NCC – Accelerated Construction

Dan DeGraaf, P.E.
Michigan Concrete Association
April 26, 2011

Maslansky Luntz & Partners

AASHTO

language to use

Much of the standstill you experience sitting in traffic could be avoided by **small improvements in technology**. For example, by synchronizing traffic lights in urban and suburban areas, we can **increase the number of green lights** you encounter and make traffic move **much more efficiently**.

This technology isn't science fiction. It exists right now.

increasing green lights

funding

- Funding is required to completely modernize our roads and highways
  - But smarter, more efficient technology is worth it to all of us, and people realize this

Technology Triad

Q. *"If I could promise you **synchronized traffic signals**, a **smarter traffic system**, and **technology that clears accidents** off the roads faster, would you be willing to pay an extra $100 a year for that?"*

A. *"I'll write you a check right now!"*

-Orlando Participant

language to use

If we're going to tackle transportation, we need a **realistic long-term plan** that takes future growth into account. We must really **think ahead** – this isn't about what's needed this year, or even just what is needed this decade. This is about what the nation needs for the next **20 to 40 years**.

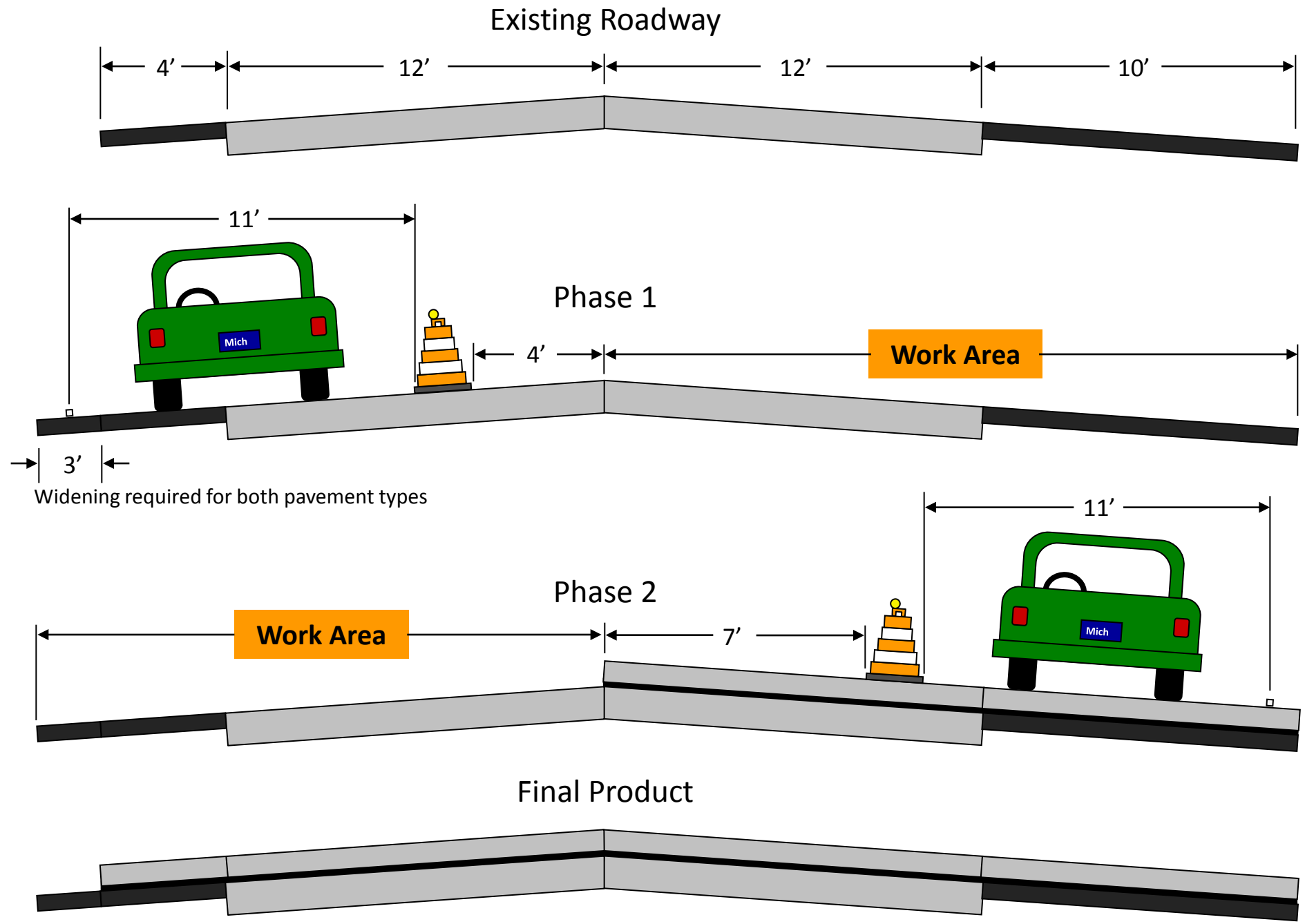
Another short-term fix isn't going to work. If we're going to take on transportation, we need to vote to fund a long-term plan that has funding built into **America's future**.

realistic long-term plan

- Taste Great
- ~~Less Filling~~
- Last Longer

MOT

- Level of service – Look at 24 hour data
- Do not stop traffic – 600 VPH/Lane
- May need additional lanes
- Moveable barrier
- Urban – full closure – 100 day window
- Clear zones work


Existing Roadway
4’
12’
12’
10’
11’
Mich
Phase 1
4’
Work Area
3’
Widening required for both pavement types
11’
Mich
Phase 2
Work Area
7’
Final Product

Schedule – Cure time

- Conventional Project
  - 6 miles, March to November
- Concrete Overlay
  - 14 miles in 78 calendar days
- Bridges and Dirt control critical path

Concrete Mix

- Durability
  - Well graded aggregates
  - Reduced cement content
  - SCM's
  - Reduced permeability
  - High Quality air system
- Early strength
  - Increased cement content
  - Fine grind cement
  - Life through chemistry – drugs have side effects

Reasons overlays can be trickier
(why overlays have higher potential for problems)

- Thinner than “reconstructs” or new pavements on new base
- Base is less forgiving
  - HMA (whitetopping) or PCC (UBOL) is a more solid base than agg. base
- Higher friction between concrete and base
- Adhesion between concrete and base

Fall

- Warm base; cool nights
  - Concrete sets from the bottom up
- Base movement generally not a problem
- May get some random cracks
  - Too green on top to allow for saw cutting, yet stresses building up from bottom of slab
- Countermeasures:
  - Place early in day; Use heat of day & sunlight to help surface gain strength to allow saw cutting
  - Increase and monitor concrete placement temperature; warmer is better
  - Use minimum amount of SCM's
  - Cover the slab with plastic sheeting

Spring

- Cool base; cool nights
  - Slows the set overall; but doesn't start from the bottom up
- Base movement is the controlling factor
  - Cool ground + warming during day = movement
  - Cooling of base at night (cold above & cold below)
- Countermeasure: Place concrete overlay during base expansion, not base contraction
  - Avoid early morning pours
  - Consider covering with plastic
  - Increase and monitor concrete placement temperature
  - Use minimum amount of required SCM's

Open to Traffic

- FHWA/IN/JTRP-2010/17 – Evaluation of In-Situ stiffness of subgrade by resilient and fwd modulusLab
  - Mr @ OMC = FWD x .48
  - Mr in winter 40% greater
- Soils at optimum moisture have highest Mr

Minimum Open to Traffic Strength

- Do we require subgrade compaction?
- If so at what moisture content?
- What is design Mr based on?
  - 12 month average
  - Spring conditions
  - Winter conditions
- Loss of support happens when?
- What strength is needed to resist cracking?

Open to Traffic

Strength vs. Loading/Damage

					ℓ	r	b					(ACPA Fatigue)		
	lb		sq. in.	psi	in.	in.	in.	Stress (psi)			Stress Ratio	Allowable	Actual #	%Fatigue
LOADS	**Total Wt.**	**Axles**	**Contact Area**	**Tire Pressure**	**Rad. Rel Stiff**	**Rad. Cont. Area**	**Radius of equiv. distr. of pressure**	**Interior**	**Corner**	**Edge**	**Max.**	**Repetitions**	**of reps**	**Used**
Passenger car	4000	2	25	40	22.40	2.82	3.61	17	24	25	0.08		0	
SUV/Pickup	7000	2	43.75	40	22.40	3.73	4.09	27	38	41	0.14	2.1512E+113	40	1.8595E-112
Panel truck	34000	2	85	100	22.40	5.20	5.07	121	153	176	0.59	26136.9302	5	0.0001913
Gravel train	143000	11	65	100	22.40	4.55	4.61	97	127	143	0.48	12241332.18	100	8.16905E-06
R/M truck	66000	5	66	100	22.40	4.58	4.63	98	128	144	0.48	7861469.182	10	1.27203E-06
Batch truck	70000	4	87.5	100	22.40	5.28	5.13	124	156	180	0.60	15961.95793	140	0.008770854
2800 paver	90000	2	1811.25	24.84	22.40	16.98	16.98	136	-35	134	0.45	72781935.41	1	1.37397E-08
Comm III	28000	2	720	19.44	22.40	10.70	10.18	67	54	85	0.28	1.3196E+22	1	7.57806E-23
PAVEMENT													TOTAL	0.90%
Thickness	9	in.												
Flex. Strength	300	psi	=	1600	psi compressive									
Mod. of Elasticity	2,025,000	psi												
k-value	500	psi/in												
Reliability	90%													