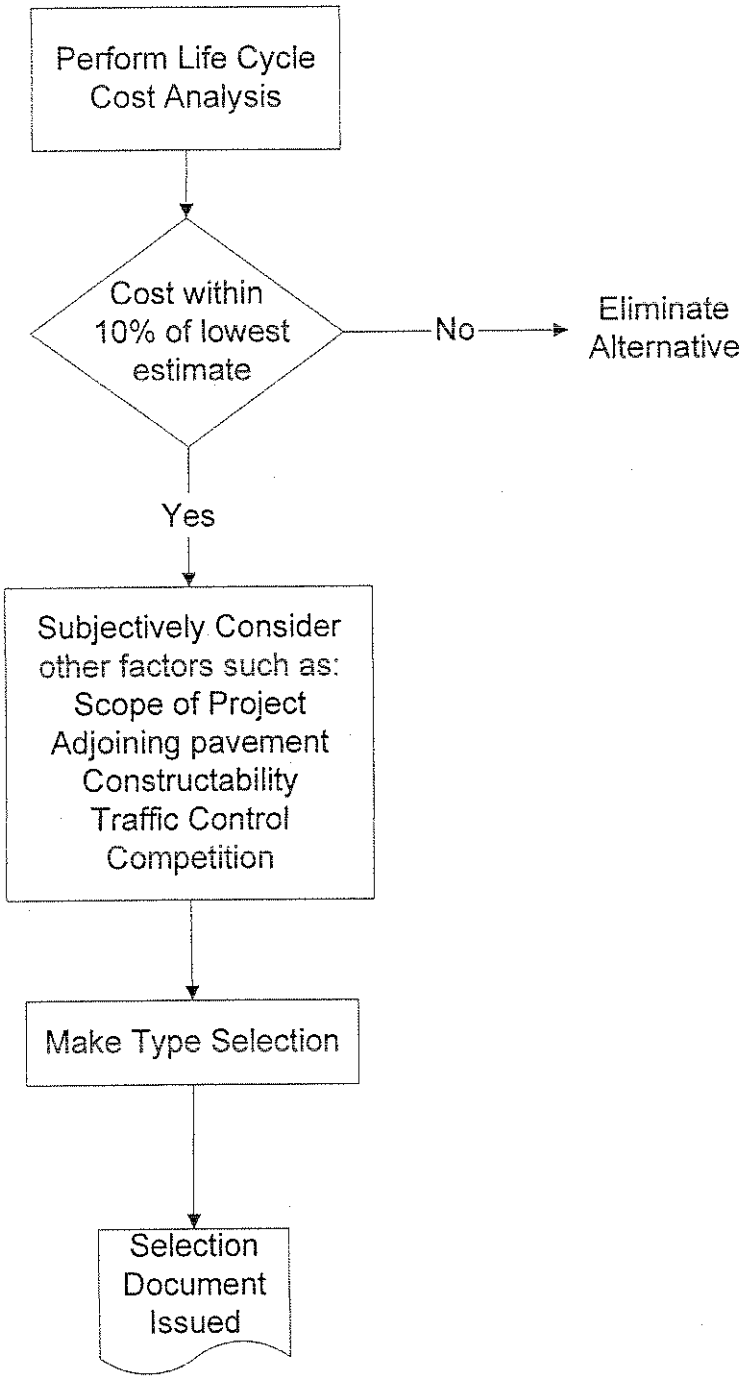
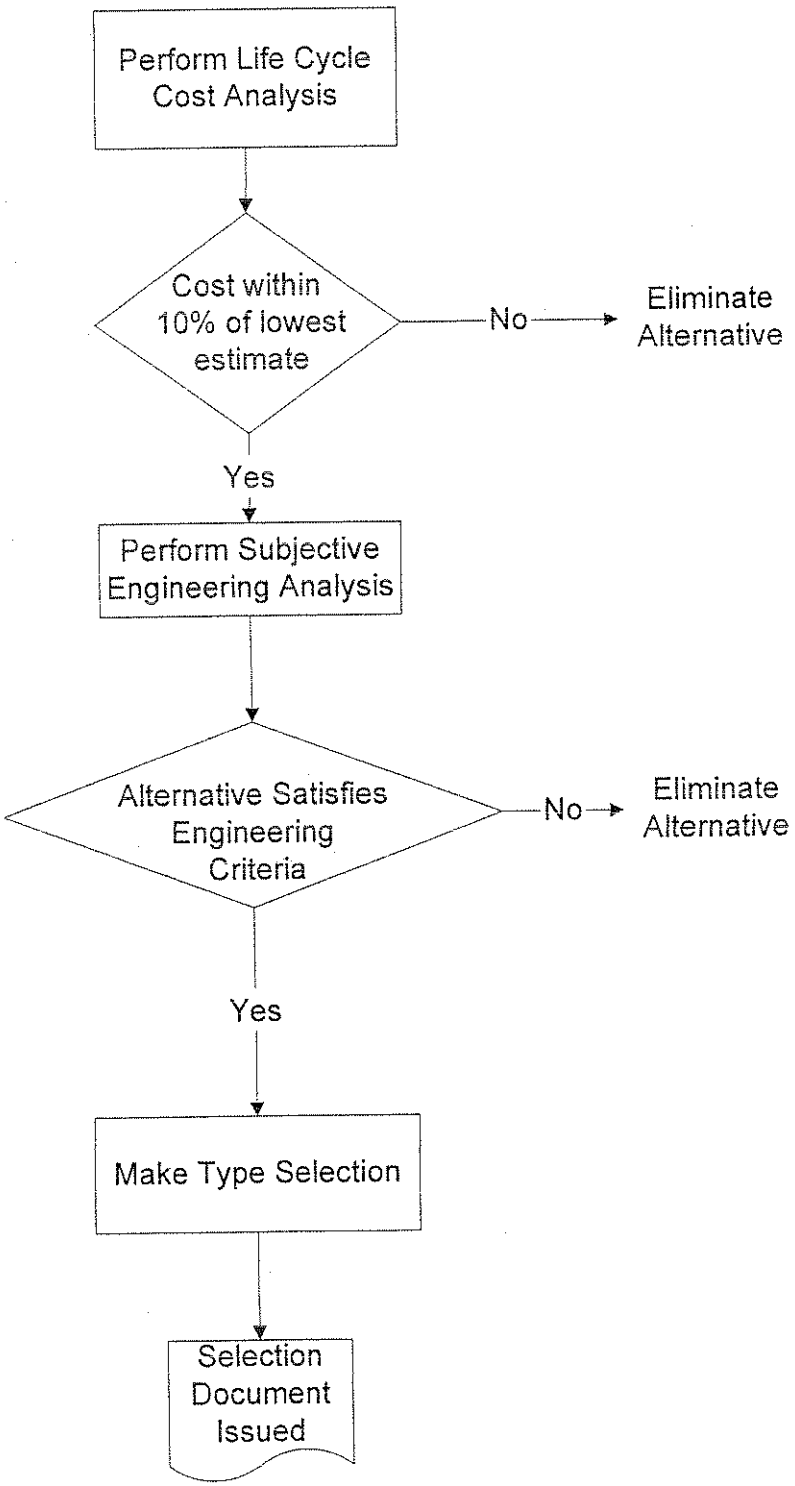
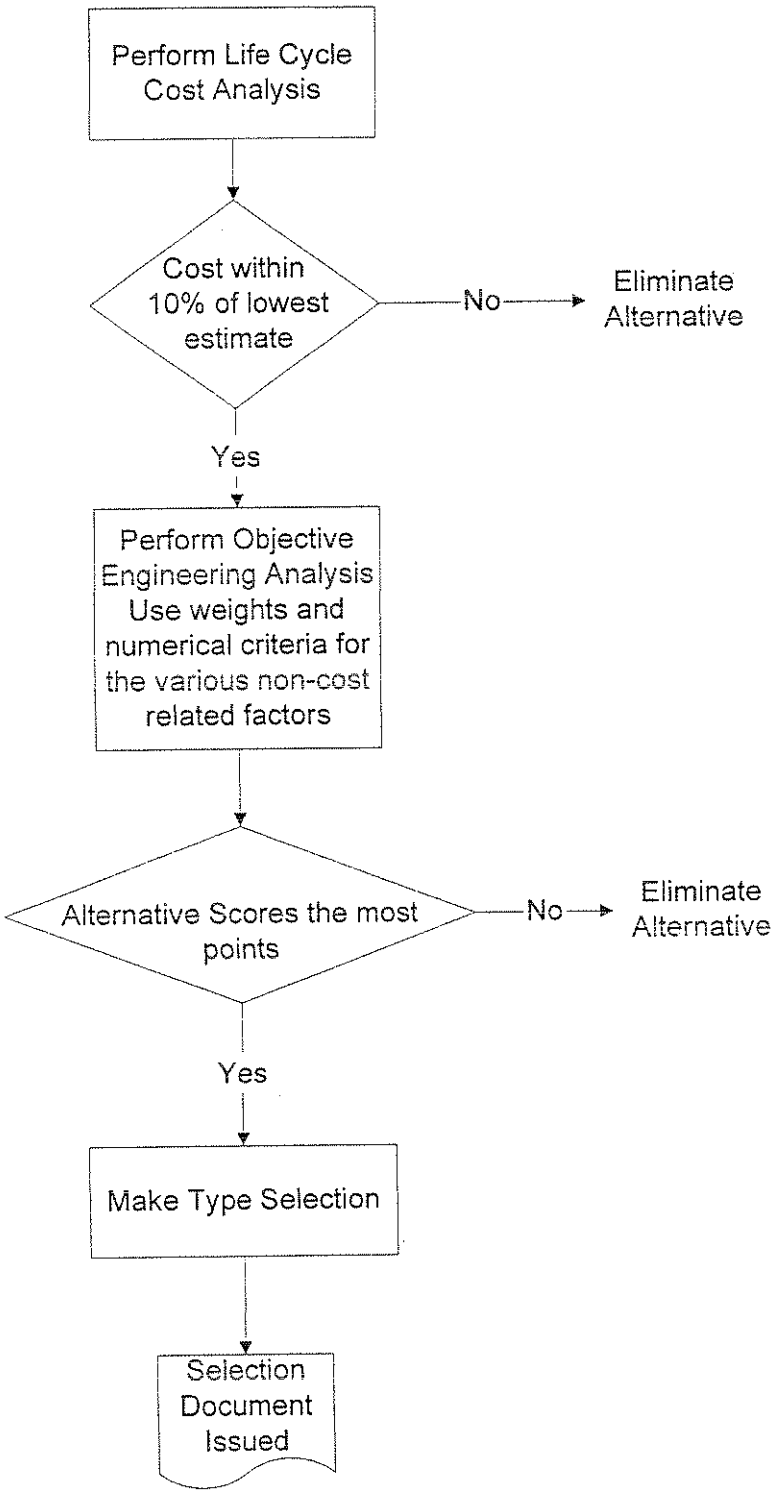
INDIANA DEPARTMENT OF TRANSPORTATION
TYPE SELECTION PROCESS
(Current)



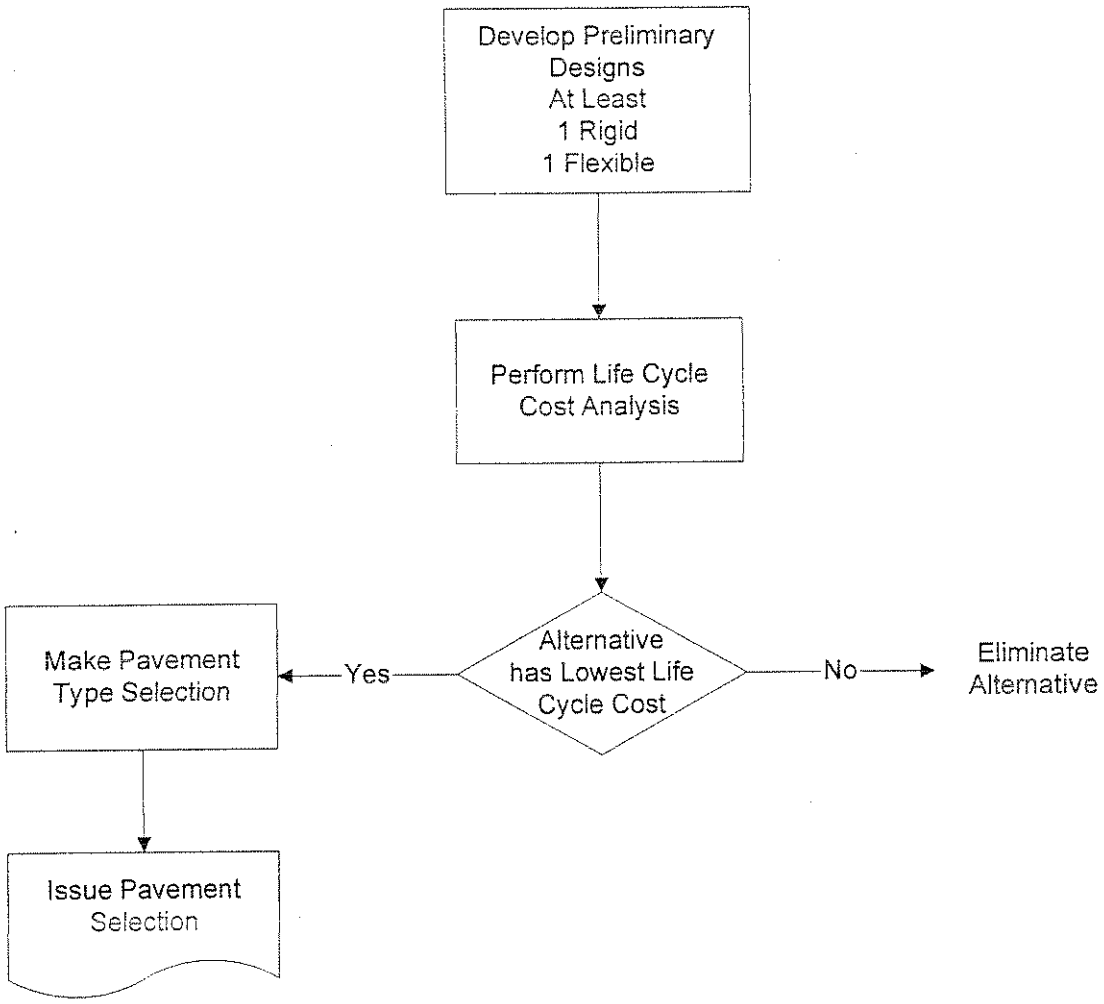
MARYLAND DEPARTMENT OF TRANSPORTATION
TYPE SELECTION PROCESS
(Existing)



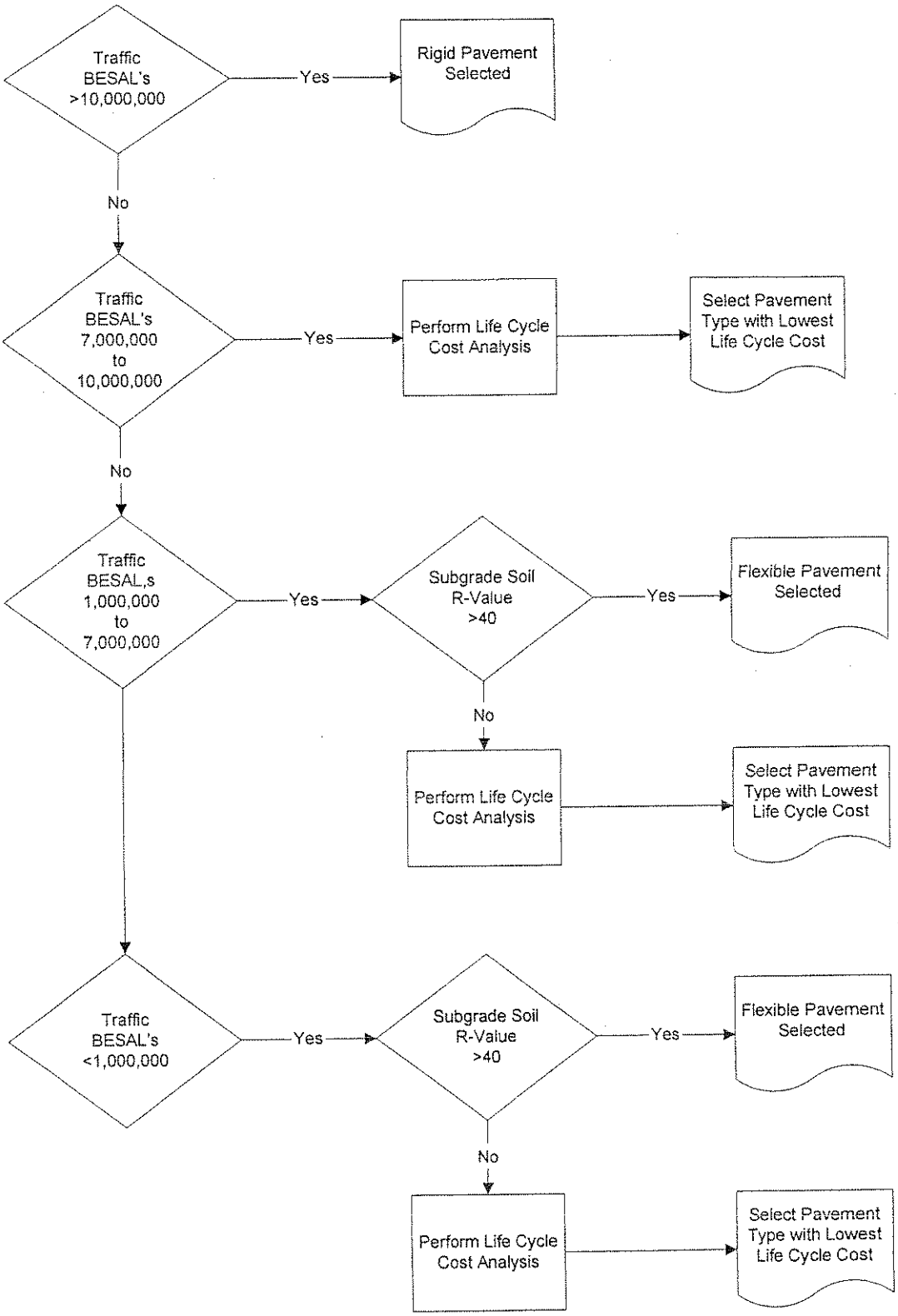
MARYLAND DEPARTMENT OF TRANSPORTATION
TYPE SELECTION PROCESS
(Future)



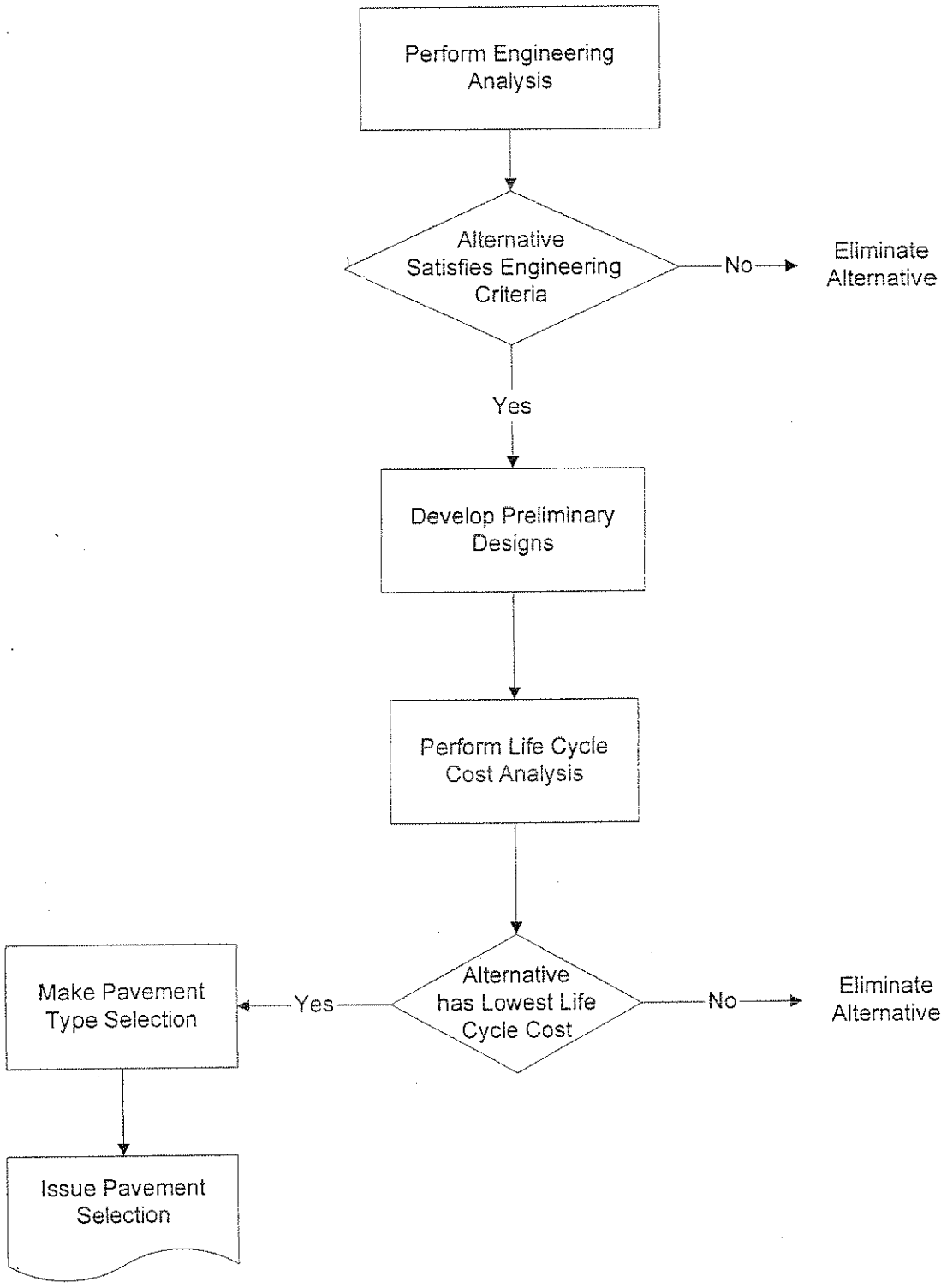
MICHIGAN DEPARTMENT OF TRANSPORTATION
TYPE SELECTION PROCESS



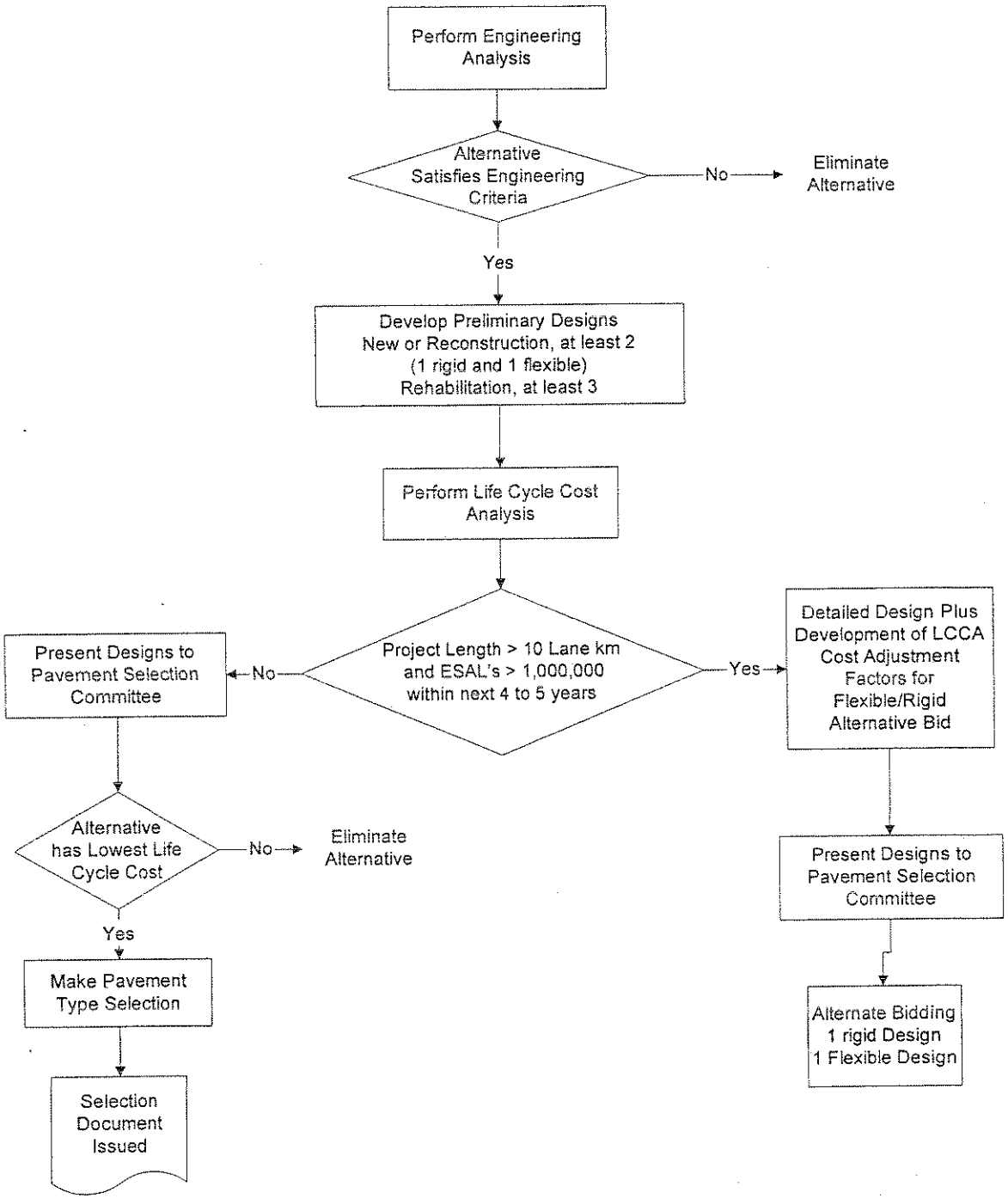
MINNESOTA DEPARTMENT OF TRANSPORTATION
PAVEMENT TYPE SELECTION PROCESS



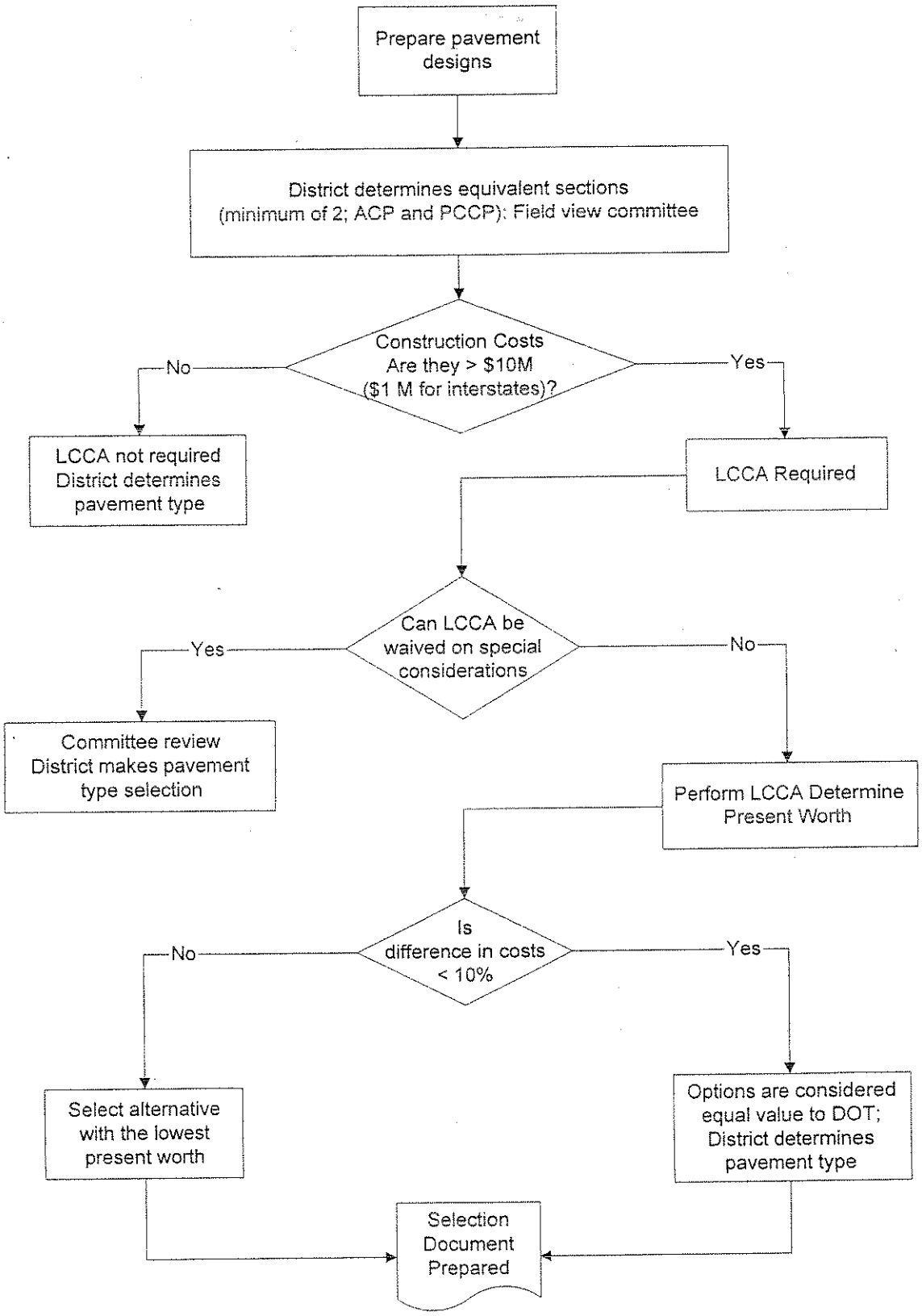
NEW YORK DEPARTMENT OF TRANSPORTATION
TYPE SELECTION PROCESS



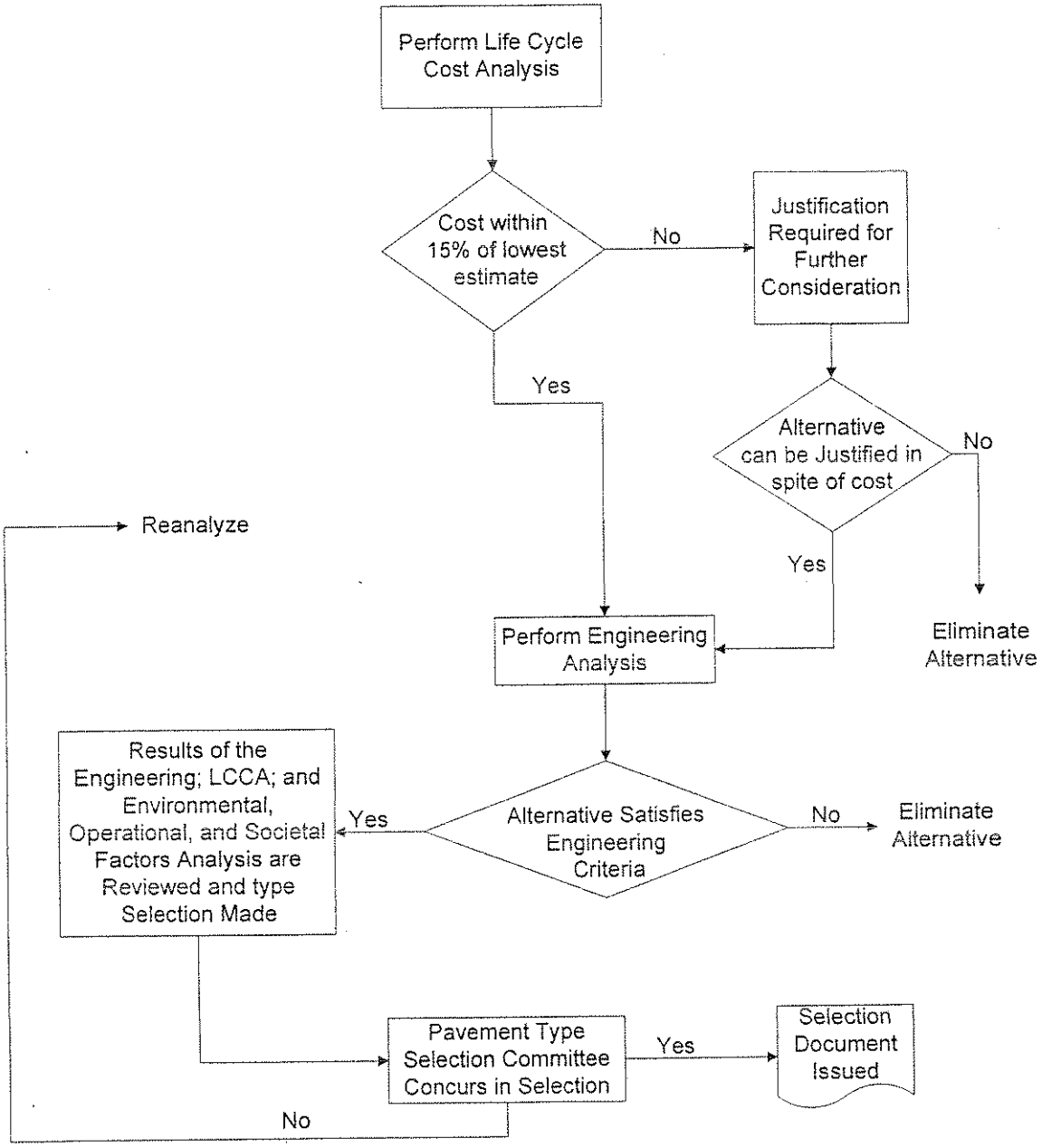
PROVINCE OF ONTARIO
PAVEMENT TYPE SELECTION



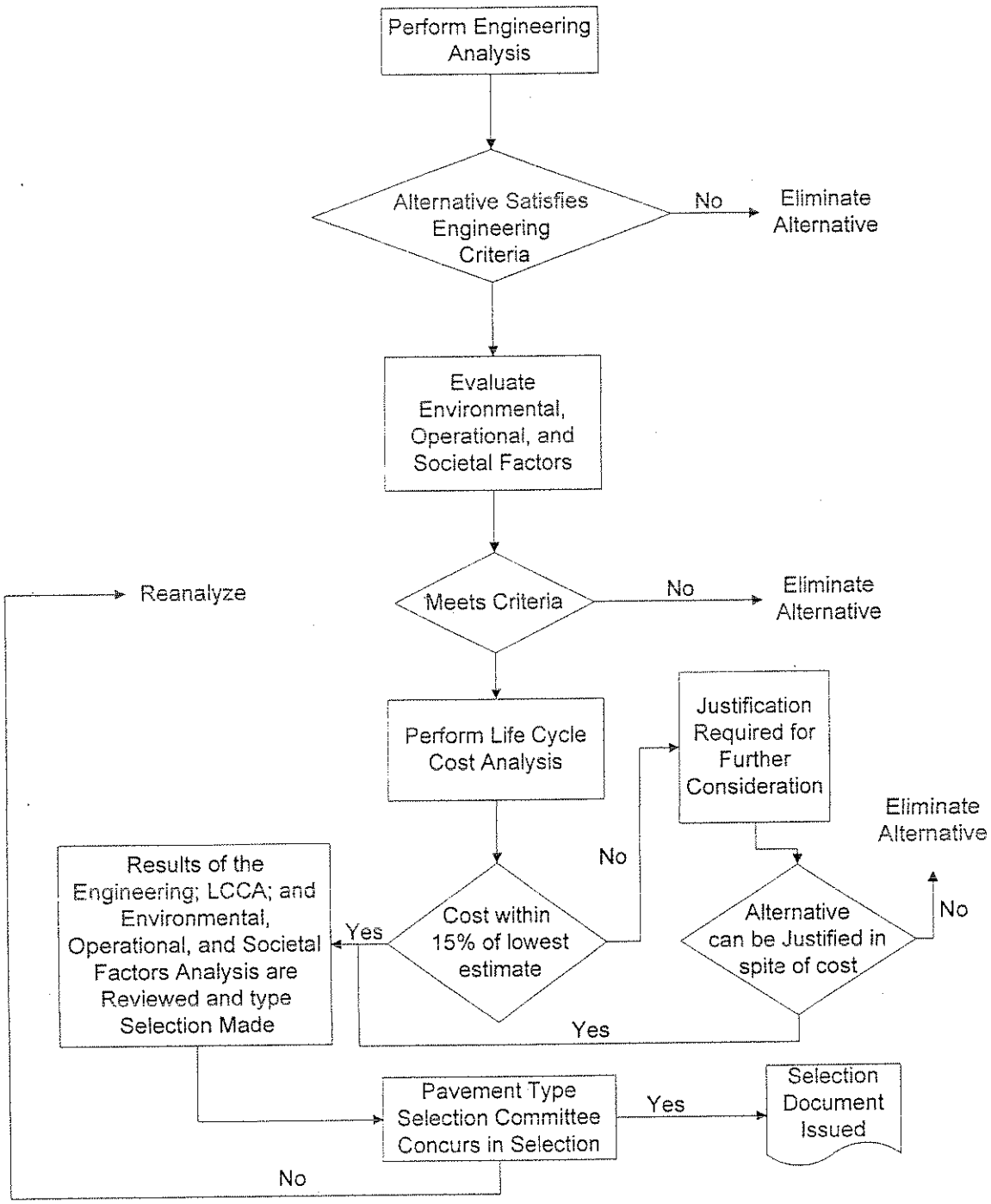
PENNSYLVANIA DEPARTMENT OF TRANSPORTATION
PAVEMENT TYPE SELECTION PROCESS



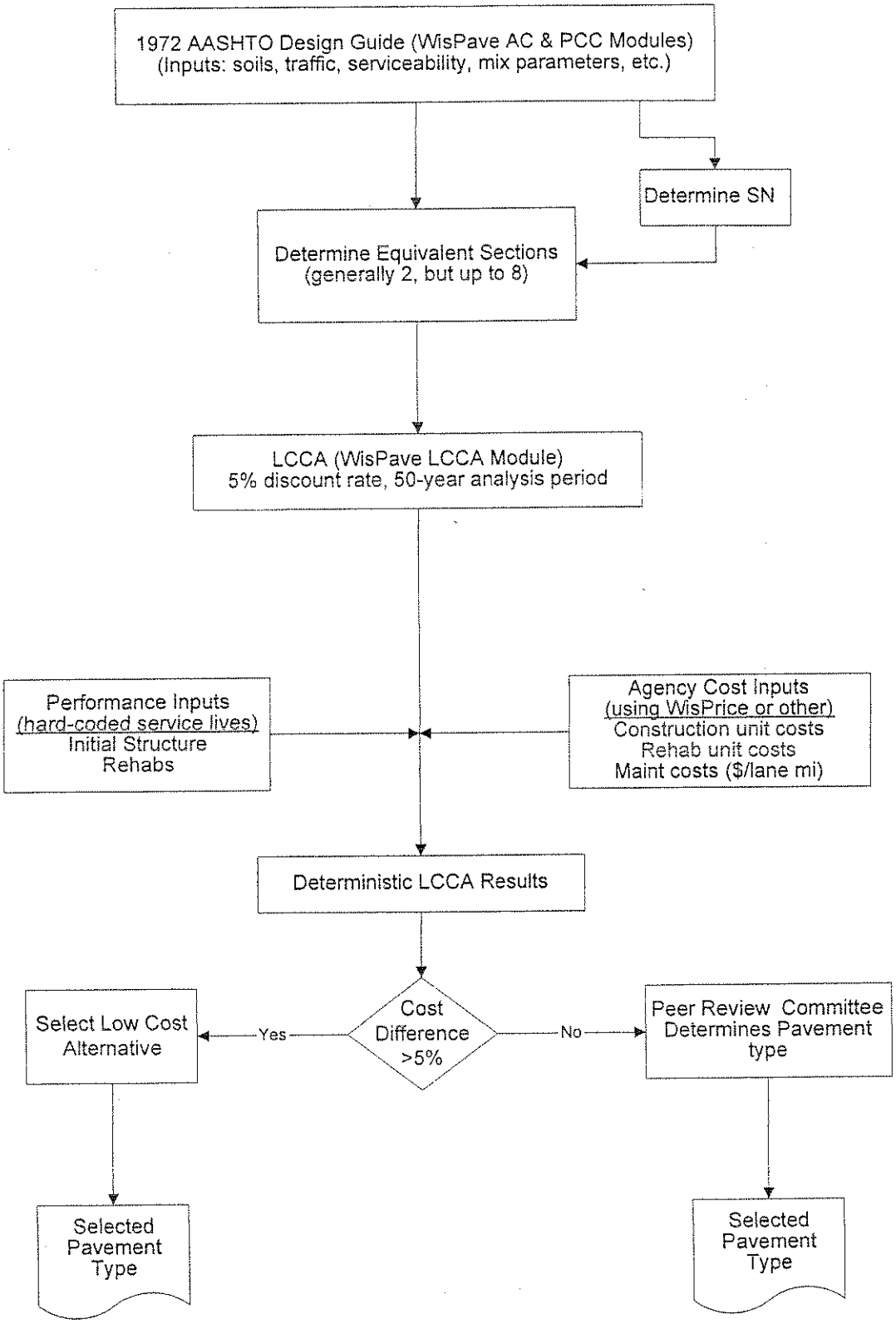
WASHINGTON STATE DEPARTMENT OF TRANSPORTATION
TYPE SELECTION PROCESS
(Existing)



WASHINGTON STATE DEPARTMENT OF TRANSPORTATION
TYPE SELECTION PROCESS
(Proposed revision)



WISCONSIN DEPARTMENT OF TRANSPORTATION
PAVEMENT TYPE SELECTION PROCESS



Appendix C

Completed Questionnaires

for the

Comparison States

Purpose

The purpose of this interview is to gain insight into the following Illinois Department of Transportation practices:

- Pavement type selection
- Engineer's estimate and life cycle cost analysis
- Other items that affect cost

Agency Interviewed

Illinois Department of Transportation
I26 East Ash Street
Springfield, IL 62704-4792

Interview conducted between 10:00 AM and 12:30 PM on October 22, 2003.

Person(s) Interviewed

Name	Title	Phone	Email
David L. Lippert, P.E.	Engineer of Physical Research	217/782-7200 217/782-2572	lippertdl@nt.dot.state.il.us
Priscilla Tobias, P.E. David L. Piper, P.E.	Policy Engineer Highway Policy Engineer	217/524-1649 217/785-0720	tobiaspa@nt.dot.state.il.us piperdl@nt.dot.state.il.us
Matt Mueller, P.E.	Technical Services Engineer	217/782-3479	muellermw@nt.dot.state.il.us

1. Do you have a documented pavement type selection procedure for:

New Construction – Yes
Reconstruction – Yes
Rehabilitation – Yes (if the job is widening, the policy advises that selection be based on first cost.)

Special designs are not covered by policy. These include rubblization and unbonded concrete overlays, "high stress" locations, high traffic with traffic factor exceeding 35), etc. LCCA is not used for these situations.

Page 54-1(9), Figure 54-1A of Pavement Design manual covers this procedure.

2. How long have you used the current type selection procedure?

A procedure has been in place since mid 70s. Mechanistic-empirical (M-E) based design was adopted in 1989 by IDOT after 8 years of research and development. IDOT subjected the M-E procedures to field verifications and internal review prior to implementation. Issues ranging from design parameters and their effect on pavement design, to life cycle cost selection, were analyzed. An IDOT-Industry task force was set up to provide a forum for industry input during

the decision-making process. Based on these activities, IDOT adopted and implemented the new pavement design procedures and associated type selection processes in 1990. These continue to serve IDOT to this day.

3. Changes made over the last 5 years:

The procedure has been "tweaked" slightly over the 5 years. Recently, the need to provide sealing of transverse joints in jointed concrete pavements has been eliminated. More changes are underway at this point, however, nothing has been made official as yet.

What prompted the change? Changes to design details (e.g., joint details such as saw cuts, dowel design, etc) prompted the minor "tweaks" to this point.

4. Have you used alternative bidding as a means of making a pavement type selection during the past 5 years? If yes describe the process. Was alternate bidding used on a Federal-aid project? If so, what was the basis of FHWA's approval?

No. IDOT does not use alternative bidding.

5. Importance and extent of industry involvement in the development of type selection process?

An IDOT-Industry task force was set up to facilitate industry input into the pavement type selection process during its development (see question 2 for details). Based on the industry review, IDOT re-evaluated and refined its design and type selection process. However, industry has no involvement in the way projects are selected within IDOT's pavement type selection process.

6. How was the selection process implemented within the agency?

The selection process is implement through a design manual. Districts perform the design and economic analyses of alternatives using the established unit costs and scheduled maintenance and rehabilitation and routine maintenance quantities and forward the results to the central bureau. The central bureau reviews the designs and economic analyses for accuracy. For new construction or reconstruction, if the LCCA leads to a cost difference of greater that 10 percent for competing alternatives, the alternative with the lowest cost is chosen. If the costs are within 10 percent of each other, then the districts refer the design to the Pavement Selection Committee for final decisions. The Committee comprises of 5 voting members – 3 central bureau members and 2 members where the project is located. The committee evaluates several "secondary" factors subjectively before arriving at a decision. These include:

- Construction considerations (e.g., staging, shallow utilities)
- Adjacent pavements (commonality, urban centers, signals, stop-go traffic, etc)
- District's local issues (past performance, impact on business due to construction, etc)
- First cost
- Project size and scope

7. How is the type selection process related to the overall project selection, budgeting, planning process used by the agency?

The type selection process is secondary to the overall programming of the DOT's capital outlay process. Programming is done years in advance and type selection is performed months (in some cases years) in advance of actual letting of jobs. Pavement type selection is done in Phase I and provides a more realistic estimate of costs.

8. Pavement types used for new construction or reconstruction over the last 5 years (guesstimate)

Pavement Type	Approximate sq. yd. (do not track lane miles)		Performance (Good Fair Poor)
	Interstate	Other 4 lane	
Full depth ACP	3,139,851		Good
Deep Strgth ACP	N/A	N/A	
ACP(less than 6") agg base	N/A	N/A	
Jointed Plain (JPCP)	4,577,865		Good
Jointed Reinforced (JRCP)	26038		N/A – Insufficient data since only small quantities built for compatibility with adjacent sections.
Continuously Reinf. (CRCP)	2,062,318		Good

*The last five years saw an unusual amount of interstate pavement being rehabilitated or reconstructed, which explains the high numbers for concrete.

9. Thickness design procedure used and design life

ACP (Full-depth AC) – M-E procedure (for new construction and reconstruction
PCCP (JPCP) – M-E procedure for new construction and reconstruction
PCCP (CRCP) – does not go through LCCA (special design); use modified AASHTO.

Widening jobs treated as special design. If widening is > 6' and involves resurfacing, modified AASHTO used for flexible and composite pavements.

10. What analysis period used for each pavement type?

For JPCP and full-depth AC, a 40-year life cycle capturing at least 1 rehabilitation is used.

11. Are there different foundation/base requirements for AC and PCC?

No. Both are treated similarly. A minimum of 12" improved subgrade (pozzolonically modified (most often lime-treated or granular backfill) is required to serve as an adequate working platform. This layer is not given structural credit and is not considered in cost analysis. Generally, JPCP requires as stabilized base and CRCP a bituminous stabilized base.

12. Do you use smoothness as criteria and if yes, do you use the same initial serviceability in design?

Smoothness is not used as a design criterion. It is only used as a construction specification.

13. Typical costs and method of contract measurement (e.g., last year's average bid price)

ACP in place $37/sy; Avg Thk = 14"
JPCP (slab only) $34/sy; Avg Thk = 10"
JRCP (slab only) N/A – Insufficient sample
CRCP (slab only) $30 to $44/sy (price based on completion schedule – accelerated completion costs more; Avg thk = 13 to 14"

Note that the CRCP design is not equivalent to other designs since it is typically considered only if heavy traffic is present (TF > 35).

14. How important is first cost versus future costs?

First cost, routine maintenance (paint markings, reflectors, lane markers, etc.), and maintenance and rehabilitation costs are all considered. There is not weighting attached to these categories in the LCCA process. All the dollar amounts are considered and reduced to present worth in LCCA.

First cost is discussed in the committee as a secondary factor when two alternate designs are within 10 percent of each other. It is possible that sometimes, this may drive decisions when the costs are very close.

15. Is life cycle cost analysis used?

Yes

16. Analysis period

40-year life cycle that ensures that at least 1 major rehab is covered.

17. Discount Rate (how established)

Department hired an economist in 1988 who reviewed the information present and established a rate of 3% for all public work. Prior to that Interest rate and Inflation rate were used.

18. Initial Costs – Estimating procedure

Quantity, material costs, and production costs enter the initial cost determination. Districts estimate costs and central bureau reviews them.

19. How does agency determine unit cost to include in the cost analysis (standardized or project by project)? Is the size of the project used in the database considered (economy of scale)? Age of the price data. How often updated.

There is a Statewide database of unit costs which are frequently updated. The Central office estimating engineer keeps a meticulous record of all the costs on unit cost worksheets and maintains a running total.

20. Are price adjustment factors used for any materials, and if so are they used in the life cycle cost analysis.

No.

21. Actual cost versus estimated cost (are completed projects evaluated for overruns etc.)

No ongoing process of active comparison. Actual costs versus estimated costs could differ based on market forces which are current to the time of letting, however, this does not affect type selection. Estimates are done sometimes years in advance. Projects are evaluated if there are overruns but not all projects are evaluated for overruns.

22. Routine maintenance (how estimated, operations included)

Routine maintenance as defined by IDOT refers to paint markings, lane markings, etc., which are common to both full-depth HMA and JPCP pavements. These quantities are assigned a fixed yearly value in the maintenance and rehabilitation schedule based on experience.

Other maintenance activities such as crack sealing, patching, etc., are directly considered in the maintenance and rehabilitation schedule. The schedule specifies that certain maintenance activities be done at fixed time intervals based on IDOT experience. These are applied in the LCCA process. The unit costs for these activities are updated annually and are a function of pavement type, location, and highway class.

Engineering and Construction Considerations

Note that all the factors listed below are secondary factors which will be considered by the Pavement Type Selection Committee only if the LCCA for the two design alternatives yields a difference of less than 10 percent.

Factor	C	P	I	Comments
1. Roadway/lane geometrics (lane widths, cross slopes, ability to provide drainage)	✓			
2. Highway functional class	✓			
3. Traffic				*Considered prior to LCCA being performed – in the design phase.*
4. Roadway peripheral features (overhead clearance, weigh-in-motion, guardrails, etc)	✓			
5. Construction considerations	✓			
a. Staging	✓			
b. Clearance for equipment	✓			
c. Construction operations				
d. Traffic operations during construction	✓			
e. Construction seasons	✓			
6. Consideration of future maintenance operations (maintenance of traffic, ease of maintenance)	✓			
7. Performance of similar pavements in the area	✓			
8. Availability of local materials, contractor's capabilities, and experienced agency personnel.	✓			
9. Pavement Continuity				
a. Adjacent sections	✓			
b. Adjacent lanes	✓			
10. Noise issues				
11. Subgrade soils	✓			
12. Climate				
13. District or local preference	✓			
14. Ease of maintenance	✓			
15. Recycling				*Indirectly accounted for in the LCCA – unit prices reflect the used of recycled materials.*
16. Conservation of materials and energy				*Indirectly accounted for in the LCCA – unit prices reflect the used of recycled materials.*
17. Stimulation of Competition				
18. Safety considerations (rutting, friction, lighting, etc)				*Addressed in specifications/maintenance rehabilitation schedule.*
19. Smoothness				*Addressed in specifications.*

C = considered; P = primary or secondary choice; I = importance (on a scale from 1 to 5)

23. Rehabilitation (how is timing estimated, techniques used, etc.)

Major rehabilitation activities such as overlays for full-depth AC pavements and CPR for JPCP are specified in the maintenance and rehabilitation schedule based on experience. The costs for these quantities are determined based on the cost worksheets maintained by IDOT.

Salvage Value (remaining life) – Not considered since it is assumed that life cycle is long enough.
Residual value (recycling) – Indirectly considered in unit cost sheets.
Construction traffic control (crossovers, added lanes, barriers, detours, etc.) – Secondary factor in type selection process.
Engineering and administration – Not considered.

24. How are users costs weighted in relation to agency costs?

N/A. User costs are not considered in LCCA.

25. Vehicle operating costs

Not considered.

26. User Delay

Not considered.

27. Description of the analysis process

N/A

28. Routine maintenance

IDOT definition differs from common perception. Definition could be revised. For full-depth AC and JPCP it includes lane striping, delineators, lane markets, etc.

29. Preventive maintenance

Preventive maintenance concepts are not used by IDOT at the present time.

30. What are the state's standard routine and preventive maintenance operation and schedule by pavement type?

As defined in Question 29, Routine maintenance is assigned a fixed cost which does not vary by pavement type. "Other" maintenance activities such as crack sealing, patching, etc., are provided in the schedules in the Pavement Design Manuals.

31. Allocation of resources between maintenance, rehab, new and reconstruction

IDOT operates on the principle of maintaining the existing system at optimum conditions. Adequate resources are allocated in each category to meet this goal.

32. Do you have a formal system to track pavement condition, cost, and survivability?

There is a system to track pavement condition (condition rating system -- CRS) and survivability. There is no system to track costs and there is no "formal" pavement management system. IDOT performs a routine review of CRS and assesses needs.

33. Do you allow old concrete to be recycled? If so into what products? Percentage limits?

Yes. Recycled concrete is used in concrete, as subbase layer, as capping layer for working platform, in fills/embankments, as well as in shoulders.

34. Do you allow HMA materials to be recycled? If so into what products? Percentage limits?

Yes. RAP is used in binder courses, shoulders, capping layers for working platform.

Purpose

The purpose of this interview is to gain insight into the following Indiana Department of Transportation practices:

- Pavement type selection
- Engineer's estimate and life cycle cost analysis
- Other items that affect cost

Agency Interviewed

Indiana Department of Transportation
120 S. Shortridge Road
Indianapolis, IN 46219

Person(s) Interviewed

Name	Title	Phone	Email
Dave Andrewski	Pavement Design Engineer	317-610-7251	dandrewski@indot.state.us
Kumar Dave	Pavement Design Engineer	317-610-7251	

1. Do you have a documented pavement type selection procedure for:

New Construction – In design Manual
Reconstruction – In design Manual
Rehabilitation

2. How long have you used the current type selection procedure?

At least 10 years

3. Changes made over the last 5 years:

Nothing significant

4. Have you used alternative bidding as a means of making a pavement type selection during the past 5 years? If yes describe the process. Was alternate bidding used on a Federal-aid project? If so, what was the basis of FHWA's approval?

No

5. Importance and extent of industry involvement in the development of type selection process?

Try to maintain an open relationship with both industries

6. How was the selection process implemented within the agency?

Included in the design manual

7. How is the type selection process related to the overall project selection, budgeting, planning process used by the agency?

Not directly related. Selection process occurs after a determination is made to proceed with the project.

8. Pavement types used for new construction or reconstruction over the last 5 years

Pavement Type	Approximate lane miles		Performance (Good Fair Poor)
	Interstate	Other 4 lane	
Full depth ACP			
Deep Strgth ACP	*		*Good*
ACP (less than 6") agg base			
Jointed Plain (JPCP)	*		*Good*
Jointed Reinforced (JRCP)			
Continuously Reinf. (CRCP)			

* Data not available from the State on miles of paving by type each year. However, subsequent conversations with industry reps indicated about 20 to 30 percent of the high reconstruction go to PCC each year.

9. Thickness design procedure used and design life (if AASHTO which version)

ACP AASHTO - DARWIN
PCCP AASHTO - DARWIN

10. What design period used for each pavement type?

Flexible – 20 years
Rigid – 30 years

11. Are there different foundation/base requirements for AC and PCC?

No

12. For those agencies that use smoothness as criteria do they use the same initial serviceability in design?

Have ride specifications for both pavement types. Currently not the same but they are moving towards that goal. Use same initial serviceability.

13. Typical costs and method of contract measurement

ACP in place $/ 42 /ton sy cy other
JPCP (slab only) $/ 10" 26.68, 11" 28.25 sy cy other
JRCP (slab only) $/_____ sy cy other
CRCP (slab only) $/_____ sy cy other

14. How important is first cost versus future costs?

First cost is one of the subjective factors considered

15. Is life cycle cost analysis used?

Yes - State currently has a research project underway at Purdue to improve the process

16. Analysis period

40 years

17. Discount Rate (how established)

For general purposes a 4% discount rate can be assumed. However, it is recommended that a range of rates between 0% and 10% be evaluated.

18. Initial Costs – Estimating procedure

Use recent unit costs for project let over the last 1 to 2 years

19. How does agency determine unit cost to include in the cost analysis (standardized or project by project)? Is the size of the project used in the database considered (economy of scale)? Age of the price data. How often updated.

Look at high and low bids, and then make a best estimate based on project factors. Industry is given the opportunity to provide input on the values used.

20. Are price adjustment factors used for any materials, and if so are they used in the life cycle cost analysis.

Not permitted by State law (constitution?)

21. Actual cost versus estimated cost (are completed projects evaluated for overruns etc.)

Not considered

Engineering and Construction Considerations

Factors used, scoring system, primary factors secondary factors, weights, importance, etc

Factor	Considered	Primary or Secondary	Importance (0 to 5)	Comments
1. Roadway/lane geometrics (lane widths, cross slopes, ability to provide drainage)	N			
2. Highway functional class	N			
3. Traffic	Y		5	
4. Roadway peripheral features (overhead clearance, weigh-in-motion, guardrails, etc)	Y		5	Yes for white topping and break and seat
5. Construction considerations				
a. Staging	Y		1	
b. Clearance for equipment	N			
c. Construction operations	N			
d. Traffic operations during construction	N			
e. Construction seasons	N			

Factor	Considered	Primary or Secondary	Importance (0 to 5)	Comments
6. Consideration of future maintenance operations (maintenance of traffic, ease of maintenance)	N			
7. Performance of similar pavements in the area	N			
8. Availability of local materials, contractor's capabilities, and experienced agency personnel.	N			
9. Pavement Continuity	N			
a. Adjacent sections	N			
b. Adjacent lanes	N			
10. Noise issues	N			*Is becoming an issue. State changed tining to address the issue*
11. Subgrade soils	Y		3	*Settlement*
12. Climate	N			
13. District or local preference	N			
14. Ease of maintenance	N			
15. Recycling	N			
16. Conservation of materials and energy	N			
17. Stimulation of Competition	Y			*Subjectively when cost are equal*
18. Safety considerations (rutting, friction, lighting, etc)	N			
19. Smoothness	N			

22. Routine maintenance (how estimated, operations included)

Based on maintenance management system, historical data, and pavement management data.

23. Rehabilitation (how is timing estimated, techniques used, etc.)

Based on pavement management data

Salvage Value (remaining life) – Consider the residual value of the pavements service life at the end of the analysis period
Residual value (recycling) – Not considered
Construction traffic control (crossovers, added lanes, barriers, detours, etc.) – Consider only if there is a significant difference between pavement types
Engineering and administration – No since similar for both

24. How are users costs weighted in relation to agency costs?

User costs will be incorporated when Purdue research is completed

25. Vehicle operating costs

26. User Delay

27. Description of the analysis process

In design manual

28. Routine maintenance

Reactive operations, pot holes, etc

29. Preventive maintenance

Crack and joint sealing, chip seals

30. What are the state's standard routine and preventive maintenance operation and schedule by pavement type?

Crack sealing every 2 to 3 years
Chip seal 4 to 6 years
Contraction joint sealing 8 to 12 years

31. Allocation of resources between maintenance, rehab, new and reconstruction

No formal allocation

32. Do you have a formal system to track pavement condition, cost, and survivability?

Pavement management system

33. Do you allow old concrete to be recycled? If so into what products? Percentage limits?

Becomes property of the contractor

Encourage the contractor to use as subgrade strengthening layer. Cap off with granular layer to prevent leaching

34. Do you allow HMA materials to be recycled? If so into what products? Percentage limits?

Becomes property of the contractor

In HMA up to 25%
Up to 15 % use grade of AC specified in contract. 15 to 25% an asphalt modifier is required to soften old asphalt.

Purpose

The purpose of this interview is to gain insight into the following Maryland State Highway Administration practices:

- Pavement type selection
- Engineer's estimate and life cycle cost analysis
- Other items that affect cost

Agency Interviewed

State Highway Administration, Maryland Department of Transportation
2323 W. Joppa Road
Lutherville, MD 21093

Person(s) Interviewed

Name	Title	Phone	Email
Tim Smith	Acting Pavement Division Chief	410-321-3110	Tsmith2@sha.state.md.us
Jeffrey N. Wthee	Transportation Engineer	410-321-3115	jwithe@sha.state.md.us

1. **Do you have a documented pavement type selection procedure for:**

   New Construction: Not formally, Using interim procedure while further revisions are under development
   Reconstruction: Not formally, Using interim procedure while further revisions are under development
   Rehabilitation

2. **How long have you used the current type selection procedure?**

6 months

3. **Changes made over the last 5 years:**

Currently being revised. New process expected to be completed and adopted early next year.

What prompted the change? Trying to develop a more consistent and objective selection process. Being do to address issues raised by the HMA industry on a major project.

Engineering and Construction Considerations

Factors used, scoring system, primary factors secondary factors, weights, importance, etc

Factor	Considered	Primary or Secondary	Importance (0 to 5)	Comments
1. Roadway/lane geometrics (lane widths, cross slopes, ability to provide drainage)	*Y*		*1*	
2. Highway functional class	*N*			
3. Traffic	*Y*		*3*	*Land use – impact of materials hauling*
4. Roadway peripheral features (overhead clearance, weigh-in-motion, guardrails, etc)	*N*			
5. Construction considerations				
a. Staging	*Y*		*3*	
b. Clearance for equipment	*N*			
c. Construction operations	*Y*		*3*	
d. Traffic operations during construction	*Y*		*4*	
e. Construction seasons	*Y*		*1*	

Factor	Considered	Primary or Secondary	Importance (0 to 5)	Comments
6. Consideration of future maintenance operations (maintenance of traffic, ease of maintenance)	Y		1	
7. Performance of similar pavements in the area	N			
8. Availability of local materials, contractor's capabilities, and experienced agency personnel.	Y		.5	
9. Pavement Continuity				
a. Adjacent sections	Y		2	
b. Adjacent lanes	Y		2	
10. Noise issues	Y		.5	
11. Subgrade soils	N			
12. Climate	N			
13. District or local preference	Y		.5	
14. Ease of maintenance	Y		1	
15. Recycling	N			
16. Conservation of materials and energy	N			
17. Stimulation of Competition	Y/N	S		
18. Safety considerations (rutting, friction, lighting, etc)	Y		2	rutting
19. Smoothness	N			

19. How does agency determine unit cost to include in the cost analysis (standardized or project by project)? Is the size of the project used in the database considered (economy of scale)? Age of the price data. How often updated.

Have just instituted the procedure and plan to update annually.

20. Are price adjustment factors used for any materials, and if so are they used in the life cycle cost analysis.

Yes – for liquid asphalt

21. Actual cost versus estimated cost (are completed projects evaluated for overruns etc.)

No

22. Routine maintenance (how estimated, operations included)

Not used

23. Rehabilitation (how is timing estimated, techniques used, etc.)

Pavement management supplies average and standard deviation for different pavement types.

Salvage Value (remaining life): Yes – remaining life at end of the analysis period
Residual value (recycling): No
Construction traffic control (crossovers, added lanes, barriers, detours, etc.): Yes
Engineering and administration: No

24. How are users costs weighted in relation to agency costs?

equal

25. Vehicle operating costs

No

26. User Delay

Yes per FHWA procedure

27. Description of the analysis process

28. Routine maintenance

Reactive - potholes, etc.

29. Preventive maintenance

Slurry seals, thin overlays

30. What are the states standard routine and preventive maintenance operation and schedule by pavement type?

Preventive maintenance applied occasionally.

31. Allocation of resources between maintenance, rehab, new and reconstruction

Nothing formal

32. Do you have a formal system to track pavement condition, cost, and survivability?

Yes – pavement management system

33. Do you allow old concrete to be recycled? If so into what products? Percentage limits?

Yes – but have not removed any in recent years

34. Do you allow HMA materials to be recycled? If so into what products? Percentage limits?

Yes -15% surface, 25% base. May increase based on mix design. Above 15 % requires asphalt modifier.

Purpose

The purpose of this interview is to gain insight into the following Michigan Department of Transportation practices:

- Pavement type selection
- Engineer's estimate and life cycle cost analysis
- Other items that affect cost

Agency Interviewed

Michigan Department of Transportation
Construction and Technology
8885 Ricks Road
Lansing, MI 48909

Person(s) Interviewed

Name	Title	Phone	Email
Curtis Bleech	Pavement Engineer	517-322-1237	bleechc@mdot.state.mi.us
Kevin Kennedy	Capital Preventive Maintenance Engineer		

1. Do you have a documented pavement type selection procedure for:

New Construction: Yes
Reconstruction: Yes
Rehabilitation: Unbonded overlays, break & seat

2. How long have you used the current type selection procedure?

3 years

3. Changes made over the last 5 years:

Developed to meet the requirements of State legislation passed in 1979. Public Act 79, states that "the department shall develop and implement a life cycle cost analysis for each project for which total pavement costs exceed one million dollars funded in whole, or in part, with state funds. The department design and award paving projects utilizing material having the lowest life cycle costs." The legislation also states "life cycle costs shall also compare equivalent designs and shall be based upon Michigan's actual historic project maintenance, repair and resurfacing schedules and shall include estimates of user costs throughout the entire pavement life."

Note: Because of the wording of the legislation, rehabilitation schedules and costs must be based on the past performance of pavements in Michigan. This does not allow modification based on design improvements. For example, asphalt mixtures are now based on Superpave and PCC

design has been change from JRCP to JPCP. However, performance must be based on the old designs

What prompted the change? Legislation

4. Have you used alternative bidding as a means of making a pavement type selection during the past 5 years? If yes describe the process. Was alternate bidding used on a Federal-aid project? If so, what was the basis of FHWA's approval?

Two projects under SEP 14. No additional projects currently planned, but the State hasn't ruled out future projects.

5. Importance and extent of industry involvement in the development of type selection process?

Participated in an ad hoc committee, where consensus on the new procedure was developed.

6. How was the selection process implemented within the agency?

Issued in a revised pavement design manual by the Chief Operations Officer

7. How is the type selection process related to the overall project selection, budgeting, planning process used by the agency?

It isn't

8. Pavement types used for new construction or reconstruction over the last 5 years

Pavement Type	Approximate lane miles, Interstate & other 4 Lane	Performance (Good Fair Poor)
Full depth ACP		
Deep Strgth ACP	*5%*	
ACP(less than 6") agg base		
Jointed Plain (JPCP) & JRCP	*95%*	
Jointed Reinforced (JRCP)		
Continuously Reinf. (CRCP)		

9. Thickness design procedure used and design life (if AASHTO which version)

ACP: AASHTO 93
PCCP: AASHTO 93

10. What analysis period used for each pavement type?

20 Years for both types

11. Are there different foundation/base requirements for AC and PCC?

Yes – Flexible requires 18-inch sand subbase and 6-inch aggregate base, PCC requires 12-inch sand subbase and 4-inch open-graded base.

12. For those agencies that use smoothness as criteria do they use the same initial serviceability in design?

Yes-Currently based on Ride Quality Index measured with either profilograph or profilometer. Will be going to IRI.

13. Typical costs and method of contract measurement

ACP in place $/25.40 to 45.39/ton sy cy other $28 to $50 metric ton
JPCP (slab only) $/10.25" 22.21sy cy other 260mm $26/m2,
JRCP (slab only) $/10.25" 27.21 sy cy other 260mm $32.55/m2,
CRCP (slab only) $/_____sy cy other

14. How important is first cost versus future costs?

Same importance, evaluated in LCCA

15. Is life cycle cost analysis used?

Yes Based on Equivalent Uniform Annual Cost

16. Analysis period

Varies depending on the design.

17. Discount Rate (how established)

OMB A94

Engineering and Construction Considerations

Factors used, scoring system, primary factors secondary factors, weights, importance, etc

Factor	Considered	Primary or Secondary	Importance (0 to 5)	Comments
1. Roadway/lane geometrics (lane widths, cross slopes, ability to provide drainage)	NO			
2. Highway functional class	NO			
3. Traffic	NO			
4. Roadway peripheral features (overhead clearance, weigh-in-motion, guardrails, etc)	NO			
5. Construction considerations	NO			
a. Staging	NO			
b. Clearance for equipment	NO			
c. Construction operations	NO			
d. Traffic operations during construction	NO			
e. Construction seasons	NO			

Factor	Considered	Primary or Secondary	Importance (0 to 5)	Comments
6. Consideration of future maintenance operations (maintenance of traffic, ease of maintenance)	NO			
7. Performance of similar pavements in the area	NO			
8. Availability of local materials, contractor's capabilities, and experienced agency personnel.	NO			
9. Pavement Continuity	NO			
a. Adjacent sections	NO			
b. Adjacent lanes	NO			
10. Noise issues	NO			
11. Subgrade soils	NO			
12. Climate	NO			
13. District or local preference	NO			
14. Ease of maintenance	NO			
15. Recycling	NO			
16. Conservation of materials and energy	NO			
17. Stimulation of Competition	NO			
18. Safety considerations (rutting, friction, lighting, etc)	NO			
19. Smoothness	NO			

18. Initial Costs – Estimating procedure

Only costs that differ between alternatives are considered. Include cost items such as mainline pavement, shoulders, joints, subbase, base, underdrains, and traffic control. Unit prices are determined from past MDOT projects and are based on the weighted average of low bid data.

19. How does agency determine unit cost to include in the cost analysis (standardized or project by project)? Is the size of the project used in the database considered (economy of scale)? Age of the price data. How often updated.

Prices are updated on a semiannual basis based on low bid data from the previous 18 months. They are developed following procedures set forth in the Pavement Design Manual.

20. Are price adjustment factors used for any materials, and if so are they used in the life cycle cost analysis.

Not used

21. Actual cost versus estimated cost (are completed projects evaluated for overruns etc.)

No

22. Routine maintenance (how estimated, operations included)

Not

23. Rehabilitation (how is timing estimated, techniques used, etc.)

Based on MDOT maintenance data (contract work only). Historical contract data and pavement condition data for the pavement management system are used to develop maintenance cost schedules.

Salvage Value (remaining life): None – Analysis period goes to the end of life
Residual value (recycling): No
Construction traffic control (crossovers, added lanes, barriers, detours, etc.): Rehab only. Considered same for initial
Engineering and administration: Included in future costs only.

24. How are users costs weighted in relation to agency costs?

Not weighted, user delay included n LCCA

25. Vehicle operating costs

26. User Delay

Speed delay and lane closure delay costs are calculated using a University of Michigan program.

27. Description of the analysis process

28. Routine maintenance

Reactive

29. Preventive maintenance

Contract

30. What are the states standard routine and preventive maintenance operation and schedule by pavement type?

Not stated

31. Allocation of resources between maintenance, rehab, new and reconstruction

32. Do you have a formal system to track pavement condition, cost, and survivability?

Yes, serves as basis for the rehabilitation schedules.

33. Do you allow old concrete to be recycled? If so into what products? Percentage limits?

Yes. Contractors become owners and generally do not use in project but rather use it in their private work. The following are the Michigan specifications for recycling of PCC:

> **902.03 Coarse Aggregates for Portland Cement Concrete.** Use Michigan Class 4AA, 6AAA, 6AA, 6A, 17A, and 26A coarse aggregate produced from natural aggregate, iron blast furnace slag, or reverberatory furnace slag sources. Michigan Class 6A, 17A and 26A may be produced by crushing Portland cement concrete, but only for uses stipulated by this specification. The bulk dry specific gravity must be within the limits established by freeze-thaw testing. Aggregates must conform to the grading requirements in Table 902-1, the physical requirements in Table 902-2, and the following.
> A. **Slag Coarse Aggregate.** Iron blast furnace slag or reverberatory furnace slag conforming to the grading specified for the concrete mixture must have a dry (loose measure) unit weight of not less than 70 pounds per cubic foot as determined by MTM 123.
> B. **Crushed Concrete Coarse Aggregate.** Use only crushed concrete coarse aggregate originating from concrete sources owned by the Department as part of the contracted project. Crushed concrete coarse aggregate may be used in concrete mixtures for curb and gutter, valley gutter, sidewalk, concrete barriers, driveways, temporary pavement, interchange ramps with commercial ADT below 250, and concrete shoulders. Crushed concrete coarse aggregate may not be used in mainline pavements or ramps with commercial ADT equal to or greater than 250, concrete base

course, bridges, box or slab culverts, head walls, retaining walls, prestressed concrete, or other heavily reinforced concrete. 693
902.03
Process crushed concrete coarse aggregate in a manner that avoids contamination with any non-concrete materials including joint sealants, HMA patching, and base layer aggregate or soil. Contamination particles retained on the-inch sieve are limited to 3.0 percent maximum by particle count of the total aggregate particles. The aggregate stockpile will be rejected totally when there is any evidence of contamination from non-Department sources such as building brick, wood, or plaster. Pieces of steel reinforcement are allowable in the stockpile provided they pass the maximum grading sieve size without hand manipulation. The fine aggregate portion of the gradation must not exceed a liquid limit of 25.0 percent or a plasticity index of 4.0. Crushed concrete coarse aggregate will be tested for freeze-thaw durability for each project. This testing requires a minimum of three months after samples of the produced aggregate are received in the laboratory. Use equipment and methods to crush concrete that will maintain uniformity in aggregate properties: specific gravity □0.05 and absorption □0.40, with no apparent segregation. This requirement includes separating crushed concrete aggregate according to its original coarse aggregate type, except for the following situations: 1. Different aggregate types may exist in the same stockpile if the quantities by weight of each aggregate type retained on the No. 4 sieve do not differ by more than □10 percent from the average quantity obtained from at least three representative samples. 2. When aggregate is produced from concrete pavement with only one aggregate type that has been repaired with concrete patches with a different aggregate type.
902.04 Coarse Aggregates for HMA Mixtures. Use natural aggregate, iron blast furnace slag, reverberatory furnace slag, steel furnace slag, or crushed concrete meeting the grading and physical requirements in the contract documents.

34. Do you allow HMA materials to be recycled? If so into what products? Percentage limits?

Yes). Contractors become owners and generally do not use in project but rather use it in their private work. The following is the Michigan Special Provision for recycling:

03SP501(G)
MICHIGAN
DEPARTMENT OF TRANSPORTATION
SPECIAL PROVISION
FOR
RECYCLED HOT MIX ASPHALT MIXTURE
C&T:GMM 1 of 1 C&T:APPR:JAR:MF:12-19-01
FHWA:APPR:08-06-02
Add the following subsection to Section 501.02.A.2 of the standard specifications.
c. Reclaimed Asphalt Pavement (RAP) Percentages and Binder Grade Selection. The method for determining the binder grade in hot mix asphalt (HMA) mixtures incorporating RAP is divided into three categories designated Tier 1, Tier 2 and Tier 3. Each tier has a range of percentages that represent the contribution of the RAP binder toward the total binder, by weight. The tiers identified below apply to both Superpave and Marshall mixtures with the following exception: **Superpave mixture types E3, E3 High Stress and E10 used as leveling or top course shall be limited to a maximum of 17% RAP binder by weight of the total binder in the mixture. Superpave Mixture types E10 High Stress, and all E30 and E50 mixtures used as leveling or top course shall be limited to a maximum of 14% RAP binder by weight of the total binder in the mixture.**

Tier 1 (0% to 17% RAP binder by weight of the total binder in the mixture) No binder grade adjustment is made to compensate for the stiffness of the asphalt binder in the RAP.

Tier 2 (18% to 27% RAP binder by weight of the total binder in the mixture) The selected binder grade for the asphalt binder is one grade lower for the high temperature than the binder grade required for the specified project mixture type. For example, if the specified binder grade for the mixture type is PG58-28, the required grade for the binder in the recycled mixture would be a PG52-28. The asphalt binder grade can also be selected using a blending chart for high and low temperatures. The Contractor shall supply the blending chart and the RAP test data used in determining the binder selection.

Tier 3 (A 28% RAP binder by weight of the total binder in the mixture)
The binder grade for the asphalt binder is selected using a blending chart for high and low temperatures. The Contractor shall supply the blending chart and the RAP test data used in determining the binder selection.

Have difficulty meeting Superpave specifications

Notes

Most PCC is 11 to 12 inches thick, ACP bound layers are 12 to 15 inches

Generally when BSEAL's are above 10 million, the LCCA favors PCC.

Purpose

The purpose of this interview is to gain insight into the following Minnesota Department of Transportation practices:

- Pavement type selection
- Engineer's estimate and life cycle cost analysis
- Other items that affect cost

Agency Interviewed

Minnesota Department of Transportation
1400 Gervais Ave.
Maplewood, MN 55109-2044

Person(s) Interviewed

Name	Title	Phone	Email
Dave Van Deusen	Pavement Design/Grading and Base Engineer	651-779-5564	Dave.VanDuesen@dot.state.mn.us
Dave Janisch	Pavement Management Engineer	651-779-5567	Dave.janisch@dot.state.mn.us

1. Do you have a documented pavement type selection procedure for:

New Construction: Yes
Reconstruction: Yes
Rehabilitation: Unbonded overlays

2. How long have you used the current type selection procedure?

Issued in 1997 and modified in 2001

3. Changes made over the last 5 years:

Modified in 2001 to increase the BESAL's from 7 million to 10 million before pavement automatically went PCC. Process is currently being further modified.

What prompted the change? Request of the HMA industry

4. Have you used alternative bidding as a means of making a pavement type selection during the past 5 years? If yes describe the process. Was alternate bidding used on a Federal-aid project? If so, what was the basis of FHWA's approval?

No

5. Importance and extent of industry involvement in the development of type selection process?

Both industries serve as non-voting members on committee responsible for recommending changes.

6. How was the selection process implemented within the agency?

Commissioner issues policy

7. How is the type selection process related to the overall project selection, budgeting, planning process used by the agency?

No

8. Pavement types used for new construction or reconstruction over the last 5 years

Pavement Type	Approximate lane miles		Performance (Good Fair Poor)
	Interstate	Other 4 lane	
Full depth ACP			
Deep Strgth ACP	X*	X	Generally good, thermal cracking and stripping have been prob.
ACP(less than 6") agg base			
Jointed Plain (JPCP)	X*	X	Generally good now. Using a premium design on high volume routes. Low w/c concrete and stainless steel clad dowels
Jointed Reinforced (JRCP)			
Continuously Reinf. (CRCP)			

*Mileage data not readily available, but most Interstate reconstruction goes concrete because design traffic exceeds 10 million BESAL's

9. Thickness design procedure used and design life (if AASHTO which version)

ACP: Modified AASHTO
PCCP: AASHTO 86

10. What *design life* used for each pavement type?

Flexible – 20 years
Rigid – 35 years

11. Are there different foundation/base requirements for AC and PCC?

Flexible design requires subbase and minimum 30-inch total pavement thickness
Rigid 12 inches select material and 4-inch granular base

12. For those agencies that use smoothness as criteria do they use the same initial serviceability in design?

Use same smoothness criteria based on profilograph. Plan to change to and IRI specification. Modified flexible procedure does not directly consider initial serviceability

13. Typical costs and method of contract measurement

ACP in place $/_____43_____/ton sy cy other
JPCP (slab only) $/_____* _____sy cy other
JRCP (slab only) $/_____sy cy other
CRCP (slab only) $/_____sy cy other

* Concrete pavements are paid for based on a combination of surface area of concrete pavement specified and the volume based on planned thickness and the computed area of pavement. Typical for 13-inch pavement was $19/sy plus $58.10/cy

14. How important is first cost versus future costs?

Straight LCCA

15. Is life cycle cost analysis used?

Yes – Agency costs only

16. Analysis period

35 years currently, going to 50 years

17. Discount Rate (how established)

Current 4.5 %, but going to OMB A94

18. Initial Costs – Estimating procedure

Not bid unit cost based. Do cost estimates based materials costs at project site. Process looks at factors such as aggregate costs, haul, and construction costs.

Additional costs for premium enhance designs are not included in the initial analysis. These features are included after pavement type has been selected.

Engineering and Construction Considerations

Factors used, scoring system, primary factors secondary factors, weights, importance, etc

Factor	Considered	Primary or Secondary	Importance (0 to 5)	Comments
1. Roadway/lane geometrics (lane widths, cross slopes, ability to provide drainage)	N			
2. Highway functional class	N			
3. Traffic	Y	P	%	
4. Roadway peripheral features (overhead clearance, weigh-in-motion, guardrails, etc)	N			
5. Construction considerations	N			
a. Staging	N			
b. Clearance for equipment	N			
c. Construction operations	N			
d. Traffic operations during construction	N			
e. Construction seasons	N			

Factor	Considered	Primary or Secondary	Importance (0 to 5)	Comments
6. Consideration of future maintenance operations (maintenance of traffic, ease of maintenance)	N			
7. Performance of similar pavements in the area	N			
8. Availability of local materials, contractor's capabilities, and experienced agency personnel.	N			
9. Pavement Continuity	N			
a. Adjacent sections	N			
b. Adjacent lanes	N			
10. Noise issues	N			
11. Subgrade soils	N			
12. Climate	N			
13. District or local preference	N			
14. Ease of maintenance	N			
15. Recycling	N			
16. Conservation of materials and energy	N			
17. Stimulation of Competition	N			
18. Safety considerations (rutting, friction, lighting, etc)	N			
19. Smoothness	N			

19. How does agency determine unit cost to include in the cost analysis (standardized or project by project)? Is the size of the project used in the database considered (economy of scale)? Age of the price data. How often updated.

Project based.

20. Are price adjustment factors used for any materials, and if so are they used in the life cycle cost analysis.

No

21. Actual cost versus estimated cost (are completed projects evaluated for overruns etc.)

No

22. Routine maintenance (how estimated, operations included)

Rout and seal cracks, Joint reseal, minor CPR are included. Based on estimates by District Engineers

23. Rehabilitation (how is timing estimated, techniques used, etc.)

Mill and Overlay, Major CPR, Some full depth and Grinding. Based on estimates by District Engineers and performance history in PMS database.

Salvage Value (remaining life): New System will consider for PCC high performance design. None for HMA.
Residual value (recycling): No
Construction traffic control (crossovers, added lanes, barriers, detours, etc.): Consider for original construction
Engineering and administration: No

24. How are users costs weighted in relation to agency costs?

Not considered now. Plan to look at for future up date.

25. Vehicle operating costs

26. User Delay

27. Description of the analysis process

28. Routine maintenance

Reactive

29. Preventive maintenance

Crack and joint sealing, minor CPR other than full depth patching, surface treatments, overlays less than 2 inches

30. What are the states standard routine and preventive maintenance operation and schedule by pavement type?

31. Allocation of resources between maintenance, rehab, new and reconstruction

Districts allocate as needed. However, $40 million is allocated statewide to preventive maintenance.

32. Do you have a formal system to track pavement condition, cost, and survivability?

Yes. Have targets for percent pavements in good category and percent with a remaining life of 12 years.

33. Do you allow old concrete to be recycled? If so into what products? Percentage limits?

Yes into aggregate base, and subbase. Contractors can't meet the w/c ratio requirements if used in PCC

34. Do you allow HMA materials to be recycled? If so into what products? Percentage limits?

30% max in wearing course
50% max on wearing course mixes

However, mixes must meet mix design specification requirements

Purpose

The purpose of this interview is to gain insight into the following State of New York Department of Transportation practices:

- Pavement type selection
- Engineer's estimate and life cycle cost analysis
- Other items that affect cost

Agency Interviewed

State of New York, Department of Transportation
1220 Washington Avenue
Albany, NY 12232-0861

Person(s) Interviewed

Name	Title	Phone	Email
Russell Thielke, P.E.	Head, Materials Bureau	518-457-4582	rthielke@dot.state.ny.us
Brad Allen, P.E.	Engineer, Materials Bureau	518-457-4582	ballen@dot.state.ny.us
Mike Brinkman	Engineer, Materials Bureau	518-457-4582	mbrinkman@dot.state.ny.us

1. Do you have a documented pavement type selection procedure for:

New Construction: Yes. For new construction, consult Chapters 3 and 5 of the New York Comprehensive Pavement Design Manual. Available on the web.
Reconstruction: Yes. For reconstruction, consult Chapters 3 and 5 of the New York Comprehensive Pavement Design Manual. Available on the web.
Rehabilitation: Yes, there are two manuals. DKH provided with copies. They are also included as chapters in the Comprehensive Pavement Design Manual.

2. How long have you used the current type selection procedure?

Rehabilitation has been in effect since 1989. The Comprehensive Pavement Design Manual was published in 2000. The manual brought together all of the designer's tools into one comprehensive document.

3. Changes made over the last 5 years:

On-going minor changes but nothing significant.

What prompted the change? Treatment selection hasn't changed much but will in 2004.

4. Have you used alternative bidding as a means of making a pavement type selection during the past 5 years? If yes describe the process. Was alternate bidding used on a Federal-aid project? If so, what was the basis of FHWA's approval?

No. Alternative bidding has not been used.

5. Importance and extent of industry involvement in the development of type selection process?

Industry doesn't have much involvement in pavement type selection. The industry tends to partner with the DOT in the review of new technology, specifications changes, etc. The industry has not generally questioned the State's decisions on pavement type selection.

6. How was the selection process implemented within the agency?

NY DOT started with the suggestions provided in the AASHTO 1993 Guide and modified them for NY State conditions. LCCA is used and at least 2 alternatives are evaluated for each project.

7. How is the type selection process related to the overall project selection, budgeting, planning process used by the agency?

Project by project selection. The initial costs usually drive the selection process. The designs are done at the regional level and they are each provided with a pot of money. The central office reviews designs but generally in a cursory way. The regions have the autonomy to choose pavement type and to pay higher initial costs in favor of lower future maintenance if desired.

8. Pavement types used for new construction or reconstruction over the last 5 years

Pavement Type	Approximate lane miles		Performance (Good Fair Poor)
	Interstate	Other 4 lane	
Full depth ACP	90 percent		Good
Deep Strgth ACP	0		
ACP(less than 6") agg base	0		
Jointed Plain (JPCP)	10 %		Good
Jointed Reinforced (JRCP)	0		
Continuously Reinf. (CRCP)	0		

9. Thickness design procedure used and design life (if AASHTO which version)

ACP – AASHTO 1993 as modified for New York State. Included in the Comprehensive Pavement Design Manual.
PCCP – AASHTO 1993 as modified for New York State. Included in the Comprehensive Pavement Design Manual.

http://www.dot.state.ny.us/cmb/consult/cpdmfiles/cpdm.html

10. What analysis period used for each pavement type?

50 years for new construction
30 years for rehabilitation

11. Are there different foundation/base requirements for AC and PCC?

They are treated the same.

12. For those agencies that use smoothness as criteria do they use the same initial serviceability in design?
Initial serviceability is not directly considered in the modified procedure.

Smoothness specifications for PCC require the use of the California Profilograph with a 5 mm blanking band to measure smoothness. There are no smoothness requirements for flexible pavements. They are working on an IRI based acceptance criteria for flexible pavements and may use this for rigid pavements as well although they are sensitive to the issues of using a light weight profiler on tined concrete surfaces.

13. Typical costs and method of contract measurement

Varies widely and depends on local conditions. Typically, HMA is $ 30 - $ 80 /metric tonne and concrete is $ 140 to $ 250 per cubic metre. All designs and payment, etc. in New York is done in metric.

ACP in place $/_____/ton sy cy other
JPCP (slab only) $/_____sy cy other
JRCP (slab only) $/_____sy cy other
CRCP (slab only) $/_____sy cy other

14. How important is first cost versus future costs?

Initial cost has about a 95 percent importance level. They are currently revising their pavement selection process to include probabilistic modeling and user costs so this may change. The expected date of implementation is summer 2004.

15. Is life cycle cost analysis used?

Yes

16. Analysis period

50 years for all new construction and reconstruction
30 years for all rehabilitation

Engineering and Construction Considerations

Factors used, scoring system, primary factors secondary factors, weights, importance, etc

Factor	Considered	Primary or Secondary	Importance (0 to 5)	Comments
1. Roadway/lane geometrics (lane widths, cross slopes, ability to provide drainage)	Y	P	5	
2. Highway functional class	Y	P	5	
3. Traffic	Y	P	5	
4. Roadway peripheral features (overhead clearance, weigh-in-motion, guardrails, etc)	Y	S	5	
5. Construction considerations				
a. Staging	Y	S	3	
b. Clearance for equipment	N			
c. Construction operations	Y	S	3	
d. Traffic operations during construction	Y	S	5	
e. Construction seasons	Y	S	3	

Factor	Considered	Primary or Secondary	Importance (0 to 5)	Comments
6. Consideration of future maintenance operations (maintenance of traffic, ease of maintenance)	Y	S	3	If the Region wants to sacrifice some of their initial cost funds to save future maintenance costs, they can do that.
7. Performance of similar pavements in the area	Y	S	4	Only if traffic warrants a change. They will tend to build pavements similar to others in a particular area.
8. Availability of local materials, contractor's capabilities, and experienced agency personnel.	Y	S	2	Regional preference.
9. Pavement Continuity				
a. Adjacent sections	Y	S	4	
b. Adjacent lanes	Y	P	4	Very high importance. They would not build differing adjacent lanes
10. Noise issues	Y	S	1	They are not very worried about noise. They have longitudinal tined sections as experiments and like the results. They also have used turf drag instead of tining but FHWA doesn't approve.
11. Subgrade soils	Y	S	2	
12. Climate	N			
13. District or local preference	Y	S	4	Regions can have local preference.
14. Ease of maintenance	N			
15. Recycling	N			
16. Conservation of materials and energy	N			
17. Stimulation of Competition	N			
18. Safety considerations (rutting, friction, lighting, etc)	Y	P	5	Very cognizant of safety.
19. Smoothness	N			

502-3.16 Profilograph. This section applies to profilographed projects and nonprofilographed projects when a full-width finishing pan or triple transverse screed paving operation is not employed, as discussed in §502-2.04B2, Paving Equipment.

Use equipment meeting §502-2.04G, Profilograph. Provide traffic control and survey stationing for referencing measurements. The Engineer will divide the pavement into 160 m long reporting segments, but may group segments shorter than 160 m with previous or subsequent placements. The reporting segment width is the placement width. Develop a profile trace and determine an initial profile index (PI) for each travel lane of each reporting segment. Obtain the trace along the longitudinal center of the travel lane in accordance with Materials Method 24, PCC Pavement Profilograph Operations. Develop a referencing system that allows the Engineer to readily associate a trace and an initial PI to the actual corresponding reporting segment travel lane. Give the traces and initial PIs to the Engineer.

The Engineer will identify bumps exceeding 10 mm in 7.6 m on each profile trace. Locate and diamond grind these bumps, if any, to 10 mm or less in 7.6 m. If no grinding is required for a given reporting segment, the initial PI may be used to determine the payable Quality Units of Smoothness Quality Adjustment per reporting segment, as discussed in §502-4.04, Smoothness Quality Adjustment. Then, up to 10% of any reporting segment's surface area may be ground to increase the amount of Quality Units payable. This 10% includes areas ground to remove bumps exceeding 10 mm in 7.6 m. Whether diamond grinding was required through profile trace analysis, or performed as a Contractor option, reprofilograph the pavement and determine a final PI for each travel lane of each reporting segment. Give the Engineer the final profile traces and final PI determined by using both the 5 mm and zero blanking bands.

The Engineer will report the final PI and payable Quality Units, if any, for each segment as discussed in §502-4.04, Smoothness Quality Adjustment. No Quality Units will be paid for a reporting segment if more than 10% of the segment's surface area requires diamond grinding to achieve the minimum acceptable PI. If more than 20% of a reporting segment's surface area requires diamond grinding to achieve the minimum acceptable PI, production grind the entire segment such that the minimum PI is achieved for the segment.

502-4.04 Smoothness Quality Adjustment (Profilographed Items Only). Quality Units of Smoothness Quality Adjustment, if any, payable for each reporting segment determined by the following:

Quality Units (Per Segment) = (SAF - 1.00) x PCC Cubic Meters (Per Segment)

The Smoothness Adjustment Factor (SAF) from Table 502-5, Smoothness Adjustment Factors, is based on the final PI obtained for each reporting segment in accordance with §502-3.16, Profilograph. Refer to §502-3.16, Profilograph, for diamond grinding limits on Quality Unit determination. No Quality Units are computed for pavements originally specified as nonprofilographed as discussed in §502-2.04B2, Paving Equipment.

TABLE 502-5 SMOOTHNESS ADJUSTMENT FACTORS		
Final Profile Index (mm/km.)	**Level 1 SAF**	**Level 2 SAF**
0.0 - 16.0	1.05	1.05
16.1 - 32.0	1.04	1.04
32.1 - 48.0	1.03	1.03
48.1 - 64.0	1.02	1.02
64.1 - 79.9	1.01	1.01
80	1	1
80.0 +	Grind	1
190.0 +	Not Applicable	Grind

17. Discount Rate (how established)

They use the OMB rate of 4 percent. This will be reviewed with the revised pavement selection methodology.

18. Initial Costs – Estimating procedure

They have a unit price bid book which is updated at 6 month intervals. It contains bid prices for all contract bidders in all regions. The LCCA staff person can call up this information and decide to use averages, filtered values, etc.

19. How does agency determine unit cost to include in the cost analysis (standardized or project by project)? Is the size of the project used in the database considered (economy of scale)? Age of the price data. How often updated.

They have a unit price bid book which is updated at 6 month intervals. It contains bid prices for all contract bidders in all regions. The LCCA staff person can call up this information and decide to use averages, filtered values, etc.

http://www.dot.state.ny.us/cmb/consult/awbpbp/awbpbp.html

20. Are price adjustment factors used for any materials, and if so are they used in the life cycle cost analysis.

Price adjustments are applied to HMA items only. They are not included in the LCCA.

21. Actual cost versus estimated cost (are completed projects evaluated for overruns etc.)

No this is not done.

22. Routine maintenance (how estimated, operations included)

Best guess based on local experience.

23. Rehabilitation (how is timing estimated, techniques used, etc.)

Best guess based on local experience.

Salvage Value (remaining life): Included.
Residual value (recycling): Not included.
Construction traffic control (crossovers, added lanes, barriers, detours, etc.): Not included.
Engineering and administration: Not really considered in initial design as it is assumed that these costs would be similar for all alternatives. They do add a 27 percent overhead cost for future maintenance and rehabilitation treatments.

24. How are users costs weighted in relation to agency costs?

None used. This will change with the expected implementation of the probabilistic approach next year.

25. Vehicle operating costs

None used. This will change with the expected implementation of the probabilistic approach next year.

26. User Delay

None used. This will change with the expected implementation of the probabilistic approach next year.

27. Description of the analysis process

Probabilistic will be used next year. Deterministic is currently being used.

28. Routine maintenance

They use the term "corrective." This includes spall repairs, pothole filling, grass cutting, sign repairs, etc.

29. Preventive maintenance

See Chapter 10 of the Comprehensive Pavement Design Manual. Includes thin surface seals, crack sealing, etc.

30. Rehabilitation

Includes all major items, mill and fill, unbonded overlay, rubblization, etc.

31. What are the state's standard routine and preventive maintenance operation and schedule by pavement type?

Best guess for each project type. No real standard.

> **Allocation of resources between maintenance, rehab, new and reconstruction—** 90 percent focus on rehabilitation, 10 percent on maintenance. Not much in the way of any new construction

32. Do you have a formal system to track pavement condition, cost, and survivability?

Yes. A formal pavement management system is in place.

33. Do you allow old concrete to be recycled? If so into what products? Percentage limits?

Yes, standard specifications allow for recycling of both asphalt and concrete. In HMA, asphalt can be recycled up to 20 percent in surface and intermediate courses and 30 percent in base courses. Concrete can be recycled into base/subbase.

http://www.dot.state.ny.us/specs/2002specbook.html

34. Do you allow HMA materials to be recycled? If so into what products? Percentage limits?

Yes, standard specifications allow for recycling of both asphalt and concrete. In HMA, asphalt can be recycled up to 20 percent in surface and intermediate courses and 30 percent in base courses. Concrete can be recycled into base/subbase.

http://www.dot.state.ny.us/specs/2002specbook.html

401-2.05 Reclaimed Asphalt Pavement. Reclaimed Asphalt Pavement (RAP) will meet the requirements as written in MM 5.16.

304-2.02 Material Requirements. Provide suitable material conforming to the requirements of Section 203 and to the requirements contained herein.

Provide a subbase material which meets the specification material requirements and is within the Contractor's capabilities to place and fine grade to the required tolerances. Should the subbase course become unstable at any time prior to the placement of the overlying course, correct the unstable condition to the satisfaction of the Engineer at no additional cost to the State. Perform any required modification prior to placing the material on the grade.

If used, glass shall conform to the applicable paragraph of Section 203.

If RCA is used and it comes from other than a Department of Transportation project, provide documentation showing that the material obtained is from a NYSDEC registered or permitted construction and demolition (C&D) debris processing facility as specified in Section 360-16.1 of 6NYCRR Part 360, "Solid Waste Management Facilities".

If Blast Furnace Slag is to be used, provide documentation showing that it has undergone a NYSDEC beneficial use determination (BUD) prior to its use as specified in 6NYCRR Part 360-1.15, "Solid Waste Management Facilities".

For Types 1, 3 and 4 furnish materials consisting of approved Blast Furnace Slag, Stone, Sand, and Gravel, or blends of these materials with not more than 30 percent by weight of glass. Alternately, the following materials are also acceptable under these types as a replacement for the materials mentioned above:

- Alternate A. At least 95 percent, by weight, of RCA, and free from organic and other deleterious material. This material may contain up to 5% by weight asphalt and/or brick.
- Alternate B. A mixture of RCA conforming to Alternate A above mixed with stone, sand, gravel or blast furnace slag. This material may contain up to 5% by weight asphalt and/or brick.
- Alternate C. Bituminous material that is reclaimed from bituminous pavement and/or shoulders (Reclaimed Asphalt Pavement, or RAP) on a project constructed by the Department of Transportation and is well-graded from coarse to fine and free from organic or other deleterious material, including tar. This material is at least 95 percent, by weight, reclaimed bituminous material and has a maximum top size, at time of placement, of 50 mm. The gradation requirements for the different Types listed below do not apply when the material consists of RAP. No soundness or Plasticity Index testing will be required for this Alternate.

For Type 2, furnish materials consisting of approved Blast Furnace Slag or of Stone which is the product of crushing or blasting ledge rock, or a blend of Blast Furnace Slag and of Stone.

If, in the opinion of the Regional Geotechnical Engineer, this material becomes unstable during construction, it may be necessary to add a mixture of natural suitable material to the RAP. Acceptance of the final product shall be based on an evaluation by the Regional Geotechnical Engineer.

Provide written documentation that the reclaimed bituminous material originated on a Department of Transportation project. Include an identifier, such as State Highway, Construction Contract or Departmental Project Identification Number (PIN).

Purpose

The purpose of this interview is to gain insight into the following Ontario Ministry of Transportation practices:

- Pavement type selection
- Engineer's estimate and life cycle cost analysis
- Other items that affect cost

Agency Interviewed

Ontario Ministry of Transportation
1201 Wilson Avenue
Central Building, Room 232
Toronto, Ontario M3M 1J8
CANADA

Person(s) Interviewed

Name	Title	Phone	Email
Tom Kazmierowski	Manager, Pavements and Foundation Section	416-235-3512	Tom.Kazmierowski@mto.gov.on.ca

1. Do you have a documented pavement type selection procedure for:

New Construction: Yes – ERES Report
Reconstruction: Yes – ERES Report
Rehabilitation: Yes – for major rehabilitation - ERES

2. How long have you used the current type selection procedure?

1998 but other processes before that to the early 1970s.

3. Changes made over the last 5 years:

A Geokom document spells out the need for pavement alternative selection for all projects.

What prompted the change? The change was prompted by changes in technology and the desire to go to alternative bidding.

4. Have you used alternative bidding as a means of making a pavement type selection during the past 5 years? If yes describe the process. Was alternate bidding used on a Federal-aid project? If so, what was the basis of FHWA's approval?

Yes. Alternative bidding was used for one project to date. All current projects that are at least 10 km in length and have at least 1 million ESALs in the design lane or are likely to have 1 millions ESALs in the design lane in the next 5 years are serious considered for alternative bid.

5. Importance and extent of industry involvement in the development of type selection process?

This is very important to MTO. The industry (Cement Association of Canada) and the Ontario Hot Mix Producers Association has been extensively involved in the pavement type selection process and sit on the evaluation committee. This is an on-going process and the committee met this week in Toronto to discuss developments including the expected inclusion of user costs. They are also consulted on new technology developments and specification changes.

6. How was the selection process implemented within the agency?

It is done early in the process and is an integral part of the design process. It generally follows the schematic outlined in AASHTO 1993. Industry and consultant teams are involved in the implementation.

7. How is the type selection process related to the overall project selection, budgeting, planning process used by the agency?

It is done early in the process and is an integral part of the design process. It generally follows the schematic outlined in AASHTO 1993.

8. Pavement types used for new construction or reconstruction over the last 5 years

Pavement Type	Approximate lane miles		Performance (Good Fair Poor)
	Interstate	Other 4 lane	
Full depth ACP	< 1 %		Fair
Deep Strgth ACP	95 %		Good
ACP(less than 6") agg base	0		
Jointed Plain (JPCP)	<5 %		Good
Jointed Reinforced (JRCP)	0		There are old JRCP but they are all now composite as they have been overlaid with HMA.
Continuously Reinf. (CRCP)	0		

9. Thickness design procedure used and design life (if AASHTO which version)

ACP:
AASHTO 1993 Modified for Ontario Conditions
Ontario Pavement Analysis of Costs
MTO Routine Method for low volume roads
PCCP:
AASHTO 1993 Modified for Ontario Conditions
Ontario Pavement Analysis of Costs
Portland Cement Association