



## San Diego Regional Fare System Modernization



**San Diego MTS**

**FY2017 ATCMTD Initiative**

## Contents

Volume 1: Technical Application .....	1
Cover Page .....	1
Project Narrative.....	1
A) Project Description .....	1
1) Introduction .....	1
2) Description of Applicant Entity .....	2
3) Geographic Area .....	4
4a) Description of Real World Issues and Challenges Addressed by Project.....	4
4b) Consistency with Program Goals.....	7
5) Description of Transportation Systems and Services to be Included .....	13
6) Project Deployment Plan .....	15
7) Description of Regulatory, Legislative, or Institutional Challenges or Other Obstacles to Deployment .....	17
8) Quantifiable System Performance Improvements such as Reducing Traffic-Related Crashes, Congestion and Costs; Optimizing System Efficiency; and Improving Access to Transportation Services.....	18
9) Quantifiable Safety, Mobility, and Environmental Benefit Projections such as Data-Driven Estimates of How the Project will Improve the Region's Transportation System Efficiency and Reduce Traffic Congestion .....	19
10) Vision, Goals, and Objectives.....	20
11) Plan for partnering with the private sector or public agencies, including multimodal and multijurisdictional entities, research institutions, organizations representing transportation and technology leaders, or other transportation stakeholders .....	22
12) Plan to Leverage and Optimize Existing Local and Regional Advanced Transportation Technology Investments.....	23
13) Schedule for Conducting the Technology Deployment and for Completion of All Proposed Activities .....	25
14) Support or Leveraging of the ITS Program or Innovative Technology Initiatives .....	26
B) Staffing Description .....	28



# Volume 1: Technical Application

## Cover Page

Project Name	Fare System Modernization
Eligible Entity Type	Transit Agency
Total Project Cost	\$33,006,338
ATCMTD Request	\$11,166,338
Are matching funds restricted to a specific project component? If so, which one?	No. Matching funds are not restricted to a specific project component.
State(s) in which the project is located	California
Is the project currently programmed in the : <ul style="list-style-type: none"> <li>• Transportation Improvement Program (TIP)</li> <li>• Statewide Transportation Improvement Program (STIP)</li> <li>• MPO Long Range Transportation Plan</li> <li>• State Long Range Transportation Plan</li> </ul>	<p>MTS has formally committed \$13,700,000 in MTS local funds to the project. These matching funds are currently programmed in two RTIP projects:</p> <ul style="list-style-type: none"> <li>• MTS30 (Bus Support Facilities and Equipment)</li> <li>• MTS34 (Bus Signal and Communication Equipment)</li> </ul> <p>There is an additional \$8,140,000 being provided by SANDAG, the region's MPO. The \$8,140,000 is included as part of the budget for the Mid-Coast Corridor Transit project 5309 New Starts Full Funding Grant Agreement awarded by the Federal Transit Administration.</p> <p>The RTIP was most recently state-approved on May 2, 2017 and federally approved on May 9, 2017. (2016 RTIP Amendment No. 3)</p> <p><i>San Diego Forward: The Regional Plan</i> includes the need for investing in a "Universal Transportation Account" that "combines all forms of public transportation payments, including transit fares, municipal parking, and toll collection into a single user-friendly system."<sup>1</sup> The Fare System Modernization project would implement such technology.</p>
Technologies Proposed to Be Deployed	<p>MTS, in partnership with NCTD, will deploy a next generation fare system in the San Diego region with the following characteristics:</p> <ul style="list-style-type: none"> <li>• Account-based system with real time communications</li> <li>• Open architecture for integration with other systems</li> <li>• Closed-loop foundation</li> <li>• Open payment capability</li> <li>• Flexible and expandable fare policy</li> <li>• Mobile ticketing integration</li> <li>• Robust back office hosting and data reporting</li> <li>• Enhanced payment card and personally identifiable information security</li> <li>• Future expandability</li> </ul>

<sup>1</sup> San Diego Association of Governments, *San Diego Forward: The Regional Plan*, Pg. 73, [http://www.sdfoward.com/pdfs/RP\\_final/The%20Plan%20-%20combined.pdf](http://www.sdfoward.com/pdfs/RP_final/The%20Plan%20-%20combined.pdf)

# Project Narrative

## A) Project Description

### ***1) Introduction***

The Fare System Modernization project includes the design and implementation of a next generation fare system in the San Diego region. The new fare system will utilize leading technology to provide the following features:

- Account-based system with real time communications
- Open architecture for integration with other systems
- Closed-loop foundation
- Open payment capability
- Flexible and Expandable Fare Policy
- Mobile Ticketing Integration
- Robust Back Office Hosting and Data Reporting
- Enhanced Payment Card and Personally Identifiable Information Security
- Future Expandability

The new fare system will replace the existing Compass Card system utilized by the San Diego Metropolitan Transit System (MTS) and the North County Transit District (NCTD), the two public transit operators in the region. The Compass Card system is outdated, expensive to maintain, cumbersome to expand/upgrade, and burdensome for customers. The new system will implement leading technologies to address these shortcomings and provide the region with a highly expandable and integrative system for the future. The deployment of new fare technology is expected to provide the following primary benefits consistent with ATCMTD Initiative goals:

- Reduced costs and improved return on investments (ROI)
- Delivery of environmental benefits that alleviate congestion and streamline traffic flow
- Measurement and improvement of the operational performance of the applicable transportation networks
- Collection, dissemination, and use of real time transportation related information to improve mobility, reduce congestion, and provide for more efficient and accessible transportation
- Delivery of economic benefits through reduced delays and improved system performance

- Integration of advanced technologies into transportation system management and operations
- Demonstration, quantification, and evaluation of the impact of these advanced technologies, strategies, and applications towards improved safety, efficiency, and sustainable movement of people and goods
- Reproducibility of successful systems and services for technology and knowledge transfer to other locations facing similar challenges

## **2) Description of Applicant Entity**

The San Diego Metropolitan Transit System (MTS) will be the lead agency for the Fare System Modernization project. Upon successful award, MTS would be the sole party entering into an agreement with the Federal Highway Administration (FHWA) and would be responsible for executing all deliverables required by the cooperative agreement. Although the cooperative agreement would be managed solely by MTS, the Fare System Modernization project will be a collaborative effort primarily between MTS and the North County Transit District (NCTD). MTS and NCTD represent the two public transit operators in the San Diego region. Figure 1 outlines some of the major characteristics of both MTS and NCTD in terms of their operations.

**Figure 1 – MTS and NCTD Service Characteristics**

MTS Service Characteristics	
<b>Bus</b>	
<b>Number of Fixed Routes</b>	100
<b>Number of Buses</b>	797
<b>Route Types</b>	Local, Urban, Express, Premium Express, Rural
<b>Light Rail (Trolley)</b>	
<b>Number of Stations</b>	53
<b>Miles</b>	54.3
<b>Number of Light Rail Vehicles</b>	130
<b>Number of Lines</b>	4 (UC San Diego Blue, Orange, Green, Silver)
<b>System-Wide</b>	
<b>Annual Operating Budget</b>	\$256M (FY16)
<b>Farebox Recovery</b>	\$101M (FY16), or 39.5% of AOB
<b>Ridership</b>	97 million (annual) / 325,000 (weekday)

NCTD Service Characteristics	
<b>BREEZE Bus</b>	
<b>Number of Fixed Routes</b>	35
<b>Number of Buses</b>	161
<b>COASTER Commuter Rail</b>	
<b>Number of Stations</b>	8
<b>Miles</b>	41
<b>Fleet Size</b>	28 Coaches, 7 Locomotives
<b>SPRINTER Light Rail</b>	
<b>Number of Stations</b>	15
<b>Miles</b>	22
<b>Fleet Size</b>	12 DMU Vehicles
<b>System-Wide</b>	
<b>Annual Operating Budget</b>	\$104.8M
<b>Farebox Recovery</b>	\$19M
<b>Ridership</b>	12 million (annual) / 39,000 (daily)

MTS currently administers the Compass Card fare system and has a cost sharing agreement with NCTD for capital and operating costs related to the fare system. MTS and NCTD have already been working collaboratively in the project planning phase for the Fare System Modernization project and will continue to do so throughout the project lifecycle. NCTD has provided a letter demonstrating support for the Fare System Modernization project and committing to a collaborative effort between MTS and NCTD to implement the new regional fare system (Attachment No.1).



### **3) Geographic Area**

The Fare System Modernization project will benefit the entire MTS and NCTD service areas.

MTS provides bus and rail services in 10 cities across 3,240 total square miles, of which 720 are located within the urbanized area of San Diego County. MTS serves approximately 3,000,000 people.

The NCTD service area includes approximately 1,020 square miles and serves approximately 842,000 people.

Attachment No. 2 includes a transit map for the entire San Diego region where the fare technology will be deployed.

### **4a) Description of Real World Issues and Challenges Addressed by Project**

The existing Compass Card (Compass) fare system was originally procured in 2004 and implemented in 2009. Compass provides customers with the ability to purchase regional one-day, two-day, three-day, four-day, 14-day, and 30-day or monthly passes for both bus and rail services. Compass Cards and reloads are available for purchase at the MTS Transit Store, NCTD customer service locations, third-party retail outlets, ticket vending machines, as well as online or over the phone through the Compass Card Service Center.

The Compass Card System currently utilizes smart cards equipped with Radio Frequency Identification (RFID) technology to store virtual “products” on the card which are redeemed at the time of use. Although the Compass system has been able to meet the most basic needs of the customers and transit agencies, there are significant limitations that the Fare System Modernization project aims to rectify. These limitations are summarized in Figure 2 below.

**Figure 2 – Limitations of Existing Regional Fare Technology**

Limitations of Existing Regional Fare Technology
<ul style="list-style-type: none"> <li>• Compass Card stores “products” only and does not allow for account-based payment</li> <li>• Multiple fare products (i.e. One-day pass) purchased in one transaction must be used consecutively</li> <li>• Compass Card system is proprietary and extremely costly to maintain and/or upgrade</li> <li>• Current infrastructure provides poor backend monitoring and reporting capabilities</li> <li>• New software and hardware must be adapted to achieve PCI-DSS Compliance</li> </ul>



These shortcomings are described in detail below:

**Compass Card only provides “stored product” capability rather than “stored value”** - The Compass Card stores fare “products” such as one-day or monthly passes as compared to storing value in the monetary sense like a debit card. This limits payment options for customers because products must be purchased in full and must be reloaded often. For example, a customer cannot decide to load twenty dollars onto a card and then redeem various passes as necessary; instead, the rider must purchase a desired number of fare products such as one day passes or monthly passes. This is particularly burdensome to customers who do not know for certain how often they will be utilizing public transit in a given time period.

The new technology deployment will incorporate an account-based architecture in which monetary value (similar to debit card) will be stored in the account-based backend. This will provide customers with flexibility in fare payment by allowing them to load value into their personal payment account and then use the stored value to redeem fares at the time of use.

The new fare technology will also be able to utilize fare “capping”. Capping refers to the ability of the backend system to automatically charge a customer the minimum fare for a given period based on the fare structure. For example, if a customer purchases multiple one-way fares in a day that exceeds the value of a one-day pass, then the fare media would automatically cap the fare amount at the value of a one-day pass. Capping is designed to enhance the customer payment process by reducing the burden of trip planning and reducing the risk of overpayment. Capping, or “best fare”, can only be implemented with a fare system with an account-based backend.

**Multiple fare products (i.e. One-day pass) purchased in one transaction must be used consecutively** - Another drawback to the existing system is that multiple products purchased in one sale must be used in consecutive periods. For example, if a customer plans on using public transit for three non-consecutive days in the course of a month, that customer cannot purchase and store three one-day passes on the Compass Card to be used on these non-consecutive days. Instead, the customer would need to purchase the initial day pass and then reload the day pass prior to each of the following non-consecutive days. If the customer were to purchase three one-day passes during one transaction, the first one-day pass would be consumed on the first day of use, and the second two passes would be consumed on the two consecutive days following the first use regardless of whether the individual used transit on those days.

This represents a significant burden to customers who utilize day passes. The proposed project would eliminate this concern through a stored-value solution in which customers could load stored value or stored product onto the selected fare media and redeem at the time of use.

**Compass Card system is a closed proprietary system and is extremely costly to maintain and/or upgrade**

– Another shortcoming of the Compass system is that the software and hardware is proprietary and relies on a single vendor for support, upgrades, and maintenance. This has proven to be very costly with limited flexibility to upgrade and expand. Many components of the existing ticket vending machines (TVMs), including the single board computers (SBCs), Passenger Card Interface Devices (PCIDs), Master Module Fours (MM4s), bill not acceptors (BNA57s), roll stock transports (RSTs), and TVM receipt printers are now obsolete and are no longer produced. Replacements must be purchased used or from other agencies with spares. Newly developed replacements have been proposed by the current proprietor, but only as part of an expensive upgrade that would keep the region financially tied to the proprietary system for years to come.

The proprietary nature of the current system is also limiting because it does not allow for “open payment”. Open payment provides customers with the ability to pay fares with open-loop contactless bank cards and mobile wallets rather than having to have specific fare media. Although the region does not plan to provide open-payment functionality at launch, the new system will include architecture that supports open-payment for the future.

Proprietary systems also represent a significant roadblock to the convergence of payment options among other transit providers and/or other services. This is because proprietary systems are not standardized and require each entity to adopt the same system and protocols provided by a single vendor.

Given the current technological landscape, it is now possible to implement standards-based, non-proprietary systems. A divergence from the proprietary system will allow for agency-controlled Application Program Interfaces (APIs), flexible procurement options, enhanced interoperability, and greater capability for integration with other private and public entities in the future. The implementation of a standards-based system will also provide the capability to support open payment and pave the way for future integration with other entities.

**Current backend provides poor backend monitoring and reporting capabilities**

– The current Hummingbird reporting system is a pre-built system designed by the sole proprietor of the Compass fare system. The canned reports provided by the software are often missing data and require validation by the proprietor. Additional expenses are paid to the vendor whenever the reports need to be updated, changed, or validated.

The current software is complex and does not allow for user-friendly querying for data analysis. Without the ability to query data for manipulation and analysis, both MTS and NCTD have been significantly limited in being able to perform data analysis related to fare revenue, one of the most important aspects of managing the financial operations of a transit system.

The new fare system deployment will address these shortcomings by including a robust back-office system that will provide the region with full ownership and access to all data and will allow MTS to freely produce custom reports and queries.

#### **New software and hardware must be adapted to achieve PCI-DSS Compliance -**

The final significant limitation of the existing software and hardware is that the current system is not currently PCI-DSS compliant. PCI-DSS Compliance refers to the “set of requirements designed to ensure that all companies that process, store, or transmit credit card information maintain a secure environment.”<sup>2</sup>

The current Nextfare software, as well as the existing TVMs, need to be upgraded as part of the path toward becoming fully PCI-DSS compliant. New “Triple DES” encrypted keypads would need to be installed on every existing TVM and a major software upgrade would be necessary to achieve compliance. Upgrading to a newer version of the Nextfare software and upgrading existing TVMs would not only be expensive, but would also be counteractive to MTS’s goal of moving away from a proprietary system.

Lack of payment and personal information security is a significant deterrent to customers who wish to pay with credit or debit card. The new system will rectify these concerns by including all of the attributes necessary for full PCI-DSS compliance.

#### ***4b) Consistency with Program Goals***

The Fare System Modernization project will support the following ATCMTD Initiative Program Goals:

**Reduced costs and improved return on investments (ROI)** – The proposed fare technology will reduce costs and increase ROI through a variety of means. First, the new technology will have open architecture, meaning that the hardware and software will be standards-based and allow MTS and NCTD to have full access to system Application Programming Interfaces (APIs) and data formats. This will provide the flexibility to competitively procure software and hardware from vendors other than the primary system integrator.

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<sup>2</sup> PCI Compliance Guide, <https://www.pcicomplianceguide.org/pci-faqs-2/>

Second, the existing hardware is obsolete and is extremely costly to repair. The existing hardware that was purchased with the original Compass system (TVMS, PCIDs, DCUs, etc.) will have exceeded the 12-year useful life in 2021. Due to the proprietary nature of the hardware, any equipment upgrades would need to be purchased through the current vendor and would be extremely expensive.

Third, MTS currently has significant staffing resources dedicated to managing the Compass system. These positions include System Administrators, Business System Analysts, a Database Administrator, Revenue Technicians, Maintainers, and Call Center customer service employees. Labor costs are expected to rise as the Compass system ages because the aging system will require more IT support, additional maintenance staff, and more call center representatives for higher call volumes as a result of an unreliable system. A new system would eliminate the need for additional staff for these functions.

Furthermore, the existing maintenance agreement with the current vendor will be exhausted in 6/30/2019. Once the maintenance agreement has expired, all support costs will be billed as block hours. These hours are extremely expensive and the need for support is only expected to increase as the Compass System becomes older.

MTS has included a calculation for the anticipated ROI calculation and forecasted cost savings over the next 15 years (Attachment No. 3). The attachment includes the assumptions used for the analysis; forecasted legacy costs over the next 15 years assuming the system is not replaced; forecasted 15 year cost of the new replacement system; operating savings over the 15 year period; and net savings over the 15 year period. Results of the analysis are summarized in the Figure 3 and Figure 4 below. The Fare Collection System is expected to yield a positive return (net cost savings) in year 13 of the project implementation schedule compared to the scenario in which the legacy system was not replaced or upgraded during the 15-year period. The project is expected to yield \$46,431,384 in operational savings over a 15-year horizon and a net savings of \$11,431,384 when accounting for capital costs.

**Figure 3 – ROI and Cost Savings Summary**

<b>ROI and Cost Savings Analysis – Fare System Modernization</b>		
	<b>Legacy System</b>	<b>Next Generation System</b>
15-year Operating Cost	\$94,164,554	\$47,733,170
15-year Operating Cost Savings		\$46,431,384
15-year Total Cost (with Capital)	\$94,164,554	\$82,733,170
15-year Total Cost Savings		\$11,431,384

Figure 4 – ROI Table

ROI Table (15-year horizon)				
Year	Capital Investment	Operating Savings	ROI	Cumulative ROI
1	\$9,000,000	\$1,176,769	(\$7,823,231)	(\$7,823,231)
2	\$9,000,000	\$2,190,453	(\$6,809,547)	(\$14,632,778)
3	\$9,000,000	\$2,409,433	(\$6,590,567)	(\$21,223,345)
4	\$8,000,000	\$2,315,927	(\$5,684,073)	(\$26,907,418)
5		\$2,387,466	\$2,387,466	(\$24,519,952)
6		\$2,760,556	\$2,760,556	(\$21,759,396)
7		\$2,842,912	\$2,842,912	(\$18,916,484)
8		\$2,931,421	\$2,931,421	(\$15,985,063)
9		\$3,394,013	\$3,394,013	(\$12,591,051)
10		\$3,496,566	\$3,496,566	(\$9,094,485)
11		\$3,482,125	\$3,482,125	(\$5,612,359)
12		\$4,056,924	\$4,056,924	(\$1,555,435)
13	Positive Return	\$4,185,796	\$4,185,796	\$2,630,361
14		\$4,325,126	\$4,325,126	\$6,955,487
15		\$4,475,897	\$4,475,897	\$11,431,384

**Environmental benefits that alleviate congestion and streamline traffic flow** - The Fare System Modernization is estimated to increase ridership by 88,016,927 passenger trips over the 12-year useful life of the new fare system. The projected ridership increase is based on the anticipated increase in demand due to enhanced payment flexibility, improved convenience, more seamless travel, and reduced actual and perceived fares from automatic fare capping. The assumptions and calculation methodology are included in Attachment No. 4.

The forecasted increase in ridership is expected to reduce the number of vehicle miles travelled (VMT) by private automobiles. Reducing the number of VMTs in the region will have direct impact on reducing the amount of greenhouse gases (GHGs). Furthermore, a reduction in VMTs will also reduce congestion in the region by reducing the number of automobiles on the road at any given time.

MTS calculated the projected VMT reduction and associated GHG reduction using a calculator tool developed by the California Air Resources Board for estimating GHG reductions from transit projects (Attachment No. 5). In addition to the calculator tool file, MTS has also included a description of the calculator tool methodology, assumptions, and selection of inputs (Attachment No. 6).

The results of the analysis provide for an estimated reduction in VMT of 9,103,204,129 miles and a reduction in GHGs of 38,547,161 metric tons of CO<sub>2</sub> over the 12-year useful life of the new fare system. The primary driver of these reductions is the increase

in public transit use by “choice riders” who choose to utilize transit over a private automobile trip. The forecasted reduction in VMT and GHGs is expected to significantly benefit the San Diego region by improving air quality and reducing automobile traffic.

*Figure 5 – Summary of Environmental and Congestion Benefits*

<b>Environmental and Congestion Benefits (over 12 year useful life)</b>	
<b>Transit Ridership Increase</b>	88,016,927 passenger trips
<b>VMT Reduction</b>	9,103,204,129 vehicle miles
<b>GHG Emission Reduction</b>	38,547,161 MTCO <sub>2</sub>

**Measurement and improvement of operational performance** - MTS’s current smart card fare collection system does not have the ability to provide adequate data reporting on passenger travel to use it effectively for financial reconciliation, service planning, and performance monitoring. A new account based fare collection system will provide accurate information regarding passenger travel patterns. This information will be used in a number of ways:

First, costly passenger surveys which have limited accuracy will no longer be needed to determine fare allocation amongst the various transit operators that will share the system. Information on riders that transfer between different transit systems will be provided in reports generated from the fare collection system, and this information will then be used for reconciliation between the agencies.

Second, reports regarding travel patterns of riders will be used to streamline and improve service planning. Understanding origin and destination information will allow MTS’s planners to use passenger demand to set service levels and routing. This information can also be used to target investment of resources such as security or transit amenities, and can be instrumental in determining when to make larger transit infrastructure investments.

Third, the enhanced data reporting capabilities of an account based fare collection system will be fed into MTS’s current data warehouse, thereby providing greater accuracy in measuring key performance metrics. These metrics will be used to measure and improve the system’s operations.

**Collection, dissemination, and use of real time transportation related information to improve mobility, reduce congestion, and provide for more efficient and accessible transportation** - An account based fare collection system provides real time data that will have a number of benefits. Customers will be able to purchase fares in ways that are unavailable to them under MTS’s current fare collection system. Since transactions occur at the account level rather than on a specific plastic card, MTS will



be able to offer fares on every conceivable media. For instance, MTS fares could be sold at retail outlets like gift cards without specialized equipment, thereby expanding the number of places a customer can access transit passes. Making it easier to purchase fares serves to enhance the attractiveness of using transit and therefore contributes to a reduction in roadway congestion.

In addition, because a special fare card would not be necessary under an account based system, MTS could expand the use of the fare collection system to bundle payment for other transportation related services such as parking, highway tolls, or transportation network company (TNC) services. Patrons could choose the mode of transport that would be most efficient for a particular trip and pay for it with a single account.

Once the fare system is integrated with parking meters and services, the real-time information it will provide can be used to reduce congestion and improve the efficiency of parking usage. The information on where people are parked could be integrated into smart signage and smart phone applications to let people know where vacancies are available. This capability can reduce congestion on local streets by reducing auto travel associated with looking for a vacant parking spot, make it easier to use transit by alerting drivers to parking availability at transit centers, and make transit center parking garages more efficient. Real time parking information could also be used by the agency to engage in demand based pricing which would optimize revenue.

### **Economic benefits through reduced delays and improved system performance –**

See previous “Measurement and improvement of Operational Performance” section (page 10). As stated, the Fare System Modernization project will provide regional transit operators with accurate data on ridership and revenue. This new data will improve modeling and analysis capabilities in order to better understand demand for transit services. The ultimate goal is for transit agencies to be able to take this information, analyze the data to provide meaningful insights, and to make better management decisions based on those insights. Economic benefits are expected to manifest in improved ridership due to the provision of a transit service that is better suited to the demand characteristics of the region.

### **Integration of advanced technologies into transportation system management and operations –**

The proposed technology will be integrated with existing transportation management systems such as enterprise resource planning (ERP) software, customer relationship management (CRM) software, computer-aid dispatch (CAD) and automated vehicle location (AVL) systems, as well as MTS and NCTD websites. The new system will also include integration with other systems for fare policy management, hardware monitoring management (real-time status update), revenue



management, and media inventory management. The exact degree of integration will be determined in the design phase.

The new technology will also incorporate robust back office hosting and data reporting. The current system has an overabundance of convoluted data reports and requires that custom reports/queries be performed by the current fare system vendor. Specifying full ownership and access to all data will allow MTS to freely produce custom reports and queries. This data ownership will improve internal data analysis and capability for making informed management decisions.

**Demonstration, quantification, and evaluation of the impact of these advanced technologies, strategies, and applications towards improved safety, efficiency, and sustainable movement of people and goods** – MTS will measure, evaluate, and demonstrate the impact of the new fare system implementation based on the following key metrics:

- System utilization – percentage of riders who use fare media other than cash
- Ridership trends – growth in ridership attributed to improved system
- Customer satisfaction levels – survey based reports on customer satisfaction
- Capital and operating costs – report on actual costs of implementing leading technology

MTS plans to report these findings not only to the U.S. Department of Transportation but also to other transit agencies. As discussed in the next section, MTS has already been engaged in open dialogue between transit agencies from across the U.S. and Canada in order to assess implementation strategies and to share information. MTS will be able to disseminate the knowledge and insight through these existing channels as well as new ones.

**Reproducibility of successful systems and services for technology and knowledge transfer to other locations facing similar challenges** – MTS has actively been involved in industry-wide discussions regarding next generation fare systems. In fact, MTS hosted a two-day peer review in which eight agencies from various parts of the U.S. and Canada discussed the attributes of their current fare systems; recent, on-going, or planned fare technology implementations; strengths and weaknesses of alternative technologies; and real-world experiences with different vendors and technologies. MTS and NCTD have incorporated the knowledge and insight from this exercise into planning and decision points during project planning.

MTS is committed to documenting and sharing the full Fare System Modernization project experiences with the transit industry as a whole. Sharing the experiences of the

San Diego region with the implementation will help other agencies make informed decisions and help demonstrate the real-world application of new, leading technologies.

### ***5) Description of Transportation Systems and Services to be Included***

The Fare System Modernization project will deploy a state of the art fare system in the San Diego region. Both public transit operators in the San Diego region, MTS and NCTD, will utilize the new technology as part of a collaborative effort to enhance the customer experience, boost demand for transit, and enhance system performance. The project will include deployment of the following technologies:

**Account-based system with real time communications** – The account based transaction processor will be the primary back office engine for the fare system. The account based transaction processor will serve multiple functions on the backend, including the real-time processing of all transactions, creating customer accounts, linking customer accounts with fare media, the management of customer accounts, loading fare products/stored value, and processing fare payment calculations based on the established fare policy rules. The account based processor will use vendor provided APIs to access these functions using real-time communications between back office and all fare collection equipment.

**Open architecture for integration with other systems** - One of the most important requirements of the next generation MTS fare collection system is an open architecture, or providing full access to system Application Programming Interfaces (APIs) and data formats. This allows the flexibility to procure software and hardware outside the primary fare system vendor, and facilitates easier third party integration. While all vendor hardware will have some proprietary design, access to system APIs will allow the agency to purchase from third party vendors.

**Closed-loop foundation** - A key component of the next generation fare system will be a closed-loop back office. Every next-generation fare system is built upon a closed-loop back office, which enables transit-specific business rules including reduced fares, transfers, and pass products. While the current card-based fare collection system also has a closed-loop back office, an account-based closed-loop back office will allow for increased functionality including instant auto-loads, centralized fare processing, and greater third party integration. A closed-loop back office is also essential for processing open payments.

**Open payment capability** - Open payments will give customers the ability to pay fares with open-loop contactless bank cards and mobile wallets, such as Apple Pay and Android Pay. While this requirement gives customers more options, open payments are

currently not widely adopted in the transit industry. Open payments currently account for less than 0.1% of total transactions in the largest open payments system. This is due in large part to the lack of issuance of contactless bank cards in the U.S. Mobile wallet usage rates are also currently low, but may increase in the future. Open payment acceptance will increase PCI/EMV scope and includes fixed and variable banking fees for every transaction. Given this uncertainty regarding the future of open payments and the additional cost, the next generation fare collection system should be open payments “ready”, but will not accept open payments at launch.

**Flexible and Expandable Fare Policy** - The account-based architecture will support a wider range of fare policies compared to card-based systems. In addition to supporting pass products, stored value, and zone-based fares, account-based systems can also support tap-on/tap-off distance fares and fare capping. Fare capping involves using stored value with a set maximum amount or “cap” per day/week/month. This ensures that customers are always receiving the most equitable or “best fare”. Specifying that a wide range of fare policies be supported will provide MTS with greater flexibility to adopt innovative fare policies over the life of the system. The account-based system will also allow retailers to sell fare media in the same manner as gift cards, where customers can purchase a MTS fare card alongside an Amazon or Starbucks gift card. This allows retailers to sell media using existing Point of Sale registers and prevents the need for special fare system sales equipment.

**Mobile Ticketing Integration** - Mobile ticketing will provide customers the ability to purchase fares using their smartphones. Validating mobile tickets can be done via visual inspection of the smartphone screen without specialized hardware. However, integrating optical barcode and/or NFC contactless readers into validators can provide for more robust fare inspection and the collection of important ridership data. MTS awarded a mobile ticketing contract to Moovel in 2016. In order to ensure full integration between mobile ticketing and smartcard systems, MTS will coordinate the existing Moovel contract with the larger fare collection system.

**Robust Back Office Hosting and Data Reporting** - The current system has an overabundance of convoluted data reports and requires that custom reports/queries be performed by the current fare system vendor. Specifying full ownership and access to all data will allow MTS to freely produce custom reports and queries. This data ownership will improve internal data analysis efforts.

**Enhanced Payment Card and Personally Identifiable Information Security** - Physical and logical security is one of the top priorities of any payment system. The open payment ready requirement in an account-based fare collection system requires that all system components, including TVMs, validators, and networks be Payment Card

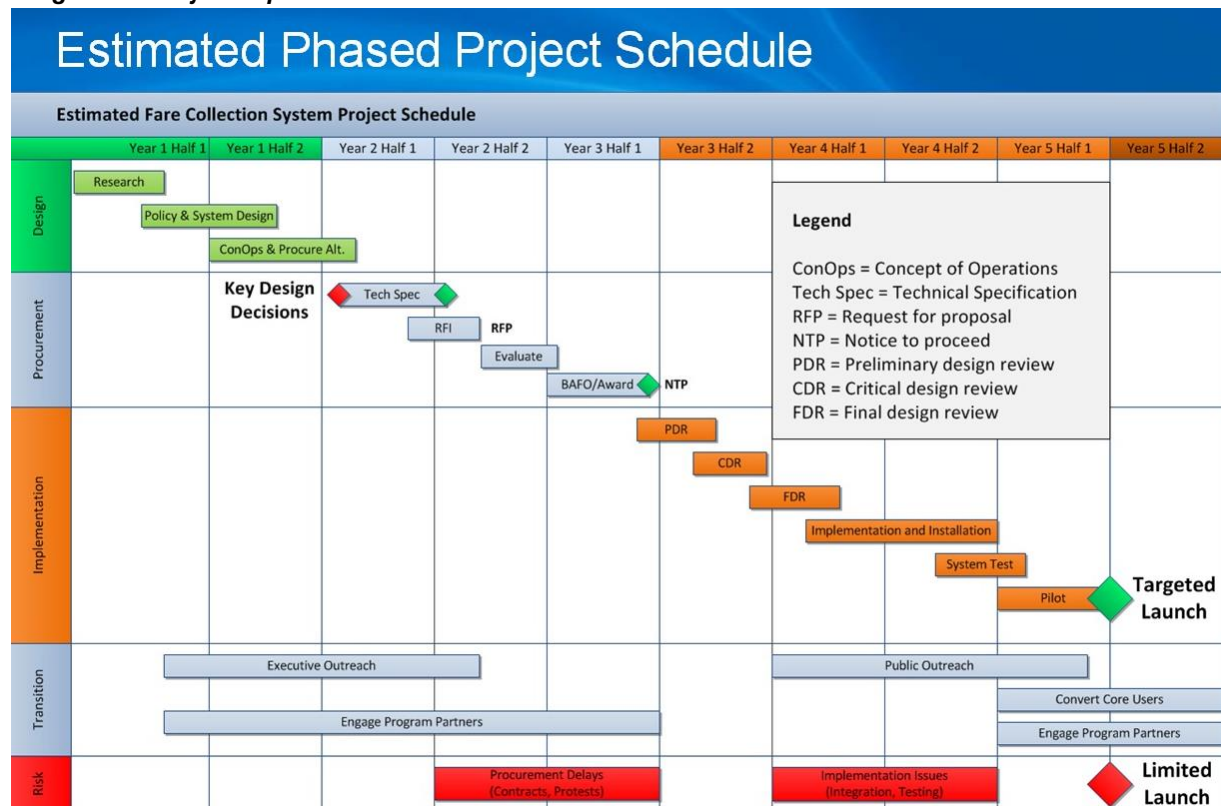
Industry (PCI) compliant and protect Personally Identifiable Information (PII). As a result, MTS will specify system architecture and database design in order to limit PCI scope and protect PCI data.

**Future Expandability** - The open architecture specification will allow for greater system expandability. An open architecture will lay the foundation for potential integration with trip planning, ride sharing, and other services. Open architecture will also allow for the ability to share technology, applications, and payment media across regional transportation agencies.

## 6) Project Deployment Plan

The Fare System Modernization project will be deployed in accordance with the schedule included in Figure 6 below.

Figure 6 – Project Implementation Plan



**Design Phase** - The design phase is currently underway. Beginning in July 2016, MTS, NCTD, and a consulting firm have been working conjunctively to compile research, formulate policy and system design, produce a Concept of Operations document, and determine procurement alternatives. In addition, MTS hosted a two-day industry-wide Fare System Peer Review at the MTS administration center beginning July 14th, 2016. Representatives from the Chicago Transit Authority (CTA), Dallas Area Rapid Transit (DART), Minneapolis Metro Transit, ORCA Card (Puget Sound region), Southeastern Pennsylvania Transportation Authority (SEPTA), Toronto Transit Commission (TTC), and TriMet (Portland area) gathered at MTS to discuss the current technology landscape, share implementation experiences, present opportunities and challenges, and explore strategies in a group setting. The workshop was extremely beneficial because it allowed regional leaders to assess different technologies and strategies as portrayed by industry users rather than by vendors. All information learned during the peer review was considered in determining the scope for the Fare System Modernization project for the San Diego region.

**Procurement Phase** – The procurement phase will be a joint effort between MTS and NCTD in which MTS will have awarding authority for the contracts. NCTD will have representatives on the procurement panels for evaluating bids but all contracts will be awarded and directly managed by MTS.

MTS and NCTD will first work with a consultant to develop the final technical specifications based on the Concept of Operations and system requirements identified during the design phase. Based on the technical specifications, MTS and NCTD will then issue request for proposals (RFPs) for system integration (primary vendor), hardware, software, and any other ancillary components identified during the development of the technical specifications. After issuing the RFP and receiving proposals, MTS and NCTD will formally evaluate bids to determine the most qualified vendor(s). When the evaluation process is complete, contracts will be awarded to the most qualified supplier in terms of technological capability and value.

**Implementation Phase** – The implementation phase will include a preliminary design review (PDR), critical design review (CDR), and final design review (FDR) prior to the physical implementation of the new software and hardware.

The PDR will involve working with the selected system integrator vendor to fine tune the technical specifications and explore variations of product performance, implementation schedule, costs, and risks associated with the proposed specifications.

The CDR will consist of a technical review to confirm that the desired performance requirements and project scope can be achieved within budget and on schedule. The CDR phase will include testing of software in the development phase.

The FDR will be the final design review and will be conducted when the design is nearly one hundred percent complete and development testing is complete. The final design specifications will be approved for use in the production environment during this phase.

After the final design has been approved, the technology will begin to be deployed in the regional service area. Hardware and software applications will be deployed, the system will be tested, and the implementation phase will conclude with a pilot launch. From preliminary design review through the final launch of the pilot program, the implementation phase is expected to last approximately two years.

**Transition Phase** – The transition phase of the project will primarily include public outreach, training of core users on new system, and engagement of program partners (retailers, student programs, corporate programs, etc.).

**Operations and Maintenance** – The new regional fare system will have a minimum useful life of 12 years. Once the fare system is live in production, MTS and NCTD will operate and maintain the system for the useful life of the asset per an established cost sharing agreement.

Cost sharing for regional fare system operations and maintenance will be conducted in accordance with MTS Contract No. G0930.21-04.1 between MTS, NCTD, and SANDAG. This agreement establishes the cost sharing rate in which MTS contributes 75 percent and NCTD contributes 25 percent of costs related to the fare system. This agreement is included as Attachment No. 7.

## ***7) Description of Regulatory, Legislative, or Institutional Challenges or Other Obstacles to Deployment***

### **Regulatory Challenges:**

- Title VI of the Civil Rights Act of 1964 “protects people from discrimination based on race, color, and national origin in programs and activities receiving federal financial assistance”<sup>3</sup>. Title VI considerations must be considered in determining which fare media will be offered to customers. According to the Transit Cooperative Research Program (TCRP) *Preliminary Strategic Analysis of Next Generation Fare Payment Systems for Public Transportation*, “since riders from unbanked or underbanked households are less likely to have their own credit or debit card, a transit agency can meet the needs of this ridership community by

<sup>3</sup> <https://www.transit.dot.gov/regulations-and-guidance/civil-rights-ada/title-vi-civil-rights-act-1964>



offering prepaid fare options...<sup>4</sup>. Although there are currently no plans to abandon prepaid options or cash payment, Title VI implications will be considered when implementing open payment functionality or mobile ticketing aspects which rely on expensive technology and/or banking services which many low-income/minority riders do not have access to.

- Senate Bill (SB) 1703 merged the planning and programming functions of MTS and NCTD together under the San Diego Association of Governments (SANDAG), the region's Metropolitan Planning Organization. Included in those functions is the "responsibility for developing a Regional Fare Policy, including setting fares for transit services in the region through a Comprehensive Fare Ordinance."<sup>5</sup> One of the regulatory challenges surrounding the project is that any changes to the fare prices or fare structure will need to be recommended by SANDAG's Transportation Committee and adopted by the Board of Directors. The regional fare policy requirements can delay the adoption of revised fare structures and can also limit the options of proposed fare changes if not supported by Board members. MTS, as project lead, will emphasize regional coordination and discussion with stakeholders to ensure seamless rollouts of changes to the fare structure.

### **Legislative Challenges:**

Not applicable. No legislative challenges have been identified for this project.

### **Institutional Challenges:**

Not applicable. No institutional challenges have been identified for this project.

## ***8) Quantifiable System Performance Improvements such as Reducing Traffic-Related Crashes, Congestion and Costs; Optimizing System Efficiency; and Improving Access to Transportation Services***

The Fare System Modernization project is expected to improve system performance by providing modern technology that not only exceeds the existing Compass System on functionality and performance, but also provides net cost savings in year 13 of the project. As summarized in Figure 3 (page 8), the project is expected to provide an operational savings of over \$46 million over 15 years and a net savings (inclusive of capital investment) of over \$11 million over 15 years. The cost savings from

<sup>4</sup> Transportation Research Board of the National Academies, *TCRP Report 177: Preliminary Strategic Analysis of Next Generation Fare Payment Systems for Public Transportation*, Pg. 6

<sup>5</sup> SANDAG Board Policy No. 029, [http://www.sandag.org/organization/about/pubs/policy\\_029.pdf](http://www.sandag.org/organization/about/pubs/policy_029.pdf)



implementing next generation technology will allow MTS to focus spending on high impact areas such as service improvements/expansions rather than on maintaining an aging system.

The Fare System Modernization project is also expected to have a significant impact on congestion in the region. Public transit is a key factor in reducing the number of automobiles on the road because an increase in the people who utilize transit translates directly into a reduction of the amount of vehicles on the road. As summarized in Figure 5 on page 10, MTS forecasts a reduction of 9,103,204,129 VMT over the 12-year useful life of the fare system. The VMT reduction is estimated to occur as a direct result of increased ridership resulting from the improved fare system. This reduction in VMT directly implies a reduction in traffic congestion because there will be less private automobiles on the road and more people utilizing mass transit.

***9) Quantifiable Safety, Mobility, and Environmental Benefit Projections such as Data-Driven Estimates of How the Project will Improve the Region's Transportation System Efficiency and Reduce Traffic Congestion***

According to the *San Diego Forward: The Regional Plan*, the long-range planning guide for the region, the population of the San Diego region is expected to increase by approximately one million people by 2050. Furthermore, it states that “the San Diego region is growing at a rate of approximately 1.3 percent per year, or an average of approximately 30,000 people per year...”<sup>6</sup>

With a rising population comes a rising need for a transit system that maximizes benefits to riders and reduces the number of vehicle miles travelled (VMT). The Fare System Modernization project is expected to enhance the customer experience by providing more convenient and flexible payment alternatives as well as a simplified fare structure that incorporates fare capping. These benefits are expected to increase the appeal of using transit for travel throughout the region and contribute toward the goals of reducing VMTs in the region.

As previously discussed, the Fare System Modernization project is estimated to increase ridership by 88,016,927 passenger trips over the 12-year useful life of the new fare system (Attachment No. 4).

<sup>6</sup> San Diego Association of Governments, *San Diego Forward: The Regional Plan*, Appendix J – Regional Growth Forecast, Pgs. 1-2, [http://www.sdfoward.com/pdfs/RP\\_final/AppendixJ-RegionalGrowthForecast.pdf](http://www.sdfoward.com/pdfs/RP_final/AppendixJ-RegionalGrowthForecast.pdf)

Increased ridership will result in less vehicle miles travelled (VMT), which reduces the amount of greenhouse gases (GHGs) in the air as well as congestion from the volume of cars on the road. MTS calculated the projected VMT reduction and associated GHG reduction using a calculator tool developed by the California Air Resources Board (Attachment No. 5). MTS has also included a description of the calculator tool methodology, assumptions, and selection of inputs (Attachment No. 6).

The results of the analysis provide for an estimated reduction in VMT of 9,103,204,129 and a reduction in GHGs of 38,547,161 metric tons of CO<sub>2</sub> over the 12-year useful life of the new system. The primary driver of these reductions is the increase in public transit use by “choice riders” who choose to utilize transit over a private automobile trip. The reduction in VMTs will significantly reduce GHGs and congestion by reducing the amount of private automobiles on the road. The estimated benefits are summarized below in Figure 7.

**Figure 7 – Environmental and Congestion Benefits**

<b>Environmental and Congestion Benefits (over 12 year useful life)</b>	
<b>Transit Ridership Increase</b>	88,016,927 passenger trips
<b>VMT Reduction</b>	9,103,204,129 vehicle miles
<b>GHG Emission Reduction</b>	38,547,161 MTCO <sub>2</sub>

### **10) Vision, Goals, and Objectives**

MTS and NCTD have collaboratively developed the following vision, goals, and objectives for guiding the development and measuring the success of the Fare System Modernization project.

**Project Vision:** *The Fare System Modernization project shall: be a non-proprietary open source system; have an expandable and flexible design that is able to evolve as needs and technology change; be simple for both customers to use and MTS to manage; be stable and compliant with security standards; and use leading, yet proven, technology for fare payment that maximizes media already held by customers.*

#### **Project Goals and Objectives:**

Goal 1) Achieve open architecture for future flexibility

- Objective A – Collaborate with fare system consultant to develop technical specifications for RFP that will ensure free access to APIs, ability to modify graphical user interfaces for hardware and back office tools, and allow usage of commercial off-the-shelf devices.

- Objective B – Procure and install best suited system integrator services, hardware, and software for deploying open architecture system

Goal 2) Ensure the region will not be constrained to single vendor for upgrades or integrations

- Objective A – Collaborate with fare system consultant to develop technical specifications for open architecture system that will minimize proprietary design, allow for competitive procurement of third party hardware, and grant access to APIs for integration with third-party vendors
- Objective B – Procure system integration services from vendor with proven track record of implementing similar systems and integrating with third-party hardware.
- Objective C – Procure and install hardware and software solutions identified in technical specifications

Goal 3) Increase agency control over configuration and data access

- Objective A – Collaborate with fare system consultant to develop technical specifications for robust back office system that will allow transit agencies to freely produce custom reports and queries, maximize response time, and actively manage the configuration of the backend system
- Objective B – Procure and install new back office system per identified technical specifications

Goal 4) Simplify fare collection operations for customers and agencies

- Objective A – Collaborate with fare system consultant to develop technical specifications for system integrator, hardware, and software solutions that will provide user friendly interfaces and flexible payment options while increasing maintainability and manageability for transit agency staff
- Procure and install new hardware and software identified in specifications
- Simplify the business rules and fare table

Goal 5) Utilize proven and secure technology that minimizes risk

- Objective A – Assess various technologies and vendors industry-wide to determine which have a proven track record
- Objective B – Procure and install technologies with record of successful deployment

Goal 6) Implement a cost-effective system quickly

- Objective A – Develop technical specifications for non-proprietary, open architecture system that will allow for competitive procurement of hardware and software
- Objective B – Procure and implement software and hardware with highest overall value

Goal 7) Leverage existing media to facilitate smooth customer transition

- Objective A – Design system capable of utilizing previously existing fare media including Compass Cards, potentially personal credit and debit cards, etc.

Goal 8) Explore integration with other agencies and services to enhance the development of San Diego as a “Smart City”

- Objective A – Conduct outreach efforts to Caltrans, the City of San Diego, and other agencies to share information and discuss potential integration of payment services
- Objective B – Use information gathered in outreach efforts to establish opportunities for execution

The goals and objectives described above have been developed to accomplish the vision for the project and to address the real world challenges discussed in section 4a.

***11) Plan for partnering with the private sector or public agencies, including multimodal and multijurisdictional entities, research institutions, organizations representing transportation and technology leaders, or other transportation stakeholders***

MTS will collaborate with the North County Transit District (NCTD) and the San Diego Association of Governments (SANDAG) in the design and procurement of the new fare collection system. MTS and NCTD initially will be the agencies that will use the fare collection system to collect passenger fares and manage parking at transit facilities. SANDAG will also participate financially in the procurement since the fare collection system will be utilized on the extension of the light rail system that SANDAG is currently constructing.

While at first the new fare collection system will be implemented regionally, MTS has been in talks with other transit agencies in southern California to eventually accept each other's fare media for a seamless travel experience. Effective achievement of this goal will rely on the implementation of an account based system. These partnerships will be

facilitated by MTS's membership in the LOSSAN Rail Corridor Agency, a joint powers authority originally formed in 1989 that works to increase ridership, revenue, capacity, reliability, coordination and safety on the coastal rail line between San Diego, Los Angeles and San Luis Obispo. The 351-mile Los Angeles – San Diego – San Luis Obispo Rail Corridor (LOSSAN Corridor) travels through a six-county coastal region in Southern California and is the second busiest intercity passenger rail corridor in the United States. The LOSSAN Corridor service includes 41 stations and more than 150 daily passenger trains, with an annual ridership of more than 2.7 million on Amtrak Pacific Surfliner intercity trains and 4.5 million on Metrolink and COASTER commuter trains.

MTS will also partner with SANDAG in projects to use the fare collection system in conjunction with demand management programs, such as bike lockers and vanpools, and the operation of the FastTrak highway tolling system.

As part of the new fare collection system, MTS will have an institutional portal that will greatly enhance the ability to integrate with other institutions and private sector entities. As an example, MTS has an extensive partnership with the University of California San Diego (UC San Diego) which includes a universal transit pass program for all UC San Diego students, and discussions have already begun regarding how the new fare collection system will integrate with the campus' identification/access card system.

Part of the procurement for the fare collection system will be to partner with a company that can assemble a broad network of retail outlets that will provide customers with the greatest access to fare products. This company will contract with convenience stores, supermarkets and other outlets throughout the region.

MTS will leverage the flexibility of the account based fare collection system to create partnerships with parking providers such as Ace Parking, transportation network companies such as UBER and LYFT, and bike share companies such as DecoBike. These partnerships will make it easier for individuals to access a variety of transportation choices to fit their unique needs.

Ultimately, the account based fare collection system can be used as a platform to implement smart city initiatives currently being planned in the region's 18 cities.

## ***12) Plan to Leverage and Optimize Existing Local and Regional Advanced Transportation Technology Investments***

The *San Diego Forward: The Regional Plan*, the long range plan developed by SANDAG, calls for increased transit and use and for \$22.8 billion in further transit

investments through year 2050 (Revenue Constrained Plan only). The proposed investments would include additional light rail lines, increased rail service, additional rapid bus lines, and improved frequencies on many bus routes. The Fare System Modernization project would optimize the proposed regional projects through a variety of means.

First, the Fare System Modernization project will drastically improve the customer experience through simplified fare payment and expanded payment options. The improved experience is expected to make transit a more attractive option and thus increase demand for transit. Increased demand is expected to bring a higher return on investment for many of the regional transit projects included in the long-range plan.

Second, The Fare System Modernization project will optimize planned regional transit investments by providing the “universal” fare payment that will be used in conjunction with all existing service and expanded services. With the addition of new services and the continual growth of the San Diego population, integration of those new services will be more important than ever. A standards-based, account-based system will provide the technology necessary for true integration and expandability.

The Fare System Modernization project will also optimize current and planned technology-specific investments aimed at reducing congestion. Such projects, as described in *San Diego Forward: The Regional Plan*, include:

- The deployment of a **Multi-Modal Management System** inclusive of a dedicated short-range communication system; enhanced data collection for regional arterials, bikeways, and pedestrian facilities in order to better monitor how the transportation system is performing; enhanced data collection for regional arterials, bikeways, and pedestrian facilities in order to better monitor how the transportation system is performing; and an enhanced California Freeway Performance Measurement System, which collects data that can be used to improve both transit and road performance
- Implementation of **Smart Parking** which combines management strategies to deliver advanced parking solutions for communities by informing people where, when, and how much parking is available in the vicinity of their destination
- **Transportation Demand Management (TDM)** innovations including “Mobility Hubs” which are “places of connectivity, where different modes of transportation – walking, biking, ridesharing, and transit – come together seamlessly to connect people to their jobs, school, shopping, errands, recreation, and back home.” Mobility hubs “include bike and pedestrian improvements, signs or apps that help people find their way... urban design enhancements, real-time traveler information, parking spots for share mobility services, and a universal payment

system.” As highlighted, the region has identified a universal payment system, such as the system that would be deployed with the Fare System Modernization project, as a component implementing TDM innovations.

- **Shared Mobility Services** such as “car-sharing, bike-sharing, real-time ridesharing, Transportation Network Companies (e.g. Uber, Lyft, Sidecar), neighborhood electric vehicles, scooter-share, and shuttle or jitney services.”<sup>7</sup>

The Fare System Modernization project will optimize these planned investments by combining payment methods into one simplified payment system. Having a unified payment system will maximize the ease of use for patrons who wish to access multiple modes or multiple services en route to their destinations. In fact, *San Diego Forward: The Regional Plan* specifically calls for investment in a “Universal Transportation Account” that “combines all forms of public transportation payments, including transit fares, municipal parking, and toll collection into a single user-friendly system.”<sup>8</sup>

Data collected from the modern back-end reporting system will be available for use in conjunction with other regional data sources to provide improved transportation modeling, improved real-time data for managing transit and transportation as a whole to reduce congestion, and for providing the public with information necessary to plan their trips such as fares, boarding times, etc.

### ***13) Schedule for Conducting the Technology Deployment and for Completion of All Proposed Activities***

MTS proposes the following schedule for executing the milestones included in the project deployment plan (Section 6). As previously noted, the project Design phase has been underway since July 2014. Reimbursable activities would begin in the Procurement phase assuming an award date by September 30, 2017. The project is expected to be complete by May 29, 2021, marking a four year period of performance of grant funded implementation activities (FY2018 through FY2021).

<sup>7</sup> San Diego Association of Governments, *San Diego Forward: The Regional Plan*, Pgs. 72-76, [http://www.sdfoward.com/pdfs/RP\\_final/The%20Plan%20-%20combined.pdf](http://www.sdfoward.com/pdfs/RP_final/The%20Plan%20-%20combined.pdf)

<sup>8</sup> San Diego Association of Governments, *San Diego Forward: The Regional Plan*, Pgs. 73, [http://www.sdfoward.com/pdfs/RP\\_final/The%20Plan%20-%20combined.pdf](http://www.sdfoward.com/pdfs/RP_final/The%20Plan%20-%20combined.pdf)



**Figure 8 – Project Schedule**

Project Phase	Project Activity	Duration (Days)	Start Date	Completion Date
Design	Research	761	7/1/2014	7/31/2016
	Policy & System Design	365	7/1/2016	7/1/2017
	ConOps & Procurement Alternatives	180	2/1/2017	7/31/2017
Procurement	Develop Technical Specifications	90	8/1/2017	10/30/2017
	Issue and Receive Request for Proposals (RFP)	60	10/31/2017	12/30/2017
	Evaluate Proposals	60	12/31/2017	3/1/2018
	Award Contract	30	3/2/2018	4/1/2018
Implementation	Preliminary Design Review	120	4/2/2018	7/31/2018
	Critical Design Review	120	8/1/2018	11/29/2018
	Final Design Review	150	11/30/2018	4/29/2019
	Implementation and Installation	365	4/30/2019	4/29/2020
	System Test	150	1/30/2020	6/28/2020
	Pilot	180	5/29/2020	11/25/2020
Transition	Executive Outreach	790	8/1/2016	9/30/2018
	Engage Program Partners	913	8/1/2016	1/31/2019
	Public Outreach	726	10/1/2019	9/26/2021
	Convert Core Users	365	5/29/2020	5/29/2021
	Engage Program Partners	365	5/29/2020	5/29/2021

#### **14) Support or Leveraging of the ITS Program or Innovative Technology Initiatives**

The Fare System Modernization project will directly support the following strategic themes included in the U.S. Department of Transportation's *ITS Strategic Plan 2015-2019*<sup>9</sup>.

- **Enhance Mobility** – the Fare System Modernization project will deploy leading technology to provide regional customers with flexible, convenient, and secure payment options. The new system will be utilized for transit fare payment in addition to other regional services. The standards-based system will allow for future integration and expandability so the potential of having one uniform payment for accessing many different regional services is maximized. Having a universal payment method for multiple sources will provide more seamless travel and enhanced mobility.
- **Limit Environmental Impacts** – As discussed in prior sections, the Fare System Modernization project is expected to increase demand for transit and reduce the number of VMTs. Specifically, the project is estimated to reduce VMTs by 38,547,161 miles over the 12 year useful life of the new system. That reduction in VMT is estimated to reduce GHG emissions in the region by approximately 38,547,161 MTCO<sub>2</sub> over the 12-year useful life of the new system. The reduction

<sup>9</sup> U.S. Department of Transportation, *ITS Strategic Plan 2015-2019*, Executive Summary, Pg. v, <https://www.its.dot.gov/strategicplan/>

in GHGs will have a significant impact on improving air quality in the San Diego region.

- **Promote Innovation** – The new fare system will be a standards-based, account-based payment system. This kind of architecture is necessary for fostering innovation because it makes the system integrative and capable of competitively bid upgrades. The development of other transportation technologies, such as the development of Transportation Network Companies (i.e. Uber, Lyft), car-sharing applications, bike-sharing applications, etc. will need to be supported by a uniform payment method to maximize ease of use and spur the adoption of these new innovative technologies.
- **Support Transportation System Information Sharing** “through the development of standards and systems architectures...” As previously discussed, the proposed project will deploy a standards-based, open architecture capable of integration with and expansion to other systems. MTS will be able to share information with other agencies with standards-based systems in order to make system improvements and test ideas through pilot programs for potential integrations (i.e. joint marketing campaigns with private businesses, etc.).

**B) Staffing Description**  
Project Management Organization

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Figure 9 – Project Management Organization

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# **Project Management Team Resumes**







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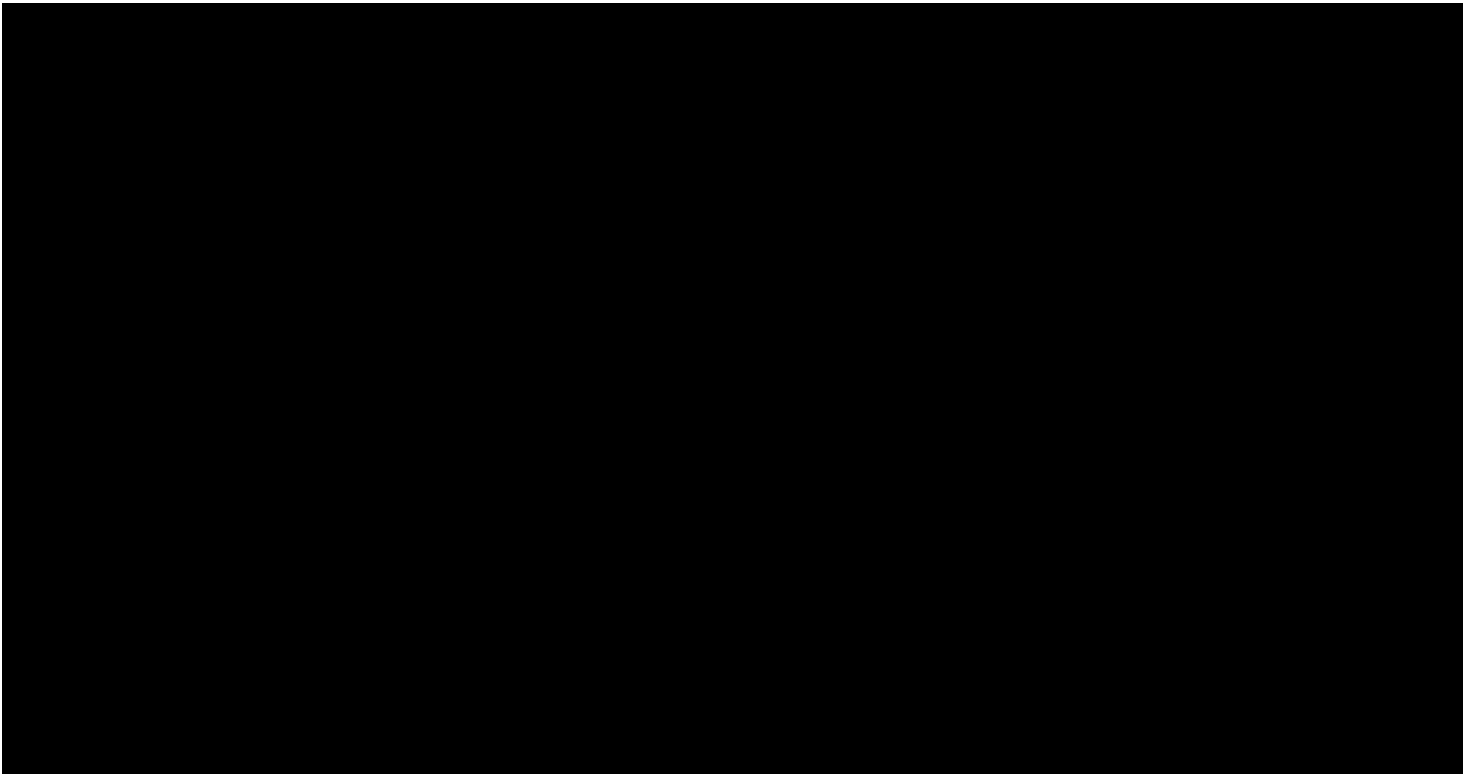
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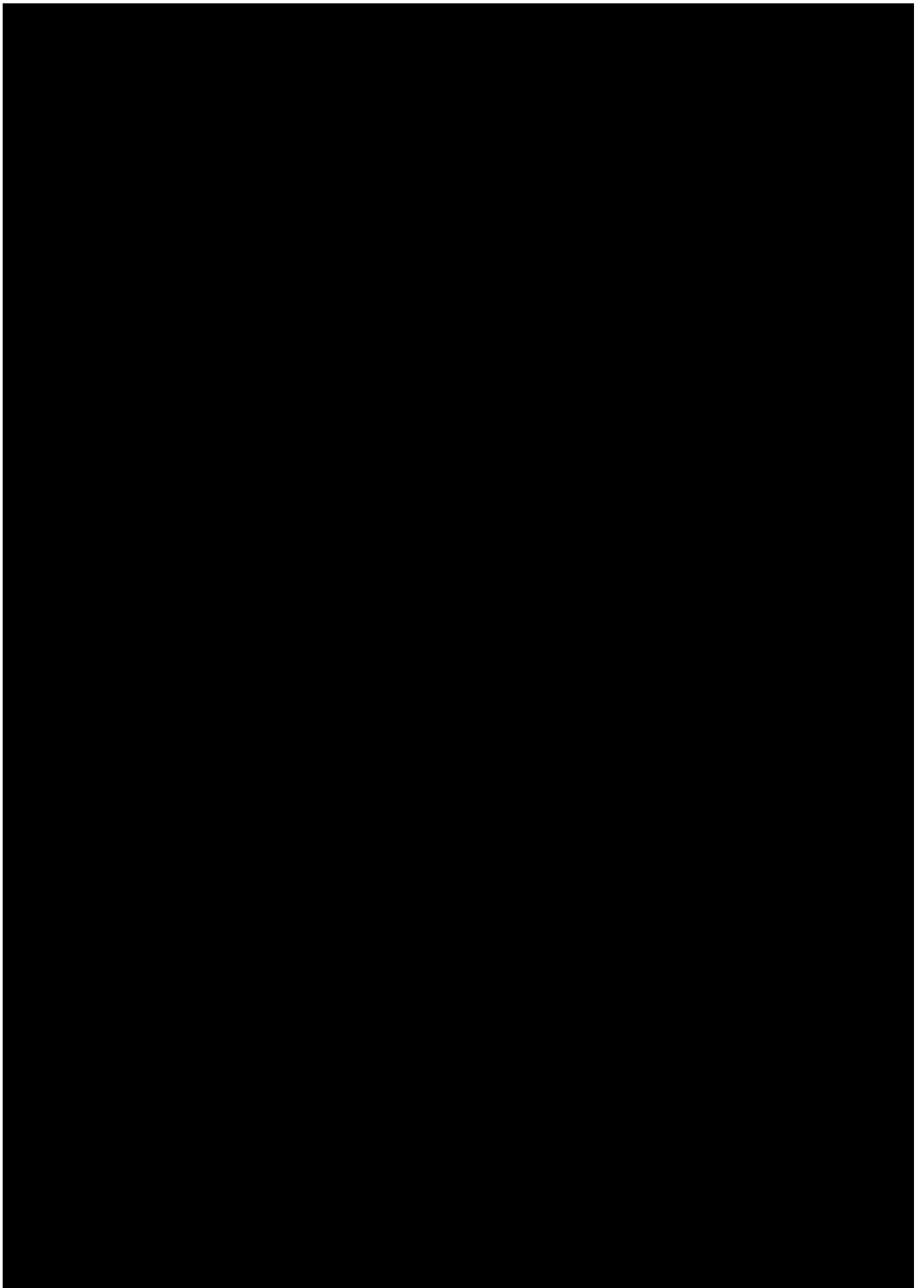
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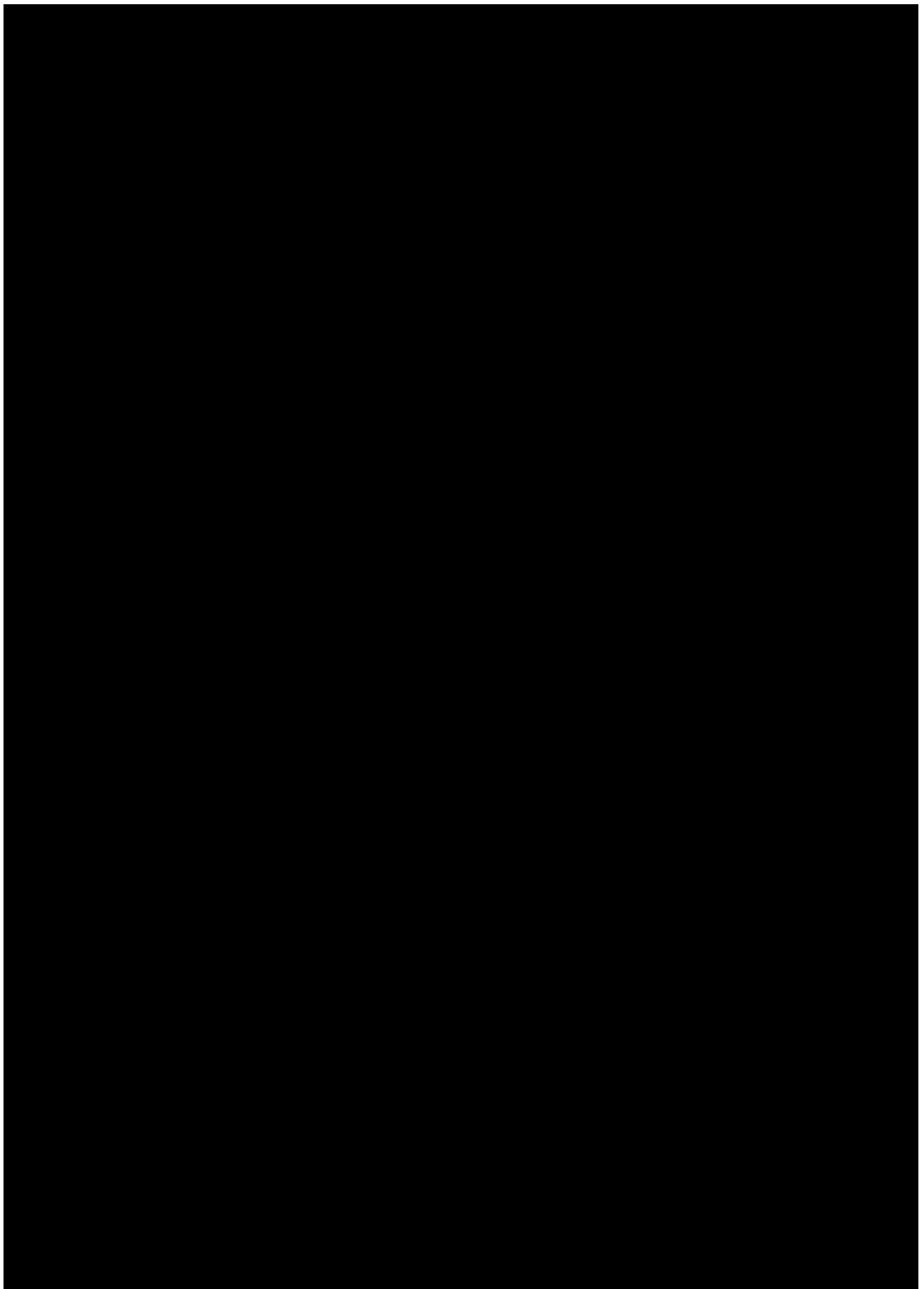


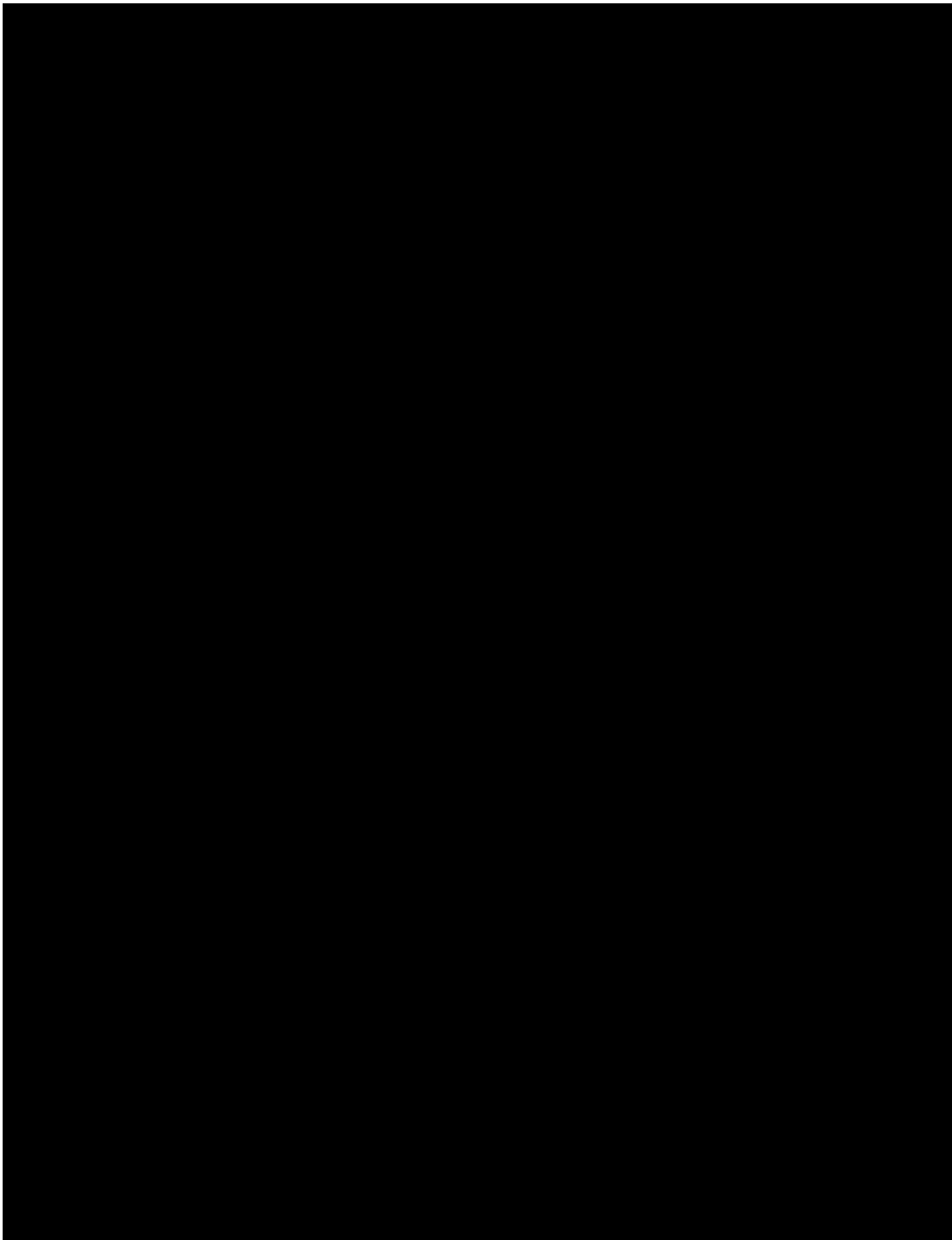


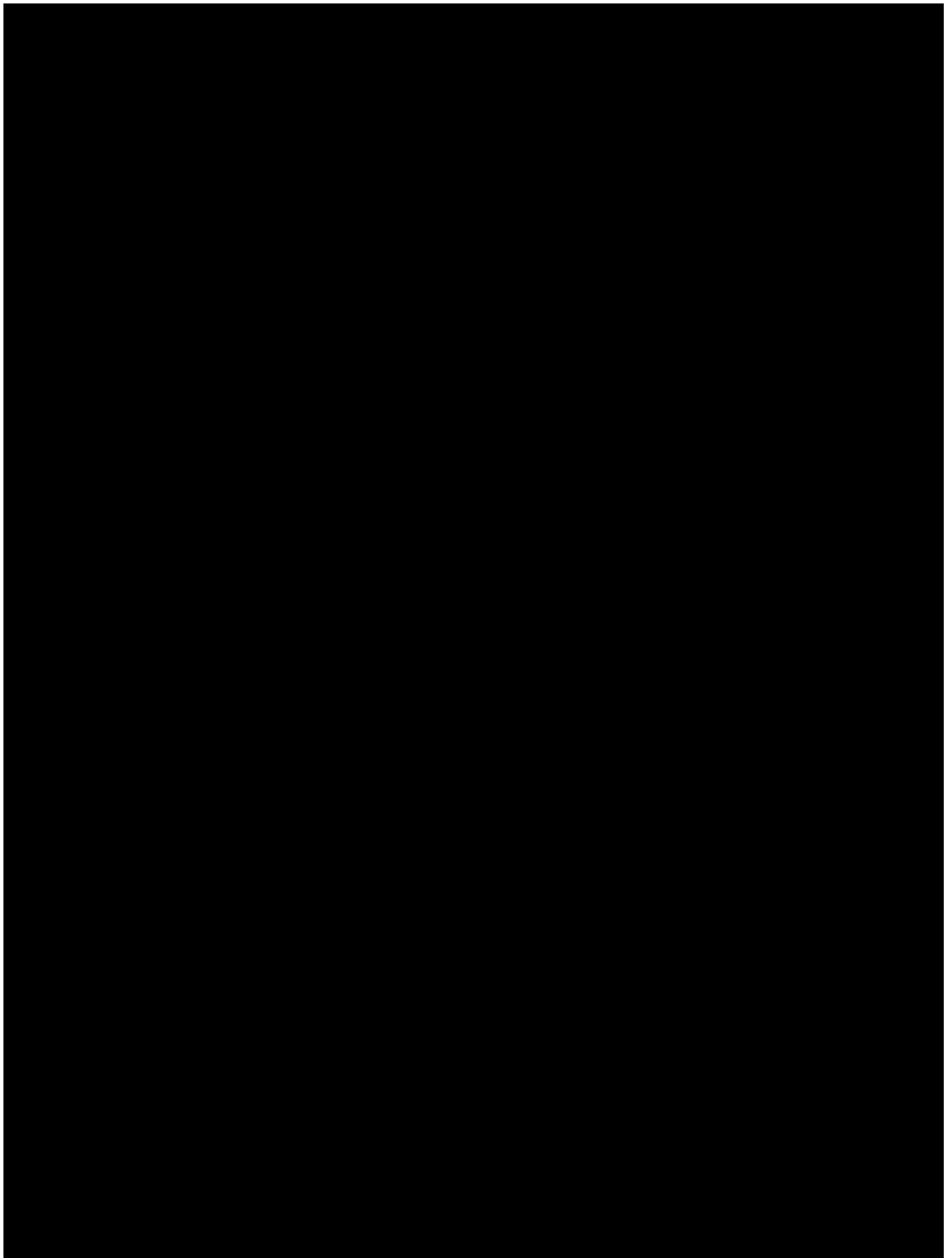












the 1990s, the number of people in the UK who are aged 65 and over has increased from 10.5 million to 12.5 million, and the number of people aged 75 and over from 4.5 million to 6.5 million (Office for National Statistics 2000). The number of people aged 85 and over has increased from 1.5 million to 2.5 million in the same period.

There is a growing awareness of the need to develop services to meet the needs of older people, and the need to ensure that services are accessible to older people. The Department of Health (2000) has published a strategy for older people, which sets out the government's commitment to older people and the need to develop services to meet their needs. The strategy also sets out the need to ensure that services are accessible to older people, and that older people are able to participate in decisions about their care.

The Department of Health (2000) has also published a strategy for mental health services, which sets out the government's commitment to mental health services and the need to develop services to meet the needs of people with mental health problems. The strategy also sets out the need to ensure that services are accessible to people with mental health problems, and that people with mental health problems are able to participate in decisions about their care.

The Department of Health (2000) has also published a strategy for social care services, which sets out the government's commitment to social care services and the need to develop services to meet the needs of people who need social care. The strategy also sets out the need to ensure that services are accessible to people who need social care, and that people who need social care are able to participate in decisions about their care.

The Department of Health (2000) has also published a strategy for health services, which sets out the government's commitment to health services and the need to develop services to meet the needs of people who need health services. The strategy also sets out the need to ensure that services are accessible to people who need health services, and that people who need health services are able to participate in decisions about their care.

The Department of Health (2000) has also published a strategy for the NHS, which sets out the government's commitment to the NHS and the need to develop services to meet the needs of people who need the NHS. The strategy also sets out the need to ensure that services are accessible to people who need the NHS, and that people who need the NHS are able to participate in decisions about their care.

The Department of Health (2000) has also published a strategy for the public, which sets out the government's commitment to the public and the need to develop services to meet the needs of people who need the public. The strategy also sets out the need to ensure that services are accessible to people who need the public, and that people who need the public are able to participate in decisions about their care.

The Department of Health (2000) has also published a strategy for the future, which sets out the government's commitment to the future and the need to develop services to meet the needs of people who need the future. The strategy also sets out the need to ensure that services are accessible to people who need the future, and that people who need the future are able to participate in decisions about their care.



