## Executive Summary

This report focuses on the structural challenges facing the emergency medical services (EMS) system along the I-376 corridor in Allegheny County from Squirrel Hill to Monroeville. As a major regional transportation artery, the combination of traffic congestion and road design issues has led to a high spatial concentration of accidents and medical emergencies, which frequently span multiple municipal jurisdictions. However, this “regional demand” is met by a highly fragmented EMS delivery system while services are primarily managed independently by individual municipalities, lacking regional coordination in governance structures, funding sources, and staffing.

The current system faces two core constraints. First, at the funding level, the existing support mechanism, which relies primarily on annual appropriations and grants, provides only short-term relief but fails to cover rising operational costs, resulting in a chronic structural funding gap. Second, regarding human resources, the volunteer-based EMS model is steadily weakening. Declining volunteer participation, an aging workforce, and rising service demand further exacerbate the system’s supply-demand imbalance.

To address the challenges, this report proposes an integrated approach that combines financing and workforce strategies. The key premise is that sustained, high demand in this corridor cannot be resolved through isolated measures, but requires coordinated intervention. On the financing side, the approach introduces targeted corridor-based subsidies alongside regional cost-sharing. This ensures that funding better reflects the high and concentrated service demand, while reducing the mismatch between localized funding responsibilities and regional service use. On the workforce side, the model incorporates financial incentives for volunteers and a hybrid staffing structure. Incentives such as stipends and educational benefits aim to improve recruitment and retention, while the combination of paid staff and volunteers ensures both baseline service capacity and flexibility during peak demand.

It is anticipated that this hybrid model will help improve service coverage in high-risk corridors, and enhance staff retention and system stability. At the same time, by promoting inter-municipal collaboration and resource integration, this approach can improve operational efficiency while reducing public health risks and potential medical costs resulting from response delays. Overall, this report offers a practical policy pathway for enhancing the sustainability and regional response capabilities of EMS systems within a highly fragmented governance context.

To quantify the financial impact of this regional demand, a dual-model cost estimation framework was developed using the Municipality of Monroeville as a case study. Model 1 applied a time-weighted proportional allocation approach to estimate the highway's share of total departmental budgets. However, this approach revealed a significant limitation: it severely understated EMS costs (estimating only $859 for 17 incidents), exposing a structural flaw where public municipal budgets typically report net expenditures rather than true operational costs. To address this discrepancy, Model 2 was developed as an independent baseline utilizing national

average unreimbursed transport costs (RAND/CMS), which estimated a much higher EMS burden of approximately $26,000. In truth, neither model provides a perfect reflection of local costs; both are forced to rely heavily on national benchmarks and estimated averages due to the absence of precise municipal tracking.

Despite their imperfections, both models and the paper as a whole confirm a measurable and uncompensated financial burden imposed by I-376 incidents. More importantly, the vast discrepancy between the two models, alongside the inability to scale this framework across other corridor municipalities, highlights a critical structural barrier: severe data inconsistencies and a lack of standardized reporting. Consequently, the primary recommendation of this report is the implementation of a voluntary, corridor-wide standardized data collection protocol facilitated through CONNECT. By standardizing incident-level metrics and tracking true net operating costs, municipalities can produce a unified, defensible "Cost of Service Analysis." This data collection mandate is the requisite foundation for securing the targeted subsidies, regional cost-sharing, and state-level reimbursements proposed in this report.

## Part One Introduction

### 1.1 Introduction to Connect

Our primary partner for this project is the CONNECT Research Council. This initiative supports community-engaged research and is jointly operated by CONNECT and the Southwestern Pennsylvania (SWPA) Municipal Project Hub. CONNECT is a nonprofit organization that convenes over forty municipalities in Allegheny County to collaborate on shared challenges, including infrastructure development, public wellbeing, and community resilience. The SWPA Municipal Project Hub further supports local governments and community organizations across twelve counties in Southwestern Pennsylvania by assisting with the design, funding, and implementation of sustainable economic development initiatives.

### 1.2 Problem Statement

This study examines the challenges facing Emergency Medical Services (EMS) along State Highway 376 in Allegheny County, focusing on the corridor between Squirrel Hill and Monroeville. Multiple municipalities along this corridor share responsibility for responding to emergency incidents, particularly those arising from high traffic volumes and frequent congestion.

Providing EMS along major highways requires significant resources, including trained personnel, emergency vehicles, and specialized medical equipment. However, many municipalities in this region rely heavily on volunteer-based EMS systems that face persistent funding constraints. These financial limitations have made it increasingly difficult to maintain adequate staffing levels and ensure timely emergency response.

In response, CONNECT is working to address these challenges by mobilizing regional collaboration and strengthening the evidence base on EMS funding gaps. The objective of this

project is to produce a research report that clearly demonstrates the extent of these gaps and supports efforts to secure additional funding from government agencies and other funding organizations.

## Part Two Policy analysis

### 2.1 System Analysis: Mechanism of EMS service Delivery

In the United States, Emergency Medical Services (EMS) operate not as a single, centralized organization, but as a complex system composed of multiple institutions, agencies, and service providers. This system integrates emergency communication centers, ambulance services, hospitals, local governments, as well as state and federal oversight into a coordinated response network.

Highway emergencies, including traffic collisions and medical incidents, rely heavily on the effective functioning of this broader system. However, EMS delivery is highly decentralized and varies significantly across communities. Some jurisdictions provide EMS directly through municipal or county governments, while others depend on fire departments, hospital-based systems, private ambulance companies, or volunteer organizations. As a result, service capacity and quality differ widely depending on local resources, workforce availability, and funding structures.

This system is supported through a multi-level governance framework. At the federal level, agencies such as the National Highway Traffic Safety Administration provide national standards and guidance. At the state level, EMS offices are responsible for regulating service providers, licensing personnel, and coordinating statewide systems. At the local level, municipalities typically bear responsibility for ensuring service coverage, either through direct provision or contractual arrangements. Financially, EMS systems rely on a combination of local government funding, insurance reimbursements, and grant-based support.

In the context of highway EMS along corridors such as Route 376, the central issue extends beyond emergency response itself. It lies in whether the surrounding system is sufficiently robust to sustain reliable and timely service delivery under conditions of persistent and concentrated demand, including its governance structure, funding mechanisms, workforce capacity, and intergovernmental coordination.

### 2.2 Existing nationwide challenges

#### 2.2.1 Financial Sustainability

Financial sustainability represents one of the most significant structural challenges facing EMS systems across the United States. Recent national data from the Centers for Medicare & Medicaid Services (CMS) Ground Ambulance Data Collection System indicate that the average

cost of an ambulance transport is approximately $2,673, while the average reimbursement is only about $1,147. This results in an average revenue shortfall of roughly $1,526 per transport, highlighting a systemic pattern of under-reimbursement (Centers for Medicare & Medicaid Services 2023).

As a result, many EMS agencies rely heavily on subsidies from local governments or municipal budgets to sustain operations, placing increasing fiscal pressure on local jurisdictions and raising concerns about long-term system sustainability.

These financial challenges are closely linked to shifts in federal policy. While early federal support helped establish EMS systems, subsequent policy changes—particularly the Omnibus Budget Reconciliation Act of 1981—shifted primary funding responsibility to states and, in practice, to local governments (U.S. Congress 1981). At the same time, the Emergency Medical Treatment and Labor Act (EMTALA) requires emergency care regardless of ability to pay, further increasing financial pressure on providers (U.S. Congress 1986).

Together, these factors have produced a persistent funding gap—exceeding $1,500 per transport on average—and have led many EMS agencies to depend heavily on local funding and community support to maintain service delivery.

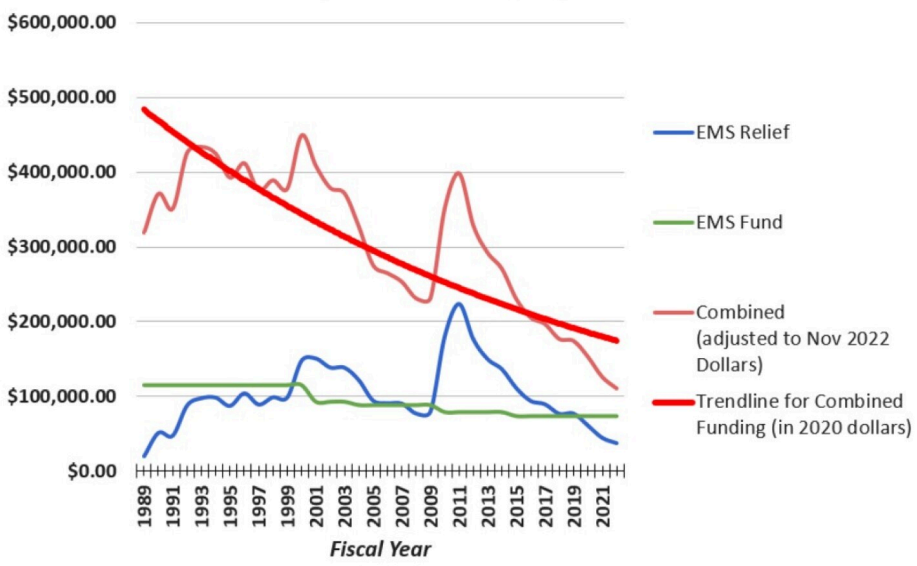


*Figure 1. EMS Systems Funding Adjusted for Inflation*
*Source: Brainerd Dispatch, "First responders seek help as funding dwindles."*

### 2.2.2 Lack of Volunteer

Another major challenge facing EMS systems is workforce sustainability, particularly the ongoing decline in available personnel. Across the United States, EMS delivery relies significantly on volunteer responders. National estimates suggest that volunteers make up approximately 20 percent of the EMS workforce, and in many rural areas, this share can reach

as high as 70 to 90 percent (National Association of State EMS Officials 2020; Center for Rural Pennsylvania 2022). As such, volunteer personnel play a critical role in maintaining emergency medical services, especially in communities with limited resources for full-time staffing.

However, EMS agencies are facing increasing difficulty in recruiting and retaining volunteers. Several structural factors contribute to this trend. First, the existing volunteer workforce is aging, while fewer younger individuals are entering the field. Second, training and certification requirements for EMTs and paramedics have become more rigorous, creating higher barriers to entry for individuals balancing full-time employment or other commitments (National Highway Traffic Safety Administration 2019).

At the same time, rising EMS call volumes in many regions have placed additional strain on an already constrained workforce. This has resulted in staffing shortages, increased workloads, and, in some cases, reduced system capacity. In certain communities, these pressures may directly affect response coverage and response times (National Association of State EMS Officials 2020).

When combined with the financial constraints discussed in the previous section, the decline in volunteer personnel presents a significant challenge to the long-term sustainability of EMS systems. These workforce and funding pressures are particularly pronounced in regions where multiple municipalities share responsibility for service provision, further complicating coordination and resource allocation.

### 2.2.3 Coordination Problems in Highway EMS Response

Highway emergency response depends heavily on coordination across multiple EMS systems and public safety agencies. However, several structural challenges make effective coordination difficult.

First, EMS governance is often fragmented along highway corridors. Major highways frequently cross multiple municipalities, yet EMS systems are typically organized at the local level rather than regionally. As a result, different agencies may operate under separate dispatch systems, response protocols, and staffing structures. This fragmentation can delay response, as dispatchers may need to determine jurisdictional responsibility before deploying resources.

Second, many EMS systems rely on mutual aid agreements between neighboring agencies when local units are unavailable. While mutual aid helps address resource shortages, it can also introduce variability in response times and coordination, particularly when agencies differ in capacity or operational procedures.

Finally, highway incidents require coordination among multiple public safety actors, including EMS, law enforcement, fire departments, and transportation agencies. Differences in communication systems, radio channels, and operational protocols can create additional barriers to timely and effective coordination during emergencies.

These coordination challenges can directly affect patient outcomes. Delays in response time are associated with increased mortality risk in emergency situations, highlighting the importance of timely and coordinated action.

For highway EMS systems, improving coordination and communication across agencies is therefore critical to reducing response delays and improving overall system performance.

### 2.3 Pittsburgh's specific circumstances

#### 2.3.1 Funding Gap in Pittsburgh

Local media reports often highlight the presence of public funding for emergency services. For example, a recent article in the *Monroeville Times Express* reported that approximately $242,000 in grants were awarded to 17 fire and EMS agencies in the region, with funds intended to support operations and emergency response capabilities (Monroeville Times Express 2026). At first glance, such funding suggests that EMS systems are being adequately supported.

However, the existence of these grants does not imply that funding needs are fully met. Instead, they illustrate a broader structural issue in EMS financing.

First, grant funding is typically limited in scope, duration, and flexibility. Federal and state grant programs, such as the Assistance to Firefighters Grant (AFG), are primarily designed to support equipment purchases, training, and capacity building, rather than ongoing operational costs (Federal Emergency Management Agency 2024). These funds are often one-time or short-term allocations and may be restricted to specific uses.

Second, EMS systems face continuous and high fixed costs. Core expenditures, including personnel salaries, vehicle maintenance, medical equipment, and readiness for emergency response, require stable and predictable funding streams. These recurring costs cannot be sustainably covered through intermittent grant funding alone.

This creates a structural mismatch between funding and expenditure. While grants provide episodic financial support, the cost structure of EMS services is ongoing and cumulative. As a result, agencies may receive funding in a given year but still face persistent budget shortfalls.

This pattern is consistent with broader national evidence. EMS funding in the United States is widely characterized as fragmented and insufficient, relying on a combination of grants, insurance reimbursements, local government contributions, and donations, none of which independently or collectively ensure full cost recovery (National Association of State EMS Officials 2020). Similarly, regional assessments have found that even when multiple funding streams are combined, EMS agencies often struggle to cover total operating costs (ROBB Consulting 2021).

Therefore, the presence of annual grants should not be interpreted as evidence of adequate funding. Instead, it reflects a system in which supplemental funding coexists with persistent financial gaps.

In summary, although grant funding plays an important supportive role, it does not address the underlying structural imbalance between stable funding needs and inconsistent revenue sources. This gap is central to understanding the EMS funding challenge in the Pittsburgh region and motivates the need for a more systematic assessment of funding adequacy.

### 2.3.2 Volunteer Shortage in Pittsburgh

Although the available studies on the topic do not specifically focused on Pittsburgh, broader evidence from Pennsylvania indicates a significant and ongoing shortage of EMS volunteers across the state, a pattern that is also relevant to local EMS systems in the Pittsburgh region. In light of this information, the reduced involvement of volunteers in the Pennsylvania EMS organizations can be explained by the existence of an imbalance between the following three elements: financial constraints, increasing service demand, and rising training requirements. Together, these forces interact to reduce both the feasibility and attractiveness of sustained volunteer engagement.

First, limited financial resources have a negative impact on the sustainable involvement of volunteers, as they restrict both organizational opportunities and personal motivation. For instance, 44 percent of rural and 61 percent of urban/mixed EMS agencies experienced financial deficits during the last three years and received no municipal support for their operations.  In this context, volunteers often receive little or no compensation, making it difficult to reconcile EMS responsibilities with employment or academic obligations.Moreover, financial resources play an important role in ensuring the stability of the workforce. As a result, EMS agencies in Pittsburgh face ongoing challenges in both recruiting and retaining volunteers.

Secondly, growth in service demand worsens these restrictions, because of the added pressure that results from an already overstretched workforce. EMS organizations still have to deal with a significant number of calls, at average levels of 4,524 per year for urban or combined areas and 2,009 for rural areas in Pennsylvania. Despite the constant call demands, EMS organizations continue to depend extensively on volunteers. Simultaneously, however, the number of volunteers continues to dwindle; 52 percent of rural organizations and 36 percent of urban or combined organizations have noted a decline in the number of volunteers during the last two years (Center for Rural Pennsylvania 2022).

Lastly, increased training requirements act as an obstacle to both entry into and retention in the volunteer EMS provider workforce. Though agencies understand that training is important to ensure continued service delivery, the level of training required from EMS providers has recently escalated not only in terms of hours but also in terms of overall time required. For instance, new EMS providers must undergo about 120 hours of training, taking between three to eleven weeks. The increased time taken for training, certification, and further training raises the cost of participation for volunteers. Workforce development mechanisms like financial incentives for

training and state-level EMS training services have been identified by agencies as crucial to addressing the problem of recruitment and retention. But without adequate funding, this increased requirement acts as a driver for voluntary departure. Job demands and time demands have always been among the most prominent reasons for departure among providers (Center for Rural Pennsylvania 2022).

When all of these factors are considered collectively, it is clear that the problem of falling EMS volunteers is not a one-off or short-term phenomenon but a result of structural mismatch. The demands for services are constantly rising, as are the professional standards that must be met.

### 2.3.3 Context for I-376 Traffic Problem

The heavy congestion experienced in the I-376 corridor, especially around the Squirrel Hill Tunnel area, is a significant structural cause of EMS demand within the city. This corridor carries more than 100,000 vehicles per day, making it one of the most heavily trafficked transportation routes in the area (511PA, 2026). The amount and rate of vehicular movement set the stage for a higher likelihood of incidents occurring.

In addition, real-time traffic data supports the constant nature of congestion in the area. In this regard, the PA Department of Transportation's 511PA program indicates that the section of I-376 under consideration has been placed under red traffic conditions. Such classifications denote lower-than-normal speeds for vehicles passing through the stretch, as well as congestion (511PA, 2026). The constant congestion pattern suggests that the highway experiences frequent congestion rather than experiencing sporadic disruptions to traffic flow.

From a risk-based perspective, traffic congestion characterized by dense traffic flow and low speed results in repetitive stop-and-go maneuvers, which in turn increase the probability of rapid stops and rear-end accidents. In such cases, multiple car accidents commonly occur in chain reactions, many of which have serious consequences and often entail injuries or even loss of lives. Overall, as can be seen, this results in the high prevalence of traffic emergencies on the road and contributes to a high level of EMS call volume.

Moreover, traffic congestion on I-376 also affects EMS demand because the demand is not only high but also spatially clustered. Due to its importance as a major transportation route crossing several municipalities, I-376 acts as an interjurisdictional corridor where emergencies are likely to take place within a limited geographical area. Consequently, such spatial clustering creates the hot spot for emergency response, which requires coordinated efforts and responses of multiple agencies located in various jurisdictions within the small geographical territory.

Overall, these considerations point to the need to recognize that traffic congestion on I-376 is more than a mere context, which is one of the key factors in driving EMS demand. The fact that it contributes to the occurrence of accidents as well as the need for emergency services in a strategic route makes traffic congestion an important aspect of EMS demand formation in Pittsburgh.

## Part three Policy Recommendations

### 3.1 Existing Solution Nationwide

#### 3.1.1 EMS Funding Models in other states

To identify viable pathways for improving EMS sustainability, this section examines how EMS funding systems are structured across different states in the United States. Despite the differences in institutions and funding systems used in different regions, a comparative study of existing funding models shows common traits that indicate certain ways to ensure financial security and stability. The central argument is that EMS systems are more sustainable when they rely on stable, institutionalized, and diversified funding mechanisms rather than fragmented or single-source revenue structures.

The first funding method includes EMS taxes or the creation of special districts for EMS services. This strategy entails the introduction of a particular tax or special EMS fee that will serve as the financing channel only for EMS services. This system has been utilized in such states as New York or Minnesota. The key benefit offered by this method is predictability in terms of funds generation. As the revenues from this tax go directly to EMS services, agencies are able to plan ahead, purchase equipment, and provide high-quality services constantly without depending on uncertain sources of financing like donations or municipal budgeting (National Conference of State Legislatures 2026).

Second, there is the inter-municipal cost sharing funding model. It entails the cooperation of several municipalities to finance the same EMS operation. The contribution made by these municipalities towards the shared EMS operation is normally calculated based on parameters like population, service demands, or fiscal capacity among other factors. Examples of the implementation of this funding model include Pennsylvania, Wisconsin, and Colorado. This method is characterized by regional equity and efficiency. Through this strategy, municipalities will be able to finance an EMS system that is bigger, meaning that services will not be duplicated, leading to enhanced coverage even beyond municipal lines (Institute of Medicine 2007).

Third, the state EMS subsidy funding model. This funding model refers to any assistance given directly to local EMS systems from the state level, which helps these agencies finance their operations. This type of funding becomes especially necessary in underserved and rural areas when the revenue base at the local levels cannot support the operations of EMS. In particular, several states have implemented funding programs for these agencies. This strategy shows that EMS is considered vital to the welfare of communities, and thus state involvement is critical (National Highway Traffic Safety Administration 2019).

Even in light of the existence of these models, however, the funding arrangement that prevails throughout the country remains a combination of both models. Indeed, it is worth noting that most EMS organizations derive their funds from various sources ranging from insurance reimbursements to taxes, grants, and community funding. By adopting such a diverse funding

model, the risk associated with the heavy dependence on one source of income is effectively mitigated (U.S. Government Accountability Office 2001; CDC 2024).

In conclusion, the above discussion highlights the importance of the financial aspect of sustaining an EMS program. As evident from the comparative analysis conducted, successful EMS programs rely greatly on sound financing practices that ensure the availability of a variety of funding options. The process entails not only the institutionalization of revenue sources but also distribution of financial obligations among different entities.

### 3.1.2 EMS workforce shortage strategies in other states

Addressing EMS workforce shortages requires more than simply increasing headcount. In practice, regions across the United States have adopted a range of staffing and workforce strategies that reflect local differences in fiscal capacity, service demand, and institutional structure. Based on an examination of current trends, it may be noted that sustainable EMS workforce development is best achieved through models that feature flexible staffing solutions and include both regional collaboration and increased focus on recruitment and training efforts (National Highway Traffic Safety Administration 2019; National Association of State EMS Officials 2020).

An important example of EMS staffing models would be the use of the mixed career-volunteer staffing model where paid EMS workers are supplemented with volunteer EMS providers. The significance of this model relates to its potential to ensure stability and flexibility at once because paid workers allow ensuring a minimum base-level staff complement, whereas volunteers enable adding manpower to deal with peak hours or situations when finances do not allow hiring sufficient numbers of paid personnel. Thus, a community benefits from the economic aspect of voluntary EMS services while avoiding vulnerabilities related to understaffing (Center for Rural Pennsylvania 2022; National Association of State EMS Officials 2020).

A second strategy involves regional workforce sharing across municipalities. In this approach, cities cooperate to manage some aspects of staff, training, and sometimes dispatch management. The main benefit of this approach is that it decreases fragmentation. Instead of having to provide sufficient staffing independently for each city, regionalized staff sharing allows small towns to tap into larger pools of labor force. It may also make staffing allocation more flexible and efficient by eliminating redundancy and improving service delivery (ROBB Consulting 2021; National Highway Traffic Safety Administration 2019).

A third response focuses on workforce development through financial and institutional support mechanisms. The problem of staffing shortages is not limited to poor retention rates among current employees but is rooted in insufficient recruitment strategies that hinder the development of adequate pipelines for future recruitment. To solve the problem, several states have started offering tuition support, training programs, and special recruitment campaigns to

attract more people to work in EMS services (Federal Emergency Management Agency 2024; National Association of State EMS Officials 2020).

Apart from these two options, most agencies use some type of hybrid workforce composed of paid personnel, volunteers, and part-timers. Such an option is important for its flexibility. A diverse labor force enables agencies to adapt to changing workforce dynamics and adjust to the labor market demands of their locality. This kind of strategy is crucial especially in places where full reliance on career employment is not feasible, but full dependence on volunteerism cannot suffice anymore (National Highway Traffic Safety Administration 2019).

Overall, all the examples discussed above illustrate the point that EMS workforce shortage problems should be tackled through a combined strategy and not a change in one staffing policy. Areas that succeed in solving the problem usually make it a combination of having a stable staffing base, working across jurisdictions, and investing in workforce development.

### 3.2 Existing Solution in PA

Building on the comparative analysis of EMS funding models, the Upper Dauphin County case provides context-specific insights into how Pennsylvania's institutional framework shapes EMS sustainability challenges. From an institutional standpoint, the key point in relation to the Upper Dauphin County's case is the following fact: there is an existing threat to system sustainability caused by institutional misalignment between service delivery and funding mechanism.

At the institutional level, Pennsylvania law assigns responsibility for ensuring the availability of fire and EMS services to municipal governments. Municipal governments have to guarantee that residents are ensured with fire and EMS protection services at their places of residence. However, the law does not provide any guidelines for developing specific funding mechanisms, giving municipal authorities considerable discretion in terms of choosing ways of organizing such funding.

Against this background, the Upper Dauphin County case describes several institutional threats related to EMS sustainability. First, insurance reimbursement appears to be the main source of funding, but it is not enough for covering costs associated with running services. Second, it should be admitted that voluntary subscription and donation appear to be ineffective sources of funding, with their share constituting only 24 percent (ROBB Consulting 2021).

There is another interesting insight from the report worth highlighting. The EMS services in the region are already provided to several municipalities and essentially operate as regional services providers. Nevertheless, their funding structure remains fragmented since it depends mainly on contributions from individual municipalities or community donations. Consequently, the system has to operate on a regional basis, but the funding structure is still highly localized.

This situation implies that the current situation reflects a certain discrepancy between the geographic scope of service delivery and funding mechanisms used. Although the process of

EMS service integration has been successfully completed, the fact that funding is still organized through a highly fragmented mechanism does not allow for stable funding and planning.

There is one more significant policy lesson which can be learned from the Upper Dauphin example. It appears that the problem of fragmented funding even within the context of successful operation integration can make service provision difficult.For multi-municipal service areas such as the CONNECT corridor, this evidence indicates that more formalized municipal cost-sharing arrangements and regional governance structures may be necessary to align funding with service delivery and ensure long-term system stability within Pennsylvania's legal framework.

### 3.3 Recommendations for 376 in Pittsburgh

In order to solve the problems encountered by EMS along the I-376 corridor, a combined approach involving financing and staffing initiatives can be considered. The key argument is that the constant pressure on EMS along the I-376 corridor will not be solved by making changes in isolation. Therefore, a combination of initiatives that will match financing to the amount of services demanded and strengthen the staff is needed.

From a financing perspective, the model includes a corridor subsidy initiative. The existing annual grant funding program does not take into account the ongoing, repetitive, and high volume of operations due to the number of calls made during congested periods in the I-376 area. A subsidized program targeting this corridor will ensure that the required level of financing is available for an EMS system operating under constant high demand conditions.In addition, reducing restrictions on how grant funds can be used would allow EMS providers greater flexibility to allocate resources where they are most needed, thereby improving operational efficiency and responsiveness.

Simultaneously, there needs to be a cost-sharing approach at the regional level to address the current imbalance between demand and funding allocation. The demand for EMS services in the region is highly centralized, yet the funding responsibility is not. By pooling funds, the costs will be spread more evenly according to service use. This strategy addresses the disparity between funding and service provision in light of its regional characteristics.

From a staffing standpoint, the model incorporates the implementation of financial rewards for the volunteers. The lack of financial compensation continues to serve as one of the primary hindrances to both recruiting and retaining personnel. Offering stipends, response fees, and educational perks can alleviate the costs associated with volunteering.

Lastly, the hybrid staffing system is one where there is a combination of paid EMS employees alongside volunteer staff members. The presence of paid employees ensures that there is a constant level of baseline services offered, while the volunteers can come in handy especially when there is high demand for their services. With the hybrid system, EMS institutions will be

able to adjust according to the changing needs in terms of service provision while not entirely relying on highly expensive staff systems.

The model above integrates all three approaches mentioned above to tackle the challenges of unstable funding and shortage of manpower in the provision of EMS services.

**Part Four: Data for Monroeville Case Study**

The subsequent phase of this project involves analyzing the cost of emergency services and utilizing the provided data to construct a framework that estimates these costs along I-376. For this data section, the focus is placed specifically on the Municipality of Monroeville. Before detailing the framework itself, it is necessary to establish why Monroeville was selected as the primary case study and outline the data utilized to accomplish this analysis.

The selection of Monroeville stems entirely from data availability. Among the municipalities along the I-376 corridor, Monroeville is the sole jurisdiction where a complete cost-allocation model could be constructed due to the availability of three key inputs: corridor-specific incident data, total departmental call volume, and detailed municipal budget figures. This specific combination allows for a structured and replicable approach to estimating the cost burden associated with highway-related emergency response.

This analysis relies on combining municipal financial records with emergency response data to evaluate the cost burden of corridor incidents. The purpose of this section is to establish the empirical foundation for the cost models developed later in the paper by describing the structure, sources, and limitations of the data used in the Monroeville case study.

The primary financial dataset is drawn from the Municipality of Monroeville's 2025 budget, which includes actual expenditure figures from fiscal year 2024. These records provide total annual spending for police, fire, and emergency medical services (EMS), representing the full cost of maintaining emergency response capacity. Because these budgets are reported as aggregate departmental expenditures rather than costs tied to individual incidents, they must be interpreted as supporting system-wide readiness rather than discrete responses.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 2105 Police Chief | 374,844 | 472,869 | 412,280 | 374,738 | 577,233 | 387,975 | -32.79% |
| 2110 Emergency Communications | 1,106,995 | 989,065 | 1,034,366 | 930,310 | 1,152,956 | 1,280,552 | 11.07% |
| 2120 Police Patrol | 8,752,895 | 8,690,488 | 8,105,490 | 7,763,478 | 7,920,457 | 8,759,821 | 10.60% |
| 2130 Police Detective Division | 1,129,144 | 1,210,047 | 1,039,198 | 1,002,830 | 1,068,972 | 1,122,325 | 4.99% |
| 2135 Support Services | 246,350 | 211,672 | 212,581 | 192,523 | 230,125 | 241,678 | 5.02% |
| 2160 School Crossing Guards | 7,829 | 24,161 | 54,953 | 43,196 | 46,636 | 52,980 | 13.60% |
| 2200 Fire Suppression | 376,395 | 390,845 | 498,878 | 494,799 | 496,337 | 566,062 | 14.05% |
| 2300 Building & Engineering Srvs Dir | 245,224 | 146,761 | 119,912 | 100,546 | 249,166 | 253,997 | 1.94% |
| 2350 Building Inspection/Fire Prev | 331,065 | 327,156 | 337,336 | 303,804 | 343,959 | 355,301 | 3.30% |
| 2400 Ambulance Service | 240,721 | 253,476 | 272,156 | 277,186 | 289,600 | 313,110 | 8.12% |

*Figure 2- Monroeville Emergency Service Budget*

*Source: 2025-Budget-PDF*

Crucially, not all budget items were included in this analysis. Expenditures for functions such as school crossing guards, the building and engineering service division, and building inspection were systematically removed. These costs bear no relation to the operational readiness of emergency services, nor do they correlate with I-376 calls or total emergency call volume. Including them would artificially inflate the baseline budgets rather than representing the true operating costs of the departments tasked with emergency response.

Additional emergency response data was obtained through CONNECT, in collaboration with Monroeville, consisting of all police, fire, and EMS incidents associated with the I-376 corridor within the municipality's jurisdiction for 2024. In total, 80 such incidents were recorded: 46 police responses, 17 fire-related incidents, and 17 EMS calls. The dataset also includes call-type classifications, allowing for differentiation between routine incidents and higher-acuity events, such as motor vehicle accidents involving injury. This distinction is critical for understanding the variation in resource consumption across different calls.

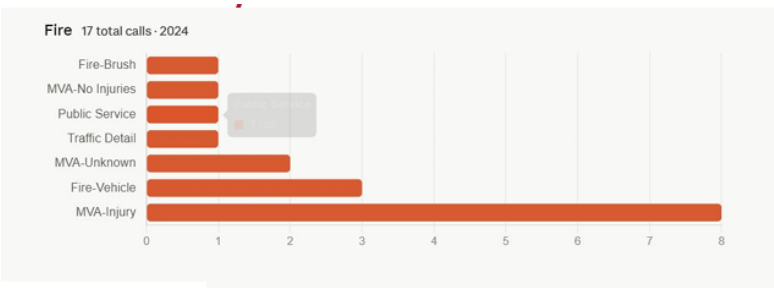


*Figure 3.1-Fire bar-graph of I-376 Calls by activity*

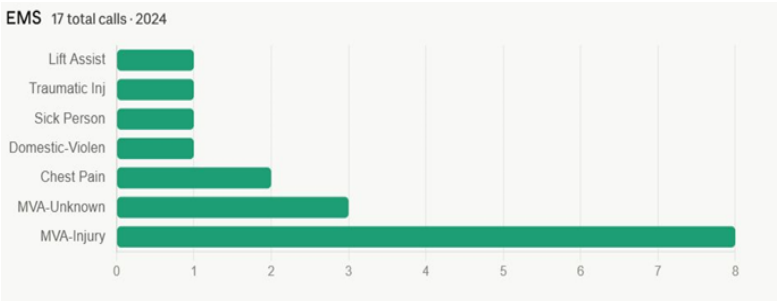


*Figure 3.2-EMS bar-graph of I-376 Calls by activity*

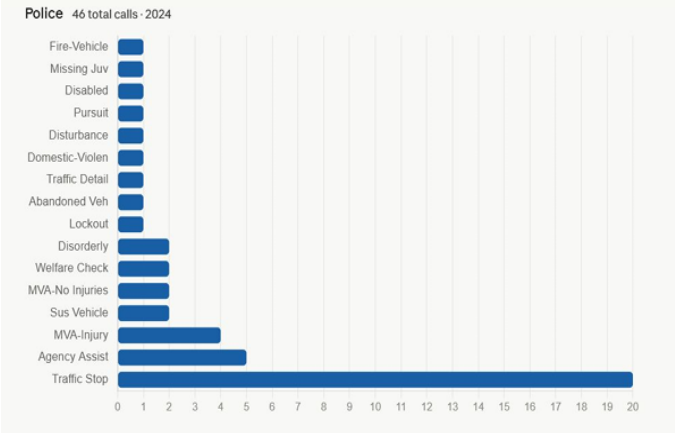


*Figure 3.3-Police bar graph of I-376 Calls by activity*

To further examine the composition of I-376 emergency responses, Figures 3.1-3.3 present a breakdown of call types by department for 2024. These visualizations provide insight into the distribution and acuity of incidents across police, fire, and EMS services, helping to contextualize the time-weighted framework used in the subsequent analysis.

Focusing first on fire and EMS responses, both departments recorded an identical number of calls (17 each) within the I-376 dataset. This alignment is not coincidental; it reflects the operational structure of emergency response in Monroeville. In many instances, particularly motor vehicle accidents, fire and EMS units are dispatched simultaneously due to the likelihood of injury, vehicle hazards, or the need for extrication. This pattern is further supported by 2025 data, which show an increase in call volumes. Additionally, Monroeville's fire stations function as EMS deployment points, reinforcing the integrated nature of these services. Consequently, the data points the same number for both fire and EMS, 17. This suggests that a single highway incident frequently generates multiple coordinated responses, highlighting the interdependent nature of fire and EMS resource utilization along the corridor.

The police call distribution reveals a different, yet equally significant, pattern. Traffic stops constitute the largest share of police activity on I-376 by a substantial margin, a trend that appears to be increasing in 2025. While these incidents are generally lower in acuity compared to motor vehicle accidents, their high frequency represents a significant and often overlooked demand on municipal resources. This pattern aligns with qualitative insights obtained from a stakeholder interview with the Churchill Chief of Police, who noted that limited enforcement presence from the Pennsylvania State Police has shifted the responsibility for traffic and speed enforcement onto local municipalities. Although the dataset analyzed here is specific to Monroeville, the consistency between observed data and stakeholder testimony suggests this is a corridor-wide phenomenon.

To place corridor-specific activity into context, total annual call volume data for each department was also collected. These totals, 16,443 police calls, 1,633 fire calls, and 6,656 EMS calls, provide the baseline necessary to compare I-376-related incidents against overall municipal

workload. The combination of corridor-specific and total call data enables the proportional framework used in the subsequent analysis.

A key methodological challenge in working with this data is the structure of municipal emergency service systems. Police, fire, and EMS departments operate as readiness-based systems, meaning costs are incurred to maintain continuous availability rather than recorded at the incident level. As a result, there is no direct accounting of cost-per-call. This creates a constraint when attempting to isolate the cost burden of a specific subset of incidents, such as those occurring along a highway corridor.

To address this limitation, the analysis adopts a time-weighted proportional framework, utilizing response time as a proxy for resource consumption. By comparing the estimated time spent responding to I-376 incidents with the total estimated time spent on all municipal calls, it becomes possible to approximate the share of departmental resources attributable to the corridor.

Despite the utility of the available data, several limitations must be acknowledged. The dataset lacks dispatch times, on-scene durations, and clear times for individual incidents, requiring the use of benchmark and stakeholder estimates rather than observed response durations. Furthermore, total call volume is not disaggregated by call type, necessitating the use of average response times that may not fully capture variations in incident complexity. The data also omits resource deployment metrics, such as the number of units or personnel assigned to each call, which likely leads to conservative cost estimates. Finally, comparable data, specifically public total call volume, is not consistently available across other municipalities along the I-376 corridor, limiting the ability to extend the rigorous framework beyond the Monroeville case study.

These limitations do not invalidate the analysis; rather, they define its scope. At the same time, they highlight a broader structural issue: the absence of standardized data collection across municipalities. This constraint affects analytical precision and severely limits the ability of local governments to quantify costs and advocate for funding. Consequently, improving data consistency emerges as a central consideration for both analysis and policy.

**Part Five: Cost Modeling**

Building upon the data described above, this section develops a cost estimation framework using Monroeville as a case study. Monroeville's location along a heavily traveled segment of the Parkway East contributes to a consistent volume of emergency incidents, many of which involve high-acuity conditions such as motor vehicle accidents. In 2024, the municipality recorded 80 I-376-related emergency responses, a figure that data indicates is growing in 2025. These conditions make Monroeville an appropriate case for analyzing how corridor-related incidents translate into measurable municipal costs.

An initial approach to estimating these costs would involve allocating a share of departmental budgets based purely on the proportion of I-376 calls relative to total calls. However, this flat

proportional model assumes that all incidents consume equal resources, an assumption that contradicts the reality of emergency response. Routine calls, such as traffic stops, require significantly less time and fewer resources than high-acuity incidents like multi-vehicle accidents with injuries. Because highway incidents are disproportionately complex and time-intensive, a flat model systematically understates their true cost.

To address this flaw, the analysis applies a time-weighted proportional allocation model, which treats response time as the primary driver of resource consumption. Under this framework, the share of municipal costs attributable to I-376 is calculated as the ratio of total response time for corridor incidents to total response time for all municipal incidents, multiplied by the relevant departmental budget. This approach reflects the operational reality that longer, complex incidents impose greater demands on personnel and equipment.

Constructing the model requires estimating both the total time associated with I-376 incidents (the numerator) and the total time associated with all municipal calls (the denominator). For the numerator, response times are assigned based on nationally recognized benchmarks for specific call types. Police response times for routine traffic stops are estimated at approximately 12 minutes, based on national averages reported through Department of Justice research sources (OJP/NCJRS 2010). Motor vehicle accident responses involving injuries are assigned durations of approximately 100 minutes, based on studies conducted by the National Institute of Justice (NIJ 2013). Fire response times are drawn from U.S. Fire Administration benchmarks, estimating 45 minutes for motor vehicle accidents and up to 60 minutes for vehicle fires (USFA 2022). EMS response durations are sourced from the National Emergency Medical Services Information System's 2025 dataset of approximately 69 million calls. For individual call types in the numerator, call-specific averages are applied, MVA-injury responses average approximately 100 minutes for high-acuity incidents per NEMSIS high-acuity breakdowns, while lower-acuity calls such as lift assists and domestic violence responses are assigned 30 minutes. The 74.1-minute figure referenced elsewhere represents the NEMSIS overall average across all EMS call types, which is used as the base case for the denominator, that is, the estimated average duration of the full Monroeville EMS call volume, not the 376-specific calls specifically.

Table 1 provides the EMS estimate to illustrate this framework in practice. It is important to reiterate that these are estimates. A future, optimized application of this framework would ideally rely entirely on precise, locally tracked stakeholder data rather than a blend of national benchmarks and stakeholder approximations, allowing for a more accurate reflection of Monroeville's specific operations.

| EMS — CALL TYPES | | | | | |
|---|---|---|---|---|---|
| # | Call Type | Count | Duration (min) | Total Minutes | Source |
| 1 | MVA-Injury | 8 | 100.0 | 800.0 | *NEMSIS/ACS 2025 national avg* |
| 2 | MVA-Unknown | 3 | 60.0 | 180.0 | *Conservative midpoint* |
| 3 | MVA-Entrapment | 0 | 140.0 | 0.0 | *NEMSIS/ACS 2025 high-acuity* |
| 4 | Sick Person | 1 | 45.0 | 45.0 | *EMS literature general* |
| 5 | Lift Assist | 1 | 30.0 | 30.0 | *EMS literature general* |
| 6 | Chest Pain | 2 | 74.1 | 148.2 | *NEMSIS/ACS 2025 high-acuity* |
| 7 | Person Down | 0 | 45.0 | 0.0 | *EMS literature general* |
| 8 | Breathing | 0 | 60.0 | 0.0 | *EMS literature general* |
| 9 | Traumatic Inj | 1 | 120.0 | 120.0 | *NEMSIS/ACS 2025 national avg* |
| 10 | Domestic-Violen | 1 | 30.0 | 30.0 | *EMS literature general* |
| | **TOTAL — EMS** | **17** | 70.4 | **1,353.2** | |

*Table 1-EMS I-376 calls broken down by duration & activity*

Applying these benchmarks to the Monroeville dataset yields estimated totals of approximately 1,140 minutes of police response time, 740 minutes of fire response time, and 1,353 minutes of EMS response time dedicated to I-376 incidents in 2024. These figures reflect the high concentration of time-intensive calls generated by the corridor.

The denominator is constructed using total municipal call volumes multiplied by estimated average response times. Because call-type breakdowns are unavailable for total municipal activity, a differential average approach was employed. Police response times are estimated between 15 and 35 minutes, with a base case of 25 minutes informed by stakeholder input. Fire response times are estimated between 30 and 60 minutes, with a base case of approximately 45 minutes supported by findings from the Center for Rural Pennsylvania (Center for Rural Pennsylvania 2020). EMS response times are estimated between 50 and 92.8 minutes, with a base case of 74.1 minutes derived from NEMSIS data (NEMSIS 2025). This range-based approach captures inherent uncertainty while remaining grounded in empirical data.

Using these inputs alongside Monroeville's 2025 departmental budgets, the model, table 2 below, estimates an annual cost burden for I-376 emergency response ranging from approximately $28,000 to $64,000, with a base-case estimate of approximately $39,000. While this aggregate range aligns loosely with what a flat proportional model might produce, the time-weighted approach reveals critical, meaningful differences at the departmental level by proving that the greater duration of highway calls translates directly to a higher cost burden.

| | LOW CASE 15 min avg | BASE CASE 25 min avg | HIGH CASE 35 min avg | Flat Proportional (Midterm) | Notes |
|---|---|---|---|---|---|
| **POLICE** | | | | | |
| 376 Call Minutes (numerator) | 1,140 | 1,140 | 1,140 | 46 | Sum of (count × duration) per call type |
| Total Monroeville Minutes (denomin | 246,645 | 411,075 | 575,505 | 16,443 | Total calls × avg duration scenario |
| Weighted Share | 0.46% | 0.28% | 0.20% | 0.28% | 376 min ÷ total min (FLAT. PROP by 376 calls/total calls) |
| Department Budget | $11,792,351 | $11,792,351 | $11,792,351 | $11,792,351 | FY2024 police total |
| **Estimated 376 Cost** | **$54,505** | **$32,703** | **$23,359** | **$32,990** | Weighted share × budget — KEY OUTPUT |
| **FIRE** | | | | | |
| | **30 min** | **45 min** | **60 min** | | |
| 376 Call Minutes (numerator) | 740 | 740 | 740 | 17 | |
| Total Monroeville Minutes (denomin | 48,990 | 73,485 | 97,980 | 1,633 | |
| Weighted Share | 1.51% | 1.01% | 0.76% | 1.04% | |
| Department Budget | $566,062 | $566,062 | $566,062 | $566,062 | |
| **Estimated 376 Cost** | **$8,550** | **$5,700** | **$4,275** | **$5,893** | |
| **EMS / AMBULANCE** | | | | | |
| | **50 min** | **74.1 min** | **92.8 min** | | |
| 376 Call Minutes (numerator) | 1,353 | 1,353 | 1,353 | 17 | |
| Total Monroeville Minutes (denomin | 332,800 | 493,210 | 617,677 | 6,656 | |
| Weighted Share | 0.41% | 0.27% | 0.22% | 0.26% | |
| Department Budget | $313,100 | $313,100 | $313,100 | $313,100 | |
| **Estimated 376 Cost** | **$1,273** | **$859** | **$686** | **$800** | |
| **TOTAL ESTIMATED 376 COST — MODEL 1 (BUDGET CEILING)** | | | | | |
| TOTAL (Police + Fire + EM | $64,328 | $39,262 | $28,320 | $39,682 | |

*Table 2- Model 1 time-weighted proportional framework*

However, a significant anomaly emerges within the EMS portion of the framework. According to Model 1, the total cost for EMS responses is calculated at a mere $859. National benchmarks indicate that the cost per ambulance ride, prior to reimbursement, averages $2,673. A total of $859 for 17 incidents deeply undersells the true cost of EMS delivery. This anomalous figure reflects a structural issue within municipal accounting: the municipal EMS budget line is likely not truly representative of total operational costs.

To address this discrepancy, a second model (Model 2) was developed to evaluate EMS costs independently. Unlike police and fire services, EMS operations typically generate revenue through insurance billing. Consequently, municipal budgets often report net costs rather than total operating expenses. To construct a more accurate standalone EMS baseline, Model 2 utilizes national cost data. Estimates from the RAND Corporation and the Centers for Medicare & Medicaid Services indicate an average cost per ambulance transport of $2,673 and an average reimbursement of $1,147, resulting in a net unreimbursed cost of $1,526 per transport (RAND 2023; CMS 2023). Applying this unreimbursed figure to the 17 EMS calls recorded along I-376 yields an estimated unfunded burden of approximately $25,942.

While Model 2 is methodologically distinct from the time-weighted approach, it serves as a crucial independent validation. Taken together, both models confirm that Monroeville absorbs a measurable and uncompensated financial burden associated with corridor-related emergency response. However, the vast discrepancy between the $859 estimate (Model 1) and the $26,000 estimate (Model 2) highlights the core limitation of the available data. Model 2 utilizes reliable national averages to illustrate what the true EMS cost likely resembles, but the limitations of

localized financial reporting prevent Model 1 from accurately capturing it. This specific data failure directly informs the final policy recommendations regarding standardized data collection.

Attempts to extend this framework to other municipalities along the corridor further highlight these data limitations. Both Churchill and Wilkins Township provided corridor-specific incident data but lacked publicly available total call volumes by department, preventing the construction of the denominator required for the time-weighted model. Furthermore, Churchill's data does not consistently differentiate between police, fire, and EMS responses. Wilkins Township presents a unique contrast: while it lacks total call volume data, its budget includes highly detailed operational cost categories, such as fuel and maintenance. This level of granularity represents a much closer approximation of true operating costs. Had Wilkins Township possessed complete call volume data, its detailed budget would have supported a far more precise cost estimate than Monroeville. Ultimately, the inability to apply the model to these neighboring jurisdictions reflects a systemic data constraint rather than a methodological flaw.

Several final limitations affect the estimates presented in this analysis. Response durations rely heavily on national benchmarks rather than localized tracking, and the model conservatively assumes a single unit per incident, which undoubtedly understates the cost of high-acuity events involving multiple responders. Furthermore, the analysis relies on a single year of data (2024), and data suggests call volumes are increasing in 2025. Because of the estimating nature of these models however, this analysis decided to focus on only one year of data. These factors indicate that the estimates presented are highly conservative and/or not fully representative of the costs to municipalities for I-376 emergency services. Nevertheless, they establish a robust framework that, if supplied with standardized and granular data, can accurately quantify the true cost of emergency services along I-376.

**Data Recommendations and Conclusion**

This analysis yields a clear conclusion: the Municipality of Monroeville bears a measurable and recurring financial burden associated with emergency response along the I-376 corridor, yet lacks any direct mechanism for cost recovery. While the time-weighted framework estimates a total departmental burden between $28,000 and $64,000, and the standalone EMS baseline identifies roughly $26,000 in unreimbursed costs for ambulance transports alone (RAND 2023; CMS 2023), the most critical finding is not the exact dollar amount. Rather, it is the systemic difficulty of producing a single, defensible cost estimate.

This difficulty is driven not by methodological flaws, but by severe data limitations. As demonstrated throughout this analysis, the absence of standardized, complete, and comparable data across municipalities prevents the construction of precise cost models. Even within Monroeville, relying on national benchmarks and estimated averages introduces a wide margin of error. Across the broader corridor, the problem is even more pronounced. Municipalities such as Churchill and Wilkins Township lack the public total call volume data necessary to construct the denominator of the time-weighted model, rendering comprehensive cost estimation impossible under current conditions.

Consequently, the primary policy recommendation emerging from this analysis is not immediate funding reform, but the implementation of standardized data collection. Data collection is the requisite first step toward any long-term solution. Without reliable and consistent data, municipalities cannot quantify their costs; without quantifiable costs, they cannot construct a credible, evidence-based argument for state reimbursement or policy intervention.

To address this structural gap, this paper recommends the adoption of a voluntary, corridor-wide data standard facilitated through CONNECT. Because this approach leverages an existing intergovernmental coordination structure, it is highly practical and can be achieved without requiring new state legislation or unfunded mandates.

This recommendation entails three consecutive steps:

- **Step 1: Standardize Incident-Level Data Collection.** Municipalities along the I-376 corridor should adopt a uniform set of data fields for every emergency response. At a minimum, these fields must track service type (police, fire, EMS), the number of units dispatched, total personnel involved, dispatch time, and clear time. Because these data points are already captured within most computer-aided dispatch (CAD) systems, the challenge lies not in generating new data, but in standardizing how existing data is recorded and shared.
- **Step 2: Transition to Net Operating Cost Tracking.** CONNECT should facilitate the collection of net operating cost data from participating municipalities. Unlike aggregate budget figures, which reflect total departmental expenditures, net operating costs isolate the resources directly consumed during emergency responses, such as labor, fuel, vehicle maintenance, and consumable equipment.

**Unlocking a Bottom-Up Approach** Integrating the data from these first two steps allows future iterations of this analysis to move beyond a top-down, budget-ceiling estimate. If municipalities collect this specific incident-level and net-operating data, they gain the ability to perform a bottom-up "Cost of Service Analysis" (COSA). As outlined in a recent white paper by the Public Consulting Group (2026), a bottom-up COSA is increasingly recognized as the industry gold standard for sustainable EMS rate setting. Fortunately, the methodology requires the exact same two inputs recommended here: verified financial data and granular incident response data.

- **Step 3: Aggregate Findings for State Advocacy.** Once this standardized data is collected across participating municipalities, CONNECT can aggregate these inputs to produce a unified, corridor-wide cost estimate. A coordinated regional figure, underpinned by consistent methodology, provides a significantly stronger foundation for engagement with PennDOT and state policymakers. Rather than relying on isolated municipal grievances, the corridor can present a collective, irrefutable assessment of the financial burden imposed by state-owned infrastructure.

The feasibility of this approach is supported by existing practices within the corridor. As observed in Wilkins Township, some municipalities already maintain highly detailed operational

cost data, including specific line items for fuel and vehicle maintenance. This demonstrates that the capacity to track meaningful cost metrics already exists at the local level. The barrier is simply a lack of consistency across jurisdictions.

Crucially, this recommendation serves as a foundational step rather than a final solution. Once standardized data collection is operationalized, municipalities will be positioned to pursue broader, systemic policy changes, such as state-level reimbursement mechanisms or proportional cost-sharing arrangements tied to highway usage. Without this empirical foundation, however, legislative advocacy efforts will continue to stall.

Ultimately, the framework developed in this analysis is inherently replicable. Any municipality capable of providing total call volume, baseline cost data, and standardized incident records can apply the time-weighted model presented in this paper. With improved data coordination through CONNECT, this methodology can be scaled across every jurisdiction along the I-376 corridor, transforming a localized case study into a comprehensive regional impact analysis.

In this sense, the most significant contribution of this project is not merely the identification of a financial burden, but the proof that the analytical tools to measure that burden already exist. The remaining challenge is ensuring those tools are fueled by consistent, coordinated data.

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