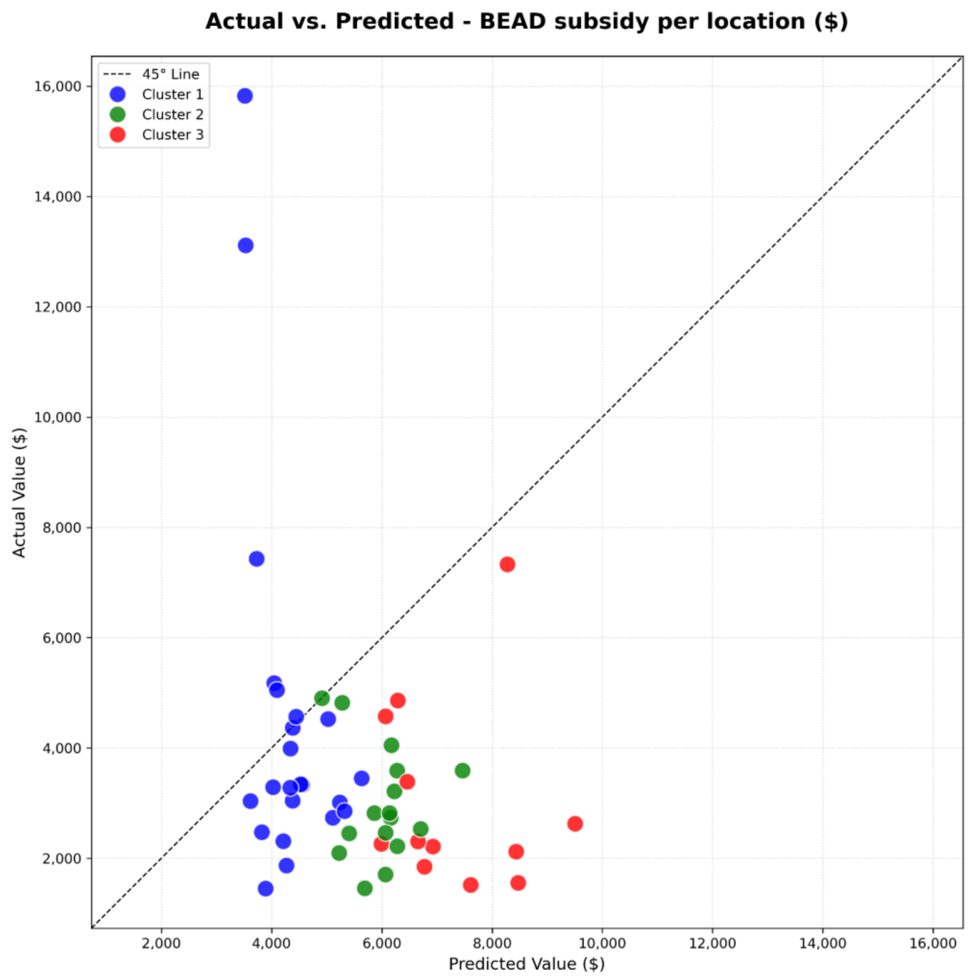

Figure B.1: Visualization of Multivariate Regression Result Predicting the BEAD subsidy per location (BSL)[28]

The second regression was conducted using the same procedure as the first, but to examine whether provider match funds per location (BSL), which is the amount of private investment for broadband deployment, was responsive to known cost drivers and other conditions affecting the commercial viability of infrastructure investment. The results indicated that only the percentage of the low-income population is negatively associated with the provider matching funding per location ($B = -300.411$, $p < 0.05$). This result is reasonable, given that private investment seeks profits and is

[28] Colors represent state clusters with comparable structural conditions, as identified by Mack et al. (2025) and above in Section 4.2. Green dots denote low-challenge states, blue denote medium-challenge states, and red denote high-challenge states.

therefore unlikely to allocate capital to locations with high proportions of low-income populations. Still, the statistical effects of rurality, Tribal land coverage, and terrain ruggedness are not observed in the regression results, indicating that provider match funds do not account for contextual factors in broadband deployment costs. As in previous regression results, private investment is not effectively allocated to eligible unserved and underserved locations and community anchor institutions, which may be related to the market failure.

As with the visualization of BEAD subsidy by location, the visualization of regression lines and residuals from the multivariate regression that predict provider match funds per location (BSL) does not align systematically with the identified clusters. In particular, states with lower challenges (green) also appeared below the reference line than in other regression results. At first glance, this seems inconsistent with the assumption that private investment under these conditions. We attribute this to heterogeneity in the context that is not captured at the state level. Future analyses will examine the data at lower levels of spatial granularity.

Table B.3: Multivariate regression results predicting provider match per location (BSL)

	B	SE	t	*p*-value
Rural areas (%)	-37.285	22.017	-1.69	0.097
Tribal areas (%)	-6.234	59.149	-0.11	0.917
RRS 5 areas (%)	43.435	174.667	0.25	0.805
ARS 6 areas (%)	-181.655	252.233	-0.72	0.475
Low-income population (%)	-300.411	145.853	-2.06	**0.045***
Intercept	8708.833	2016.451	4.32	0.000
F (5, 45)	2.11			
R^2	0.1899			

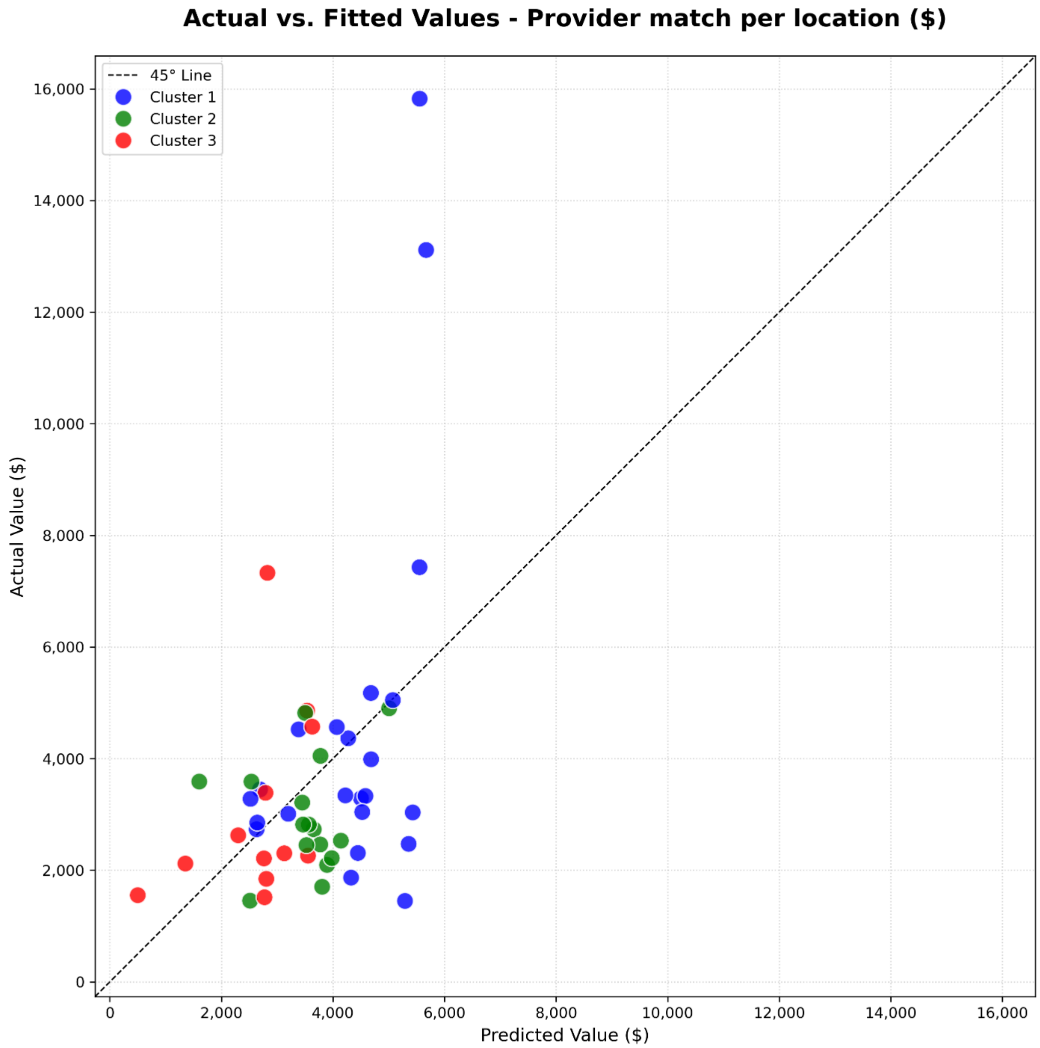

Figure B.2 Visualization of multivariate regression result predicting provider match funds per location[29]

The last regression was conducted to explore whether total funding per location (BSL), which is the sum of federal subsidy and private investment per location, was responsive to key contextual factors associated with deployment costs. The same regression procedures used in the previous analyses were applied, and the results indicated that none of the independent variables were statistically significant in their association with total funding per location (BSL). This lack of significance suggests the absence of strong or consistent patterns in the relationship between the

[29] Colors represent state clusters with comparable structural conditions, as identified by Mack et al. (2025) and above in Section 4.2. Green dots denote low-challenge states, blue denote medium-challenge states, and red denote high-challenge states.

total funding per location and cost-related factors. These findings indicate that total funding per location across states is not strongly responsive to key cost drivers of broadband deployments.

As with the visualization of BEAD subsidy by location, the visualization of regression lines and multivariate regression residuals for total funding per location does not systematically align with the identified clusters. The deviations in the figure appeared to be dispersed regardless of the identified clusters, and the clusters appeared across both positive and negative deviations. In other words, the addition of private investment to the federal subsidy does not improve the allocation of total funding for broadband deployments. Thus, both the regression results and the visualization indicate that total funding per location does not account for state-specific needs and contextual factors in broadband deployment costs and is not allocated effectively.

Table B.4: Multivariate regression results predicting expected total funding per location (BSL)

	B	SE	t	*p*-value
Rural areas (%)	8.667	40.678	0.21	0.832
Tribal areas (%)	64.596	109.283	0.59	0.557
RRS 5 areas (%)	-61.685	322.71	-0.19	0.849
ARS 6 areas (%)	-54.494	466.02	-0.12	0.907
Low-income population (%)	-154.548	269.475	-0.57	0.569
Intercept	10694.73	3725.549	2.87	0.006
F (5, 45)	0.34			
R^2	0.0369			

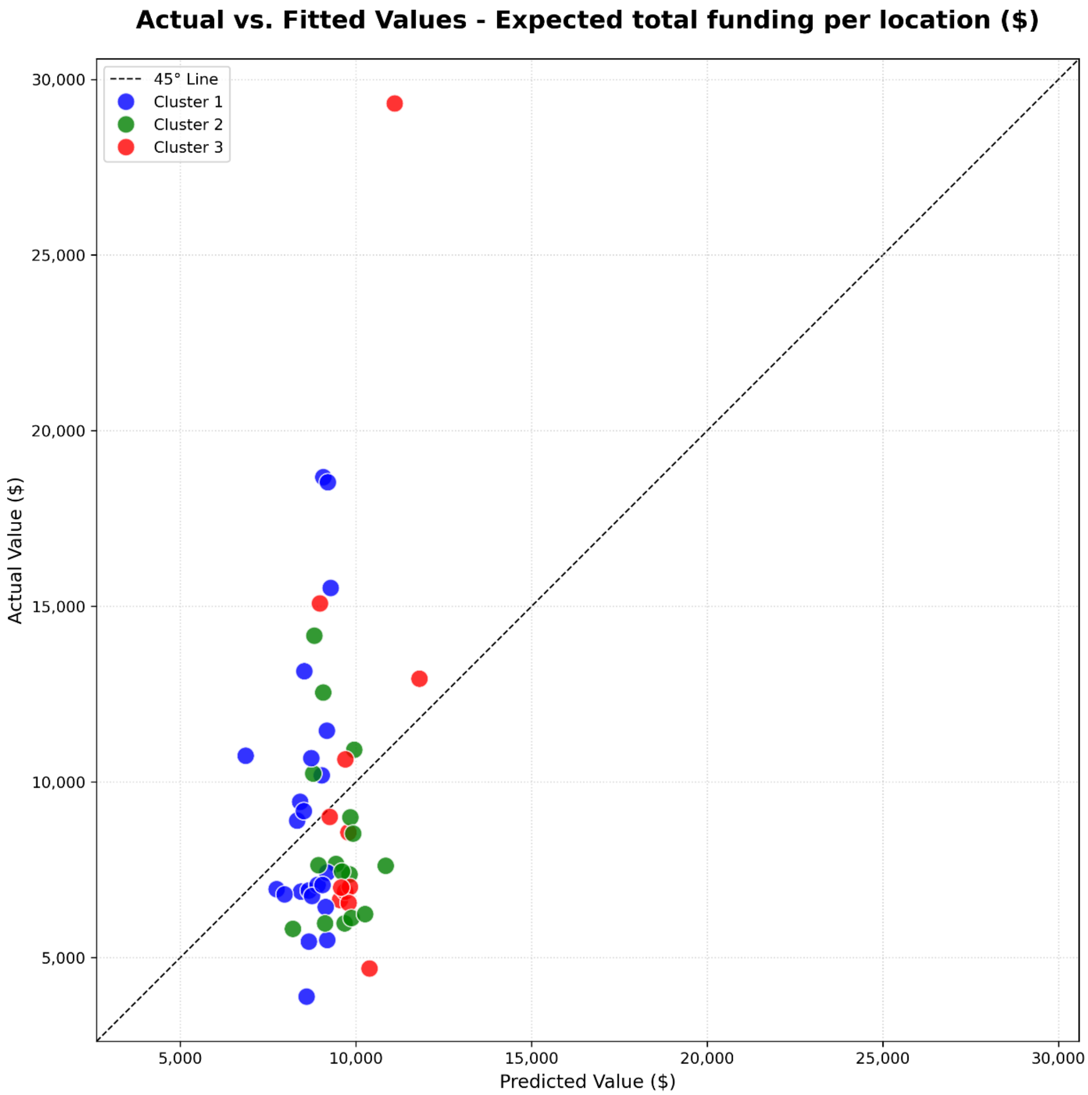

Figure B.3 Visualization of Multivariate Regression Result Predicting Total Funding per Location[30]

The inconsistency of significant contextual factors among several multivariate regression analyses indicates that the BEAD subsidy, provider match funds, and total funding per location (BSL) for each state do not systematically reflect the structural and contextual conditions of each state, suggesting that the allocation of both federal and private funds may not be optimally aligned with the underlying broadband deployment challenges.

[30] Colors represent state clusters with comparable structural conditions, as identified by Mack et al. (2025) and above in Section 4.2. Green dots denote low-challenge states, blue denote medium-challenge states, and red denote high-challenge states.

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