

**North Dakota State University
Upper Great Plains Transportation Institute
Agency 627
Denver Tolliver, Director**

2019-2021 Biennial Budget Request

**Presented to:
The Senate Appropriations Committee**

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INTRODUCTION

Greetings, Chairman Holmberg and members of the Senate Appropriations Committee. My name is Denver Tolliver. I am the director of North Dakota State University's Upper Great Plains Transportation Institute (UGPTI). Thank you for the opportunity to present the UGPTI's 2019-2021 budget request to you. In my presentation, I will discuss:

- The major components making up the "base level" amounts of UGPTI's budget
- 2019-21 budget changes to the "base level" made by the House of Representatives
- A request to the Senate Appropriations committee for an adjustment to the House bill (with an explanation and justification for that request)

In addition to this narrative, I will be using slides during my presentation to make effective use of time. The slides will follow the narrative directly.

2017-2019 BASE LEVEL BUDGET

The Upper Great Plains Transportation Institute's base level budget is shown in Table 1, by funding source. These values represent UGPTI's current appropriations for the 2017-2019 biennium, minus carry over funds and one-time funding.

Line	Item	Amount	Percentage
1.	General funds	\$3,443,174	15.5%
2.	Special funds	\$6,338,850	28.5%
3.	Federal funds	\$12,478,218	56.0%
4.	All funding sources	\$22,260,242	100.0%

GENERAL FUND COMPONENT

All of UGPTI's general funds are used for research, technology transfer, training, technical assistance, and other purposes directly related to the agency's mission. These activities comprise UGPTI's *Core Program*. UGPTI's general fund budget is distinct from NDSU's. The agencies' funds are not co-mingled.

Critical Agency Objectives

UGPTI's research, training, and technical assistance activities that comprise its Core Program provide timely and essential information to state agencies, shippers, businesses, counties, townships, cities, and tribal governments. Some of the agency's leading objectives are to:¹

- Support urban planning by offering expertise in: a) traffic analysis software (e.g., traffic signal optimization and simulation), b) metropolitan travel demand modeling, and c) automation of traffic data collection

¹ The objectives are not prioritized.

- Improve mobility by providing transit stakeholders, users, providers, suppliers, and agencies with the information and human resources needed to deliver cost-effective services in rural areas and small urban centers
- Enhance the competitiveness of North Dakota producers and businesses through freight transportation, supply chain, and logistics research
- Improve transportation infrastructure management through statewide models of economic production, truck traffic, road/bridge investment analysis, and asset management
- Support Vision Zero through an improved understanding of safety risks and mitigation strategies for rural areas and tribal communities, and through motor carrier safety research
- Enable the transfer of technology and information to state, local, and tribal units of government through technical assistance, training, and workforce development
- Facilitate the deployment of Intelligent Transportation Systems that use sensors, automated controls, and integrated communication systems to inform travelers and improve highway safety and efficiency

Importance of General Funds

Although state general funds comprise a minor percentage of UGPTI's overall budget, they are vital to the agency's success and sustainability. State funds are needed to match federal grants and provide continuity in times of delay or disruption in federal funding. Most federal grants require matching funds, which must consist entirely of non-federal funds or state planning and research dollars. Many of UGPTI's direct grants (such as the University Transportation Center grant) require a 100% match. UGPTI's general funds are the only dependable source of match for these grants.

SPECIAL FUND COMPONENT

Special funds include grants and contracts from state and local agencies and private industry. Most of UGPTI's special funds originate from the North Dakota Department of Transportation (NDDOT) under a strategic agency partnership that has benefited North Dakota for the last four decades. In addition to NDDOT funding, an annual grant from the Wheat Commission has allowed UGPTI to continuously track and report on grain shipments exported from the state over time.

Several of North Dakota's Metropolitan Planning Organizations (MPOs) provide regular (although not necessarily annual) funding to UGPTI for travel demand modeling and technical assistance in urban transportation planning. The remainder of UGPTI's special funds consist of one-time funding from commodity groups, the South Dakota Department of Public Health (for safety studies), the Montana Department of Transportation, the Minnesota Department of Transportation, and counties in Minnesota.

While UGPTI receives funds from these organizations to cover the costs of specific studies, UGPTI does not assess fees or operate facilities that generate revenue on a continuous basis. The only fees assessed by UGPTI are those charged for short courses and workshops, which are only intended to reimburse the costs of these events.

FEDERAL FUNDS

More than half of UGPTI's funding comes from federal grants and contracts. The vast majority originates from the U.S. Department of Transportation (U.S. DOT), including grants from the Office

of the Secretary, Federal Highway Administration, Federal Transit Administration, Federal Motor Carrier Safety Administration, and the National Highway Traffic and Safety Administration. Some grants (such as the University Transportation Center grant) are provided directly to UGPTI by federal agencies. In other cases, the funds are “federal source funds” provided by third parties through the federal procurement process.

In addition to the U.S. DOT, the U.S. Department of Agriculture provides UGPTI with regular funding for transportation and market reports (typically less than \$50,000 per contract). Periodically, UGPTI receives grants from the U.S. Army Corps of Engineers. However, Corps of Engineers grants are infrequent and less than \$100,000 per award. From a federal funding perspective, UGPTI is almost entirely dependent upon the U.S. Department of Transportation.

Although federal funds are important to UGPTI’s budget, they have pre-determined uses. Federal funds must be used to analyze national priorities. They cannot be refocused on state and local issues. Ultimately, UGPTI has limited discretion in determining which critical issues are researched with federal funds, as these objectives are prescribed in law. Federal research funds are not a substitute for state research dollars.

BUDGET UNCERTAINTIES

The Legislature’s special and federal funds appropriations enable UGPTI to collect grants and contracts up to the amounts shown in Table 1. These values represent the agency’s best projections of the authority needed to procure all funds that may become available during the biennium. These forecasts reflect historic grant levels, applications in progress, and anticipated RFPs.

Most grants are competitive in nature and subject to the budget constraints of the sponsoring agencies. Therefore, UGPTI’s federal and special funds appropriations reflect a range of uncertainties. The only hard dollars in UGPTI’s budget are the state general funds. Federal and special funds are provided at the discretion of intermediate agencies and are subject to the budget limits experienced by those agencies.

2019-2021 BUDGET PASSED BY THE HOUSE OF REPRESENTATIVES

As shown in Table 2, the House added \$777,487 to UGPTI’s base level. Of this sum, \$257,255 reflects authority to collect additional special or federal funds. The remainder (\$520,232) represents an increase in general funds.

As shown in Table 3, the \$520,232 increase in general funds reflects adjustments in three underlying budget components. (1) The House added \$141,095 to UGPTI’s base level for 2019-21 biennium salary adjustments of 2% per year and increases in health insurance premiums from \$1,241 to \$1,427 per month. (2) UGPTI’s general fund was reduced by \$70,863 for “miscellaneous expenses.” This adjustment relates to the 5% general fund reduction required by the initial budget guidelines, which was included in the Executive Recommendation. The House reduced the cut from 5% to 2%. (3) The House then added \$450,000 in ongoing funding to continue the road and bridge study.

Item	Base Level	Adjustments or Enhancements	Appropriation
Total all funds	\$22,060,242	\$777,487	\$22,837,729
Less estimated income	\$18,617,068	\$257,255	\$18,874,323
Total general fund	\$3,443,174	\$520,232	\$3,963,406
Full-time equivalent positions	43.88	0.00	43.88

Item	Adjustments or Enhancements			
	Salary and Benefit Increases	Miscellaneous Expenses	Road and Bridge Study	Total House Changes
Total all funds	\$398,350	(\$70,863)	\$450,000	\$777,487
Less estimated income	\$257,255	\$0	\$0	\$257,255
General fund	\$141,095	(\$70,863)	\$450,000	\$520,232

As shown in Table 4, \$257,255 of the \$398,350 budgeted for salary and health insurance increases must be paid from grants and contracts collected by UGPTI. Only 35% of the total increase would be paid from general funds.

Item	General Fund	Other Funds	Total
Salary increase	\$83,222	\$136,645	\$219,867
Health insurance increase	57,873	120,610	178,483
Total	\$141,095	\$257,255	\$398,350

REQUEST TO THE SENATE APPROPRIATIONS COMMITTEE

In 2108, the State Board of Higher Education recommended the addition of \$975,000 to UGPTI's general fund budget for a county road and bridge planning center and \$500,000 for the establishment of a research program in transformative technologies. The latter program would focus on the deployment and impacts of vehicle automation and the utilization of real-time information systems in transportation planning. The State Board's recommendations are the same as those of UGPTI's Advisory Council.

In HB 1020, the House of Representatives rejected UGPTI's request for funding for the transformative technologies program. Therefore, this option is not included in UGPTI's request to the Senate Appropriations Committee. However, the House provided partial funding for the county road and bridge planning center. Therefore, this request is being carried forward to the Senate. However, UGPTI is requesting that the Senate fully fund the county road and bridge planning center, so that all the benefits described in the following paragraphs can be realized.

BIENNIAL ROAD AND BRIDGE INVESTMENT NEEDS AND CONDITION REPORT

Movements from farms to initial storage or transfer facilities depend on county and township roads. Much of the crude oil produced in western North Dakota moves from wells to pipeline and rail transfer facilities by truck. Similarly, most of the inputs needed for oil production are delivered by truck to remote production sites located off the state highway system. County and township roads are heavily utilized in many areas of the state and are essential to the state's rural economy.

In 2012, 2014, and 2016 the Upper Great Plains Transportation Institute provided the Legislature with reports of needed investments in county, township, and tribal roads. These studies were financed with one-time appropriations. The Legislature did not provide funds for a study in the 2017-2019 biennium. Hence, UGPTI's latest traffic, road condition, and investment needs estimates are three years old. With a dynamic economy, it is important to have up-to-date information and forecasts of road conditions and investment needs when setting priorities and determining funding levels.

If this request is funded, UGPTI will collect traffic data in partnership with the NDDOT at more than 1,000 locations on county and local roads each biennium, develop current estimates of the surface conditions of all paved county and local roads, and forecast truck traffic levels resulting from economic activity in the state. These inputs will be used to predict the resurfacing, rehabilitation, graveling and other maintenance needs of county and local roads throughout the state for the next 20 years.

UGPTI's traffic model is illustrated in Figure 1. Truck trips are predicted from and to each oil spacing unit, cropland section, and major processing plant in the state. The predicted trips generated from each activity are accumulated for individual road segments. The predicted trips are compared to observed truck volumes (derived from UGPTI's traffic counts) on principal road segments. In this way, the model is calibrated against observed traffic levels in the base year. As this relationship suggests, detailed economic modeling and traffic data collection are both necessary on a regular basis to achieve the desired level of accuracy.

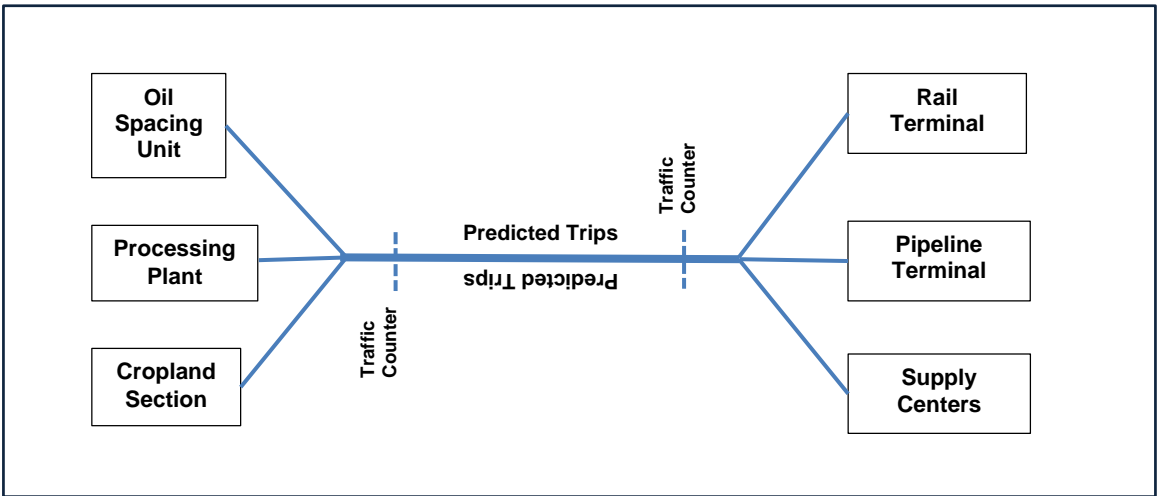


Figure 1. Truck Traffic Counting and Forecasting Process

County bridge replacement and maintenance needs are quantified in a similar manner, using a bridge

deterioration model that considers age, traffic, and design factors, as well as typical inspection/maintenance needs. If this request is funded, UGPTI will prepare road and bridge reports for the Legislature and function as a center of expertise (and source of technical information) for counties, townships, and tribal governments. In addition, UGPTI will provide the information needed for legislative proposals such as Operation Prairie Dog.

Impacts of Road Condition on Freight Costs

Good roads are vital to North Dakota’s export competitiveness and economic development. Most freight travels the first and last miles in trucks. As shown in Table 5, trucking costs increase by more than 35% when road condition deteriorates from good (a Present Serviceability Rating (PSR) of 4) to very poor (a PSR of 1). These costs ripple throughout the economy, affecting merchandisers and producers.

Road Condition	Present Serviceability Rating (PSR)	Cost Index
Excellent	5	0.91
Good	4	0.93
Fair	3	1.00
Poor	2	1.14
Very Poor	1	1.26

Source: National Academies of Sciences. 1990. *New Trucks for Greater Productivity and Less Road Wear: An Evaluation of the Turner Proposal – Special Report 227*. Washington, DC.

Trucking costs affect the net prices received by producers. By providing better roads, the Legislature is enhancing the competitiveness of North Dakota producers and increasing their access to markets.

Benefits of Road Investments

According to Federal Highway Administration, each dollar spent on roads, highways, and bridges returns more than \$5 in savings on vehicle maintenance and repairs; lower road, highway, and bridge maintenance costs; improved safety; and less fuel consumption and tailpipe emissions.² As shown in Figure 2, routine maintenance costs (such as patching and crack sealing) increase as road condition deteriorates. For example, routine maintenance cost is 60% greater at a PSR of 1.5 than at 2.5.

As shown in Table 6, deferring improvements ultimately increases capital costs. If a road can be resurfaced at the optimal time (e.g., PSR = 2.5) it can be restored to a smooth, serviceable highway (e.g., PSR ≥ 4.2) at minimal cost (e.g., \$200,000 per mile) with a thin 2-inch overlay. If, however, the improvement is deferred until the PSR drops to 2.0, a thicker overlay (e.g., 4 inches) will be needed at a higher cost (\$375,000 per mile). If the condition of the road deteriorates further (e.g., the PSR drops to 1.8), the existing surface and base layers will be too cracked, rutted, and deformed to provide structural support for an overlay. In this case, the layers must be removed (mined) and

² Kahn, M. and D. Levinson. *Fix It First, Expand It Second, Reward It Third: A New Strategy for America’s Highways*. The Brookings Institute, 2011.

blended with new material before being replaced on the subgrade. The minimum cost of such a mine and blend operation is \$600,000 per mile. In some cases, the roadway width may be insufficient for the thicker layers. If so, the road must be widened—in which case, the cost of rehabilitation could be as much as \$1 million per mile. If the PSR drops below 1.8 (e.g., to 1.5), the road must be fully reconstructed from the subgrade up at a cost of \$1.25 million per mile.

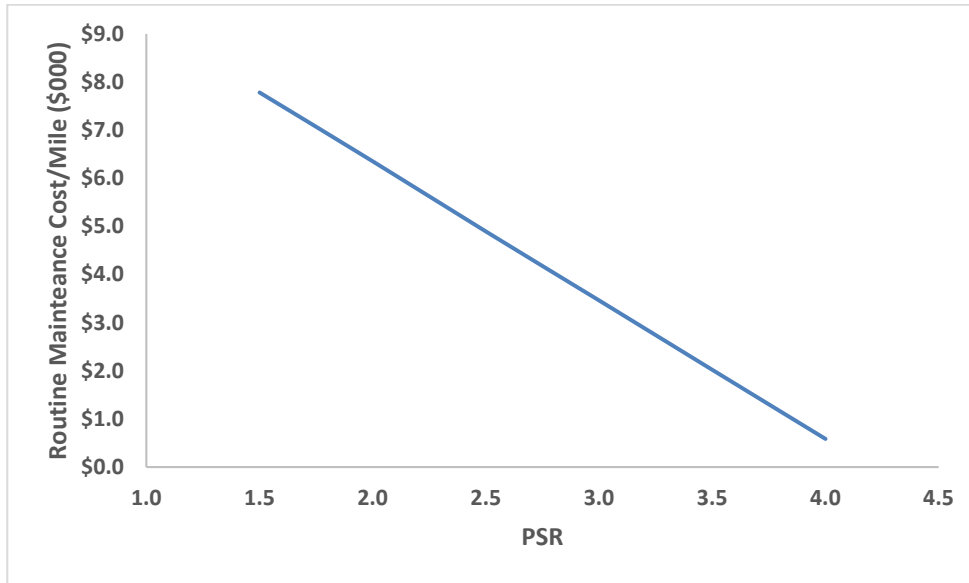


Figure 2 Change in Routine Maintenance Cost with Road Condition³

Improvement	Thickness (inches)	PSR Threshold	Cost per Mile (\$000)
Thin Overlay	2	2.5	\$200
Structural Overlay	4	2.0	\$375
Rehabilitation (Mine/Blend)		1.8	\$600-\$1,000
Reconstruction		< 1.8	\$1,250

As these illustrations suggest, timely road investments pay for themselves. The same is true of UGPTI’s biennial needs and condition studies. By quantifying the near-term investments needed, UGPTI’s studies return cost savings far greater than the costs of the studies themselves.

Road Investment and Condition Monitoring

If the county road and bridge planning center is funded, the Upper Great Plains Transportation Institute will provide the Legislature with objective and consistent estimates of investment needs and measures of effectiveness—e.g., how road conditions are improving or stabilizing over time. With the assistance of counties and the NDDOT, UGPTI will maintain a list of all resurfacing,

³ U.S. Department of Transportation. *Highway Economic Requirements System: Technical Report*, 2001, Table 5-10. Original source: Witczak, M. and G. Rada. *Microcomputer Solution of the Project Level PMS Life Cycle Cost Model*, University of Maryland, Department of Civil Engineering, December 1984.

reconstruction, and surface improvements. Given this information, UGPTI can report effectiveness measures to the Legislature, such as the number of miles improved, trends in road condition, and the freight traffic volume benefitting from the investments.

ASSET MANAGEMENT PROGRAM

Capital investments in roads and bridges can be optimized through a timed sequence of preservation and maintenance activities. Without timely maintenance, roads may deteriorate more rapidly than anticipated. According to several studies, \$1 spent on maintenance at the right time (e.g., spending on crack seals, chip seals, and other surface treatments) could save \$4 to \$5 in the future.⁴ When properly implemented, asset management can provide better road service for longer periods of time.

Basic Inventory

As envisioned, UGPTI’s asset management system will have several levels. The pace of implementation will be determined by the amount of funding available. The first level consists of a comprehensive (up to date) inventory of road and bridge assets. Each major segment of a county road between two junctions is part of this inventory. For each segment, the information shown in Table 7 will be compiled and updated biennially.

Table 7. Level 1 of Road Asset Management System – Basic Inventory	
Length of segment	Road name
Number of lanes	Owner
Roadway width	Classification (e.g., CMC or local)
Surface type	Geo-coordinates (end points of the segment)
Shoulder type/width	Public grade crossings
Structures (bridges, culverts)	Traffic control devices

If a road segment includes a bridge that is part of the National Bridge Inventory (NBI), a set of attributes will be derived for the structure (e.g., design type, age, and weight limits) using its geo-coordinates. If the bridge’s weight limit is less than 80,000 pounds, smaller trucks must be used on the segment or the payload must be reduced, thus impacting logistical efficiency. In addition to bridges included in the National Bridge Inventory, UGPTI’s asset management system will include information on minor structures – i.e., those that are less than 20 feet in length. The number of minor structures exceeds the number of NBI bridges in North Dakota. An inventory of these smaller structures would allow for better infrastructure management and load-carrying decision making at the county level.

The attributes of an at-grade railroad crossing on a road segment can be accessed by querying FRA’s Grade Crossing Database, which includes the type of crossing protection and the average number of trains per day at the crossing. Although counties are not responsible for grade crossing improvements or maintenance, the presence of crossings on a segment may affect traffic flow and safety.

A key to ensuring that all inventory items are accurate and up to date is an easy to use tool that

⁴ Kahn, M. and D. Levinson. *Fix It First, Expand It Second, Reward It Third: A New Strategy for America’s Highways*. The Brookings Institute, 2011.

allows local road managers to update the information online. This goal has been accomplished with the initial development of the Geographic Roadway Inventory Tool or GRIT. This web tool (which is already operational and in use by most counties in North Dakota) provides the capability to edit and maintain data in a geographical or map-based environment. In addition, GRIT provides online mapping tools that allow road managers and the public to view and understand the information. With GRIT, all the data collected by UGPTI each biennium will be geographically combined with basic inventory data updated by local road managers.

Road Condition

In addition to a basic inventory, Level 2 includes essential information about the condition and quality of a road (Table 8). The relevant characteristics may vary with the type of surface (paved versus aggregate). However, for a given surface, the information listed in Table 8 is essential to determining the condition and quality of the road. Ideally, all investments (using federal, state, or local funds) will be reflected in the improvement list.

Table 8. Level 2 of Road Asset Management System – Condition and Quality	
Paved Surfaces	Aggregate Surfaces
Surface condition rating	Aggregate class
Structural rating	Gravel depth
Improvements made	Date of last gravel placement
Dates of improvements	Blading frequency
Costs of improvements	Cost per mile

Substantial progress has been made during the last four years toward a consistent inventory of assets (Level 1) and surface conditions (Level 2). However, further development is necessary. By taking advantage of emergent technologies, many data collection efforts can be automated, thereby reducing the costs of maintaining an up-to-date inventory. A cost-effective method of collecting condition data can be achieved by deploying low-cost sensors in vehicles. With widespread use of these devices, the roughness of a road surface can be approximated by monitoring the motion, acceleration, and responses of vehicles. Once this new technology is deployed, road condition data can be collected each year on all segments in the state, not just on a sample of roads. Moreover, the condition assessments will be consistent from county to county and across segments.

Traffic and Operations

In Level 3, current estimates of traffic, truck factors, and roadway characteristics can be used to develop biennial assessments of the operational characteristics and utilization of roads. The average annual daily traffic (AADT), percent trucks, and distribution of traffic during the week and day are key indicators of traffic conditions and levels of service (Table 9). In addition, the annual equivalent single axle loads (or ESALs) are indicators of the structural demands being placed on roads.

AADT – all vehicles	Speed limit
Truck AADT (by class)	Directional traffic distribution
Weekday average daily traffic	Peak hour factor
Annual ESALs (paved roads)	No passing zones

Decision Making Tools

The Surface Selection tool (which has already been developed) provides technical assistance in determining when an unpaved road could be economically paved, based on life-cycle cost comparisons of paved and unpaved roads. A traffic/road condition forecasting model (which will be added in the near future) will allow counties to estimate future rates of road deterioration (based on projected traffic levels) and the timing of future improvement needs. In addition, the development of a gravel road component will provide information about graveling frequency and depth, dust control applications, and other costs (such as blading frequency), which vary with levels of truck traffic (Table 10).

Function	Decision Information
Surface selection	Paved versus aggregate surface
Condition forecasting	Deterioration of condition with time and traffic
Remaining life	Remaining ESALs or equivalent truck trips
Preservation treatments	Type and timing of treatment

In Level 4, improvement selection tools will provide technical information about the many types of improvements that could be considered for a road segment. For paved roads, these options include a range of improvements such as a thin overlay, a structural overlay, rehabilitation, and shoulder improvements; as well as typical maintenance treatments such as crack seals, chip seals, patches, and microsurfacing. For unpaved roads, the improvement selection process will consider various frequencies of blading, graveling, and gravel depth.

Consistent Comparable Measures

The ideal situation is for all counties in the state to use the same asset management system, which will generate consistent performance measures and allow UGPTI to develop comparable estimates of investment needs across jurisdictions. If each county develops its own system and measures, the Legislature must compare requests from individual counties based on different assumptions and metrics. If each county develops its own system, large-scale duplications of effort will result. With

base-level funding, UGPTI can host an asset management system for the entire state and add functions over time to make it a decision making tool similar to the one used by Federal Highway Administration.

CONCLUSION

Thank you for the opportunity to present the Upper Great Plains Transportation Institute's 2019-2021 budget requests. UGPTI's general fund budget request (exclusive of the compensation package) is summarized in Table 11. I am asking the Senate Appropriations Committee not to cut UGPTI's starting base level budget and to add the full funding requested for the county road and bridge planning center.

Line	Item	Amount
1	Base level budget	\$3,443,174
2	County road & bridge planning center	\$975,000
3	Total general fund budget request	\$4,418,174