

Pueblo Area Council of Governments Metropolitan Planning Organization

June 5, 2014



**Phase 1 Milestones:  
PACOG Travel Demand Model Evaluation, Update and 2040 RTP Support**

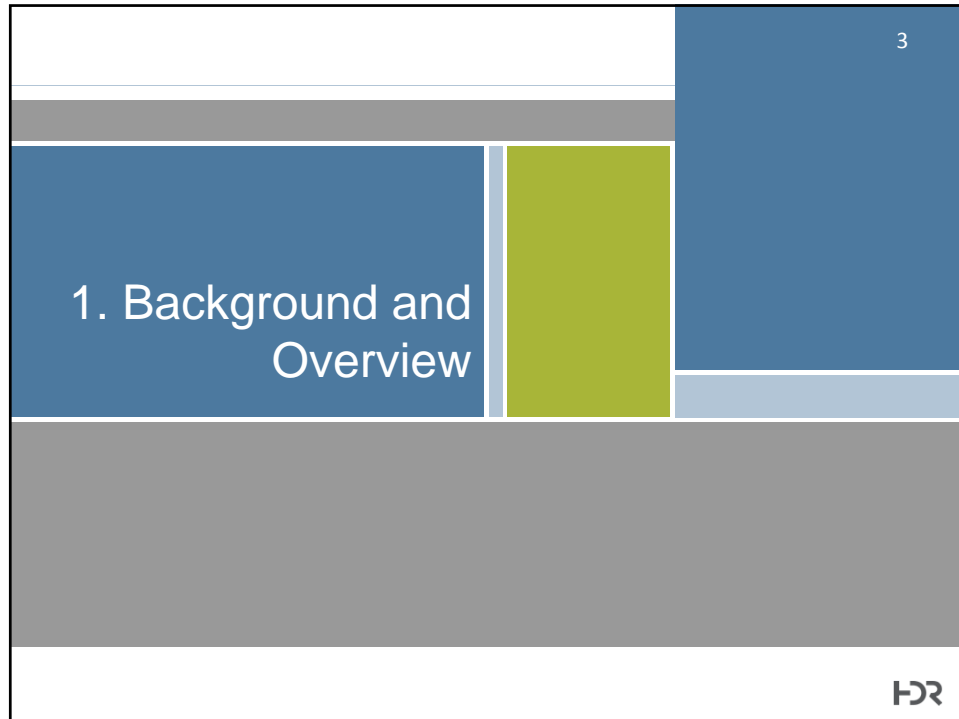
Project No. 14-009



Presentation Overview

1. Background and Overview
2. Blended Team Approach
3. Data Collection Status
4. Model Evaluation Status
5. Critical Path Activities
6. Next Steps
7. Combined Project Schedule





## Purpose and Need

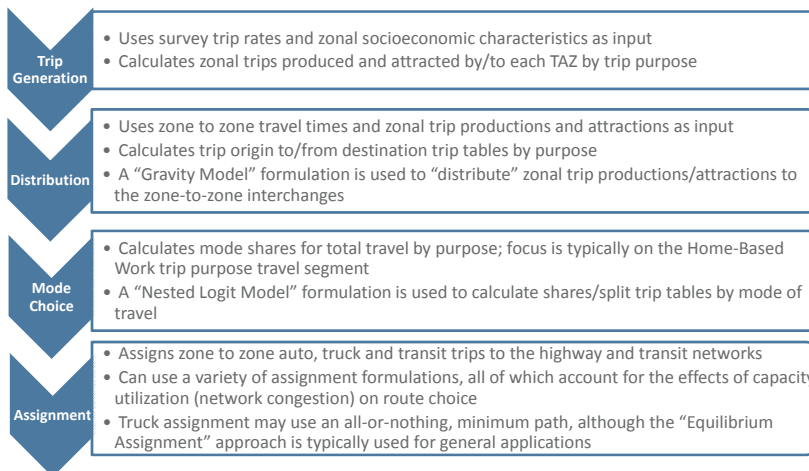
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- Moving Ahead for Progress in the 21<sup>st</sup> Century (MAP-21) and National Environmental Policy Act (NEPA) legislation require transportation planning processes to use the most current available data
- An update to PACOG's Travel Demand Model (TDM) is needed to support development of the 2040 Regional Transportation Plan
  - The TDM update will incorporate Front Range Travel Survey (2010) travel data
  - The TDM update will use the current traffic analysis zone (TAZ) structure that was required for the 2010 Census

PACOG's Travel Demand Model is a tool to support investment decision-making HR

## 4-Step Travel Demand Model (TDM) Structure and Operation

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Four simulation steps comprise traditional 4-step travel demand models



## TDM Building Blocks – Network Data

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Count	12312	No	FromNodeNo	ToNodeNo	TypeNo	TypeDesc	Length	NumLanes	CapPct	VPPT	VofWspP1(AH)	VofWspP1(AP)
1	3	1001	1002	56	ab,h,kx	0.151mi	1	600	25mph	16342	45	
2	3	1002	1001	56	ab,h,kx	0.151mi	1	600	25mph	8986	25	
3	4	1001	1006	56	ab,h,kx	0.153mi	1	600	25mph	8986	25	
4	4	1006	1001	56	ab,h,kx	0.153mi	1	600	25mph	16342	45	
5	5	1002	1003	56	ab,h,kx	0.166mi	1	600	25mph	30002	101	
6	5	1003	1002	56	ab,h,kx	0.166mi	1	600	25mph	49007	134	
7	7	1003	1014	44	ab,h,kx	0.214mi	2	1000	30mph	23456	916	
8	6	1014	1003	44	ab,h,kx	0.214mi	1	700	30mph	27662	758	

Count	250	Index	LineName	LineRouteName	DirectionCode	NodeNo	StepPointNo	PostLength	AccountLength
1	05	Boulder - Clatsop	Inbound	<	5144	5144	0.130mi	0.000mi	
2	05	Boulder - Clatsop	Inbound	<	2034		0.000mi	0.000mi	
3	05	Boulder - Clatsop	Inbound	<	2033	2033	0.350mi	0.135mi	
4	05	Boulder - Clatsop	Inbound	<	2031	2031	0.000mi	0.150mi	
5	05	Boulder - Clatsop	Inbound	<	4203	4203	0.215mi	0.517mi	
6	05	Boulder - Clatsop	Inbound	<	2265	2265	0.177mi	0.733mi	

Highway, transit and connector network data feeds the TDM



## TDM Building Blocks – Zonal Data

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The image displays three screenshots from a software application used for transportation modeling. The first screenshot, titled 'Congested Travel Time Matrix', shows a table of travel times between various zones. The second screenshot, titled 'TAZ Socioeconomic Data', shows a table with columns for population, employment, and other socioeconomic indicators for each zone. The third screenshot, titled 'AM Peak Hour Non-Home-Based Origin-Destination Trip Table (matrix)', shows a matrix of trip counts between zones during the AM peak hour.

Zonal data (travel times, socioeconomic data, and trip matrices) are also needed

## TELUM Basics

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- PACOG uses TELUM to make long term forecasts of the MPO region's spatial patterns.
- TELUM uses current and prior residential, employment data to forecast future locations of each by employment sector (TELUM-EMP), household income group (TELUM-RES).
- TELUM uses a *gravity model formulation* for spatial allocation.

**Simple Formulation**

$$T_{ij} = k \frac{P_i^\alpha \cdot P_j^\beta}{D_{ij}^\gamma}$$

	W	X	Y	Z	T <sub>i</sub>
W					71,378
X	6,069		2,203	36	8,298
Y		19,420			19,420
Z			153,893		153,893
T <sub>j</sub>	6,069	244,892	2,203	36	252,990

The diagram shows four zones: X (2,000,000 people), Y (2,000,000 people), Z (1,000,000 people), and W (2,000,000 people). Distances between zones are: X-Y (800 km), X-Z (800 km), X-W (400 km), and Y-Z (800 km). Interaction parameters are: X-Y (λ = 0.95, α = 1.05), X-Z (λ = 1.03, α = 0.96), X-W (λ = 1.03, α = 0.96), and Y-Z (λ = 1.00, α = 0.90). A legend defines the variables: Centroid (i), Distance (D), Interaction (T), Weight (P), Constant (k), and Exponent (α).

**Gravity Model Formulation**

PACOG uses TELUM software to forecast TAZ socioeconomic data inputs

## TELUM Basics 9

- Required TELUM-EMP input data for each time (t):
  - Employment of type (k) in all TAZ's
  - Population of all types in all TAZ's
  - Total area per zone for all zones
  - TAZ to TAZ travel cost (time) between TAZ (j) and all other TAZ's for all TAZ's
- Required TELUM-RES input data for each time (t):
  - Residents of all h types in TAZ (i) at previous time (t-1)
  - Land used for residential use in TAZ i at time (t)
  - Vacant developable land in TAZ (i) at time (t)
  - TAZ to TAZ travel cost (time) between TAZ (j) and all other TAZ's for all TAZ's at time (t+1)
  - Employment of all (k) in all TAZ's at time (t+1)

```

graph TD
  IDEU[IDEU  
Initial Data Entry Unit] --> DOPU[DOPU  
Data Organization and  
Preparation Unit]
  DOPU --> TIPU[TIPU  
Travel Impedance  
Processing Unit]
  TIPU --> MCPU[MCPU  
Model Calibration Processing  
Unit]
  MCPU --> MFCU[MFCU  
Model Forecast Calculation  
Unit]
  
```

TELUM Flow Diagram


PACOG uses TELUM software to forecast TAZ socioeconomic data inputs

## Scope of Work Overview 10

- Phase 1:
  - Work Plan and Team Identification ✓
  - Data Collection ✓
  - Legacy Travel Demand Model Evaluation ✓
- Phases 2A and 2B:
  - Allocate 2010 Socioeconomic Data to TAZ's
  - Develop/Validate 2010 Base Year Model
  - Prepare 2040 Socioeconomic Forecasts
  - Model Alternatives for Regional Transportation Plan (RTP) 2040 Update
  - Develop Model Upgrade Goals and Objectives
  - Develop TDM Applications/Procedures
  - Prepare Documentation/Provide User Training

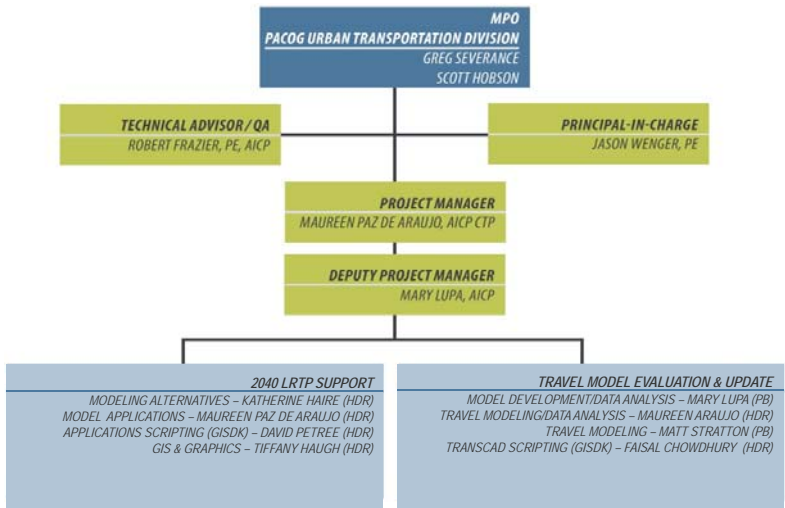
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## 2. Blended Team Team Approach




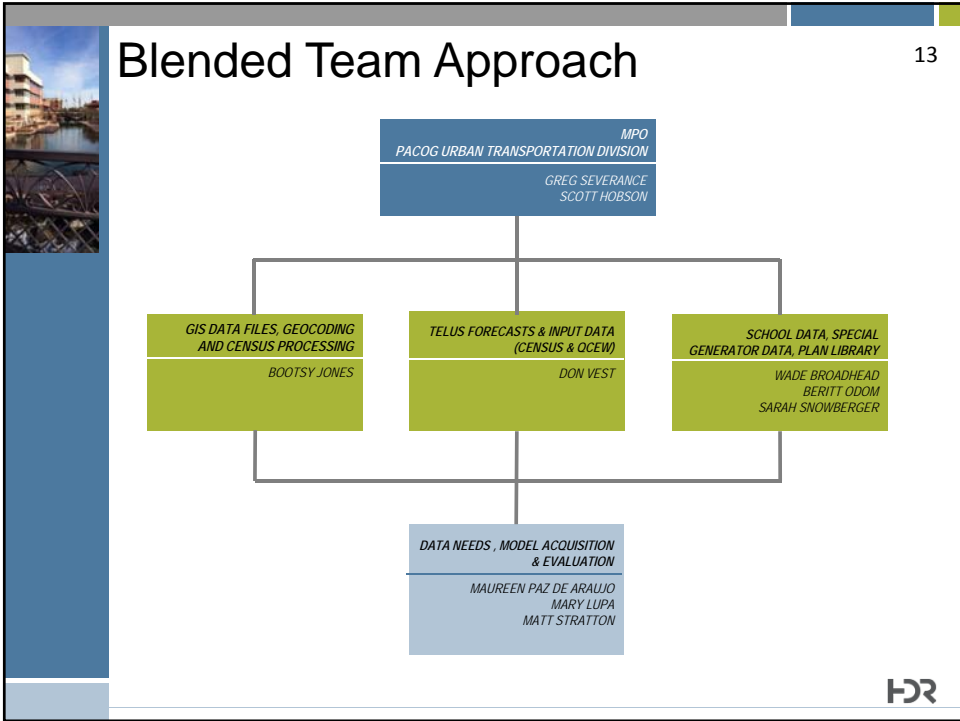
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## Consultant Team



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TRAVEL MODELING - MATT STRATTON (PB)  
TRANSCAD SCRIPTING (GISDK) - FAISAL CHOWDHURY (HDR)"];
```





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## 3. Data Collection Status

## Phase 1 Data Collection Approach

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- Assemble complete inventory of PACOG archived travel model files
- Complete an inventory of PACOG's project-oriented travel model versions
- Engage PACOG staff collaboration as a key resource for data collection
- Utilize a "Quick-Start" approach to advance data collection and processing to support advancing Phase 2 travel demand modeling!



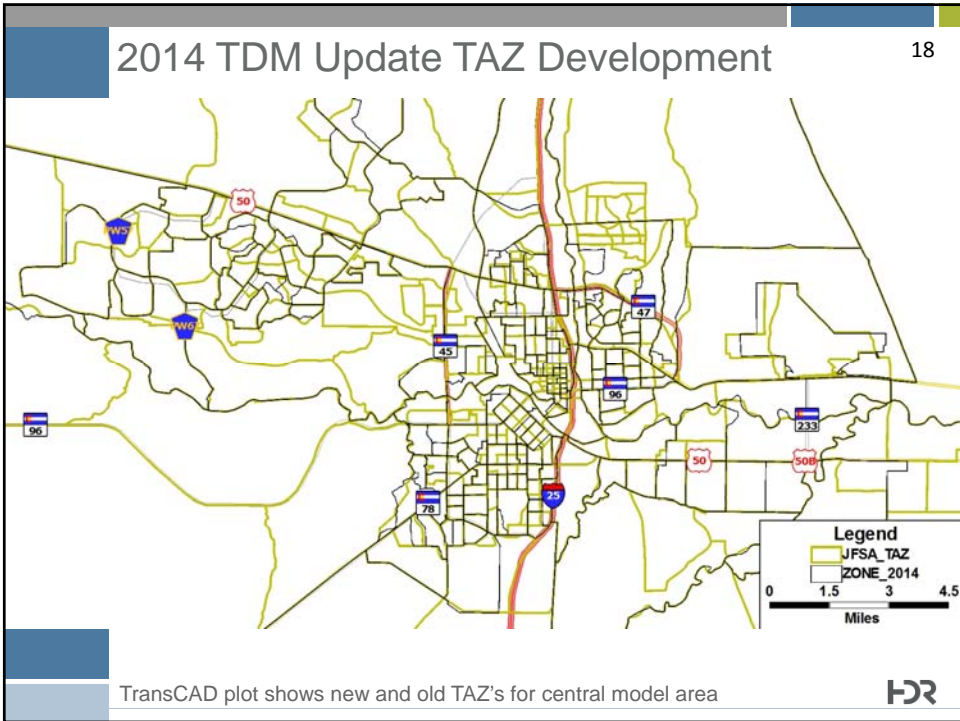
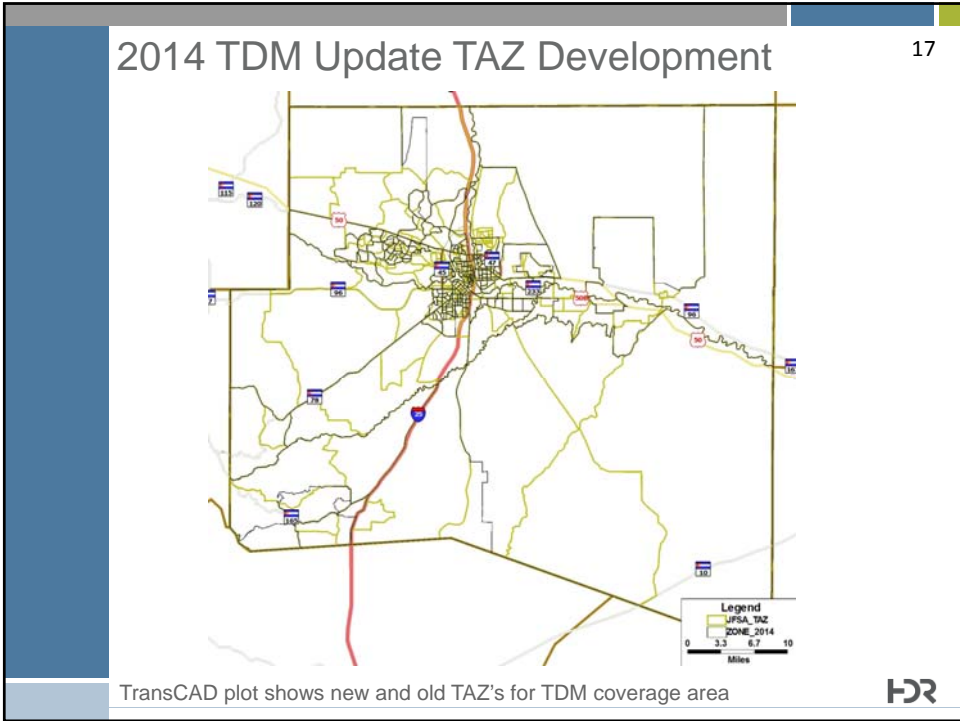
## Data Initially Provided by PACOG

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- Available economic and socioeconomic reports
- Available planning and land use reports
- Available travel demand model documentation
- GIS shape files and data (Census 2000, 2010)
- Official PACOG TAZ layer
  - To be named "ZONE2014"
  - Includes 206 internal zones
  - Identical to PACOG-specified 2010 Census TAZ
- Available TransCAD model files for three travel model application "versions"









## Phase 1 Data Collection Status 19

- Obtain employment data ✓
- Obtain household (Census) data ✓
- Collect special generator data ✓
- Collect school data ✓
- Obtain Department of Local Affairs (DLA) data and forecasts ✓
- Obtain “current” travel model computer code and documentation ✓
- Assemble available planning, land use, economic and socioeconomic data ✓
- **This work is complete!**




## Special Generator Data Collection 20

- Provides important detail to the travel model not captured by household trip generation
- Includes data and handling for:
  - 20 Largest Employers
  - Major Tourist Destinations
  - Colleges/Universities
  - Hospitals
  - Large Government Employers
  - Motels/Hotels
- **This work is complete!**




## School Enrollment and Employment Data Collection 21

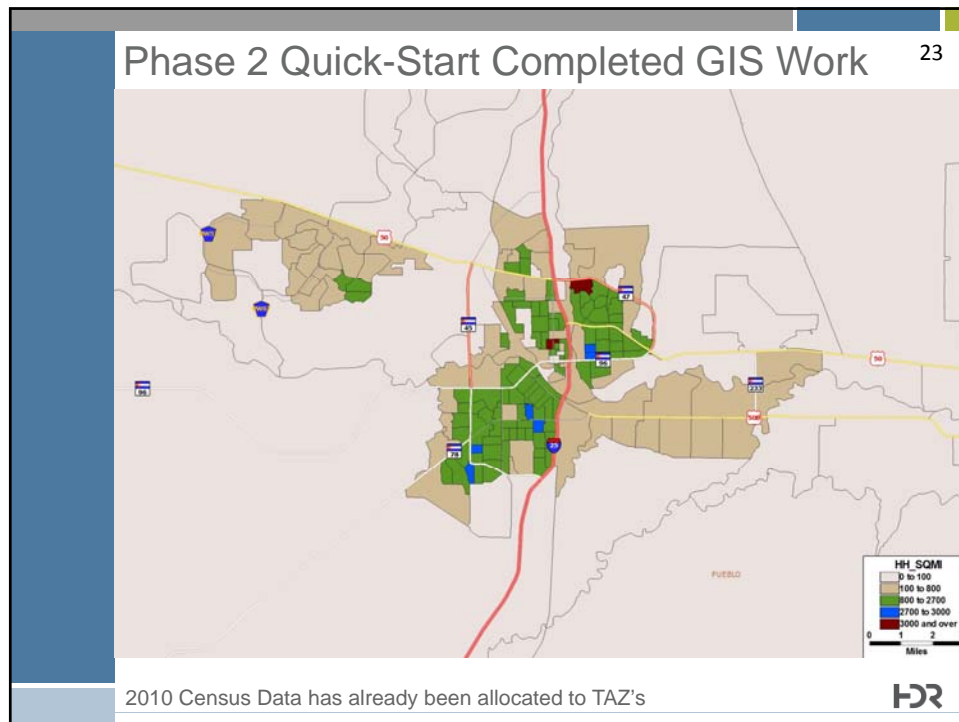
- Focused on two school districts – City and County
- Allocated to the correct school facility
- Tabulation of employees all a district headquarters was an issue
- **This work is complete!**



## Quick-Start Phase 2 Data Tasks Status 22

- **Complete Census GIS: Allocate 2010 household data to TAZ's ✓**
- **Complete processing of 2010 employment data**
- **Complete employment GIS: Allocate 2010 employment data to TAZ's**
- **This work is ongoing!**





Phase 2 Quick-Start 2010 Employment Data Processing 24

- PACOG requested and received the Quarterly Census of Employment and Wages (QCEW), formerly ES-202 for 2005 and 2010
- Staff reviewed and began to process data
- May need up to 100 hours staff time to clean and reconcile data
- Issues – missing addresses, zip codes or number of employees
- **Work is ongoing - No tasks are more critical in May-June 2014!**

HR

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## 4. Model Evaluation Status

HDR

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## Travel Model Version Evaluation

- Additional files and supplemental documentation were obtained from multiple sources ✓
- Four travel model versions were researched and evaluated for use in the PACOG TDM Update:
  - Legacy 1993 MINUTP Model (Barton Ashman) ✓
  - I-25 EIS model application (CH2MHill) ✓
  - Pueblo Ranch model application (LSA) ✓
  - US 50 PEL Study model application (JF Sato) ✓
- Each version data set was a valuable resource for a different reason
- **Sum total – enough to make a good start on official PACOG travel model**

HDR


## Phase 1 Model Evaluation Status 27

- Model Computer Code Audit and Integration ✓
- Hardware and Software Acquisition (PACOG) ✓
- Trip Generation Audit ✓
- Phase 2 “Quick-Start” approach was implemented and expanded model data needs were identified ✓
- This work is complete!



## Quick-Start Phase 2 Model Tasks Status 28


- Build TransCAD Library ✓
- “Standup” US 50 PEL model version with ZONE2014 TAZ structure (2005, 2010, 2035 scenarios)
- Prepare TELUM input zone-to-zone travel time matrices (for ZONE2014; 2005, 2010, 2035)
- Initiate setup for TELUS runs to forecast/allocate 2040 socioeconomic data
- This work is ongoing!



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## Quick-Start Phase 2 Socioeconomic Forecasting Tasks

- PACOG uses the Transportation Economic and Land Use Model (TELUM) to prepare socioeconomic forecasts for the Travel Demand Model
- TELUM will be used to forecast household and employment allocations to TAZ's for 2040
- TELUM freeware was sponsored by the Federal Highway Administration (FHWA) and is supported by New Jersey Institute of Technology (NJIT)
- PACOG has in-house TELUM expertise
- Building blocks for 2040 TELUM application are in progress – specifically assembly of 2005 and 2010 employment seed data is still underway




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## 5. Critical Path Activities

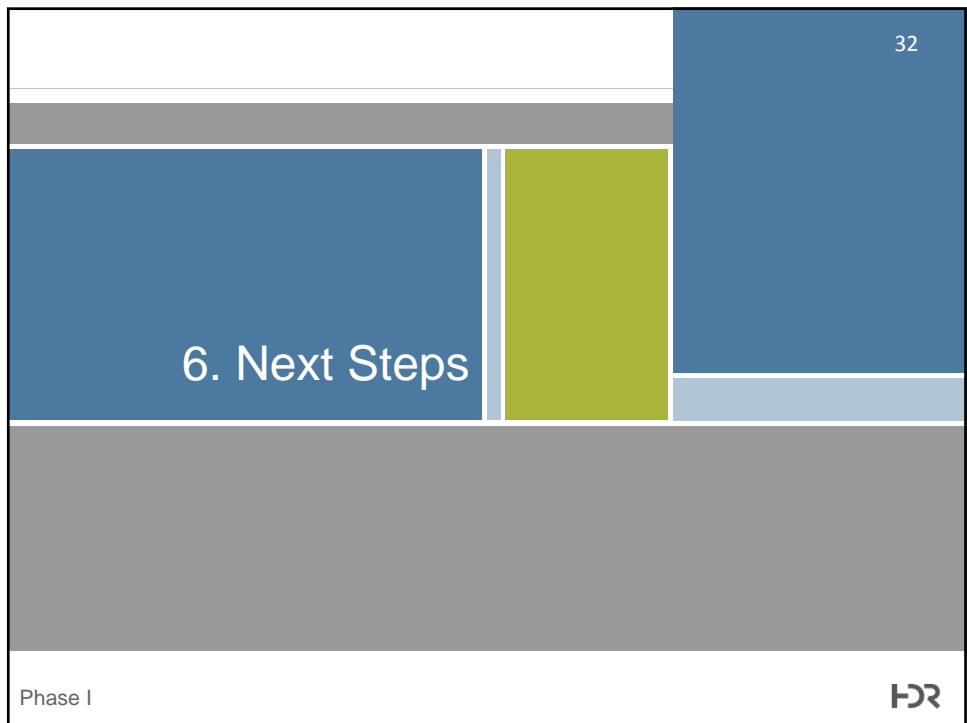



## Critical Path Activities 31

- 2010 Employment data processing
  - In progress
  - PACOG - HDR Blended Team supported
  - Highest priority
- TELUM Model Runs
- Selected model activities
  - Stand-up of US 50 PEL model version in ZONE2014 TAZ structure
  - Trip generation update for new 2010 base year
  - Travel time matrices for TELUS (206 x 206)



## 6. Next Steps 32




Phase I 



## Short Term Next Steps 33

- Continue critical path activities under Phase 1 NTP
- Prepare for initiation of work under Phase 2 NTP
  - Contractual
  - Work plan
  - Budget
- Begin strategy sessions to advance completion of PACOG 2040 Regional Transportation Plan Update



## 7. Combined Project Schedule 34

