

# APRAS MODERNIZATION

## PENNDOT EXCELLENCE IN PERMITTING OVERSIZE/OVERWEIGHT LOADS



### NASCIO 2021 State IT Recognition Awards

**State:** Commonwealth of Pennsylvania

**Agency:** Department of Transportation

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Infrastructure and Economic Development Delivery Center

**Project Dates:**

**Category:**

June 2018 – June 2020

Business Process Innovations

## EXECUTIVE SUMMARY

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Every year, the Pennsylvania Department of Transportation (PennDOT) Automated Permit Routing and Analysis System (APRAS) issues over 400,000 Special Hauling Oversized/Overweight (OS/OW) permits. These permits authorize carriers to move extremely large and/or heavy items on state-owned roads and bridges and generate over \$32M in revenue each year for the state.

When the APRAS legacy web application no longer supported the modern business processes of the business partners using the system, PennDOT crafted a roadmap for modernization. The first and most critical project of the modernization effort was to replace the APRAS legacy web application used by thousands of external users to obtain permits.

The modernized APRAS web application incorporates cutting-edge technologies and development approaches, including the use of responsive UI/UX frameworks to support varying screen sizes and devices, visual map and routing solutions developed using Esri ArcGIS Server, and integration with PennDOT's enterprise security solution for user provisioning, authentication, and authorization. Using an overlapping iterative approach, the project team completed all development on schedule and on budget, going live in December of 2019.

By working collaboratively with PennDOT's business partners and engaging with other states, the federal government, and the Pennsylvania Turnpike Commission (PTC), this project delivered a new permit application system that supports and exceeds the modern business processes they use at their companies and with other jurisdictions. They no longer have to plan their routes with paper maps and Google searches, manually enter their planned routes with turn-by-turn directions, or guess if they completed the application correctly, sometimes with equipment costing thousands of dollars per hour to rent hanging in the balance. The average time spent to plan a route and submit an application was reduced to approximately 10 minutes, saving business partners over 66,000 hours per year, and GIS route mapping capabilities in the new application have reduced the rejection rate for permits by over 50 percent.

The APRAS Modernization project team has continued to the next phase of the APRAS Modernization program, including projects to modernize PennDOT's internal processing, provide new payment options, improve financial management, and offer better management insights to support ongoing improvement.

## IDEA

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### Overview of APRAS Legacy

When APRAS was first implemented in 1998, it was considered state-of-the-art. However, with advancing technologies and new demands from our user community on the rise, APRAS became dated and updates to the system were required. While PennDOT could still use the backend APRAS applications to manage workflows, the web application used by the external business users no longer met industry expectations. As the carriers' and permit services' business processes modernized, APRAS was not able to keep pace. Compared to other states, PennDOT had fallen behind and business partners encouraged PennDOT's Special Hauling Permits management to upgrade the APRAS web application. By the mid-2010s, PennDOT developed a strategy to modernize APRAS that would integrate the latest geospatial technologies and provide a modern user experience to align with how business partners needed the system to work. Prior to beginning work on modernizing the legacy APRAS application, PennDOT evaluated business partner needs and PennDOT objectives to determine an approach.

### Key Business Partner Needs & PennDOT Goals

PennDOT gathered requirements from the APRAS business partners as well as from PennDOT users:

- Incorporate GIS-based features using Esri ArcGIS

- Eliminate time spent manually creating routes
- Reduce the time to complete an OS/OW permit and increase probability of immediate issuance
- Implement cutting edge technology reflecting current PennDOT technology standards
- Give external business partner users a better user experience
- Align with the legislative purpose of OS/OW permitting
- Create a solution that is better than commercial products
- Provide routing options to improve the auto-approval process and get loads on the road as quickly as possible
- Provide analysis of routes without requiring application submission to assist in job bidding
- Incorporate maps in route generation and modification as well as providing restriction information
- Provide guidance and validation during application creation to help assure a complete and accurate submission
- Make a simple and easy to follow application creation and submission process workflow

With a list of needs and goals, PennDOT began considering modernization options. After a thorough evaluation, PennDOT concluded that industry Commercial Off the Shelf (COTS) solutions would not meet Pennsylvania’s needs and the Special Hauling Permits division began working with PennDOT’s IT leadership to design a replacement system. To make sure the new APRAS web application met the needs of their business partners, PennDOT reached out to the carriers and permit services to include them directly in the APRAS modernization effort. This resulted in a detailed APRAS Modernization road map and the development of a project team. The project team officially kicked-off their efforts in the summer of 2018.

### **PennDOT’s Approach: Focus on Business Partners**

PennDOT knew it was critical to engage with business partners throughout the entire project. This included requirements, UI/UX design, testing, and training. Consulting carriers were invited to PennDOT offices for demonstrations, and every member of the APRAS development team had the opportunity to visit the business partner locations to observe APRAS users perform their jobs and gather input directly. PennDOT team members were able to see, firsthand, the loads being permitted and the real-world impact of the APRAS system on this vital industry. Carriers and permit services explained their internal business processes and how they worked with the APRAS application submission process. The business partners had never worked this closely on a development effort. Their frustrations were seen and their ideas were heard. This was a crucial component contributing to the success of this project and improving business partner and PennDOT business processes.

*“Building this system has brought PennDOT and industry more of a ‘team’ dynamic. It was so great to meet the people who have been reviewing applications and on the phone with us so many times over the years.”*  
– APRAS business partner

*“Site visits for the development team were such an important step in the process. Incredible value. It should be the model for any large project.”*  
– APRAS GIS Architect

### **The OS/OW Industry & NASCIO**

In addition to working directly with the APRAS business partners, PennDOT worked with other states, the federal government, and the Pennsylvania Turnpike Commission (PTC). PennDOT requested demonstrations from other states with well-respected OS/OW solutions, attended events including Federal Highway Administration (FHWA) seminars on OS/OW enforcement, and worked closely with the PTC on data capture and modeling to support joint permits in the future. OS/OW permitting is performed around the world. Everywhere there are roads and bridges, there is a need to

control very large and very heavy loads and vehicles. The APRAS Modernization project applies to state, federal, and NASCIO priorities in the following ways:

**STATES:** All states have permitting of OS/OW loads to preserve infrastructure, protect citizens, and keep commerce moving.

**FEDERAL:** Aligns to 1) USDOT FHWA Best Practices in Permitting of Oversize and Overweight Vehicles: Final Report and 2) USDOT FHWA Freight Management and Operations (FMO) identified mandates and standards for Oversize/Overweight Load Permits.

**NASCIO: #1 - Cybersecurity and Risk Management:** Incorporates a new enterprise security model with strict standards and governance. This greatly mitigates threats and risks and increases data protections.

**NASCIO #2 - Digital Government/Digital Services:** Provides 24/7 Internet access, communication of important road issues and notifications, and an improved user experience.

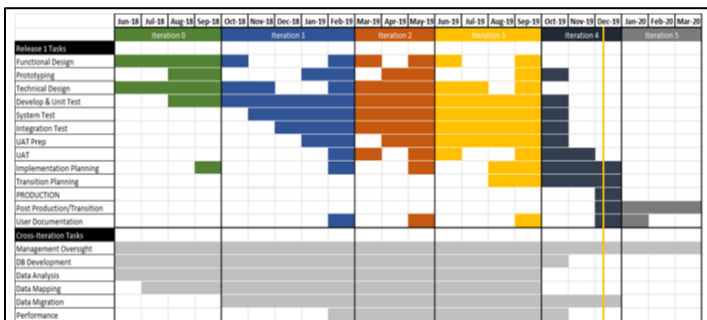
**NASCIO #6 - Data Management and Analytics:** A new data architecture including effective use of cleansed GIS data. This allows for deep analysis such as finding opportunities for improving permitting, adjusting routing, and identifying infrastructure hot spots for potential overuse.

**NASCIO #5 - Budget, Cost Control, Fiscal Management:** By taking a phased approach, PennDOT has been able to distribute modernization costs over multiple years while mitigating risk and maintaining annual permit revenue of over \$35 million annually. Improved permitting also helps reduce infrastructure costs by mitigating damage and reducing maintenance, repair, and replacement costs.

**NASCIO #10 - Customer Relationship Management:** Customer-facing, user-centric, and available 24/7 through the Internet; APRAS Modernization is designed to support business partners processes. Business partners involvement resulted in solution alignment with industry needs. Development team attended SC&RA Specialized Carrier Symposium in February of 2020 to provide demonstrations of new system to 100s of industry users.

## IMPLEMENTATION

### The Project



In June 2018, PennDOT began the APRAS Modernization External Web Application project, the first phase of the APRAS Modernization program. Because APRAS is critical to the issuance of over 1,000 permits daily and supports movement of billions of dollars of OS/OW equipment and materials annually, it was imperative to deliver a successful go-live and seamless transition.

A development team of senior-level staff was established, and a focused discovery iteration began. Using an overlapping iterative approach, the project team completed all development on schedule and on budget, going live in December of 2019.

PennDOT minimized risk by developing a detailed Rollout Plan. The plan included pre-rollout activities and a three-wave rollout that incrementally transitioned users from the legacy solution to the modern solution over a period of approximately six months. Pre-rollout tasks included multiple communications to business partner users prior to go live, provision of new credentials via the enterprise security application, and frequent reminders of key dates for training, demonstrations, and other activities. The project team conducted training through several types of media, including via

targeted training videos, FAQ documents, and live question and answer sessions. Prior to rollout, the development team also trained internal PennDOT permitting staff to assist haulers as they acclimated to the new system.

The three rollout waves began in December of 2019, with a very small number of consulting carriers and with project team members on site at the carrier locations when they transitioned to the new APRAS. After Wave 1 was successfully completed, Wave 2 brought on a larger number of carriers and permit services. The largest wave, Wave 3, began in early March and continued through mid-June. Despite occurring during the early months of the COVID-19 pandemic and the related upheaval in the hauling industry, Wave 3 was completed successfully and as planned. The final users were onboarded on May 17, 2020, and the legacy system was decommissioned on June 14, 2020, as scheduled.

## The Technology

In addition to solving a multitude of PennDOT and business partner frustrations, the modernized APRAS web application also incorporates cutting-edge technologies and development approaches. This includes continuous delivery and integration to ensure code quality and mitigate security vulnerabilities throughout development, including:

- The use of responsive UI/UX frameworks to support varying screen sizes and devices
- Visual map and routing solutions developed using Esri ArcGIS Server
- Integration with PennDOT’s enterprise security solution for user provisioning, authentication, and authorization

APRAS was also architected as a microservice application to support seamless migration to Kubernetes environments. As a result, APRAS will be the first enterprise PennDOT Highway application to move to the cloud in Azure, using Azure’s Kubernetes Service (AKS), in the 2<sup>nd</sup> quarter of 2021.

## The Team

Four major groups contributed to the success of this project: Project Governance Committee, Project Execution Management Team, IT Development Team (comprised of Computer Aid, Inc., in partnership with Pennsylvania’s Office of Administration), and Carrier and Permit Service Staff

The table below describes the various roles and responsibilities of the four groups.

APRAS Modernization Project Team			
<p><b>Project Governance Committee</b> <i>Advocates, Oversight, Governance</i></p> <p>Executive management personnel representing agency business staff, OA leadership staff, and vendor staff providing project support, oversight, and governance. Received bi-monthly presentations and project updates, participated in communications, provided direction and funding.</p>	<p><b>Project Execution Management Team</b> <i>Oversight, Implementation</i></p> <p>Management personnel representing OA staff, business staff, and the development team providing project input from support teams such as database, server teams, security teams, enterprise architecture, and GIS. Conducted bi-weekly meetings and constructed project updates. Involved in all technical and architectural decisions.</p>	<p><b>IT Development Team</b> <i>Development, Oversight, Implementation</i></p> <p>Provided all Project Management, architecture (solution, infrastructure, database), business analysis, solution design &amp; development, unit testing, system integration testing, training, and oversight of user acceptance testing. Responsible for assisting business in communicating changes, training materials, and documentation.</p>	<p><b>Carrier and Permit Service Staff</b> <i>Development, Implementation, Beneficiary, End Users</i></p> <p>Business process improvement input, requirements input, design input, testing, post-implementation feedback. Feedback gathered via on-site visits, virtual discussions, and surveys. Attended prototype demos during development as functions were designed and completed. Involved in iterative rounds of UAT.</p>

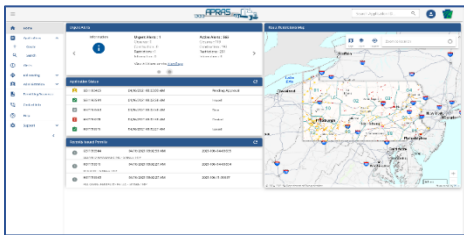
## IMPACT

The APRAS Modernization External Web Application project successfully delivered all the items on the business partner wish list and achieved all the PennDOT goals described in the **IDEA** section above. It also aligns with the legislative intent from 67 Pa. Code § 179 to protect the structural integrity of the highway and bridge system, facilitate the movement of oversized vehicles and loads while keeping other vehicle traffic moving, and encourage the economic growth of commerce and industry in Pennsylvania.

PennDOT’s business partners now have a permit application system that supports and exceeds the modern business processes they use at their companies and with other jurisdictions. They no longer have to plan their routes with paper maps and Google searches. They no longer have to enter their manually planned routes with turn-by-turn directions. They no longer have to guess if they completed the application correctly, sometimes with equipment costing thousands of dollars per hour to rent hanging in the balance. They now have a system they can trust will allow them to “get the load on the road” - with a valid permit - as quickly as possible every time.

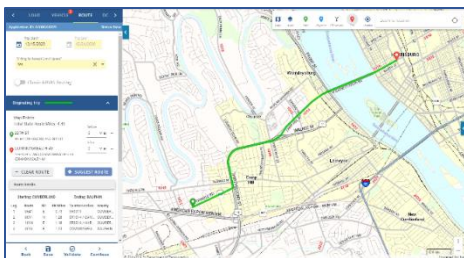
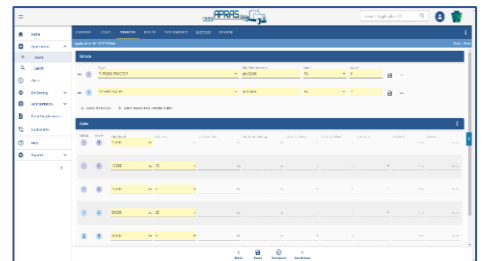
### The APRAS External Web Application

APRAS was developed as a responsive application with approximately 20 different screens, organized into an intuitive workflow and UI/UX that guides the permit application from beginning to end. Three of the most innovative screens with some of the most impactful benefits to the business partner processes are highlighted below.



The **Landing** page is customized for each user and displays urgent alerts and notifications, a map with current route restrictions so they can quickly view potential impacts, a list of their most recent applications with the status and disposition, and a list of recently issued permits. On the left is an easily navigable menu to quickly enter applications, do bid routes, and perform other important tasks.

The **Vehicle** page makes data entry easy. Users can select an existing option from the fleet of vehicles they have saved for reuse. For new vehicles, the user selects at least one powered unit and then additional items as necessary. The axle weight and spacing information is simple to enter and can be performed quickly. The validation on this page confirms all the numbers work before moving to the next step of the process.



The **Route** page allows users to select a trip start and end date, click a start and end point, and then ask APRAS to generate a feasible route that avoids restrictions that will be in place during that timeframe. Users can change map layers, add waypoints between the start and end points, indicate off-network travel, and zoom in and out. The system displays the recommended route and any waypoints, and then allows users to adjust and revalidate before submission.

### Success Metrics

PennDOT achieved its project goals, including anticipated use of new features, business process improvements, business process time savings, and improvement in auto approvals by reducing the denial rate because of bad routes. The table below lists some of the key metrics gathered in the months after going live. Post-project metrics continue to be gathered, with later projects in the APRAS Modernization program expected to contribute additional benefits.

Item	Metric	Benefits
Use of Mapping Features in APRAS	62%	<ul style="list-style-type: none"> <li>• Reduced planning and application submission time</li> <li>• Increased user satisfaction</li> <li>• Alignment with FHWA best practices</li> </ul>
Route Planning & Application Submission Time saved	10 minutes per application	<ul style="list-style-type: none"> <li>• Reduced planning and application submission time</li> <li>• Increased user satisfaction</li> </ul>
Business Partner Hours Saved Yearly	66,000 hours	<ul style="list-style-type: none"> <li>• Reduced planning and application submission time</li> <li>• Increased user satisfaction</li> </ul>
Application Denial Rate When Using Map Routing	Reduced by over 50%	<ul style="list-style-type: none"> <li>• Reduced planning and application submission time</li> <li>• Increased user satisfaction</li> </ul>

## User Feedback

PennDOT’s goal of greatly improving the business processes supporting the APRAS business community has been extremely successful. In addition to metrics, the project team collected user feedback following rollout of the modernized system to gauge the benefits to APRAS users.

The following quotes represent the experience of several of the largest APRAS users in the country:

*“This is the best implementation I’ve seen across all the jurisdictions - yes, that means across all the states and all the systems, ProMiles, Bentley, etc...”*

*“[Previously], we could spend as little as 30 minutes on a midsized load to hours on a large dimensional load . . . What would have taken us 15-20 minutes to get around a construction zone, now takes minutes.”*

*“Keep up the good work and thank you for the continued support and customer service, which has been excellent!”*

*“No more searching route numbers and counties to find restrictions - just go to the map and zoom in!”*

*“I would prefer to use the mapping feature and not have to do the application 3-4 times.”*

## The Future

In 2018, PennDOT had three options: continue a cumbersome government-to-business interaction with OS/OW haulers via the legacy APRAS web application, settle for a COTS solution that did not meet its requirements, or blaze its own trail. PennDOT chose to blaze a new trail, but to do so innovatively and in partnership with the business partner community. This joint effort resulted in significant time and cost savings, better application data, better routing, fewer failed applications, fewer denials, and a higher auto-approval rate. PennDOT’s solution provides faster permit issuance, which translates into less burden on the transportation infrastructure, less congestion and traffic, and safer roads.

The APRAS Modernization project team has continued to the next phase of the APRAS Modernization program, including projects to modernize PennDOT’s internal processing, provide new payment options, improve financial management, and offer better management insights to support ongoing improvement.

PennDOT is extraordinarily grateful for the top-notch results of the project team and the willingness of the consulting carriers to welcome our team members to their offices. Their commitment to this project and their enthusiasm in helping guide requirements and design efforts was invaluable to our success.