An Introduction to

TRANSPORTATION AIR QUALITY

and Why Transportation Agencies Care About It

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TxDOT Houston District– Aug 14th 2018

Outline

- Transportation Air Quality
- Transportation Planning
- Transportation Conformity
- Emissions Analysis
- Project Consistency*

Transportation Air Quality

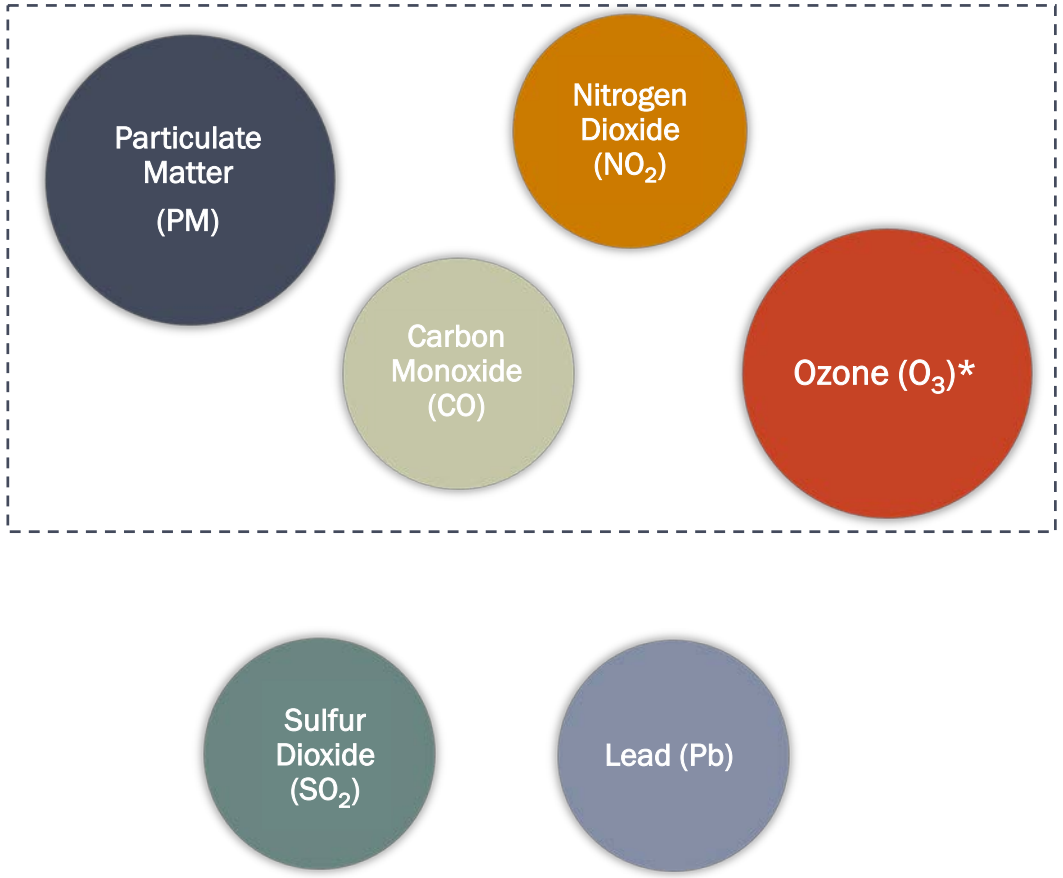
Section 1

What Is Air Pollution?

A mixture of solid particles and gases in the air

It occurs when the air contains
harmful amount of gases, dust, fumes and odor

Important Air Pollutants



Air Quality & Public Health

- Approximately 200,000 early deaths per year in the U.S.

  53,000 can be attributed to contributions of road transportation emissions

NO_x — **Oxides of Nitrogen**
Irritates airways, especially lungs

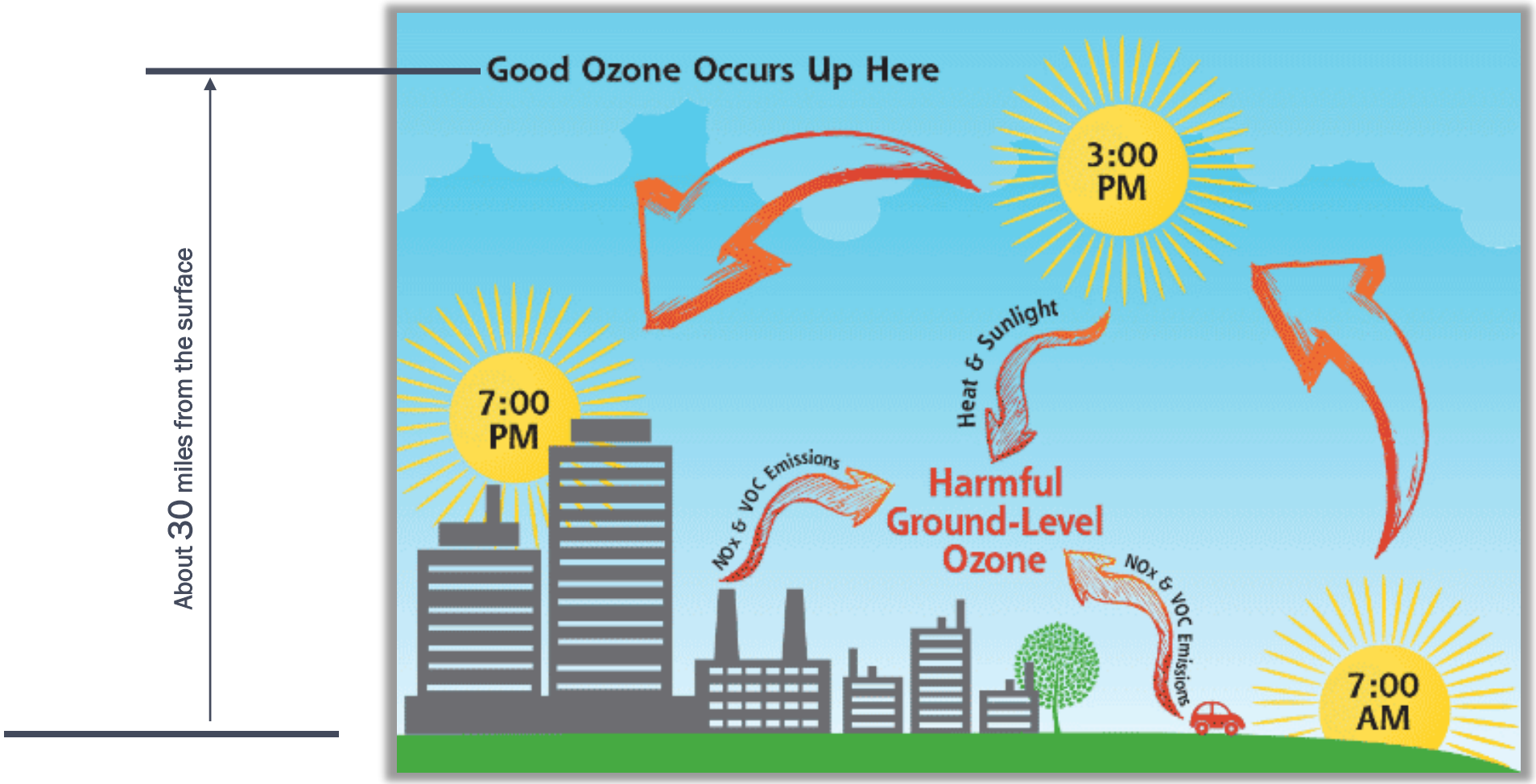
O_3 — **Ground-Level Ozone**
Triggers reactions in people who have asthma

VOCs — **Volatile Organic Compounds (Hydrocarbons)**
Triggers conjunctival irritation, nose and throat discomfort, cancers, etc.

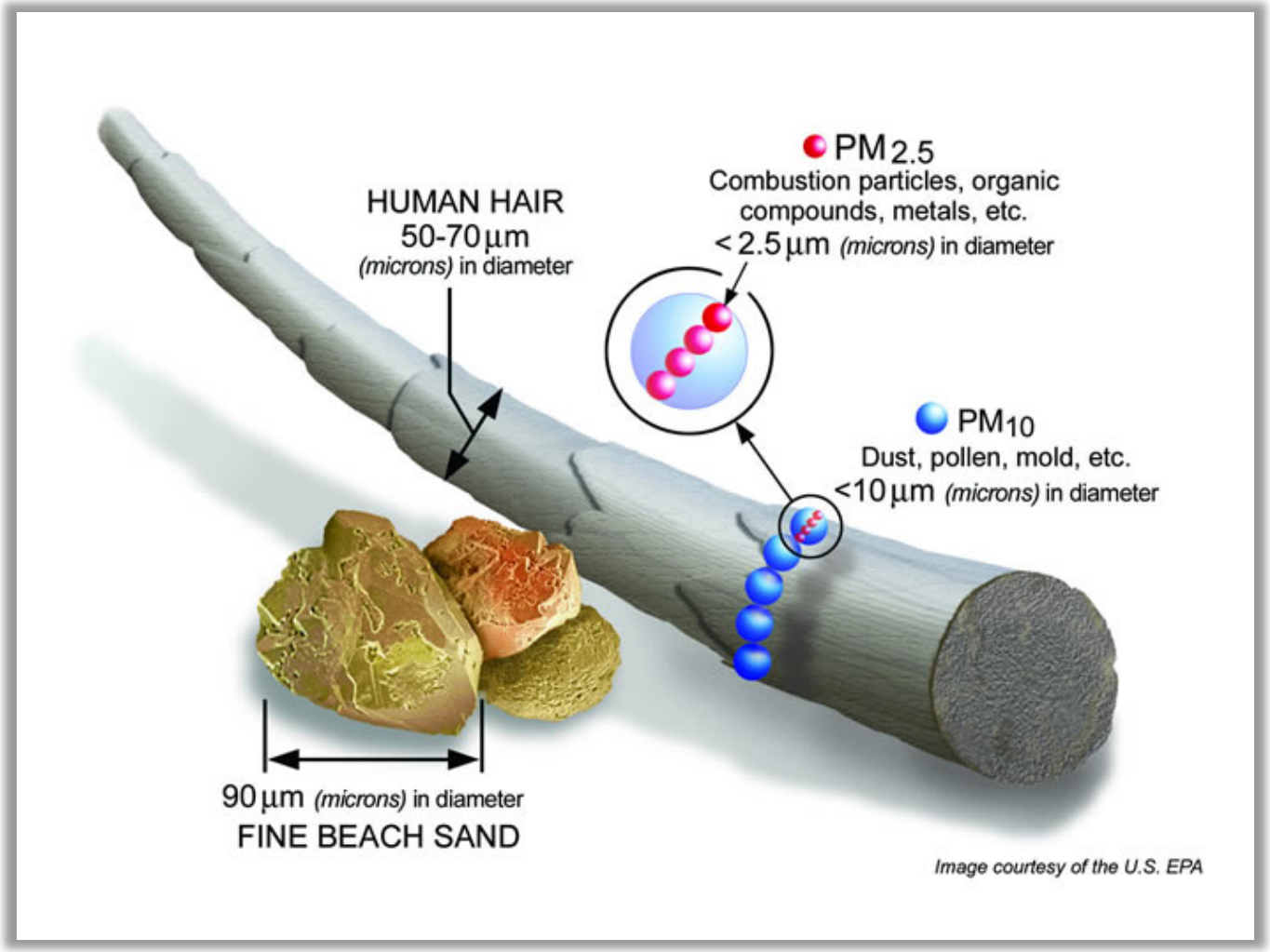
CO — **Carbon Monoxide**
Decreases the ability of your blood to carry oxygen

PM — **Particulate Matter**
Aggravates symptoms in individuals who already suffer from respiratory or cardiovascular diseases

Good Ozone, Not So Good Ozone



Particulate Matter (PM)



OK…… Got It

It is a **Big Deal**

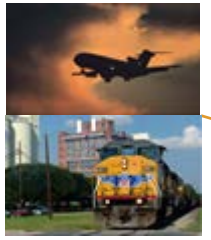
… but why should transportation and planning agencies care*?

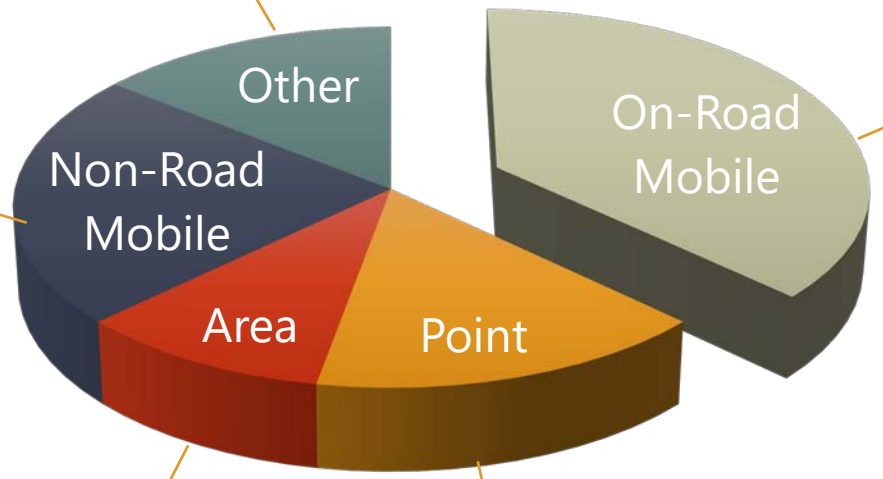
Transportation is a Major Source of Air Pollution

Emission Sources

Emissions from biogenic sources, e.g., crops, lawn grass, and trees

Emissions from vehicles or equipment that are not operated on roads or highways





Emissions from on-road vehicles

Regulated as part of **Transportation Conformity**

Emissions from small stationary and non-transportation pollution sources

Emissions from fixed or large facilities

Ever heard of

Conformity?

Clean Air Act (CAA)

National Ambient Air Quality Standards (NAAQS)

Area Designation

Transportation Conformity & Emission Budget

Federal Air Quality Regulations

- Clean Air Act (CAA), 1970
  - 40 CFR Part 50
  - Established national ambient air quality standards (NAAQS) and six criteria pollutants
  - Established requirements for state implementation plan (SIP)
- CAA Amendments, 1977
  - Introduced transportation conformity
- CAA Amendments, 1990
  - Current legal authority
  - Expanded transportation conformity provisions
    - Identified the actions states/MPOs must take to reduce emissions from on-road mobile sources in nonattainment/maintenance areas
  - Established 5-year NAAQS review period

National Ambient Air Quality Standards

- Standards for criteria pollutants (considered harmful to public health and the environment)
  - Primary standards (public health)
  - Secondary standards (public welfare protection)

Pollutant		Primary/ Secondary	Averaging Time	Level	Form
Ground-Level Ozone		Primary and Secondary	8-hour	**0.070 ppm (70 ppb)**	Annual fourth-highest daily maximum 8-hr concentration, averaged over 3 years
Particle Pollution	**$PM_{2.5}$**	Primary	Annual	12 µg/m^3	annual mean, averaged over 3 years
		Secondary	Annual	15 µg/m^3	annual mean, averaged over 3 years
		Primary and Secondary	24-hour	**35 µg/m^3**	98th percentile, averaged over 3 years
	PM_{10}	Primary and Secondary	24-hour	150 µg/m^3	Not to be exceeded more than once per year on average over 3 years

Area Designations

– Based on air quality monitoring
– Done by TCEQ in Texas
– New designations required when NAAQS are revised

Attainment	Maintenance	Nonattainment
Meet all NAAQS	Meet all NAAQS, but previously violated	Does not meet NAAQS

What is Transportation Conformity?

Federally mandated process

Ensure that transportation projects will not worsen air quality in the future

For non-attainment areas

Transportation Conformity in Plain English

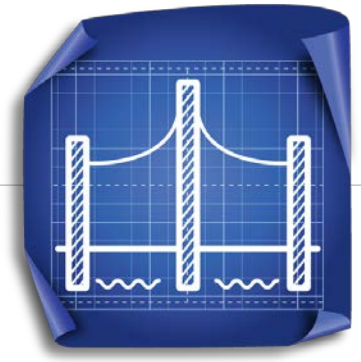
If you

- Plan to use federal $$$, or
- Need a federal approval for your transportation project

You have to show that your project doesn't add to the AQ problem

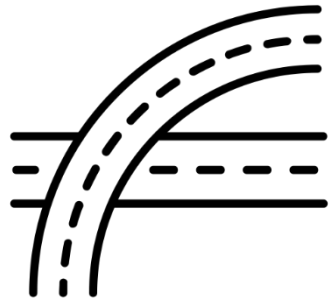
Transportation Planning

Section 2



Transportation Planning

Process to decide **which** transportation projects to fund and **when** to fund



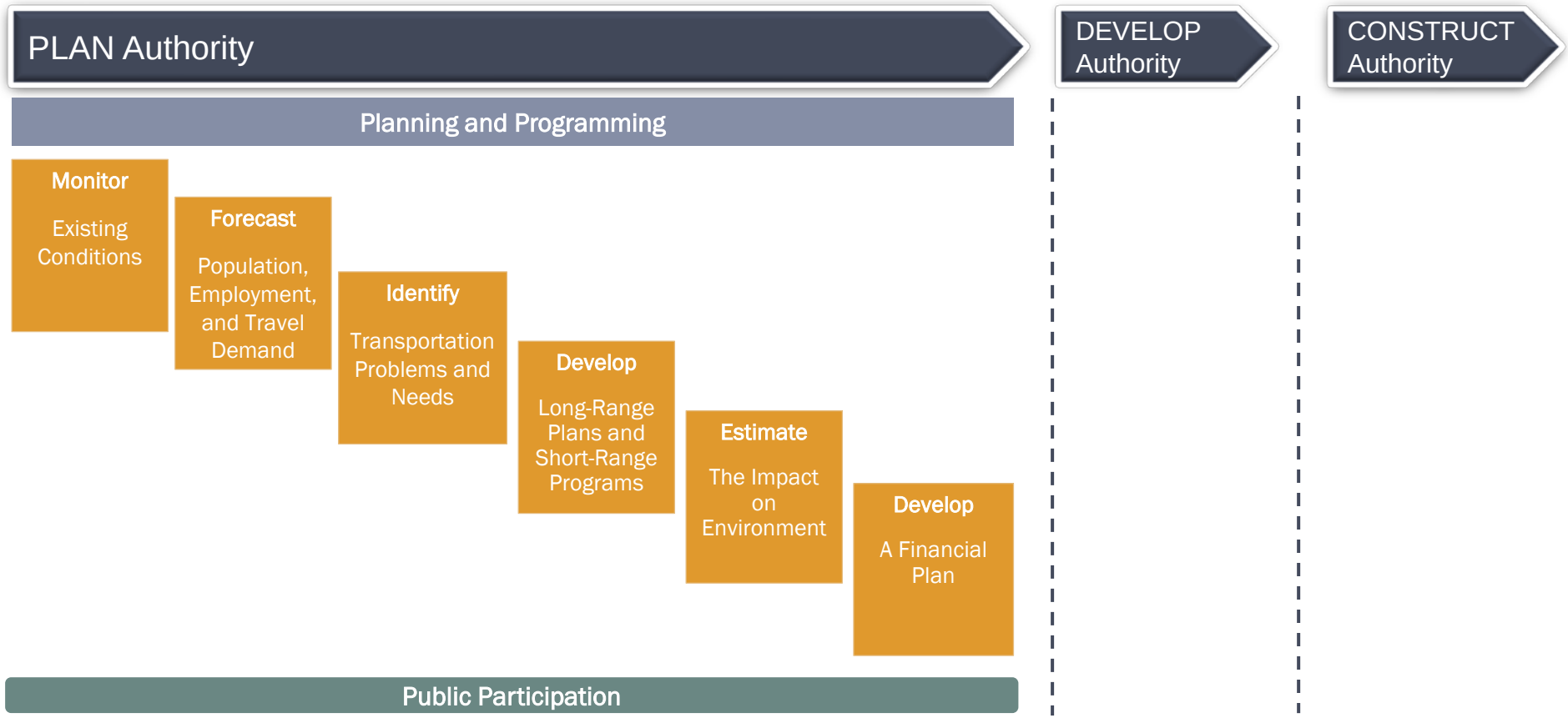
Support mobility needs of region

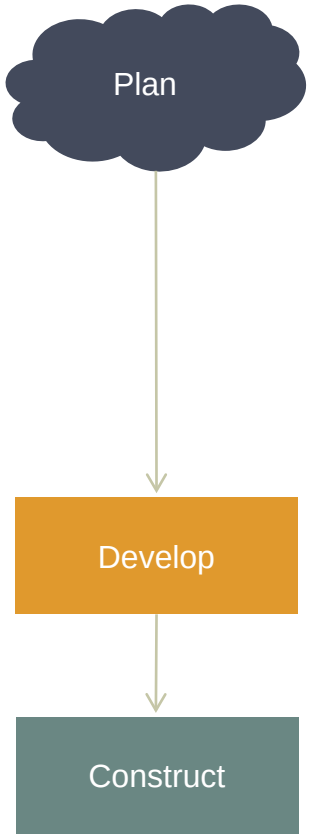
Consider future system demand

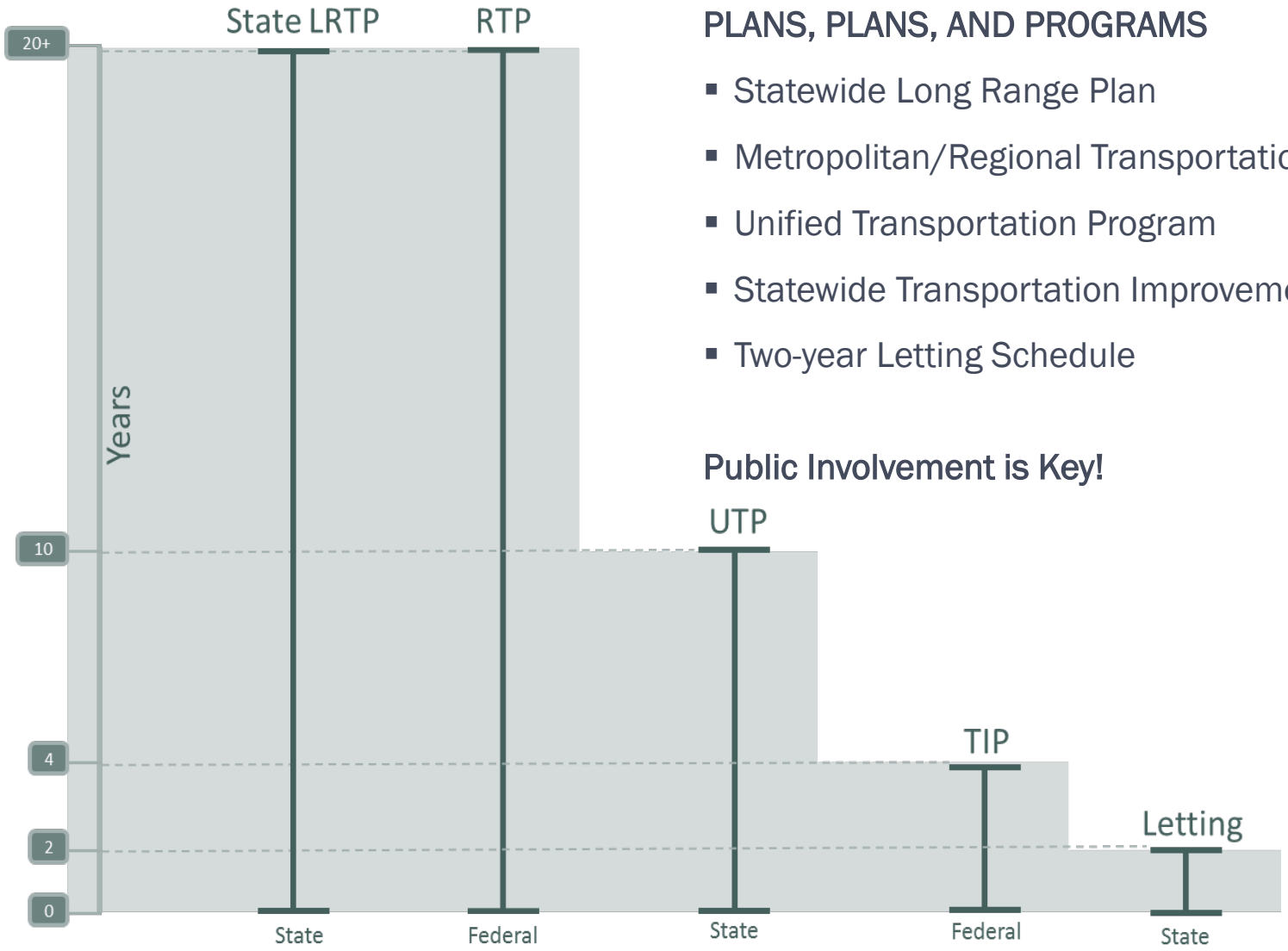
Identify transportation needs

- investment needs
- timeline

Transportation Planning Process







PLANS, PLANS, AND PROGRAMS

- Statewide Long Range Plan
- Metropolitan/Regional Transportation Plan
- Unified Transportation Program
- Statewide Transportation Improvement Program
- Two-year Letting Schedule

Public Involvement is Key!

Texas Transportation Plan (TTP)

Time Frame

25 years

Geographic Area

Entire State

TxDOT's statewide long-range transportation plan

Includes:

- Infrastructure inventory
- Future needs
- Future funding projection
- Analysis of funding alternatives
- Performance goals, measures, targets

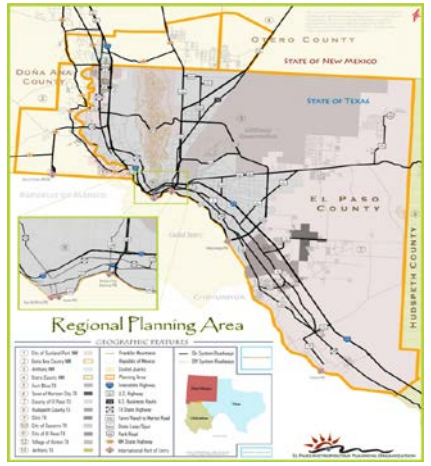
Metropolitan/Regional Transportation Plan (MTP/RTP)

Time Frame

20+ years

Geographic Area

Region



Federally required 20+ year planning document, constrained to scenario-based planning forecast

City Area	Project Element	CSJ	Project ID	Project Name	Project Description
Regional	Exempt	0924-06-527	M086X	El Paso County Regional Transit Feasibility Study	Provide research to document options for a county-wi agency for the County of El Paso
Regional	Exempt	0924-06-471	M085X	Metropia Synergy Solution	Reduce congestion and mobile source emissions Metropia Synergy Solution, the no-constructi management, Intelligent Transportation Sy Metropia Mobile, Metropia Dynamics, a Solution.

Unified Transportation Program (UTP)

Time Frame

10 years

Geographic Area

Entire State (by District)

Identifies and authorizes project development up to 10 years in advance of project letting

CSJ	District		MPO	City		Letting FY
0021-01-053	EL PASO	BREWSTER COUNTY		BREWSTER	US 67	2017

Limits From: JCT US 90
Limits To: 1.35 MI E OF SH 223
Project Description: ROADWAY REHABILITATION
Ranking Tier 1

Total Project Cost Information

INFORMATIONAL PURPOSES ONLY	
Preliminary Engineering	$128,974
ROW & Utilities	$0
Construction	$2,632,114
Construction Engineering	$128,974
Contingencies	$1,316
Indirect Costs	$0
Potential Change Orders	$118,972
Total Project Cost	$3,010,349

Programmed Funding

Category	Description	Authorized	Other	Local	Total
1	PROP 1 MAINTENANCE	$1,930,000	$0	$0	$1,930,000
11	PROP 1 ENERGY SECTOR	$300,000	$0	$0	$300,000
1	PREVENTIVE MAINT & REHAB	$351,000	$0	$0	$351,000
	Total	$2,581,000	$0	$0	$2,581,000

Transportation Improvement Program (TIP)

Time Frame

4 years

Geographic Area

Region

Fiscally constrained short-range program of transportation improvements

DISTRICT	COUNTY	CSJ	HWY	PHASE	CITY	PROJECT SPONSOR	YOE COST
NM DIST. 1	DA	**CN E100100**	Various	C	Other	NMDOT	**$2,060,000**

TIP PROJECT NAME: Southern DAC Bridge Replacement Project

LIMITS FROM:	NM 28: MP 19.3 NM 186: MP 0.7 NM 226: MP 1.3
LIMITS TO:	NM 28: MP 19.5 NM 186: MP 0.8 NM 226: MP 1.5
TIP DESCRIPTION:	Bridge Replacement; Structure #2730, #5296, #2814
REMARKS:	CN E100120 and CN E100130 (both FY 2015 projects) deleted and work combined in this project (CN E100100); amend in FY 2015 H2040MTP, EPMPO H13-16 TIP, EPMPO H15-18 TIP & NM 14-17 STIP (simultaneous submittal)

REVISION DATE:	11/2014
MPO PROJECT ID:	**B606X**
FUNDING CATEGORY:	STP-TPU
MTP REFERENCE:	B606X

PROJECT HISTORY: Add to FY 2015 in EPMPO H13-16 TIP, EPMPO H15-18 TIP & NM 14-17 STIP (simultaneous submittal)

Total Project Cost Information:

Preliminary Engineering:	$0
Right Of Way:	$0
Construction:	$2,060,000
Construction Engineering:	$0
Contingencies:	$0
Indirects:	$0
Bond Financing:	$0
Potential Change Order:	$0
Total Project Cost:	**$2,060,000**

Cost of Approved Phases: **$2,060,000**

Authorized Funding by Category/Share

	Federal Share	State Share	Regional Share	Local Share	Lcl Contribution	Total Share
Cat NM STP-TPU	$837,312	$142,688	$0	$0	$0	$980,000
Cat NM STP-TPA	$922,752	$157,248	$0	$0	$0	$1,080,000
Fund by Share	**$1,760,064**	**$299,936**	**$0**	**$0**	**$0**	**$2,060,000**

Statewide Transportation Improvement Program (STIP)

Time Frame

4 years

Geographic Area

Statewide (by MPO and Rural Areas)

Federally required 4-year programming document

2015-2018 STIP			05/2016 Revision: Approved 06/24/2016				
DISTRICT	MPO	COUNTY	CSJ	HWY	PHASE	CITY	YOE COST
EL PASO		PRESIDIO	0924-07-016	CS	C,E,ENV,ENG		$ 1,151,500
LIMITS FROM	(ON HURD AVE) MARKET ST					PROJECT SPONSOR	CITY OF PRESIDIO
LIMITS TO	(ON REDE FRANCO RD) RANCH RD					REVISION DATE	05/2016
PROJECT DESCR	SHARED USE PATH FOR PEDESTRIANS AND CYCLISTS (ON HURD AVE AN D REDE FRANCO RD)					MPO PROJ NUM	
						FUNDING CAT(S)	9TAP
REMARKS	STATE-SELECTED TAP 2015; ADD TO 15-18 STIP				PROJECT HISTORY		
P7							

TOTAL PROJECT COST INFORMATION			AUTHORIZED FUNDING BY CATEGORY/SHARE					
PREL ENG	$ 61,629		CATEGORY	FEDERAL	STATE	REGIONAL	LOCAL	LC	TOTAL
ROW PURCH	$ 0	COST OF	9TAP	$ 921,200	$ 188,846	$ 0	$ 41,454	$ 0	$ 1,151,500
CONSTR	$ 1,257,734	APPROVED	TOTAL	$ 921,200	$ 188,846	$ 0	$ 41,454	$ 0	$ 1,151,500
CONST ENG	$ 61,503	PHASES							
CONTING	$ 14,212	$ 1,151,500							
INDIRECT	$ 0								
BOND FIN	$ 0								
PT CHG ORD	$ 52,322								
TOTAL CST	$ 1,447,401								

2-year letting schedule

Time Frame

2 years

Geographic Area

Entire State
(by District and County)

Authorizes projects for construction in line with plans and baseline forecast.

El Paso County						
CCSJ	Highway	Let Status	Letting Date	Contract Cost	Fund Cat	Description
0001-05-017	FM 259	Actual	JUN 2016	$190,776	8	INSTALL LIGHTS AND GATES WITH ADVANCED PREEMPTION DETECTION

How Air Quality Fits In (i.e. Transportation Conformity)

Section 3

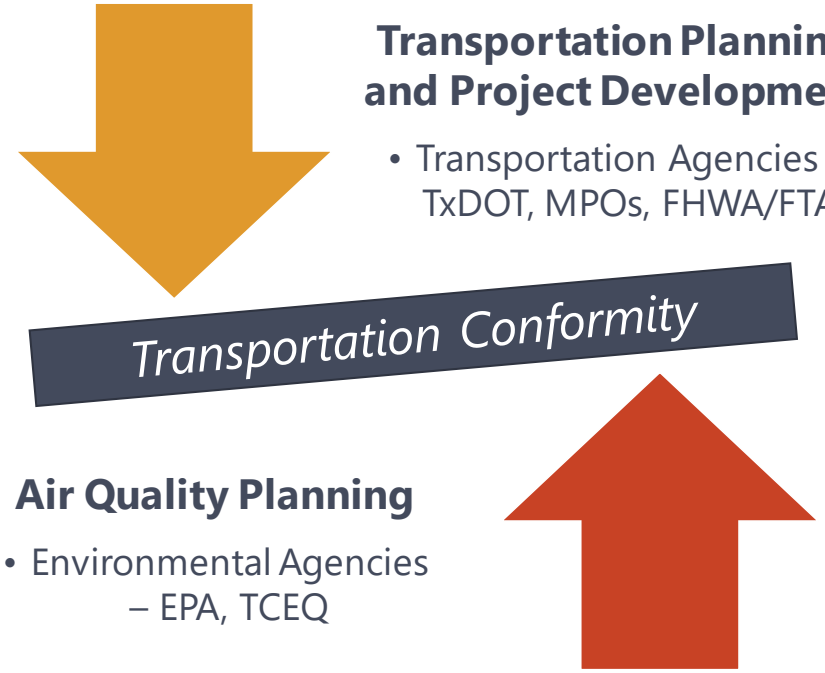
What is Transportation Conformity?

Federally mandated process

Ensure that transportation projects will not worsen air quality in the future

For non-attainment areas and attainment maintenance areas

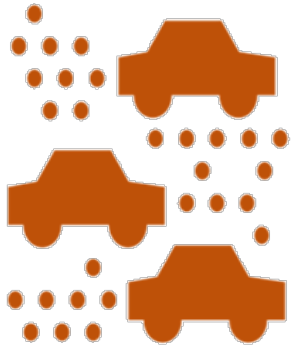
Requirement for FHWA/FTA action and/or the release of funding



State Implementation Plan and Emissions Budget

State Implementation Plan (SIP)

- Air quality plan for the state to meet the NAAQS
- Emissions “budgets” for pollutants in nonattainment area from all sources including transportation



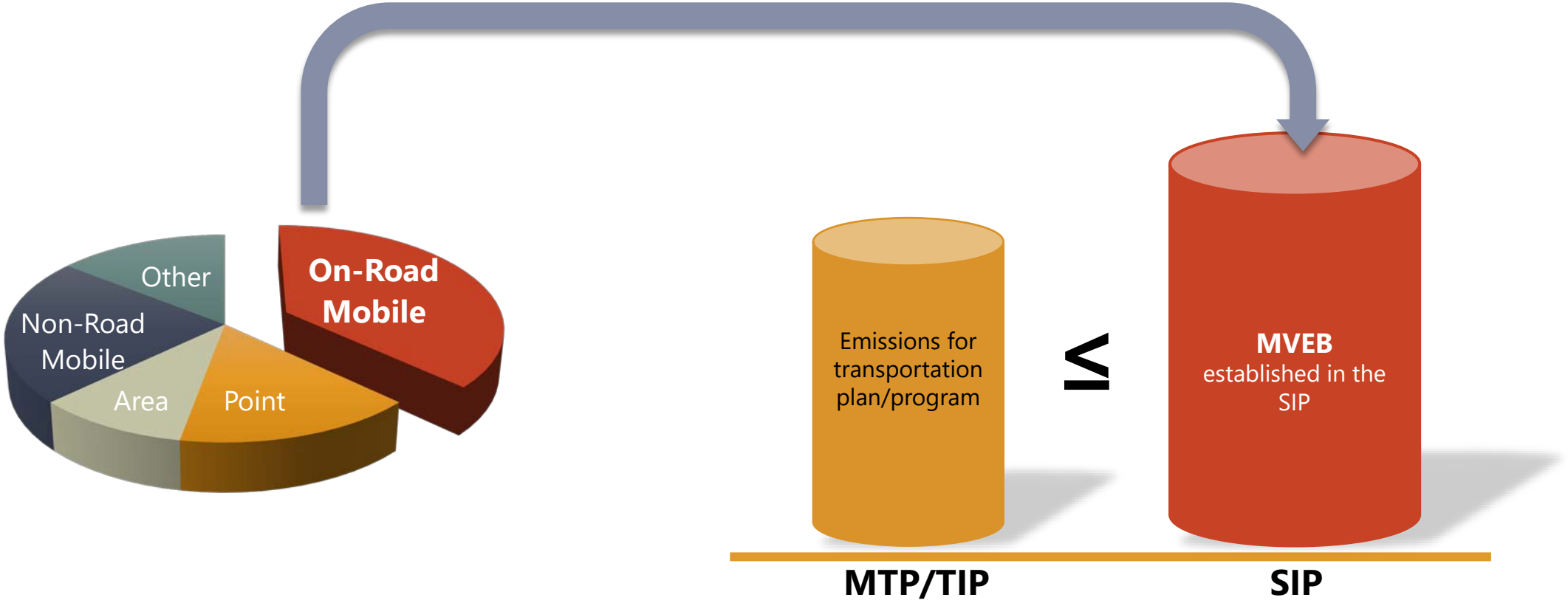
Motor Vehicle Emissions Budget (MVEB)

- Limit for pollutants from all regional motor vehicle activities

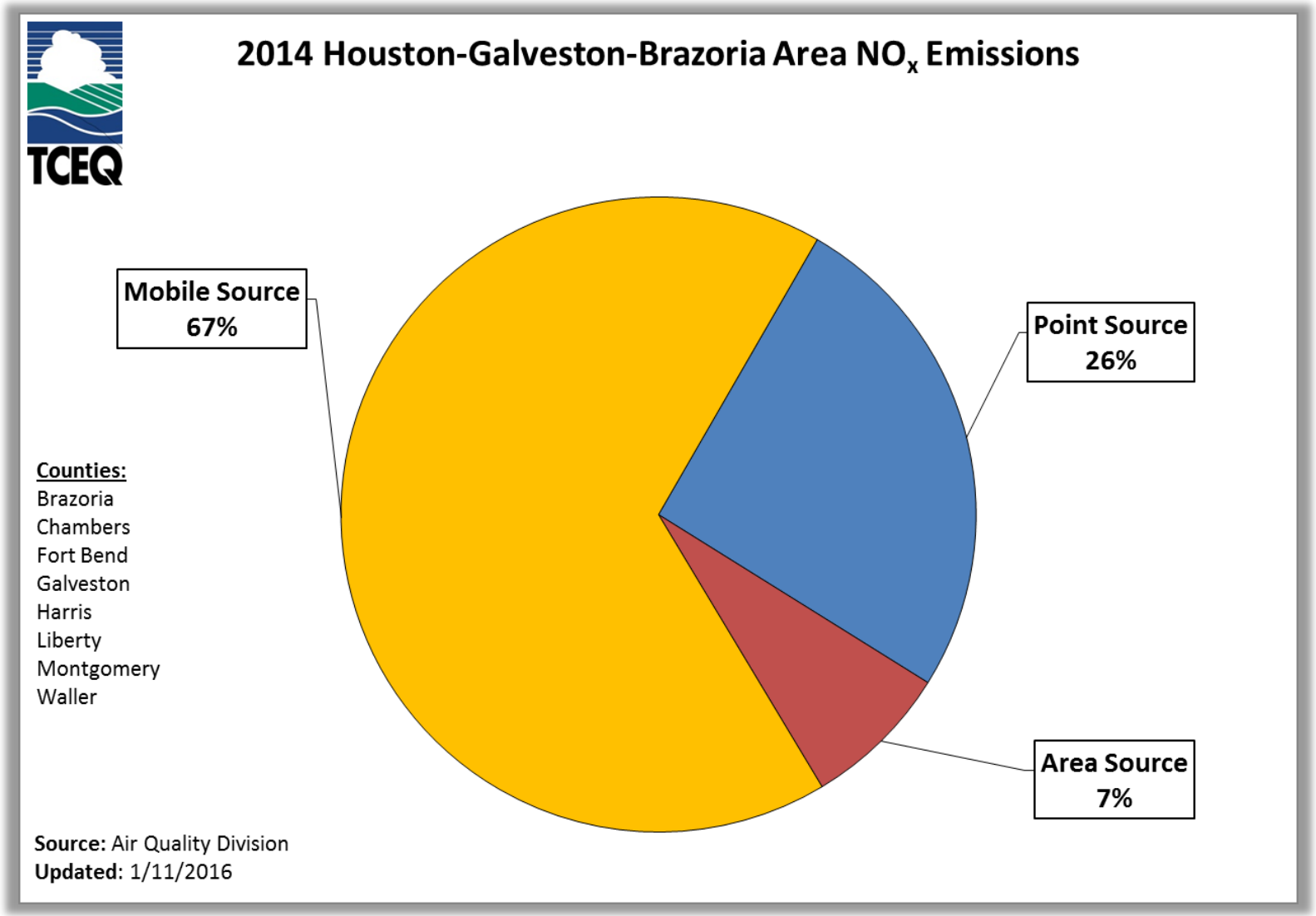
SIP, Transportation Conformity and the MVEB

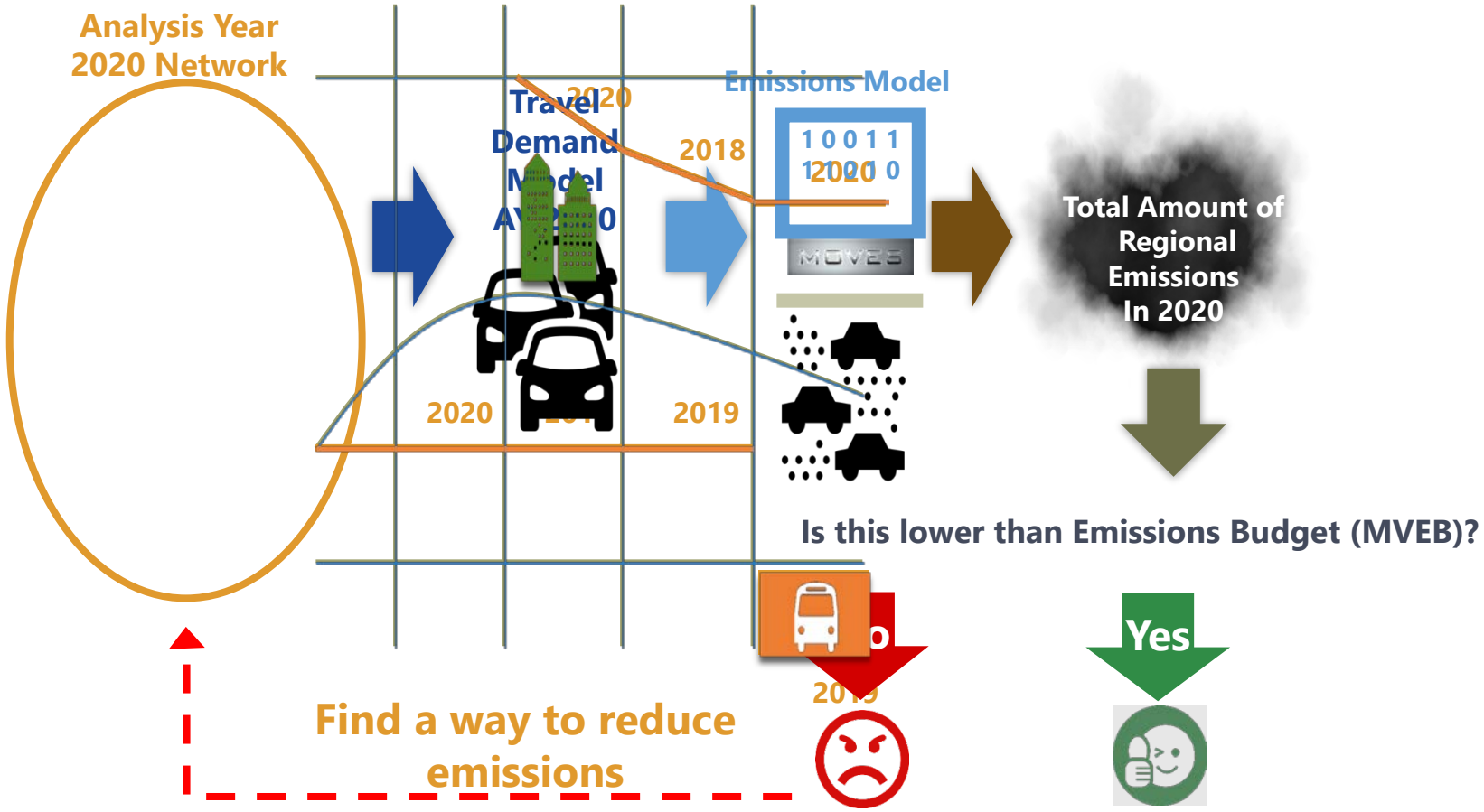
All federally funded transportation projects/plans must conform to the SIP, which is determined through the transportation conformity process

SIP sets the motor vehicle emissions budget (MVEB) for conformity purposes



Houston-Area NOx Emissions

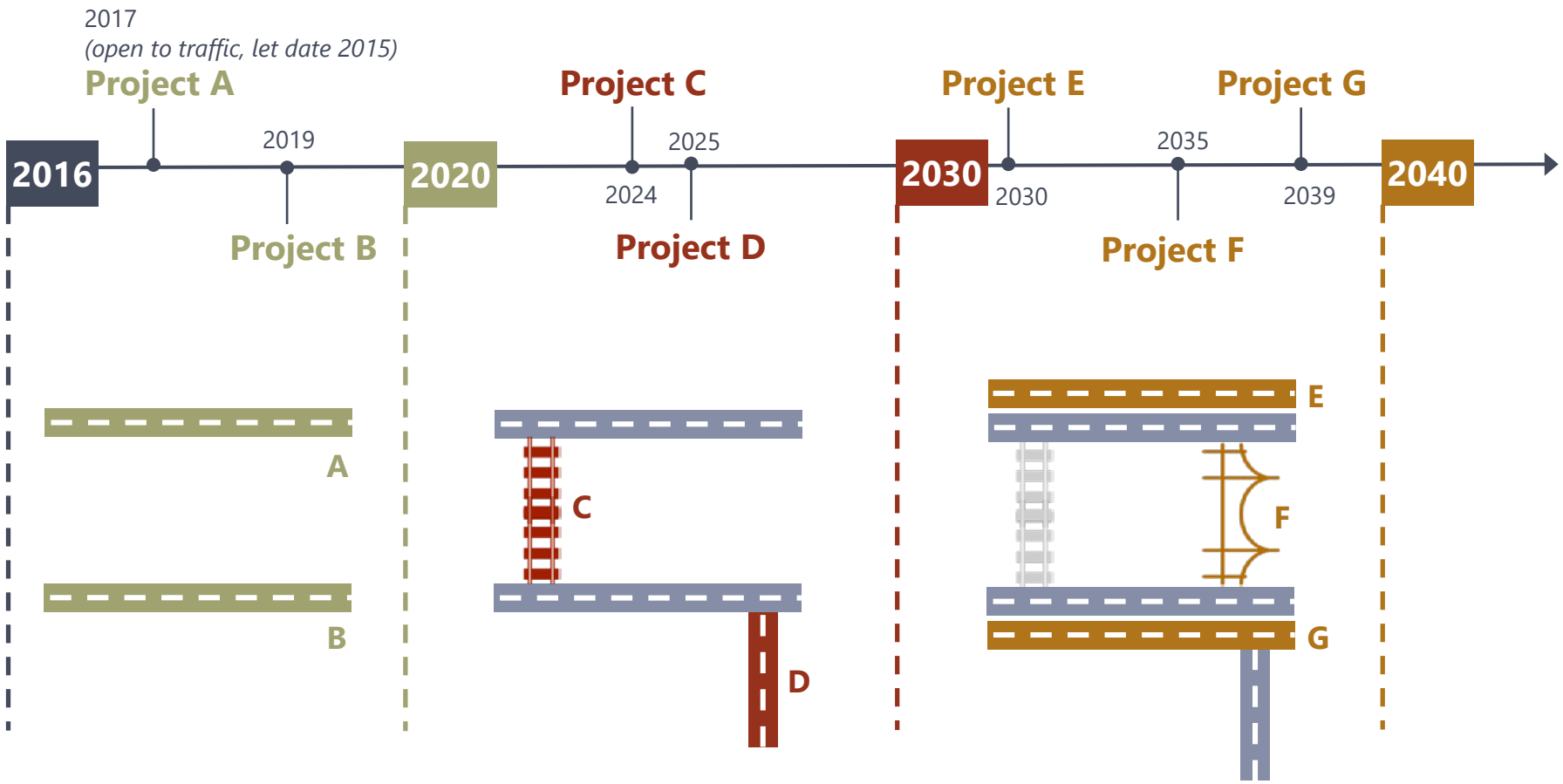



Analysis Year
2020 Network
Travel
Demand
Model
2020
2018
2020
2019
Emissions Model
MOVES
Total Amount of
Regional
Emissions
In 2020
Is this lower than Emissions Budget (MVEB)?
Yes
Find a way to reduce
emissions

Conformity Analysis Years

- Must include
  - The designated attainment year, if applicable
  - The last year of the transportation plan
  - Must be not more than 10 years apart

Know Your Conformity Analysis Years



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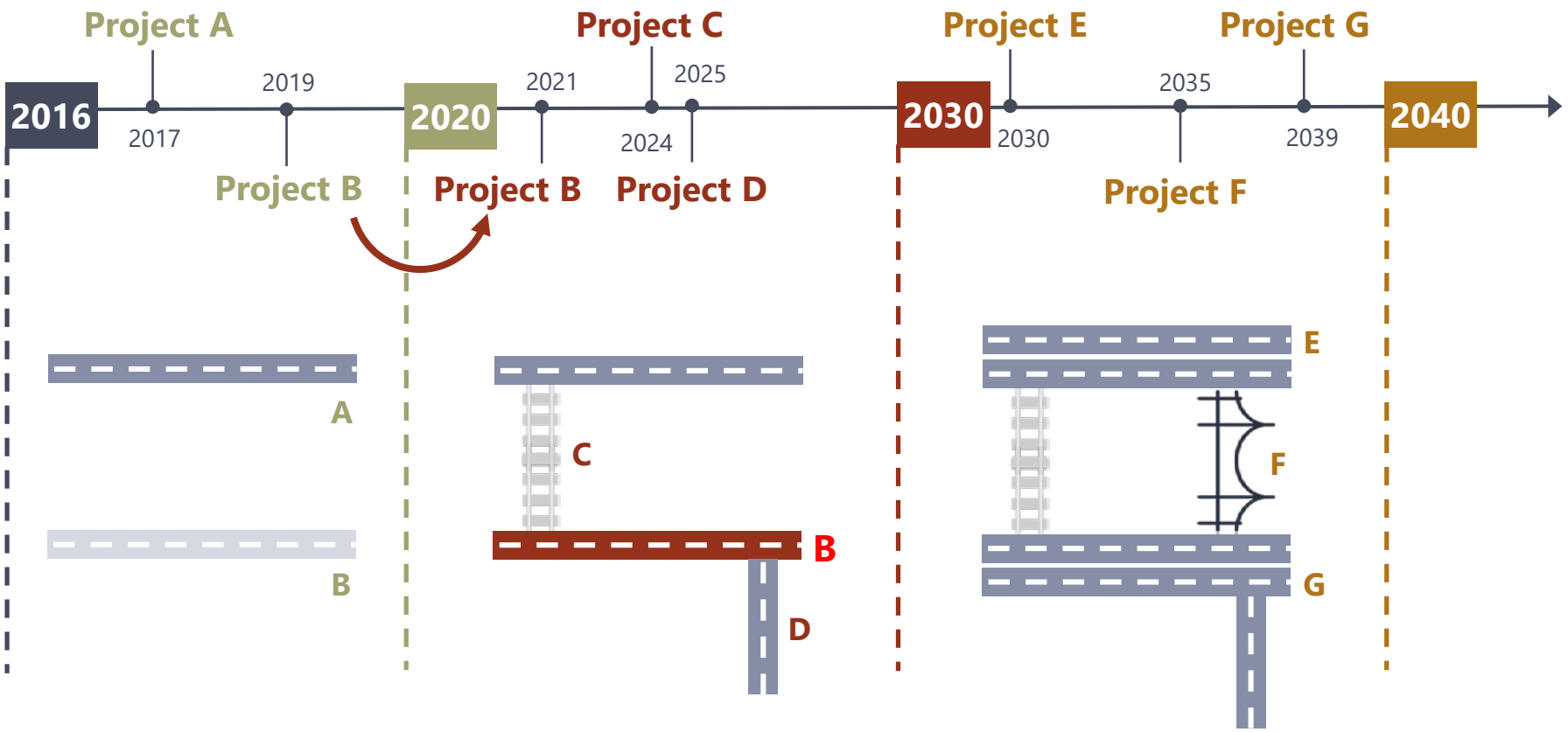

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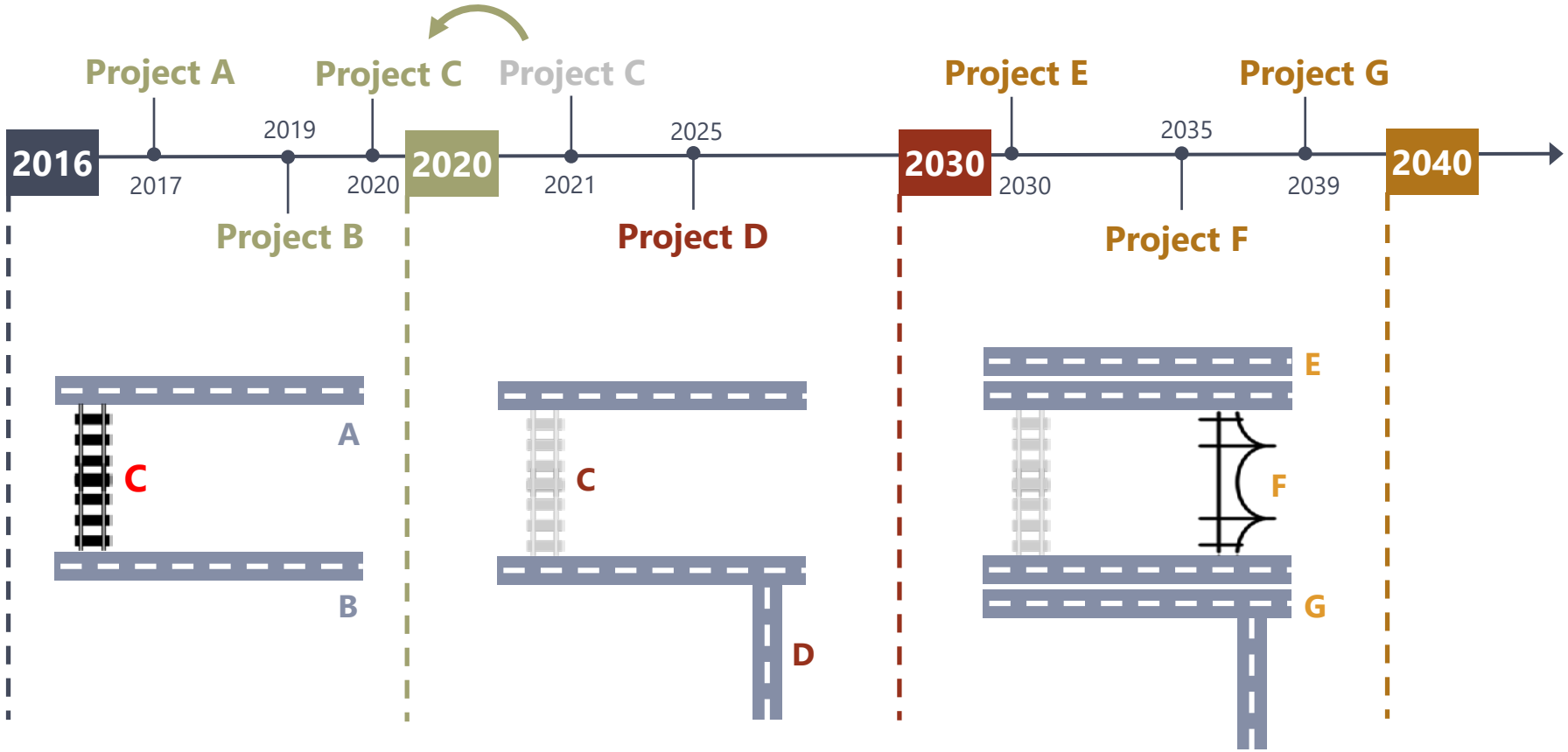
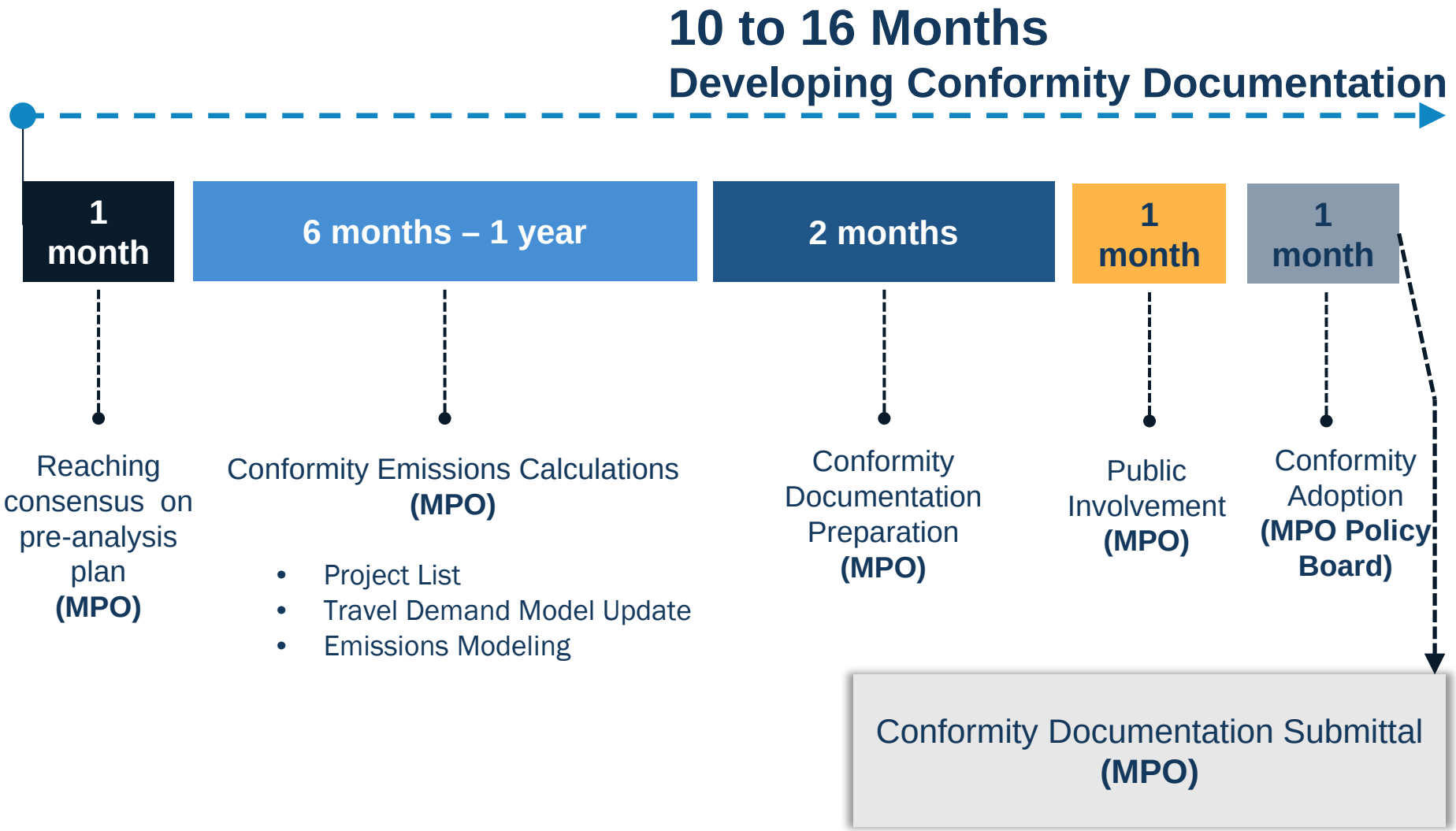
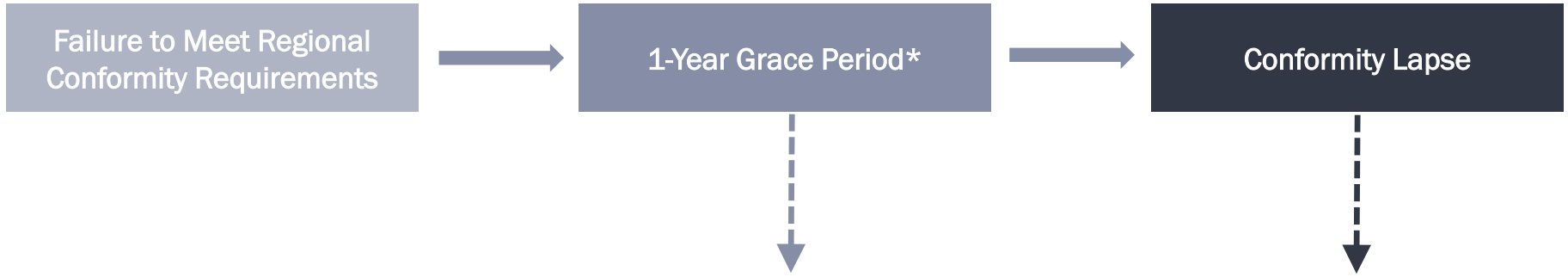


Texas Transportation Conformity Process



Failure of Conformity



During the Grace Period

- No changes made to TIP or STIP
- Can work only on projects approved in previously conforming STIP or TIP

During the Conformity Lapse, Only the Following Projects Can Proceed

- Exempt Projects
- TCMs in the Approved SIP
- Approved by FHWA/FTA (with a signed FPAA** before failure)

* Grace period doesn't apply to new designation
** FPAA: Federal Project Authorization Agreement

Partner Agencies (Consultative Partners)

- TxDOT (project sponsor)
- Local MPO
- FHWA/FTA
- EPA
- TCEQ
- Other agencies when necessary

Regional Emissions Analysis

Section 4

Emissions Estimation

Calculated as mass/time (lbs/day, kg/day, tons/year, etc.)

Where:

- Activity can be VMT, number of starts, idling hours, fuel consumed, etc.
- Emission rates can be function of fuel, speed, duration, etc.

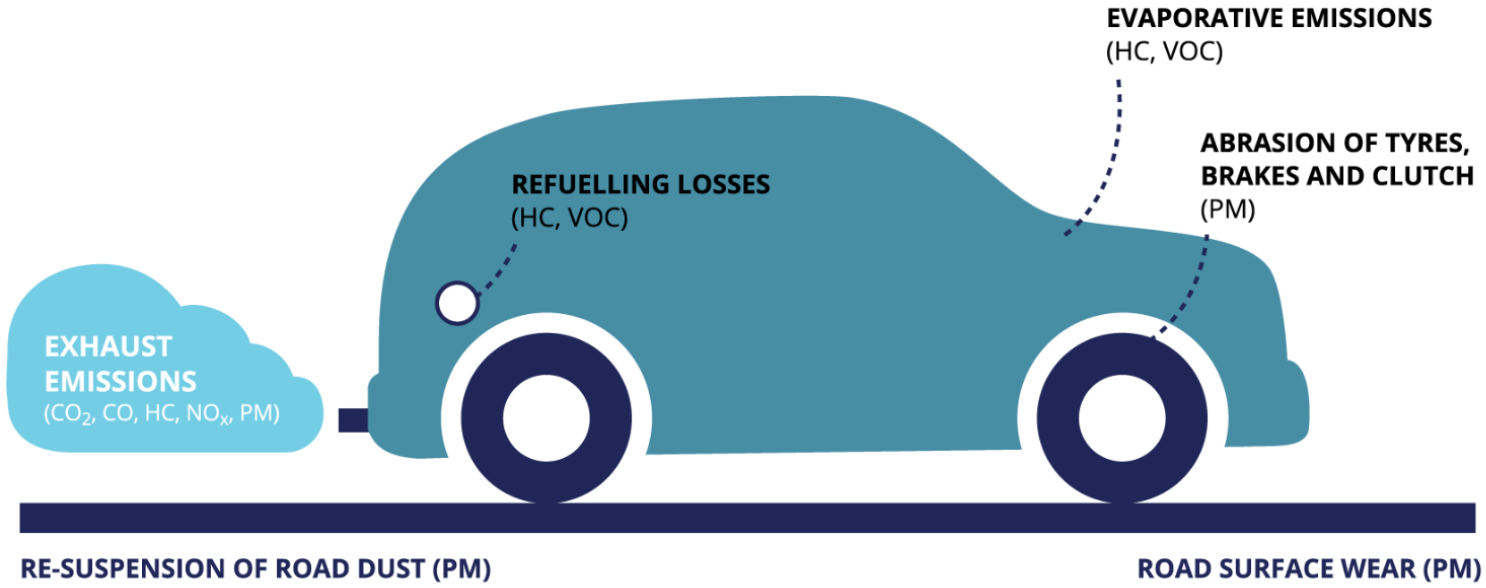
Vehicular Emissions Sources

Emissions occur when vehicle

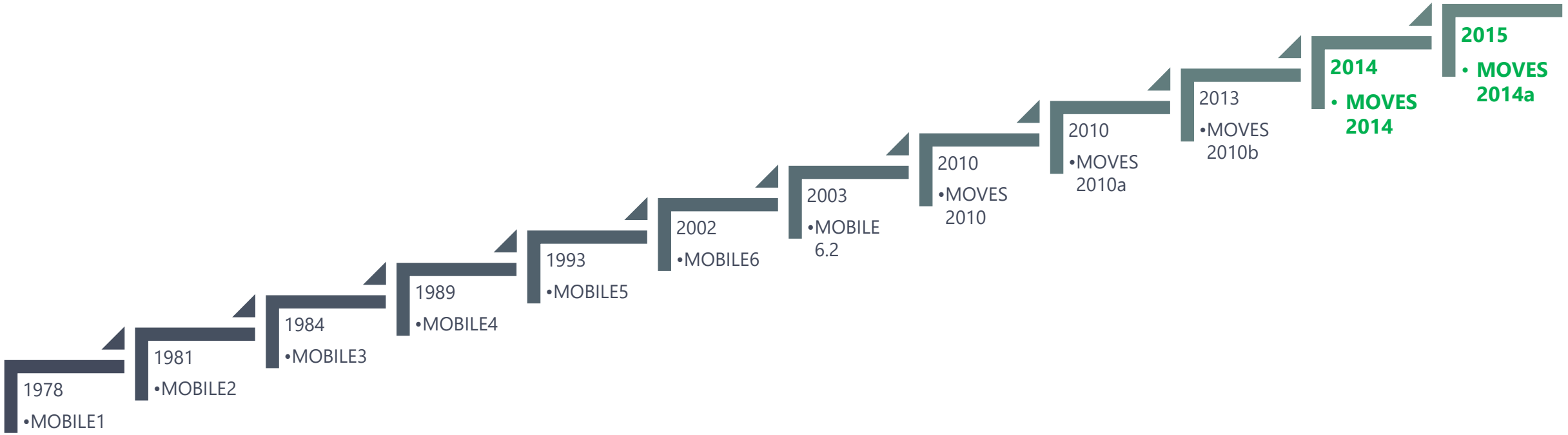
- Starts
- Idling
- Running
- Parked

Emissions vary

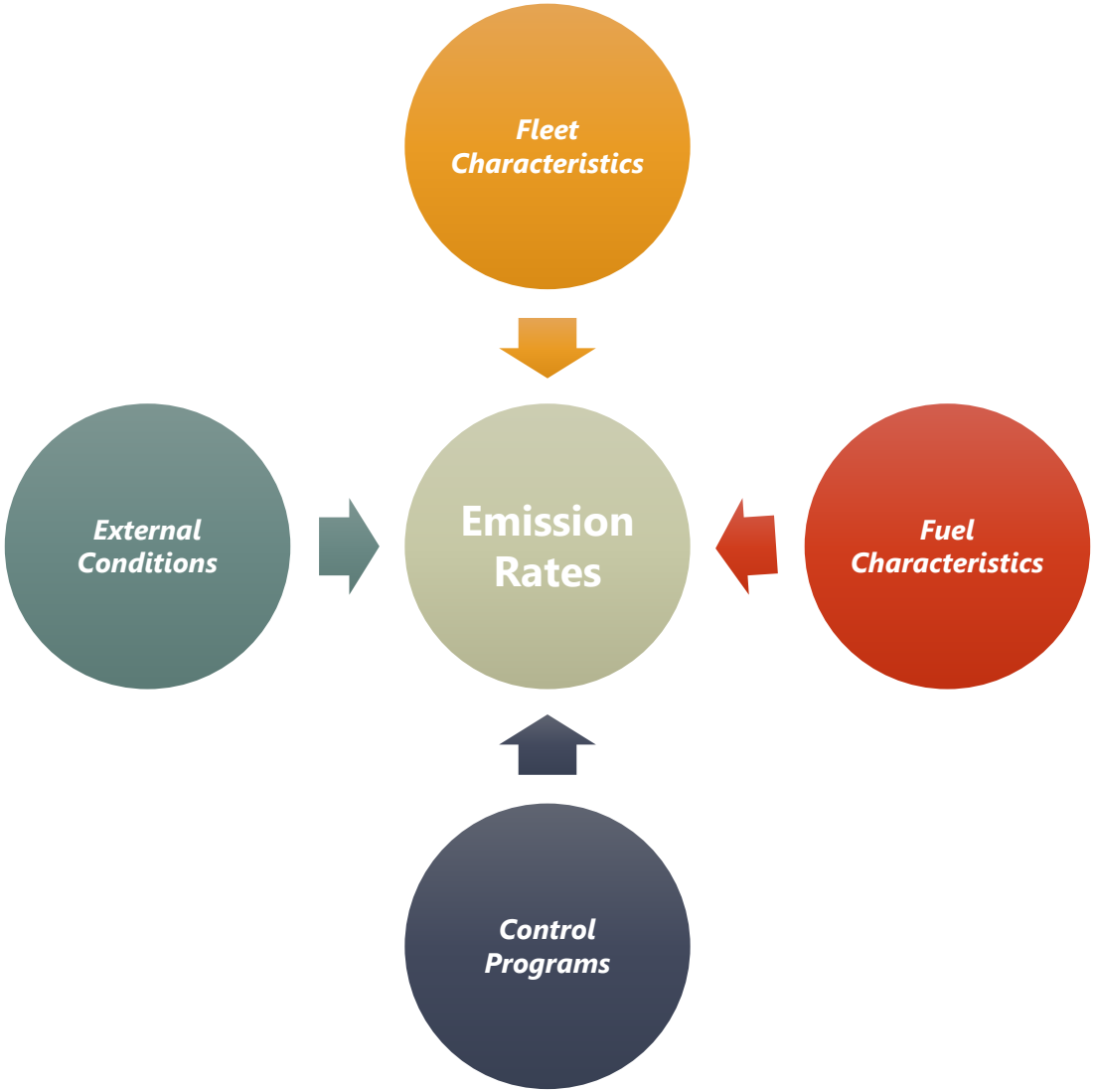
- Fuel
- Vehicle type & age
- Operating speed



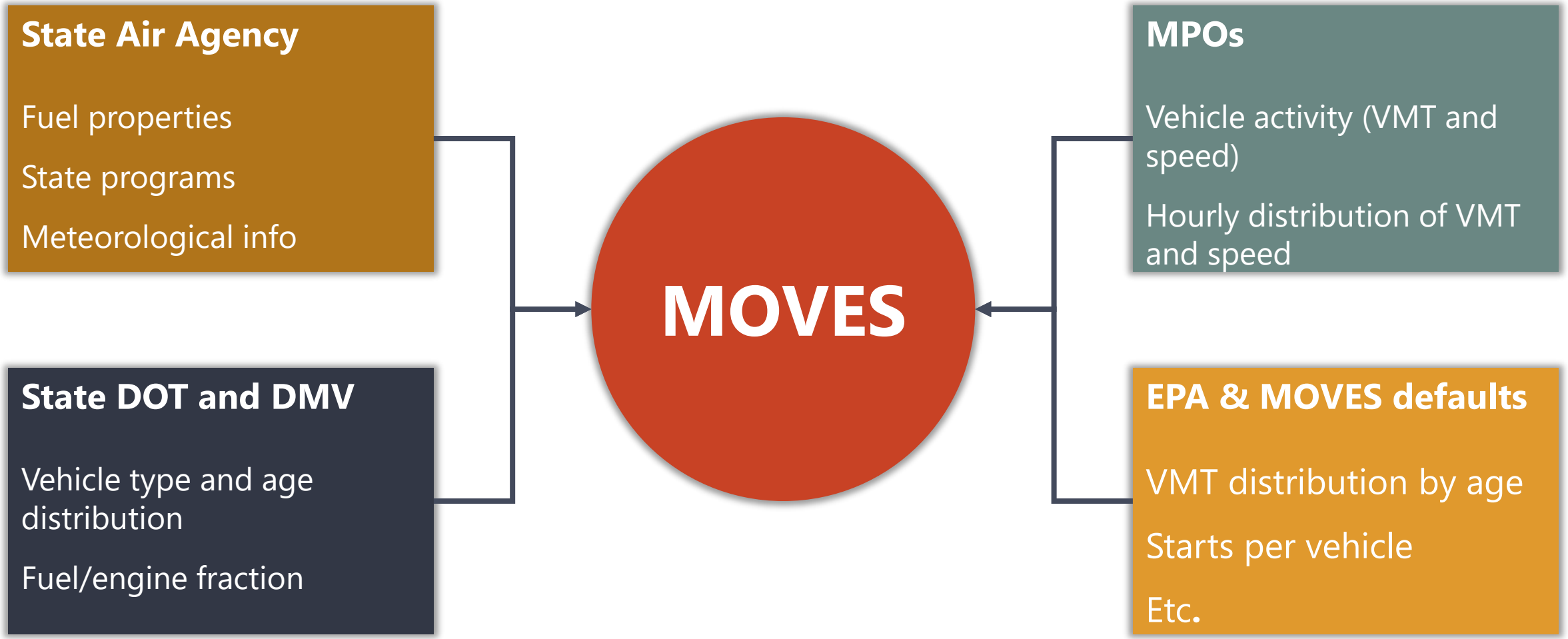
Emission Rates Estimation Models



Factors Affecting Emission Rates



Major Sources of Key Input Data



How Are Emission Rates Used?

Emission Outputs

Rates per Distance

- Running exhaust
- Evaporative permeation
- Evaporative fuel vapor venting
- Evaporative leaks
- Crankcase running

Rate per Activity

- Start Exhaust
- Evaporative permeation
- Evaporative fuel leaks
- Crankcase start
- Extended idle exhaust
- Evaporative fuel vapor venting

Activity Information

- Link-based speed and VMT
- Number of starts in each zone
- Number of ends in each zone
- Hours of trucks idling in each zone

Vehicle Activity

X

Emission Rates

Link, Zone, and Regional Emissions

MOVES Emission Process

Process ID	Emission Process	Rates/Distance	Rates/Vehicle	Rate/Profile
1	Running Exhaust	X		
2	Start Exhaust		X	
9	Brakewear	X		
10	Tirewear	X		
11	Evap Permeation	X	X	X
12	Evap Fuel Vapor Venting	X		X
13	Evap Fuel Leaks	X	X	X
15	Crankcase Running Exhaust	X		
16	Crankcase Start Exhaust		X	
17	Crankcase Extended Idle Exhaust		X	
18	Refueling Displacement Vapor Loss	X	X	
19	Refueling Spillage Loss	X	X	
90	Extended Idle Exhaust		X	
91	Auxiliary Power Unit		X	

MOVES Roadway Type

Rural & Urban Restricted Access

- Freeways/interstate highways
- Toll-ways
- Managed/HOV lanes

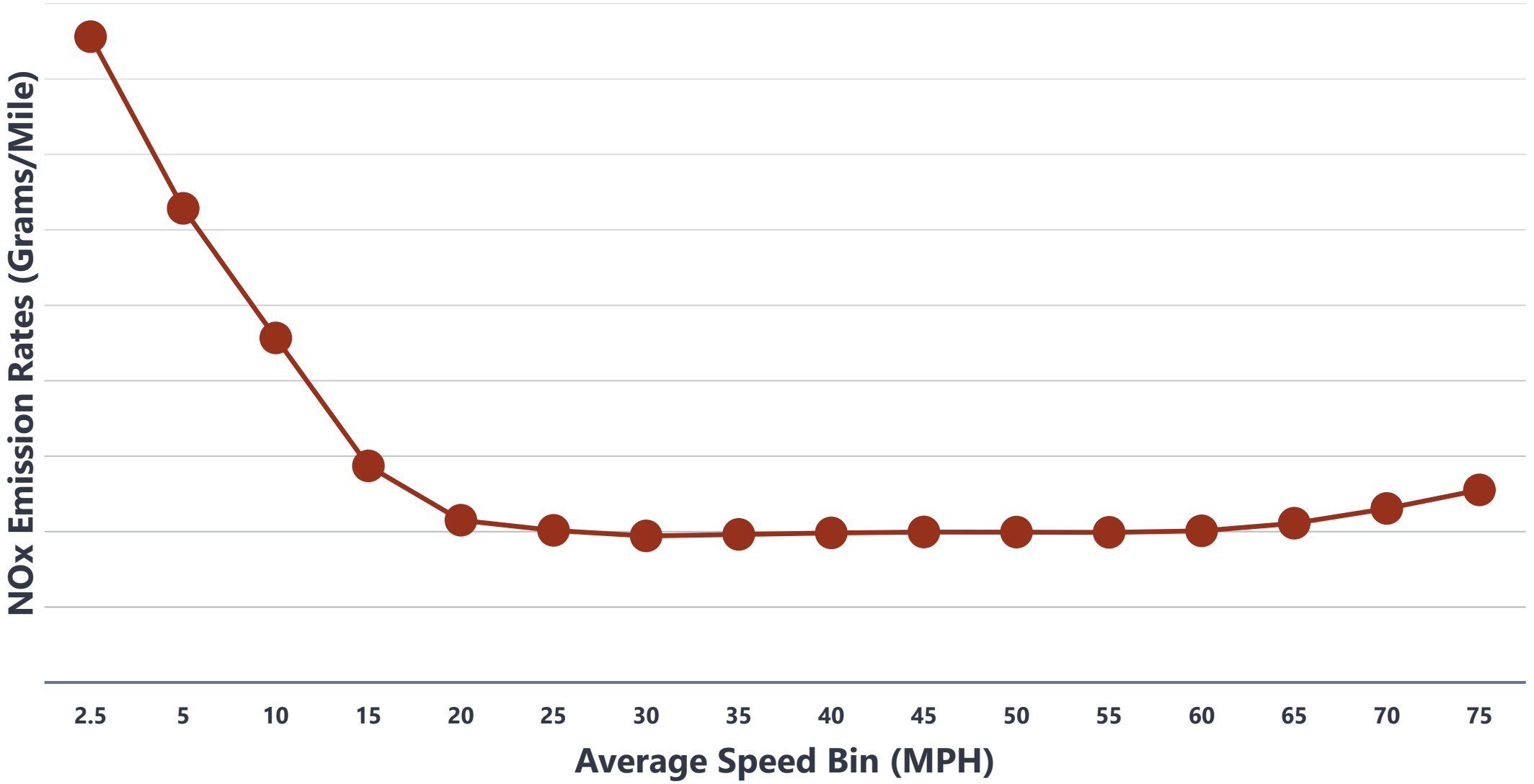
Rural & Urban Unrestricted Access

- Arterials
- Collectors
- Locals
- Ramps

MOVES Vehicle Types

Vehicle Class	Source Type ID	Description
Light Duty	11	MotorCycle
	21	Passenger Car
	31	Passenger Truck: SUV, Pickup Truck, Minivans - Two-Axle/Four-Tire Single Unit
	32	Light Commercial Trucks - Two-Axle/Four-Tire Single Unit
Buses & Medium-Duty	41	Intercity Buses
	42	Transit Buses
	43	School Buses
	52	Single-Unit Short-Haul Trucks
	53	Single-Unit Long-Haul Trucks
	54	Single- Unit Motor Homes
Heavy Duty	51	Refuse Trucks
	61	Combination Short-Haul Trucks
	62	Combination Long-Haul Trucks

Emission Rates by Speed (Light Duty Gasoline)



Additional Notes for Emission Rates

Emission models - time consuming & data intensive

Not necessary to run models to calculate emissions for all strategies

Preference for local data where available

Emission rates requires post processing depending on the strategy

You can get emission rates from

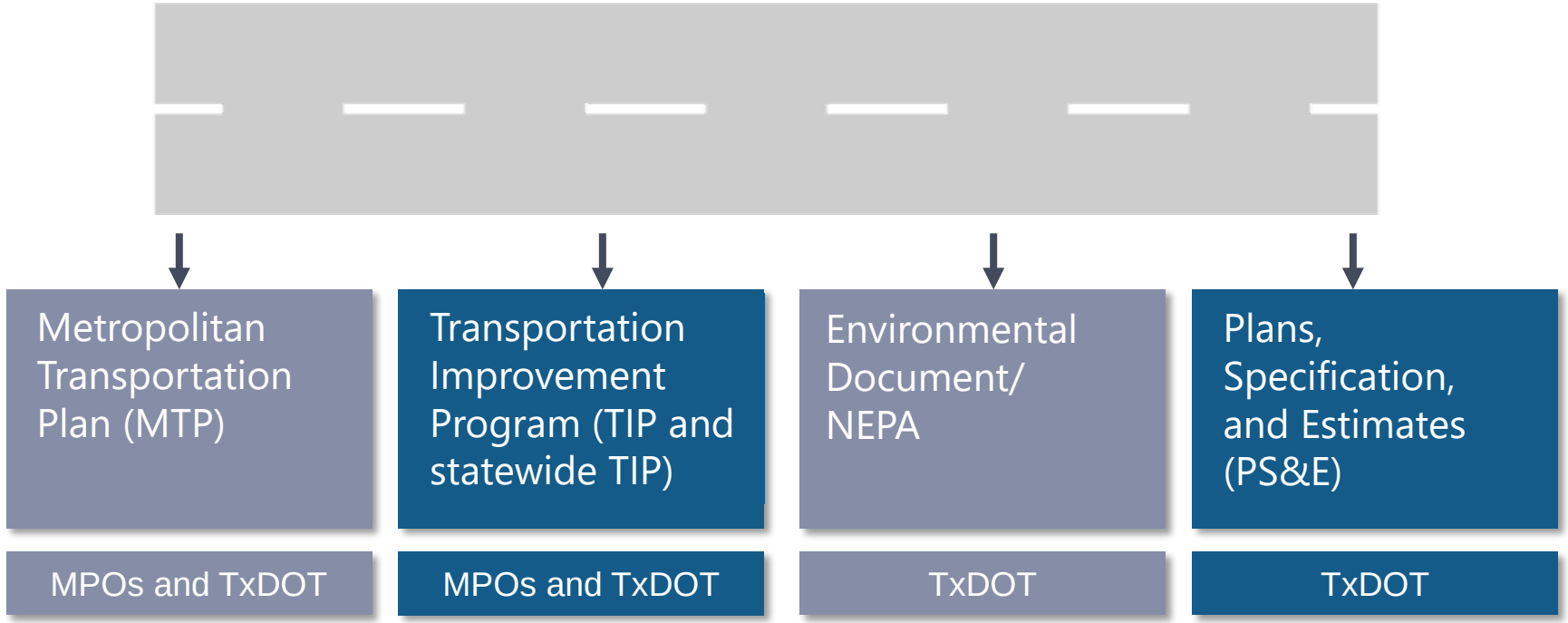
- MPOs
- TCEQ
- TxDOT/TTI

Project Consistency

Section 5

What Is Project Consistency?

Consistent description across planning and project documents



What Needs to Be Consistent?

Design Concept

- Project Limits
- Location
- Type of Facility
- Group Eligibility
- Scheduled Let Date

Design Scope

- Number of Lanes
- Length
- Signalization
- Other Specific Information

Cost/Funding

- Funding amount
- Funding source

Must be consistent
in All Planning, Design, and Environmental Documents

What Projects Are Subject to Federal Consistency Requirements?

All transportation projects in a STIP **if:**

- Federal funding is provided, or
- Needs FHWA/FTA action or decision, or
- Meets definition of regional significance

Challenges to Project Consistency

Projects Evolve

Communication Issues

Changes in Funding Scenarios

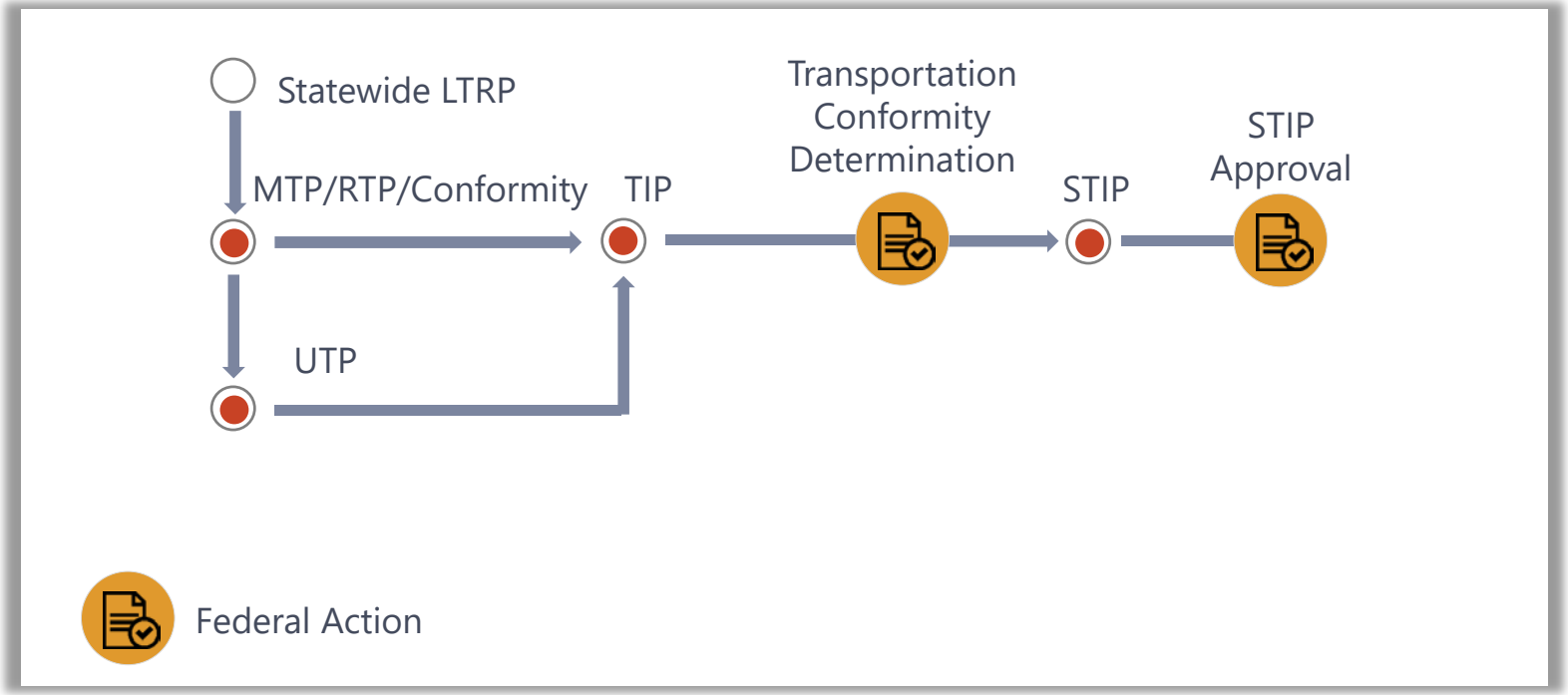
Maintaining Project Consistency

- Project consistency
  - Ongoing process
  - Covers all phases of a project
  - Critical during the last 4 years before letting
  - Critical for Nonattainment and Maintenance areas
  - Early and on-going coordination is key

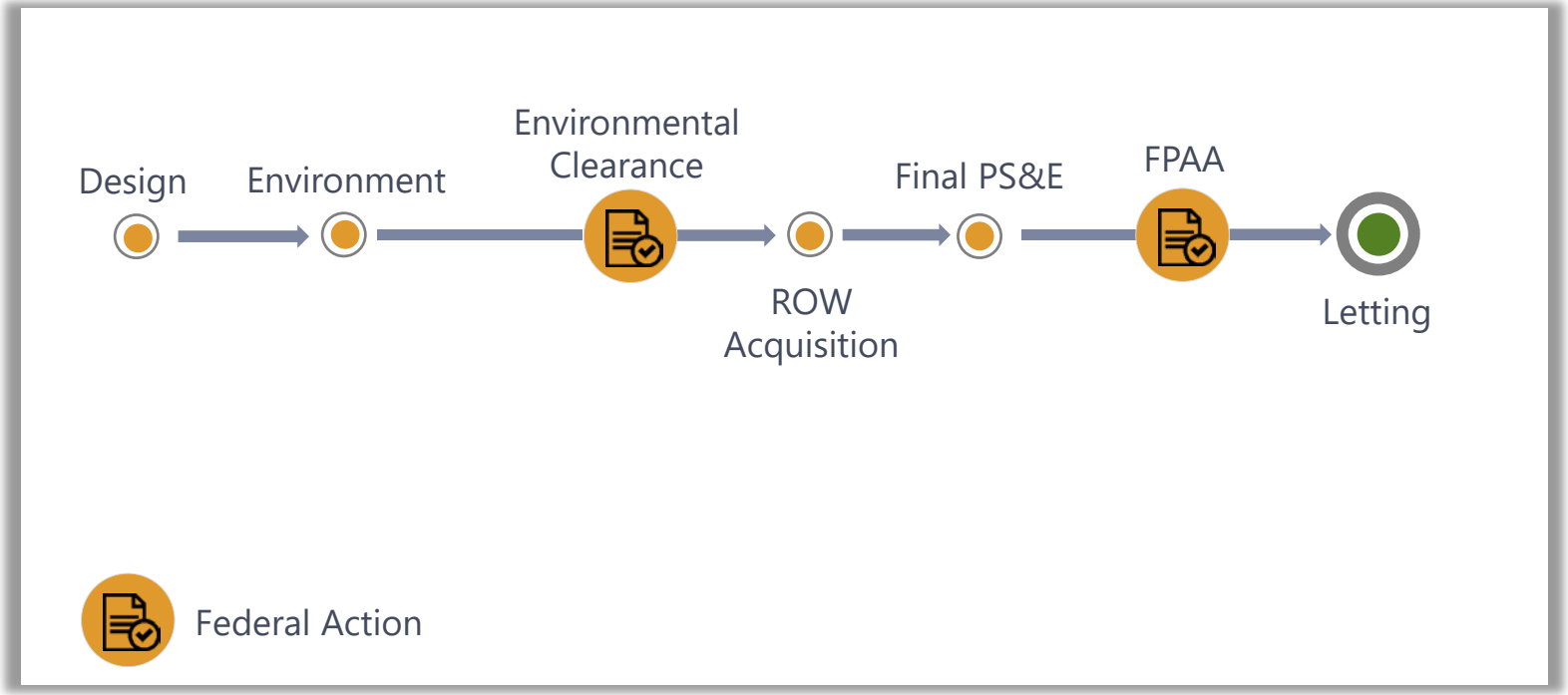
Maintaining Project Consistency

- Consistency is key for receiving federal action and funding for federal actions

Planning and Programming Documents



Project Development Steps



Project Consistency Responsibility

Primary

TxDOT Districts:

- Director of Transportation Planning and Development (TP&D)
- Project Managers
- Environmental Coordinator
- Planners

MPOs

Project Sponsor

Secondary

TxDOT Divisions:

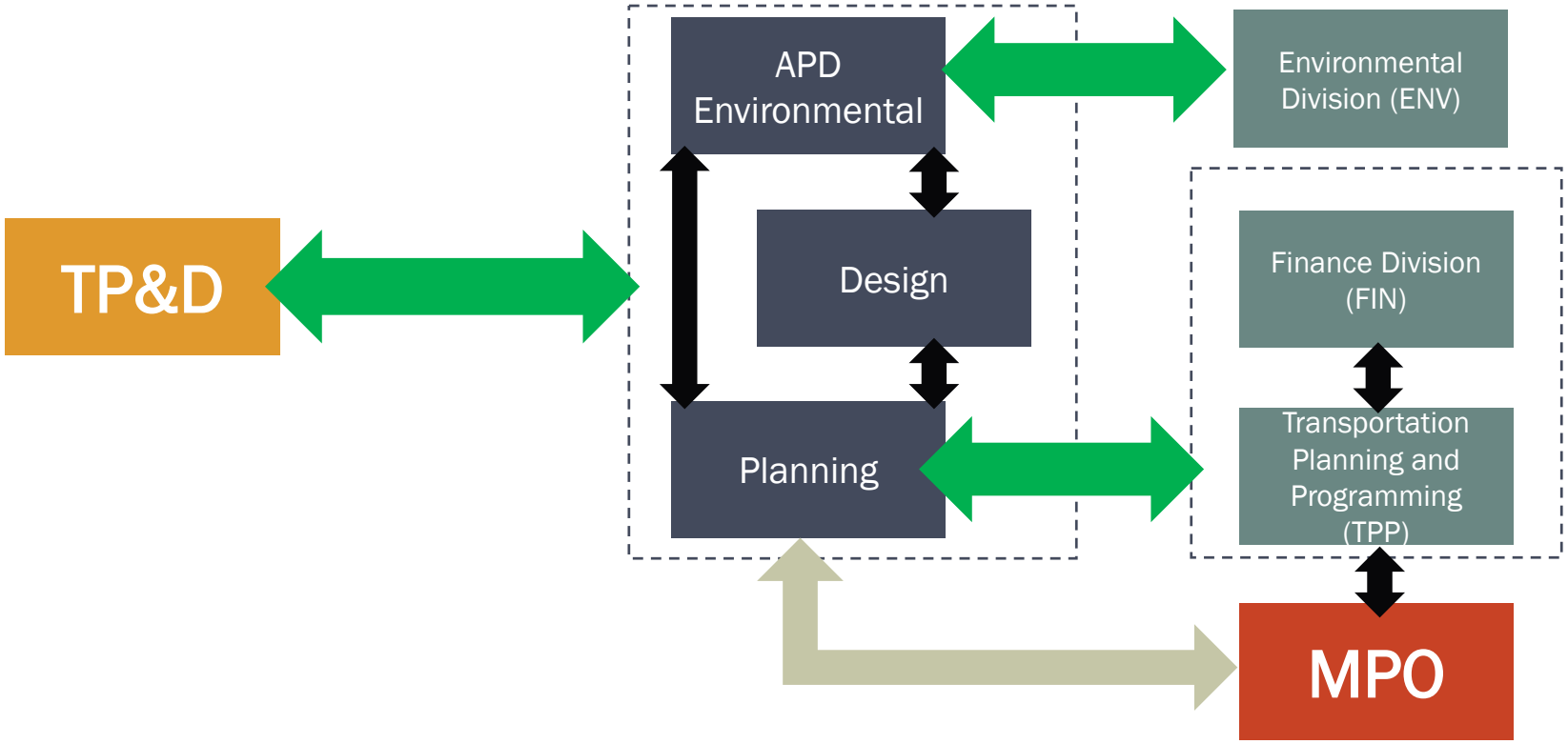
- Transportation Planning and Programming (TPP)
- Finance (FIN)
- Environmental Affairs (ENV)

TxDOT District Consistency-Related Roles

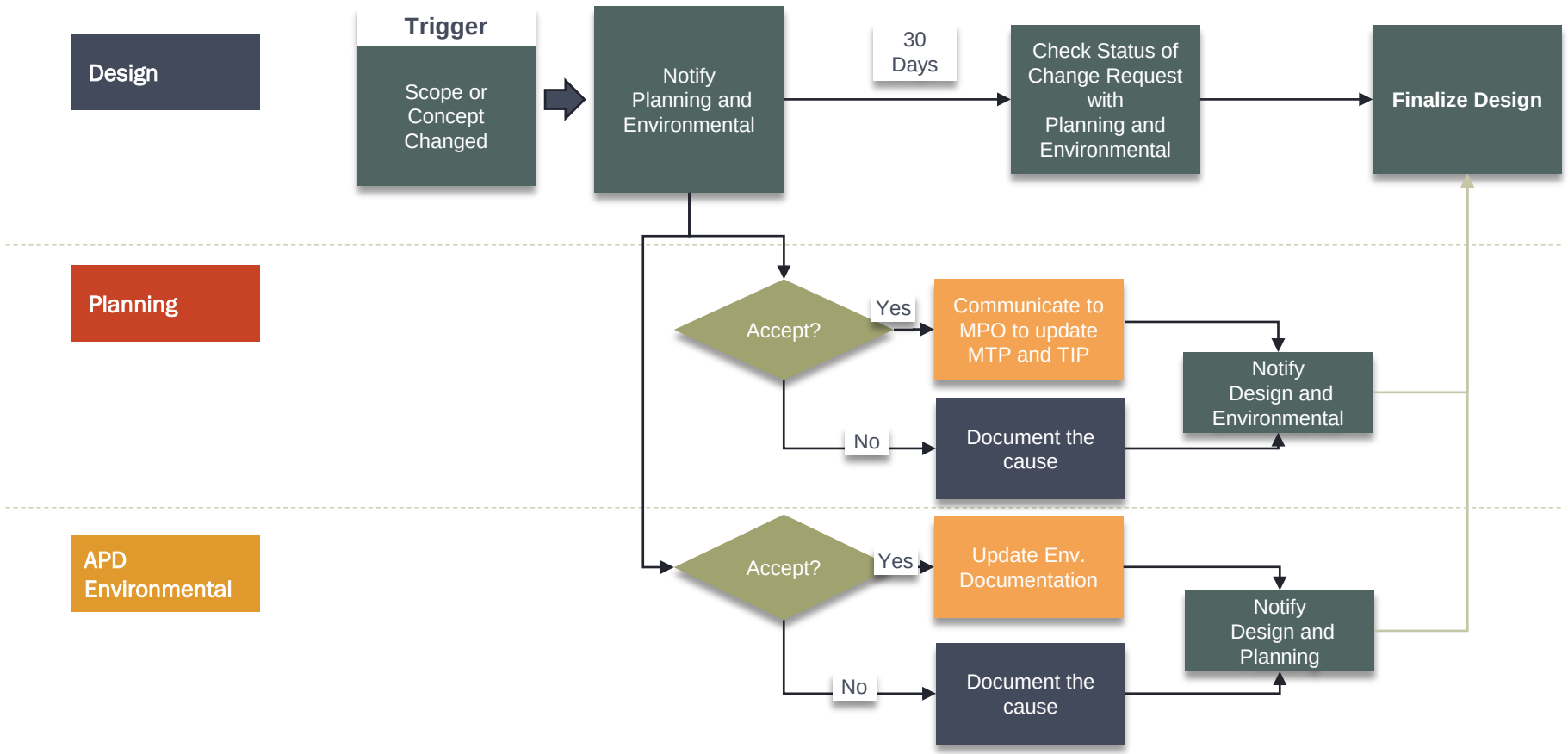
Transportation Planning and Development (TP&D)

Planning	Advanced Project Development (APD)	Design
• MTP • TIP • STIP • Conformity	• Schematics/Preliminary Design • Environmental	• Consultant Contracts • Central Design A-F • PS&E

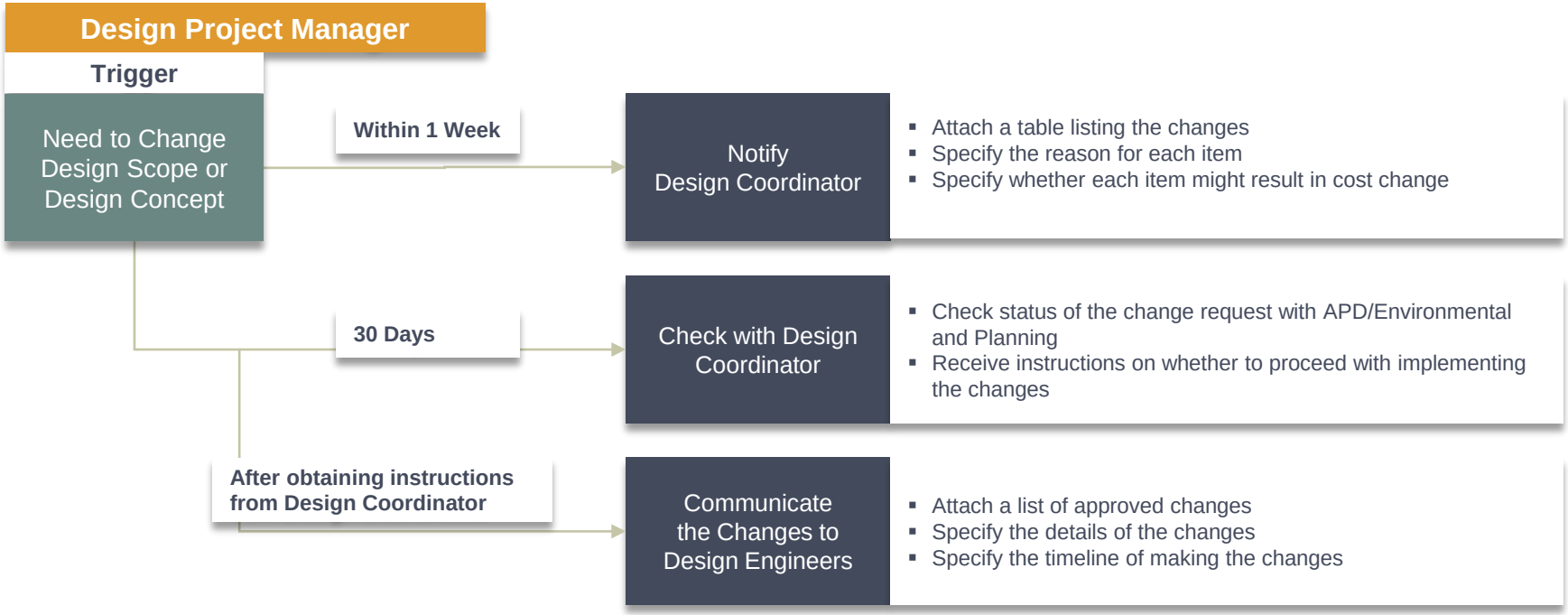
TxDOT District Consistency Related Roles



Example Communication Flow – Change During Design Stage



Example Communication Plan



Consistency Enforcement

No federal action without project consistency

No Release of Funding

Project Delays

Transportation Conformity Failure

Questions and Comments

Contact Information

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