Kimley-Horn
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FINAL

METRO-DADE ROAD PRICING STUDY

prepared for:

METRO-DADE METROPOLITAN PLANNING ORGANIZATION

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EXECUTIVE SUMMARY

INTRODUCTION

Kimley-Horn and Associates, Inc., in cooperation with the Metro-Dade Metropolitan Planning Organization (MPO) and its designated steering committee, has studied the issues and potential solutions involving the County's growing traffic congestion. This study has specifically examined this urban congestion problem from a road pricing (supply and demand) perspective. In other words, can the County's congestion be partially mitigated through creative pricing solutions that would provide motorists, particularly single occupant vehicles (SOV), with financial incentives sufficient to alter their travel behavior? The results of that analysis and the ensuant recommendations are summarized in the following paragraphs.

What is Road Pricing?

Road pricing is simply imposing a toll on road users. It is a user fee. The more one uses the toll facility, the more one pays. The user has the option of *not* using the toll facility.

What is Congestion Pricing?

Congestion pricing is a subset of road pricing. The value of the roadway network is higher in the peak periods, as demonstrated by the higher demand during peak hours. Even though the value is higher, no one "pays" for this higher value except through congestion "taxes"... perhaps the cruelest tax, if you're the one in the ambulance that cannot reach the emergency room in time. Congestion pricing simply involves placing premium or congestion tolls on roads, airport gates or other congested assets during peak periods. These higher user fees are customarily designed to 1) discourage peak usage and reduce congestion, and 2) increase revenues to improve peak capacity of the congested assets.

Does Road Pricing Mean Toll Booths on All Highways?

It generally does not make sense to place tolls on all highways. Only carefully selected roads should be tolled at all. Secondly, modern technology has evolved to a point where toll booths are almost obsolete: tolls can be electronically credited, debited or billed to the road user's "smart card" account (a special transponder that automatically identifies the user). Enforcement can be electronic and semi-automatic, or fully automated, too. Eventually, toll booths will disappear entirely.

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Is Road Pricing Fair?

As a user fee, road pricing is judged to be one of the fairest forms of pricing because the fee paid increases/decreases with usage. There is also the option of not using the toll facility. "Free" roads are almost always available. Special hardships sometimes do occur. These must be dealt with by issuing special passes or discounted passes for the transit or highway system. The best technique might be to offer free transit passes and discounted road user passes for the economically disadvantaged.

Congestion Pricing and Current Federal Law

The Intermodal Surface Transportation Efficiency Act (ISTEA) was signed into law on December 18, 1991. This Act authorizes the use of Federal funds to be allocated for a wide-range of transportation programs throughout a six-year period (1992-1997). Section 1012(b) of the ISTEA authorizes the Secretary of Transportation to create a Congestion Pricing Pilot Program by establishing agreements with up to five state or local governments or public authorities to conduct and monitor congestion pricing pilot projects. Three such agreements may involve the use of tolls on the Interstate System. Annual funding for this program is $25 million of which no more than $15 million may be allocated to any single entity in a given year. The intent of this program, as further defined by FHWA, is to use congestion charges to encourage driver behavior in a manner that will promote the use of alternative times, routes, modes or trip patterns to reduce congestion. These charges shall be direct point, time-of-travel charges varying by location and/or time.

Since initially receiving proposals in February of 1993, many proposals and pre-project proposals have been submitted to the Federal Highway Administration (FHWA), but none has been formally selected to participate in the Congestion Pricing Pilot Program. Failure to meet the request's criteria, insufficient public involvement programs, and lack of local public/political support appear to be the primary reasons that no projects have been selected. As a result, the FHWA is working very closely with the local entities which have submitted proposals in order that this pilot program may become a reality. Should the Metro-Dade MPO decide to pursue congestion pricing as a road pricing strategy, participation in this Pilot Program would be extremely beneficial during the formative years of the new Dade County Expressway Authority.

Reasons for the Study

The logical reason for implementing any road pricing program is economic. Congestion suffered by individual motorists also increases the less tangible social costs of accidents, pollution, and other services such as emergency medical, police, and the court system. These costs, ranging from 32 cents to 71 cents per vehicle mile, are not perceived by individual road users. Therefore, if drivers could be exposed to these additional social costs through the payment of tolls, a more efficient road system results, and the total system benefits would exceed the total system costs.

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Due to limited resources and insufficient right-of-way to build additional expressway facilities, the MPO has commissioned this study of road pricing strategies, including transit alternatives involving high occupancy vehicles (HOV's), to address increasing traffic volumes. One of the main objectives of this study is to investigate the potential of creating a revenue base for the construction of new road pricing facilities and for funding transit. These road pricing strategies were developed in response to new federal requirements contained in the *Intermodal Surface Transportation Efficiency Act of 1991* which now mandate certain compliance measures aimed at curbing air pollution while improving urban mobility.

ROAD/CONGESTION PRICING STRATEGIES

There are six basic pricing strategies that can be employed for any road/congestion pricing program:

1. **Static Pricing, 24 Hours** - Static pricing is road pricing in its simplest form. This consists of a fixed toll which is charged to vehicles along a roadway, at an on or off ramp, at a mainline barrier, or on a causeway. (Tolls can be levied at several locations along the roadway.) Being "static," the amount of toll paid by a particular type of vehicle remains fixed 24 hours a day. The toll collection technique for all strategies are assumed to initially be a combination of manual and electronic--and evolving to almost fully electronic toll collection (ETC).

2. **Static Pricing, Peak Period Only (PPO)** - Similar to strategy number one, except that the toll is only applied at one flat rate during designated predetermined peak periods. Off-peak travel is "free."

3. **Fixed Time, 24 Hour Congestion Pricing** - This strategy has one significant difference from the static 24 hour pricing strategy. In this case, the toll rate will be higher in the peak periods and lower the rest of the day. Within the peak period, the toll rate may change one or more times within predetermined time slots in the peak period. For example, the toll rate may be 25¢ during off-peak periods, 35¢ from 6:00 AM to 7:00 AM and 50¢ from 7:00 AM to 8:00 AM, etc.

4. **Fixed Time, PPO Congestion Pricing** - Similar to strategy number three, however, the tolls are variable during the designated peak hours and peak hour fringes (periods immediately preceding and following the peak period). The toll rates may increase from 25¢ to 35¢ at 6:00 AM, then move upwards again at pre-prescribed times to 40¢ and 50¢ as congestion increases within the peak period. Off-peak travel is "free."

5. **Realtime, 24 Hour Congestion Pricing** - This is the most advanced form of congestion pricing. It is similar to strategy number four, however, the tolls are applied all day and the tolls vary in response to actual congestion present on the road at the time of travel. Actual

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congestion levels can be determined using advanced techniques such as embedded freeway loop detectors or video image detection technology. Other dynamic toll structures, based on vehicle occupancy and vehicle type can also be implemented in a similar manner.

6. **Realtime, PPO Congestion Pricing** - Similar to strategy number five, with the tolls only being applied during the peak periods, when congestion beyond a certain predefined tolerance is detected automatically by the system, and toll rates are automatically changed in response to realtime system demand/performance profile. Motorists are notified of impending toll rate changes via variable message signs (VMS).

The strategies to be used for any particular road/congestion pricing program depend on the local conditions. Furthermore, strategies 5 and 6 are still in the development stage, and will require advanced detection, control and other Intelligent Transportation Systems (ITS) equipment to implement. Although Automatic Vehicle Identification (AVI), automated occupancy detection, and other such ITS technology exists to implement these pricing strategies, there are very few examples in use. As freeways become more "intelligent," tollroads will continue to move toward real time congestion pricing and away from static and fixed time pricing.

The above six road pricing strategies can be applied to either the entire freeway (or causeway), or only along any HOV lanes that may be present. Therefore, a total of twelve road pricing techniques are available. The HOV lane pricing options involve four possibilities:

1. **Add a Lane** - Adding a lane to an existing facility for exclusive HOV use.

2. **Take a Lane** - Taking an existing lane from a facility and converting it from general use into HOV use. This option is politically very aggressive and often quite difficult to impose.

3. **Add and Take a Lane** - A combination of the above two options. This option involves widening a facility to accommodate a new HOV lane, while at the same time, converting an existing general use lane for exclusive HOV use. The option can be controversial if not handled properly through effective public information processes.

4. **Ramp Metering Bypass (RMB) Lane Pricing** - A ramp metering system is currently under design for I-95 in Dade County. This system is designed to optimize freeway flow. Selected ramps could have bypass lanes for buses and carpools, who may bypass the queue at the ramp meter signal by using a parallel lane. SOV's may also be permitted to use the bypass lane--at a price, and only if the SOV is equipped with an AVI transponder to enable the toll to be electronically exacted.

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Levels of Aggressiveness

As indicated previously, certain road pricing strategies can be more aggressive and controversial than others. The degree of aggressiveness of any particular strategy can be classified from very conservative to ultra-aggressive. The level of aggressiveness for any road pricing strategy also depends on the toll rate that is used. An aggressive plan would generally implement tolls at a high rate, say 10¢ to 15¢ per mile, while a conservative plan may charge 7¢ to 10¢ per mile. Research by the authors has shown that major metropolitan markets can sustain optimum toll rates averaging between 10¢ to 15¢ per mile during the off-peak period and 20¢ to 25¢ per mile during the peak period.

Toll Collection Systems

The collection systems involved with traditional road pricing include manual toll booths in combination with automatic collection systems using pre-sold decals. Electronic Toll Collection (ETC) systems are coming of age with technological advancements in both hardware and software. One form of this technology is the Automatic Vehicle Identification (AVI) system. This technology uses both credit and debit collection systems in combination with manual collection techniques for users who do not have the automatic payment equipment installed in their vehicles.

The consultant team is supportive of the rapid implementation of AVI/ETC technology on all new and existing toll facilities. For the purposes of this study, it is recommended, and it was assumed that any new toll facilities would be constructed with AVI/ETC equipment, and existing facilities would be converted to uniform AVI/ETC facilities on a countywide basis.

Uses of Funds

Potential applications for use of road/congestion pricing revenues are many with the goal being to advance the state-of-the-art for improved congestion management. The following list summarizes some of the more popular funding opportunities with state and federal governments.

- Additional, revenue-producing road pricing projects, such as the SR 112 extension and other unfunded projects.
- ITS projects, including AVI/ETC hardware and software applications, either for capital or operating costs.
- Fixed guideway transit or commuter rail, or high speed rail projects, either for capital or operating improvements.
- The acquisition or operation of express bus routes and park-ride facilities, possibly as part of an HOV lane pricing project.
- Any HOVL or busway project, especially those that promote a reduction in SOV's.

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Congestion pricing revenues derived from one facility are generally used to improve operations in the immediate corridor. However, they could also be used in other corridors to promote regional improvements.

The use of pricing revenues must be placed in proper perspective during the decision-making process for selecting the appropriate strategy. The intended use of funds could mollify the degree of aggressiveness assumed for a pricing strategy.

For example, the placement of a peak period only toll on I-95 and the Palmetto Expressway would normally be considered "very aggressive" or "ultra aggressive." However, if the funds generated could change the outcome of the NW 27th Avenue extension of the Metrorail Extension from "not feasible" to "feasible," then the acceptability of the pricing strategy might be judged less harshly.

PACKAGING PROJECTS INTO PLANS

Numerous combinations of eligible roadway facilities and congestion pricing strategies were considered in structuring packages and sub-packages of congestion pricing projects. Initially eight packages of projects were developed from the eligible facilities previously identified. Subsequently, those categories were reduced to four by combining those that were similar. The resultant road pricing plans were: Do Nothing, Conservative, Moderate, and Aggressive.

RECOMMENDATIONS

Based on the program's evaluation factors in combination with the projected revenue, it is recommended that Dade County implement (in phases) the Moderate Package of congestion pricing strategies. Table I shows the evaluation of the four (4) plans and the Year 2030 Net Present Values (NPV) of the revenues in 1994 dollars. Figure I shows the recommended plan at the end of its full implementation. It must be noted that a phased implementation of this plan is recommended, and Figure I only shows the final phase, which includes strategies implemented in previous phases.

TABLE I
PLAN EVALUATION

	Evaluation	Year 2030 Net Present Value
Do Nothing	Poor	$ 0.2 Billion
Conservative	Good	$ 1.5 Billion
Moderate	Very Good	$ 6.2 Billion
Aggressive	Good	$ 13.0 Billion

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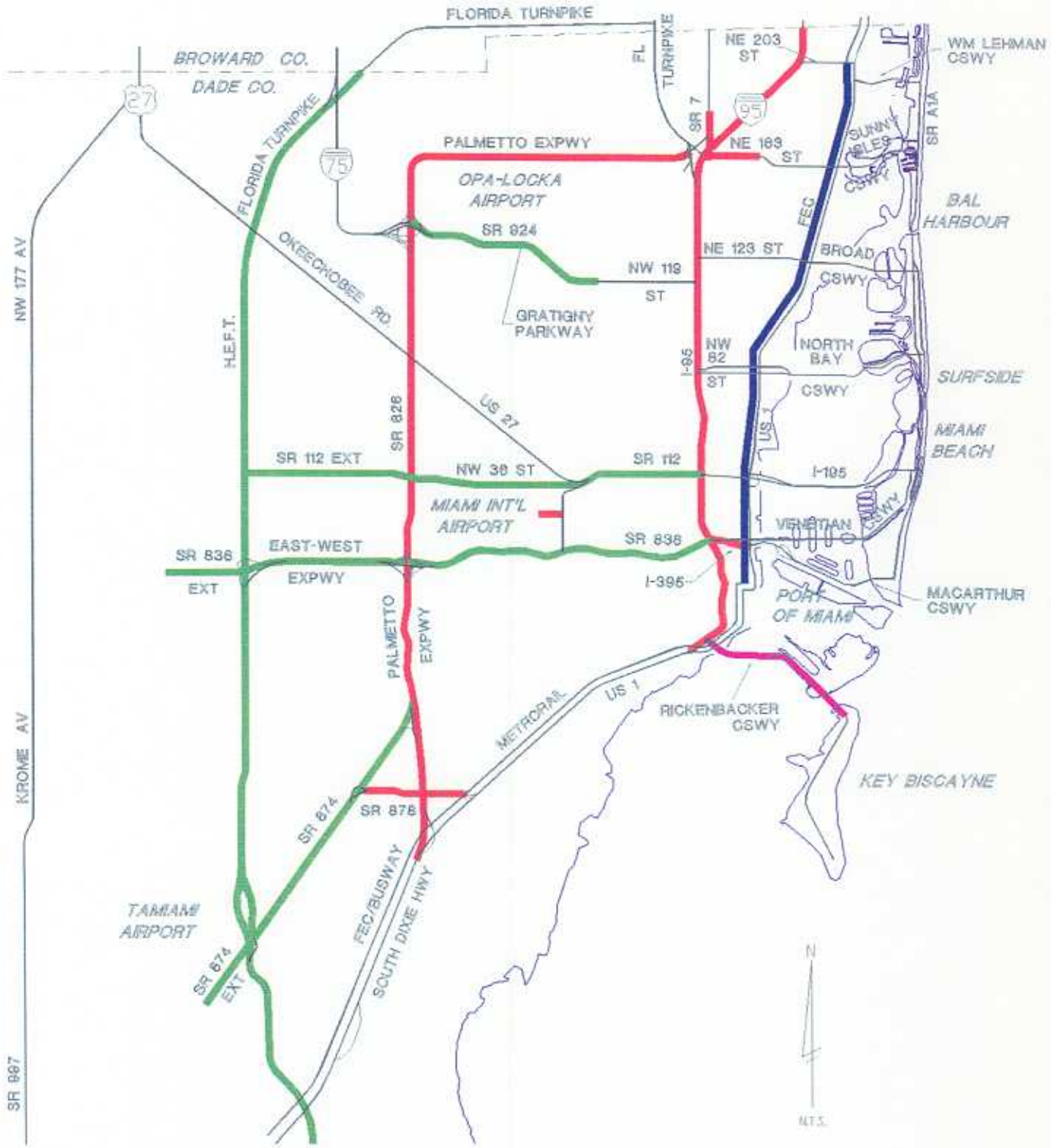

LEGEND

- 24 HOUR TOLL (CONGESTION PRICING)
- BUSWAY/HOV-WAY - ADD 1 LANE
- PEAK PERIOD ONLY PRICING
- WEEKEND CONGESTION PRICING

FIGURE I

METRO DADE ROAD PRICING STUDY

MODERATE ROAD PRICING PACKAGE

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All recommendations are being made at a sketch-planning level of analysis. Therefore, each project recommendation should be confirmed by a detailed, project-specific feasibility study prior to its implementation. In general, the recommendations developed as part of this study are the result of the following considerations:

1. The MPO should adopt a road pricing policy for Metro-Dade County.

2. Certain strategies, such as raising tolls on existing toll facilities up to reasonable national norms, should be instituted as soon as possible to create more revenue for modernizing existing toll operations in the short term, and creating capital for more assets in the long term.

3. All existing toll facilities should be converted from manual operation to automated AVI/ETC operation as soon as possible to reduce operating costs and increase net revenues.

4. All toll facilities (city, county, and state) should utilize consistent AVI technology, such as that being deployed by Florida's Turnpike, to reduce operating costs and increase net revenues. A centralized computer-based management control center for all city, county and state toll facilities should be implemented to further reduce operating costs.

5. An application should be made for federal funding under the ISTEA (Section 1012(b)) Congestion Pricing Pilot Program for selected elements of the Metro-Dade Road Pricing Plan, including: AVI technology and congestion pricing.

6. To effectively deal with Year 2030 traffic volumes, Dade County must implement certain congestion pricing strategies regardless of their political and/or social "acceptability".

7. In the final analysis, the "best" package is one consisting of a good balance between public acceptability and revenue generating ability.

The following list summarizes recommended specific road pricing projects by phase over the next 15 to 20 years. These projects are also shown in Table II.

Phasing

- Phase 1 (2 years) 1995 - 1996

  - Convert all existing tolled facilities to AVI/ETC.
  - Apply for FHWA grant under the Congestion Pricing Pilot Program and implement congestion pricing on selected facilities in 1996-97.

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- Increase existing 24-hour tolls (first to 7¢/mile and then to 12¢/mile) on all existing tolled expressways including a new toll plaza on SR 836 west of SR 826 and bi-directional tolls on existing SR 836/SR 112 plazas in 1995-96.
- Build 2 "priced" HOVL's (3 passengers or more) on SR 826.
- Prepare PD&E studies and obtain location/design approval of the SR 112 Extension, the SR 836 Extension, and the SR 874 Extension.
- Implement weekend/holiday congestion pricing on the Rickenbacker Causeway in 1996.

• Phase 2 (4 years) 1997 - 2000

- Implement congestion pricing on all existing tolled expressways.
- Implement ramp-metering bypass pricing on I-95.
- Construct the planned freeway extensions: SR 836, SR 874, SR 112 and implement congestion pricing.

• Phase 3 (5 years) 2001 - 2005

- Take a lane on I-95 and implement HOVL pricing (2 HOV lanes in each direction, total).
- Take a lane on SR 826 and implement HOVL pricing.

• Phase 4 (5 years) 2006 - 2010

- Apply PPO congestion pricing to all "generators" including (AM peak) approaches to the Golden Glades interchange, and the entrance to the Miami International Airport.
- PPO congestion pricing on all existing non-toll freeways.
- Construct U.S. 1/Biscayne Boulevard busway/HOV-way and sell the surplus capacity to SOV's at a premium.

ARTERIAL IMPACTS

A diversion analysis was conducted to determine the impacts that the Moderate Road Pricing Package may have on Dade County's arterial roadway network. The volumes and LOS for the Year 2000 Existing+Committed network were compared to the volumes and LOS for the Moderate Package network to determine the significance of the traffic diversion.

The diversion analysis indicates that the addition of tolls (as identified in the moderate road pricing plan) to currently untolled facilities produces significant diversions of traffic to parallel arterial streets. The amount of diversion varies substantially from facility to facility, anywhere from 20% to 70 %, largely based upon the alternative routes available.

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However, the analysis shows that the LOS on the parallel arterial facilities on almost all the segments analyzed does not exceed LOS "D." There are only three segments where the LOS falls to "F" after the tolls are imposed. It can therefore be concluded that there is a significant amount of unused capacity on arterial streets that is more efficiently utilized once these tolls are imposed.

The peak hour conditions are expected to be more severe on the arterial streets, since currently, there are already some capacity problems on these facilities. In general, the amount of peak hour diversion desired can be managed by the toll rate that is in effect during these hours. Pricing can be used as an effective management tool, and the ability to control the toll rates on a real-time basis in the future will further enhance this tool.

CONCLUSION

Further detailed study is needed to confirm or deny the rough sketch planning estimates of revenue and net present value. It is recommended that detailed project-specific road pricing feasibility studies, implementation plans, and project-specific concept development reports be prepared for all the projects listed above before implementation of any of these sketch planning recommendations.

A comprehensive public involvement and public relations program should be undertaken to educate and inform the affected communities. In addition to this, an administrative program to balance/equitably distribute the economic impact should also be designed in detail.

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Table II

SUMMARY OF RECOMMENDED ROAD PRICING PROGRAM

Criteria	Phase 1	Phase 2	Phase 3	Phase 4
STRATEGIES	Increase tolls on all tolled expressways and implement AVI/ETC Add one lane in each direction for HOV use and implement HOV lane pricing Apply for FHWA Congestion Pricing Grant	Implement congestion on tolled expressways Ramp metering bypass pricing on I-95 Construct all planned freeway extensions and implement congestion pricing	HOV lane pricing - Take-a-lane strategy	Congestion pricing of all "generators" PPO pricing of non-toll freeways Busway / HOVway Pricing Busway / HOVway Pricing
KEY FACILITIES AFFECTED	Florida Turnpike HEFT Gratigny Parkway SR 112 SR 836 SR 874 SR 826	Florida Turnpike HEFT Gratigny Parkway SR 112 SR 836 SR 874 I-95 SR 112 Extension SR 836 Extension SR 874 Extension	SR 826 I-95	MIA Golden Glades Interchange I-95 SR 826 SR 878 US 1/Biscayne Blvd

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CHAPTER 1
INTRODUCTION

1.1 Introduction

An efficient and effective transportation infrastructure is a key factor in the economic well being of any community, state, or country. It is the transportation infrastructure that provides the means by which goods, services, and people can be moved between the activity points within the community. Because of this function, the efficiency and effectiveness with which the transportation infrastructure operates can have a significant impact on the health and growth potential of the community it serves.

A community with an inadequate and poorly maintained transportation infrastructure will have a difficult time keeping its existing economic base businesses and industries and an even more difficult time attracting new ones. Existing companies will begin to seek new locations for their operations as the use of the community's inadequate transportation network becomes more costly and frustrating. Additionally, businesses considering moving to the community may decide to look elsewhere for a location with an infrastructure and network that will allow them to operate in a more efficient and profitable manner.

On the other hand, a community that maintains an efficient and effective transportation network will have an enhanced ability to grow and prosper. Maintaining and improving the transportation system also provides its own direct economic stimulus by putting people to work.

Today, most urbanized areas throughout the United States are finding it increasingly difficult to maintain an adequate transportation network. The problems facing these areas include ever increasing traffic congestion, declining air quality, and fierce competition for funding. Although these problems are difficult to solve, creative solutions will likely involve two key strategies: 1) congestion management, and 2) generating new revenues from which to fund enhanced or new facilities. Road pricing and congestion pricing are two techniques which focus on these two strategies. As a result, interest in these techniques has been growing rapidly in recent years.

1.2 Economic Theory

The case for implementing congestion pricing can be made by examining the economics of a freeway system. It relates to the overall efficiency with which congested road networks are used.

As demand to use a freeway increases, speeds decrease, adding to the private cost to individual users. Drivers decide to use the freeway if their personal benefits are equal to or greater than their costs.

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The traffic volume on a freeway is determined by the point at which the user benefits and the user costs are in equilibrium.

With falling speeds, each additional user not only further reduces speeds, but imposes additional social costs. These costs include additional delays, accidents, air, water and noise pollution, and degrade public services such as emergency medical service, police and the court system. These social costs can be substantial. Research has shown that the combined social costs of a congested freeway range between 32 cents and 71 cents per vehicle-mile.[1] The individual driver generally does not perceive these costs and decides to travel even though the total system costs exceed the total benefits. The fact of the matter is that highway infrastructure is more valuable during peak periods than off-peak periods. However, this increase in value is not reflected in the cost of usage. As a result, a very large, and growing demand-supply imbalance is produced in the peak periods of every major western city.

This is a situation where an additional private cost, or "toll" can be imposed. If all freeway users were charged a toll equal to the social costs of their trip, efficiency of the freeway, according to economic theory, would be maximized. A driver exposed to this additional cost, must then decide whether or not the benefits derived from the use of the transportation network warrant the additional cost.

Once the cost of freeway usage becomes "perceived" by the motorist, more rational and economically productive decisions are created:

1. Truckers and business persons who can make the tolled trip "pay" for itself will use the tolled highway. They will be able to use it in a more efficient and economically productive way, since traffic flow conditions will improve because of those "tolled-off" the freeway.

2. Motorists that don't really need to make the trip at that price will often defer, delay or suppress the trip. This results in less travel and less air pollution.

3. Some motorists will decide that the cost of the transit fare is cheaper, and elect to use the transit system. New transit usage is created.

4. The new revenues created can be used to fund:

[1]De Corla-Souza, Patrick and Anthony Kane. "Peak Period Tolls: One Cure for Urban Congestion." Compendium of Technical Papers for the 61st Annual Meeting of the Institute of Transportation Engineers, September 1991.

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a. more road-pricing options to create even more revenues, and
b. new transit services and new transit assets to attract more transit usage.

At the same time, it must be recognized that economic inequities can be produced by road pricing for the economically disadvantaged. Modern road pricing strategy provides some methods to overcome this valid concern:

1. First, alternative "free" (often less congested) routes are always available to all users.

2. Second, transit passes or toll "passes" (transponders) can be discounted and given or sold to the qualified economically disadvantaged population.

In summary, road pricing, and particularly congestion pricing, are two of the most powerful behavior-modification tools available in the realm of travel behavior. Perceived, out-of-pocket costs can produce large-scale changes in road-user behavior and simultaneously solve the demand-supply problem in a two-fold manner:

1. by increasing the perceived cost, demand can be reduced, and

2. by increasing revenues, new supply-side assets can be created.

1.3 Overview of the Report

The overall purpose of this study is to identify, on a preliminary basis, several promising road pricing strategies and possible application sites in Dade County.

Chapter 2 provides a brief discussion of the issues and economic rationale associated with the congestion pricing and road pricing concepts. Also included in this chapter is a summary of interviews conducted with entities either planning or currently operating congestion/road pricing programs. These interviews were conducted at the national as well as international level.

Chapter 3 presents the goals, objectives, and evaluation criteria of a road pricing and congestion pricing program. These are not specific to Metropolitan Dade County but would apply to most transportation pricing programs throughout the world.

Pricing strategies for a congestion pricing program are developed and presented in Chapter 4. These strategies range from "very conservative" (small increases in existing tolls) to "ultra aggressive" (24-hour pricing of selected major highways).

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Eligible facilities within Metropolitan Dade County are identified in Chapter 5. These facilities include existing tolled expressways as well as major arterial streets.

In Chapter 6, pricing strategies and eligible facilities are combined to form project "packages" and "subpackages" which are classified according to their respective levels of aggressiveness. Revenue forecasts for the project packages are developed and presented in Chapter 7. And finally, a summary of findings and recommendations is presented in Chapter 8.

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CHAPTER 2
ROAD PRICING CONCEPTS

2.1 Congestion Pricing

The cost of a trip on a transportation facility includes the traveler's time and vehicle operating costs as well as the impact on other travellers by adding to the level of congestion. A congestion price is a user fee based on the difference between the perceived cost and the actual cost imposed on other users as a result of additional delay. "Congestion Pricing" is a method of road pricing which implements time-of-travel charges for roadway use which can vary by location, time of day, and/or vehicle occupancy. The goal, in addition to raising sufficient revenue, is to reduce congestion, improve air quality and economic efficiency, conserve energy, and shift traffic to off-peak periods, to other modes of transportation, to higher occupancy vehicles, or to less congested routes.

One example of congestion pricing is the charging of different toll rates by time of day. For example, a causeway toll rate could be double the regular rate during the morning and evening peak periods. This strategy discourages travel during the peak hours, and therefore could be used to manage congestion levels on the causeway.

A more creative example of congestion pricing would be to charge Single Occupant Vehicles (SOV) a fee to use under-utilized High Occupancy Vehicle (HOV) lanes during the peak traffic periods. This strategy, sometimes referred to as "selling excess HOV lane capacity" has a number of benefits. First, it derives additional transportation revenues for use in maintaining existing facilities or constructing new HOV lanes. Second, it balances facility utilization by increasing the volumes within the HOV lanes so that they are better utilized. Third, congestion relief is provided in the SOV lanes by diverting some of the traffic that is willing to pay a premium for using the HOV lanes. Finally, air and noise impacts are reduced due to the traffic operating at a higher Level of Service (LOS).

It should be noted that road pricing is only one of several ways to increase revenue for transportation purposes. While this report focuses on road pricing, it is not our intent to suggest that this is the preferred method for increasing transportation revenues. Motor fuel taxes and other pricing mechanisms such as sales taxes were not comparatively analyzed nor included within the scope of this study. This report does, however, analyze a variety of road pricing applications and strategies and identifies eligible facilities for the possible application of these strategies. In the final analysis, any revenue stream derived from the implementation of road pricing strategies must be optimally blended with other new sources of revenue to completely achieve the County's strategic transportation objectives.

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The variety of road/congestion pricing options is almost limitless. The list below presents some strategies identified by the Federal Highway Administration:

• Fixed Point Tolls:	Tolls collected at fixed intervals along a freeway or causeway.
• Regional/Area-wide Tolls:	Tolls implemented at several critical locations to have a regional congestion management impact.
• Corridor Tolls:	Tolls implemented along congested corridors on one or more parallel facilities.
• Congestion Generators:	Tolls implemented at entrances to major congestion generators such as airports.
• Existing or New & Public or Private Toll Facilities:	Tolls implemented on expressways.
• Area Licensing:	Tolls charged usually at several entry points into a large area such as a CBD.
• Peak Period Discounts:	Strategy usually used on transit alternatives, particularly LRT and busways, to encourage transit use.
• Sales of Excess HOVL Capacity:	Allow SOV's to use the HOV lanes at a premium rate.
• Area-wide Parking Charges:	A strategy that is generally applicable in certain areas such as a theater or historic district.
• Graduated Pricing:	Pricing that varies with congestion levels. Realistically can only be used in combination with AVI technology.

This report presents a broad, but finite, array of policy choices and their consequences. The ultimate policy decision will involve balancing trade-offs between the positive and negative impacts derived from implementing a comprehensive road pricing plan. Ultimately, this report should result in a conscious decision by the County to either maintain the status quo, or adopt some level of aggressiveness by including a road pricing element in the Comprehensive Development Master Plan.

The strategies described above have differing degrees of aggressiveness. Some, such as area licensing, are much more controversial than others, as they could have significant consequences for business in the area. Others, such as fixed point tolls, have a long history of implementation and as a result, are much less controversial.

2.2 Equity

A congestion pricing program that effects the desired congestion level goals would have negative implications for lower income households. This would be particularly true for work trips, which would be hardest hit by congestion pricing, since these trips generally occur during the peak periods.

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The impact on lower income groups would be disproportionate to the relative benefits received by these groups, unless countermeasures or "special benefit payments" (rebates) were implemented to offset this impact. Such countermeasures might include the following:

- Discounted rates for lower income groups. This can be implemented by accessing the existing welfare system database. Persons currently eligible for food stamps or other welfare payments could receive discount toll cards for use on the toll facilities.

- Allow a portion of the revenues derived from the congestion pricing program to be used to subsidize transit fares for lower income households.

2.3 Impacts of Road Pricing

In addition to the equity issues described above, there are both positive and negative impacts associated with the implementation of a road pricing program. These include impacts on revenue yield, roadway congestion (on the subject facility as well as the adjacent street system) the environment (primarily air quality), beach residents and workers, and the tourist industry. Impacts on these elements and various economic groups have been analyzed in a qualitative manner and the results are presented in Table 2.1.

2.4 Literature Search and Current Applications

Kimley-Horn undertook a literature search of the congestion pricing subject. The search was conducted using the Transportation Research Information Service (TRIS), which searches several United States and European databases for articles on a given topic. The resulting data includes the name, author, source, and abstract of the related articles. This information is included in Appendix A of this report.

In addition to the TRIS literature search, detailed research was conducted by Kittelson & Associates, Inc. on existing or planned congestion pricing programs. This effort details programs in Singapore, Hong Kong, Norway, and also the United States. A comparison summary of all the programs is shown in Table 2.2. This report is attached as Appendix B.

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TABLE 2.1
ROAD PRICING IMPACTS

Category	Do Nothing	Increase Tolls on Existing Toll Facilities[1]	New Tollroads[2]	HOVL Pricing[3]	Toll Existing Non-Toll Causeways[4]	Toll Existing Non-Toll Freeways	Toll Arterial Streets
Revenues	0	1	2	1	1	3	3
Congestion							
- On expressways/causeways	-3	1	2	1	1	3	-1
- On adjacent arterial streets	-1	-1	2	0	0	-2	-2
Environment	-1	1	-1	1	0	2	2
Social/Financial							
- Beach residents	0	0	0	0	0	0	0
- Low income persons[5]	0	0	0	0	0	0	0
- Moderate income persons	0	-2	0	0	-2	-2	-2
- High income persons	0	-1	0	0	-1	-1	-1
- Tourists	0	-1	0	0	-2	-2	-2
- SOVs	0	-1	0	-2	-2	-2	-2
- HOVs[6]	0	0	0	2	0	0	0

Scale:

	Negative Impacts			No Impacts		Positive Impacts	
-3	-2	-1	0	1	2	3	
Worse ←	----------	----------	----------	----------	----------	----------	→ Better

Notes:
[1] Assumes no increases in the number of toll roads.
[2] Includes tollroads on new alignments, plus increasing tolls on existing toll roads, coupled with added capacity.
[3] HOVL pricing involves adding HOVL capacity to an existing freeway or arterial, sometimes by taking an existing SOVL, and sometimes adding lanes for HOV usage.
[4] Beach residents and low income persons travel free.
[5] All low-income households receive discounted or free access to transportation facilities.
[6] HOV3s would always receive free travel under the proposed pricing schemes.

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TABLE 2.2

CONGESTION PRICING PROGRAMS
SUMMARY TABLE

ITEMS	SINGAPORE	HONG KONG	BERGEN	OSLO	ORANGE COUNTY	SAN FRANCISCO
TYPE	Area Licensing Scheme 33 entry points Manual toll collection	Area Licensing Scheme 18 toll points, plus higher gas taxes, registration / licence fees	Area Licensing Scheme Random video surveillence	Area Licensing Scheme Inbound-only 18 gates, video surveillence	Corridor Pricing Scheme New toll facility, includes ETTM collection	Bridge Pricing Scheme Existing tolls will be replaced variable tolls, including ETTM
START	June 1975	March 1983	January 1986	February 1990	Expected to open in 1995	Pending approval
GOALS	Reduce congestion 25-30% Slow vehicle ownership Encourage transit use	Reduce traffic Observe driver behaviour Test ETTM technology	Fund road improvements and additional roads	Fund road improvements and additional roads	Increase throughput and person trips, encourage car pooling	Reduce congestion, increase mobility, influence behaviour, demonstrate congestion pricing
TIMES	Start: AM, 1989: AM/PM Since Jan 1994: All day	5 periods between 7 AM and 7 PM	6AM to 10PM weekdays	24 hours a day	24-hour real-time congestion pricing	24-hour real-time congestion pricing
VEHICLES	All vehicles except scheduled buses	2,600 equipped vehicles	All vehicles except scheduled buses	All motorists entering the CBD	All vehicles except those with three or more passengers	All vehicles except those with three or more passengers
TOLLS	Vehicles $1.25 /day, motor-cycles $0.50 /day, company vehicle $2.50 /day	$0.90 peak period, half price during "shoulder" peaks	$0.70 - $1.60 per day with discounted seasonal passes (month, six-month, year)	$1.60 per transaction	Dependant on congestion between 25 cents and $2.	Dependant on congestion
RESULTS	Inbound AM traffic decreased by 44%, car pooling trips went from 23% to 53%.	% of vehicle fleet that were private cars decreased 50%. Private car use decreased 10%.	5.4% (seasonal), 29.8% (daily) decrease in vehicle trips; 10% reduction in CBD-bound vehicles	Evaluation is underway. Preliminary results show 5% reduction in CBD traffic	Not open yet	Not open yet
SUCCESSES	Reduction in CBD vehicle trips Increased transit use and funding	Tecnical success with use of vehicle identification technology and roadside computers	Very carefully negotiated, all parties were involved	Not yet documented	Not open yet	Not open yet
PROBLEMS	Some outlying congestion	Public outcry, poor timing Experiment was stopped	No significant problems	N/A	Not open yet	Not open yet
COSTS	$2.8M (1975) + $0.4M between 1975 and 1989 capital costs. Operation: $118,000 / month	Estimated at $31.65M	$2.58M capital, plus $1.45M per year operating (in 1986 $)	Approx. $2 billion capital costs, plus approx. $1 M / year in operating costs	Approx. $125 M	Estimated to be $28.9M
REVENUES	$15M per year	N/A	$11.1M in 1986, matched by central government	Estimated at $96 M	Not open yet	Not open yet
USES OF FUNDS	All revenues go to Central Revenue Fund	N/A	80% for roads, 20% for bus lanes and transit, and some bikeways	80% for roads, 20% for transit, including busways	O&M of the facility, profits returned to investors	Improve rideshare, bus, ferry, BART, drive-alone services
FUTURE	ETTM and AVI being tested	ETTM and AVI being tested for harbor tunnels	Outer loop being considered	No other plans	Not applicable	Not applicable

Note: All currencies are in U.S. dollars.

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CPROGSUM.WB1

As Table 2.2 shows, there are no existing congestion pricing programs currently in operation in the United States, however, two are pending; one in San Francisco, and the other in Orange County, California. Both programs would employ 24 hour real-time congestion pricing techniques and will include electronic toll collection.

Internationally, Singapore's Area Licensing Scheme was the world's first congestion pricing program, implemented in 1975. Single Occupant Vehicles (SOVs) are required to pay premium rates to enter the CBD area. An excellent transit system and high vehicle ownership taxes encourage transit and carpool usage. Other area licensing schemes are in operation in the cities of Bergen and Oslo, in Norway.

2.5 Congestion Pricing and Current Federal Law

The Intermodal Surface Transportation Efficiency Act (ISTEA) was signed into law on December 18, 1991. This Act authorizes the use of Federal funds to be allocated for a wide-range of transportation programs throughout a six-year period (1992-1997). Section 1012(b) of the ISTEA authorizes the Secretary of Transportation to create a Congestion Pricing Pilot Program (CPPP) by establishing agreements with up to five state or local governments or public authorities to conduct and monitor congestion pricing pilot projects. Three such agreements may involve the use of tolls on the Interstate System. Annual funding for this program is $25 million of which no more than $15 million may be allocated to any single entity in a given year. The intent of this program, as further defined by FHWA, is to use congestion charges to encourage driver behavior in a manner that will promote the use of alternative times, routes, modes or trip patterns to reduce congestion. These charges shall be direct point, time-of-travel charges varying by location and/or time.

Since initially receiving proposals in February of 1993, many proposals and pre-project proposals have been submitted to the Federal Highway Administration (FHWA), but none has been formally selected to participate in the Congestion Pricing Pilot Program. Failure to meet the request's criteria, insufficient public involvement programs, and lack of local public/political support appear to be the primary reasons that no projects have been selected. As a result, the FHWA is working very closely with the local entities which have submitted proposals in order that this pilot program may become a reality. Should the Metro-Dade MPO decide to pursue congestion pricing as a road pricing strategy, participation in this Pilot Program would be extremely beneficial during the formative years of the new Dade County Expressway Authority.

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CHAPTER 3
GOALS AND OBJECTIVES OF A CONGESTION PRICING PROGRAM

The ultimate goal of any congestion pricing program is to produce a systemic change in transportation philosophy. A change that will result in increased transportation system efficiency coupled with the resultant gains in mobility, air quality, and energy conservation. This goal is typically sought through a comprehensive program of improvements which are designed to influence traveler behavior through the effective use of existing and proposed facilities, pricing strategies, state-of-the-art technology such as Automated Vehicle Identification (AVI), Electronic Toll Collection (ETC), and Intelligent Transportation Systems (ITS), and a focused promotional program. A secondary, but extremely important benefit to the overall goal of system efficiency is the revenue producing potential of the program.

3.1 Goals and Objectives

Goals and objectives are the tools that must be developed in order to establish and maintain the direction and evaluation of any program. Goals are long term in nature and reflect the ultimate desired targets. Objectives, on the other hand, are measurable, intermediate steps which typically must be met in order to achieve the associated long-range goals.

3.1.1 - Goal 1: Reduce congestion by promoting the efficient use of available roadway capacity.

Objectives for Goal 1 include:

- To effect a paradigm shift in traveller behavior through a road pricing structure which more closely represents the actual cost of a trip on the highway network. Pricing may vary by time of day, vehicle occupancy, location, and/or actual level of congestion (real time pricing).

- To provide a means, such as pricing, by which Single Occupant Vehicles (SOV) can legally use High Occupancy Vehicle (HOV) lanes to effect more efficient utilization of under-utilized HOV lanes.

- To encourage greater utilization of the region's under-utilized major arterial street system assets.

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- To increase transit ridership through subsidized fares and increased services funded by road pricing revenues.

Evaluation Criteria for Goal 1 are:

- System travel time and delay
  - Vehicle-miles of travel (VMT)
  - Volume to capacity ratios (v/c)
  - Roadway levels of service (LOS)
  - Traffic accident rates
  - Vehicle occupancy rates
  - Transit ridership
  - HOV lane throughput

3.1.2 - Goal 2: Increase revenues available for transportation infrastructure.

Objectives for this goal are:

- To develop a road pricing structure which more accurately represents actual the cost of a trip which is the sum of individual and societal costs.

- To generate revenues through road pricing strategies which may be used to subsidize and/or improve a transit facility within the same corridor.

- To secure discretionary, competitive ISTEA Section 1012(b) funding for the development of a congestion pricing pilot program.

Evaluation Criteria include:

- Transportation revenues and funding
- Transit ridership
- Transportation infrastructure improvements

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3.1.3 - Goal 3: Improve air quality and reduce energy consumption.

Objectives are:

- To create a road pricing structure designed to reduce congestion and manage traffic operations thereby reducing emissions and energy consumption.

- To increase transit ridership through the development of a congestion pricing program.

Evaluation Criteria are:

- CO and ozone levels
- Fuel consumption
- Travel time and delay
- Transit ridership

To attain these goals, a congestion pricing program will likely consist of the following components:

- Pricing strategies according to time of day, vehicle occupancy, and location.
- Introduction of AVI and ETC technology.
- Sale of excess HOV-lane capacity.
- Expanded transit facilities and service.

Potential road/congestion pricing packages for Dade County were developed with the goals, objectives, and components of this chapter in mind.

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CHAPTER 4
ROAD/CONGESTION PRICING STRATEGIES

The purpose of this chapter is to identify possible road/congestion pricing strategies which could be implemented as a part of a Dade County Congestion Pricing Program.

4.1 Strategy Definitions

There are six basic pricing strategies that can be employed for any road/congestion pricing program:

1. **Static Pricing, 24 Hours** - Static pricing is road pricing in its simplest form. This consists of a fixed toll which is charged to vehicles along a roadway, at an on or off ramp, at a mainline barrier, or on a causeway. (Tolls can be levied at several locations along the roadway.) Being "static," the amount of toll paid by a particular type of vehicle remains fixed 24 hours a day. The toll collection technique for all strategies are assumed to initially be a combination of manual and electronic--and evolving to almost fully electronic toll collection (ETC).

2. **Static Pricing, Peak Period Only (PPO)** - Similar to strategy number one, except that the toll is only applied at one flat rate during designated predetermined peak periods. Off-peak travel is "free."

3. **Fixed Time, 24 Hour Congestion Pricing** - This strategy has one significant difference from the static 24 hour pricing strategy. In this case, the toll rate will be higher in the peak periods and lower the rest of the day. Within the peak period, the toll rate may change one or more times within predetermined time slots in the peak period. For example, the toll rate may be 25¢ during off-peak periods, 35¢ from 6:00 AM to 7:00 AM and 50¢ from 7:00 AM to 8:00 AM, etc.

4. **Fixed, Time PPO Congestion Pricing** - Similar to strategy number three, however, the tolls are variable during the designated peak hours and peak hour fringes (periods immediately preceding and following the peak period). The toll rates may increase from 25¢ to 35¢ at 6:00 AM, then move upwards again at pre-prescribed times to 40¢ and 50¢ as congestion increases within the peak period. Off-peak travel is "free."

5. **Realtime, 24 Hour Congestion Pricing** - This is the most advanced form of congestion pricing. It is similar to strategy number four, however, the tolls are applied all day and the tolls vary in response to actual congestion present on the road at the time of travel. Actual congestion levels can be determined using advanced techniques such as embedded freeway

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loop detectors or video image detection technology. Other dynamic toll structures, based on vehicle occupancy and vehicle type can also be implemented in a similar manner.

6. **Realtime, PPO Congestion Pricing** - Similar to strategy number five, with the tolls only being applied during the peak periods, when congestion beyond a certain predefined tolerance is detected automatically by the system, and toll rates are automatically changed in response to realtime system demand/performance profile. Motorists are notified via variable message signs (VMS).

Table 4.1 displays a hypothetical set of pricing regimes for these strategies.

TABLE 4.1
EXAMPLE OF PRICING STRATEGIES

TIME OF DAY	STATIC 24-HOUR PRICING	STATIC - PPO	FIXED-TIME 24-HOUR CONGESTION	FIXED-TIME PPO CONGESTION	REALTIME 24-HOUR CONGESTION	REALTIME PPO CONGESTION
6:00 AM - 7:00 AM	25¢	0¢	35¢	35¢	Varies	Varies
7:00 AM - 8:00 AM	25¢	50¢	50¢	50¢	Varies	Varies
8:00 AM - 9:00 AM	25¢	0¢	25¢	0¢	Varies	0¢
9:00 AM - 4:00 PM	25¢	0¢	25¢	0¢	Varies	0¢
4:00 PM - 5:00 PM	25¢	0¢	35¢	35¢	Varies	Varies
5:00 PM - 6:00 PM	25¢	50¢	50¢	50¢	Varies	Varies
6:00 PM - 6:00 AM	25¢	0¢	0¢	0¢	Varies	0¢
Note: Pricing shown is a hypothetical structure, not a recommendation.						

The strategies to be used for any particular road/congestion program depend on the local conditions. Furthermore, strategies 5 and 6 are still in the development stage, and will require advanced detection, control and other ITS equipment to implement. Although Automatic Vehicle Identification (AVI), automated occupancy detection, and other such ITS technology exists to implement these pricing strategies, there are very few examples in use. As freeways become more

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"intelligent," we will continue to move toward real time congestion pricing and away from static and fixed time pricing.

The above six road pricing strategies can be applied to either the entire freeway (or causeway), or only along any HOV lanes that may be present. Therefore, a total of twelve road pricing techniques are available. The HOV lane pricing options involve four possibilities:

1. **Add a Lane** - Adding a lane to an existing facility for exclusive HOV use. (See Figure 4.1.)

2. **Take a Lane** - Taking an existing lane from a facility and converting it from general use into HOV use. This option is politically very aggressive and often quite difficult to impose. (See Figure 4.2.)

3. **Add and Take a Lane** - A combination of the above two options. This option involves widening a facility to accommodate a new HOV lane, while at the same time, converting an existing general use lane for exclusive HOV use. The option can be controversial if not handled properly through effective public information processes. (See Figure 4.3.)

4. **Ramp Metering Bypass (RMB) Lane Pricing** - A ramp metering system is currently under design for I-95 in Dade County. This system is designed to optimize freeway flow. Selected ramps could have bypass lanes for buses and carpools, who may bypass the queue at the ramp meter signal by using a parallel lane. SOV's may also be permitted to use the bypass lane--at a price, and only if the SOV is equipped with an AVI transponder to enable the toll to be electronically exacted (see Figure 4.4).

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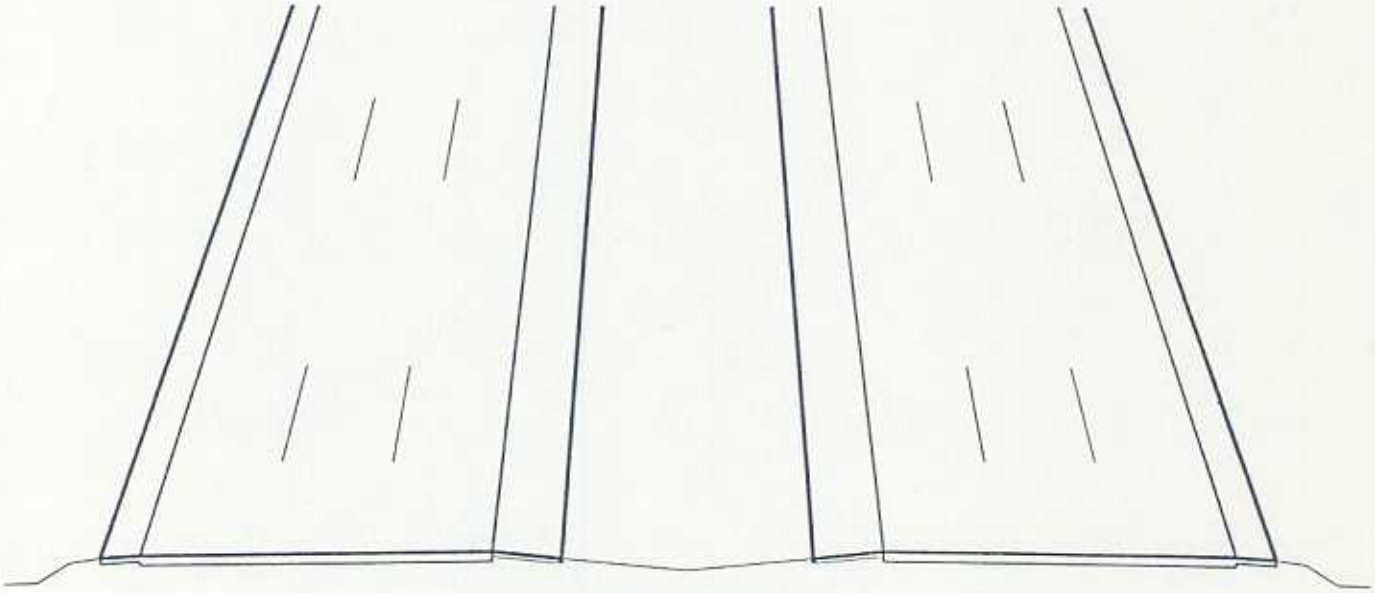

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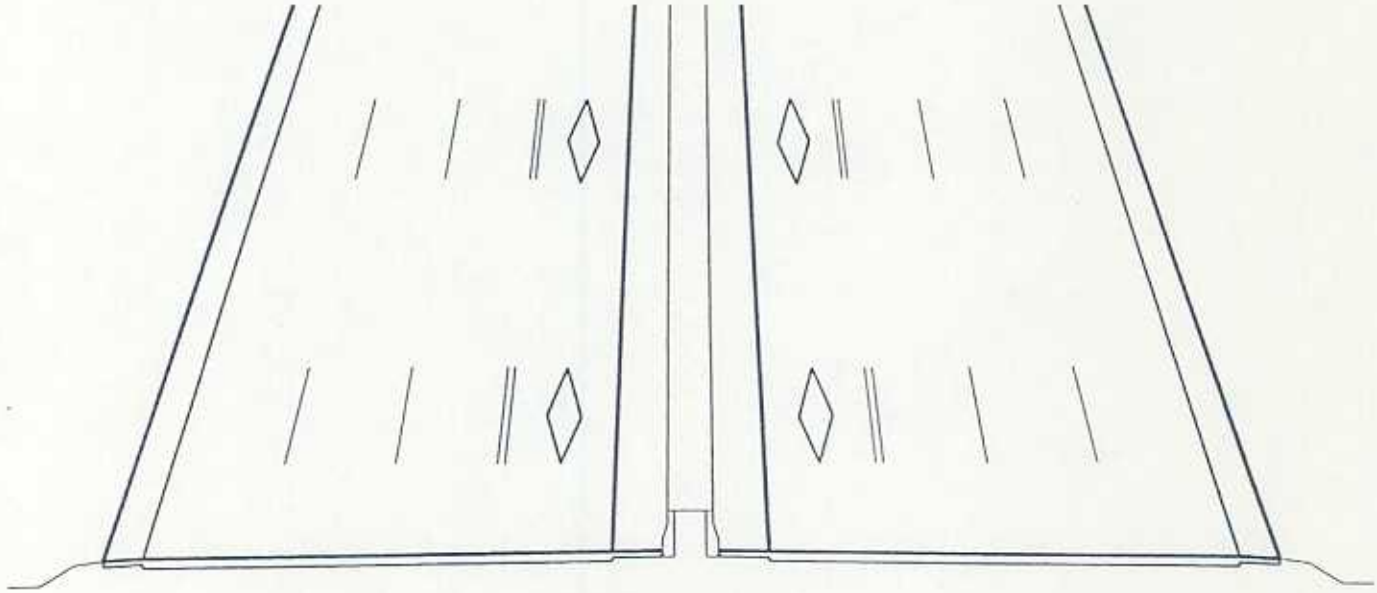

ADD-A-LANE

FIGURE 4.1

DADE ROAD PRICING

HOV LANE STRATEGIES
ADD-A-LANE

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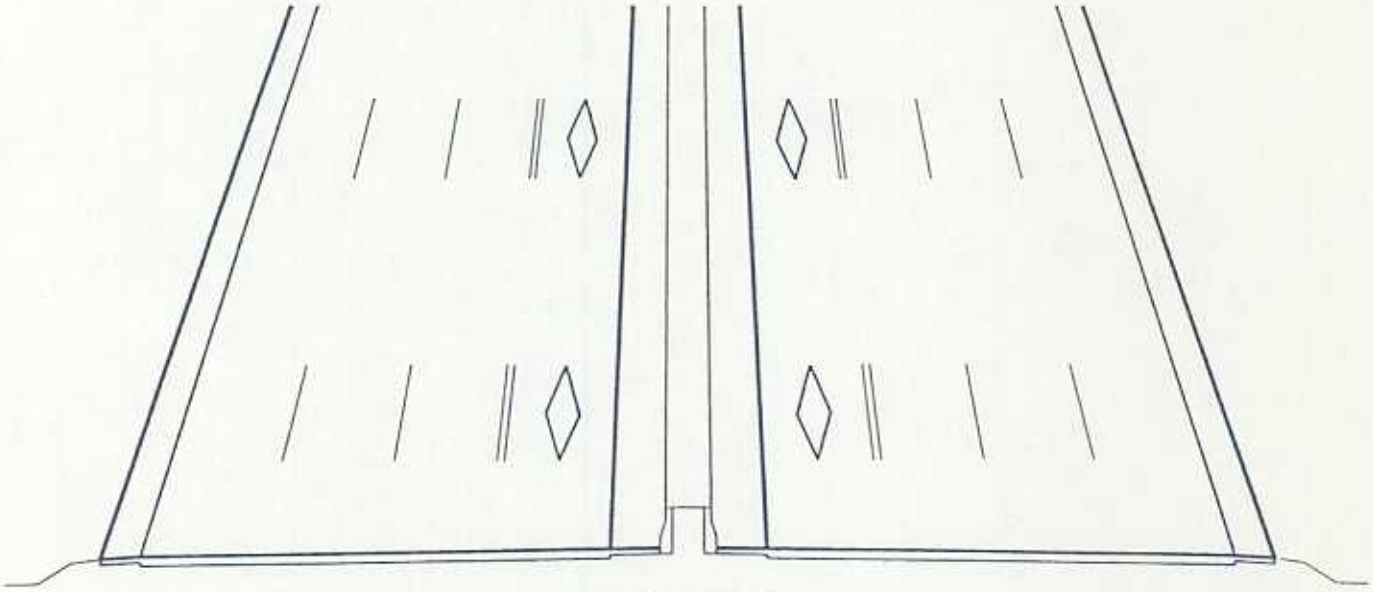
NOT TO SCALE



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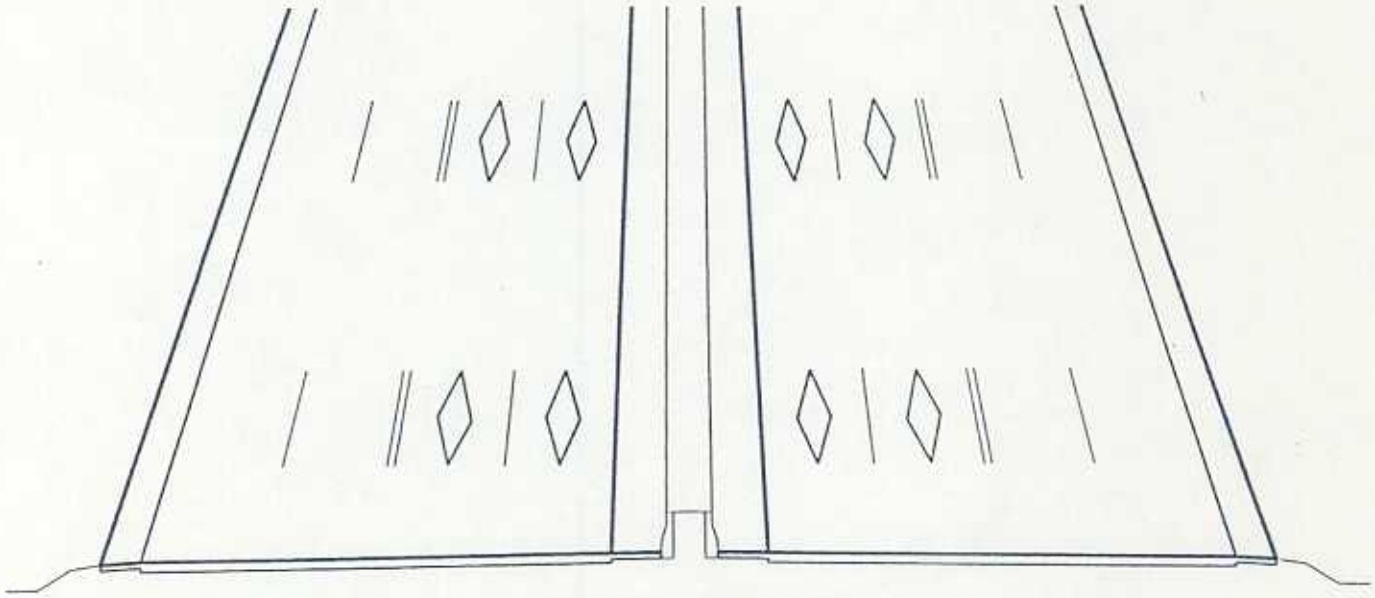

TAKE-A-LANE

FIGURE 4.2

DADE ROAD PRICING

HOV LANE STRATEGIES
TAKE-A-LANE

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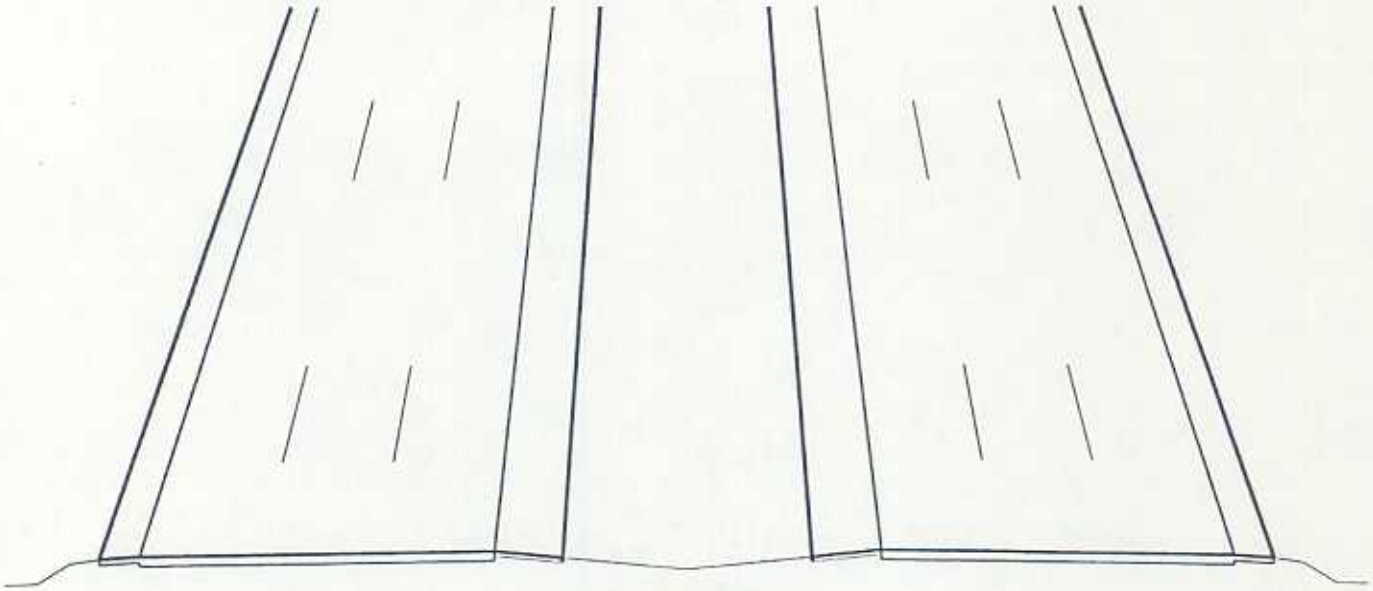

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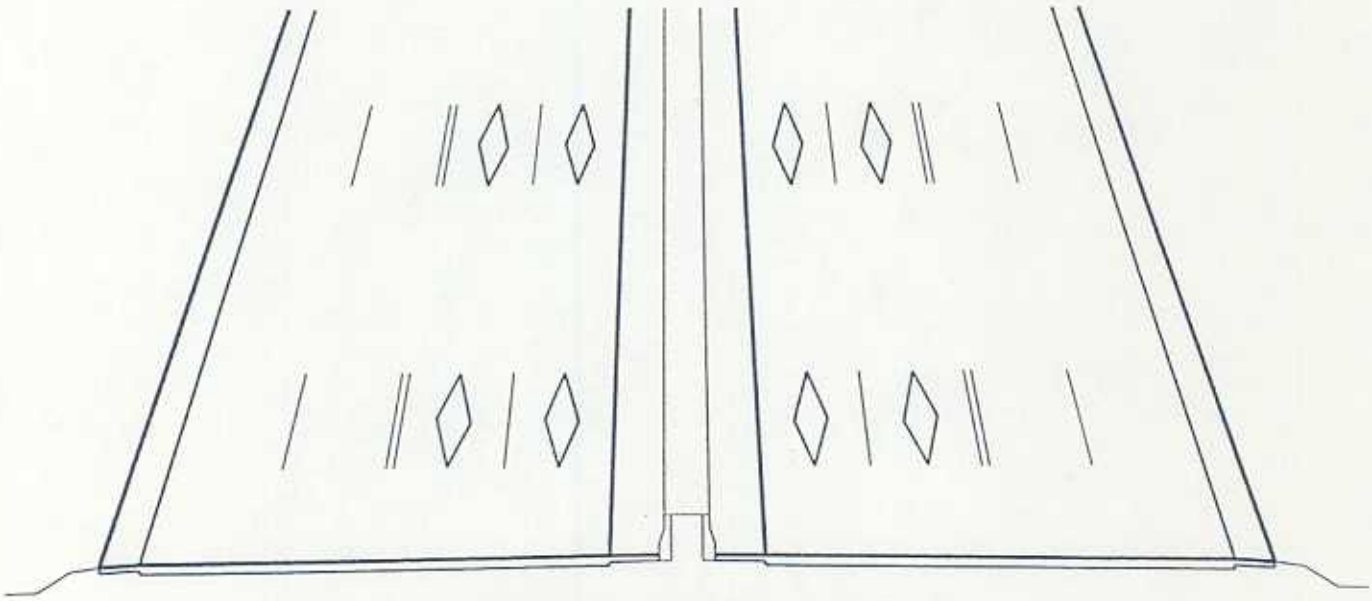

ADD & TAKE-A-LANE

FIGURE 4.3

DADE ROAD PRICING

HOV LANE STRATEGIES
ADD & TAKE-A-LANE

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NOT TO SCALE

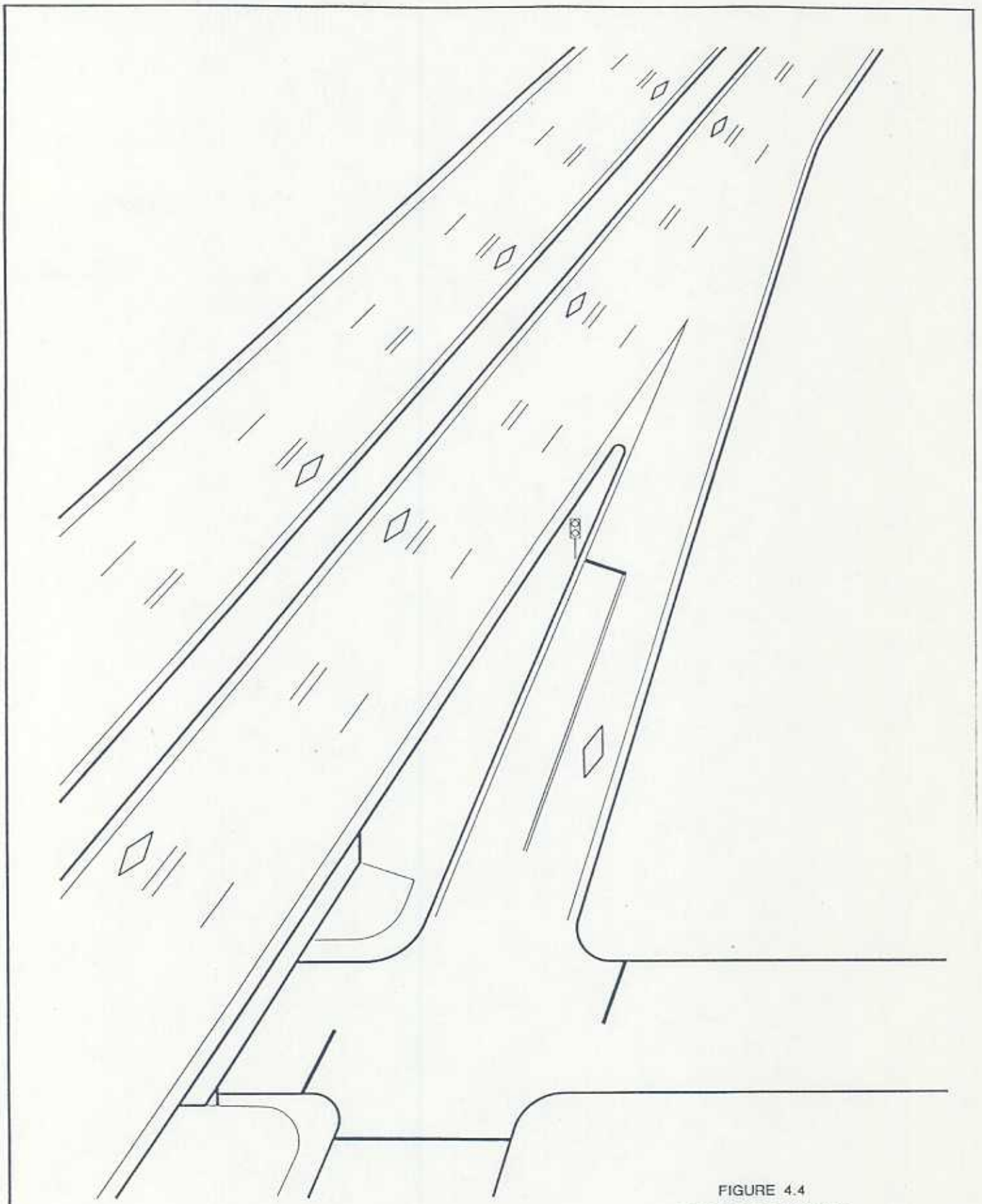

FIGURE 4.4

DADE ROAD PRICING

RAMP METERING
BYPASS CONCEPT

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NOT TO SCALE

On the I-95 HOV lanes in South Florida, HOV's are currently defined as vehicles with two or more passengers. The general recommended strategy is to classify vehicles by type and occupancy. HOV3's (three or more persons) could travel free, while HOV2's (two persons) would pay a discounted rate. The rational for this is that HOV3's produce 50% greater societal benefits than HOV2's and they should be rewarded equitably. All three of the above options could include the "selling" of excess HOVL capacity to SOV's at a premium rate. Trucks and other heavy vehicles would be required to pay the highest rates (usually three to five times the SOV rate). Furthermore, the actual amount of toll paid would be determined by the degree of congestion at the time of travel.

The current I-95 Intelligent Corridor System (ICS) design project being conducted by the FDOT includes the implementation of ramp metering on selected ramps along I-95. A concern expressed by some authorities is the apparent conflict of implementing HOVL pricing in conjunction with ramp metering. Kimley-Horn's extensive experience with both strategies on the Phoenix Freeway Management System has shown that there are situations where both need to be implemented simultaneously to achieve the required congestion management. Selected (and possibly all) ramp metering locations on I-95 are recommended to be designed with HOV bypass lanes. With these, HOV3's could bypass ramp meters for free, while HOV2's could bypass ramp meters at a discounted rate. SOV's would be required to pay premium rates to bypass the ramp meters.

4.2 Levels of Aggressiveness

As indicated previously, certain road pricing strategies can be more aggressive and controversial than others. The degree of aggressiveness of any particular strategy can be classified from very conservative to ultra-aggressive. Table 4.2 shows the various road pricing strategies and their particular classification, as assessed by Kimley-Horn and Associates, Inc. road pricing experts.

The level of aggressiveness for any road pricing strategy also depends on the toll rate that is used. An aggressive plan would generally implement tolls at a high rate, say 10¢-15¢ per mile, while a conservative plan may charge 7¢-10¢ per mile. Research by the authors has shown that major metropolitan markets can comfortably sustain toll rates averaging between 10¢-15¢ per mile during the off-peak period and 20¢-25¢ per mile during the peak period.

Table 4.3 illustrates the application of a range of congestion pricing strategies on some of Dade County's existing toll roads and the resultant tolls. As shown, the tolls required to achieve these rates on a mileage basis are fairly typical in today's market. Compared to international tolls, Dade County's existing rates are exceptionally low.

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TABLE 4.2

CONGESTION PRICING STRATEGIES VS AGGRESSIVENESS

Strategy Description	Do Nothing	Very Conservative	Conservative	Moderate	Moderately Aggressive	Aggressive	Very Aggressive	Ultra Aggressive
Toll at existing rates	X							
Raise tolls to 7 cents/mile		X						
Raise expressway tolls to premium levels (10-15 cents/mile)			X	X	X	X	X	X
Add planned freeway extensions as toll roads			X	X	X	X	X	X
HOVL Pricing - Add a lane				X				
Add unplanned freeway extensions as toll roads							X	X
Congestion pricing and toll indexing of all toll facilities				X	X	X	X	X
Congestion pricing of all congestion "generators"					X	X	X	X
Peak period-only pricing of non-toll causeways							X	
HOVL Pricing - Add one lane plus take one lane					X			
HOVL Pricing on arterials - Take one lane (S Dixie Hwy)								X
Busway (HOV-way) pricing - (US 1 / Biscayne Blvd)						X	X	X
Peak period pricing of existing non-toll freeways							X	
24-hour pricing of all non-toll causeways								X
24-hour pricing of existing non-toll freeways								X
24-hour pricing on arterials								X

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TABLE 4.3

TOLLS FOR VARIOUS CONGESTION PRICING RATE STRUCTURES

Existing Toll Facility	Existing Toll EB/NB	Existing Toll WB/SB	Average Toll/Mile	Traditional Toll at 7 cents/mile EB/NB	Traditional Toll at 7 cents/mile WB/SB	Contemporary/Premium Toll at 10-15 cents/mile EB/NB	Contemporary/Premium Toll at 10-15 cents/mile WB/SB	Congestion Pricing Toll at 20-25 cents/mile EB/NB	Congestion Pricing Toll at 20-25 cents/mile WB/SB
Gratigny Parkway	$0.25	$0.25	$0.06	$0.30	$0.30	$0.50	$0.50	$1.00	$1.00
SR 112 / Airport Expressway	$0.25	$0.00	$0.06	$0.30	$0.00	$0.60	$0.00	$1.00	$0.00
Option 1						$0.30	$0.30	$0.50	$0.50
SR 836 / Dolphin / E-W Expressway	$0.25	$0.00	$0.02	$0.75	$0.00	$1.50	$0.00	$2.50	$0.00
Option 1				$0.45	$0.45	$0.75	$0.75	$1.25	$1.25
Option 2								2 x $0.75	2 x $0.75
SR 874 / Don Shula Expressway	$0.25	$0.25	$0.03	$0.50	$0.50	$1.00	$1.00	$2.00	$2.00
Option 3								2 x $0.75	2 x $0.75

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Notes:
Option 1 - Add a westbound toll plaza at the same location as the current eastbound plaza, and toll in both directions.
Option 2 - Add a bi-directional toll facility between the Palmetto and the Turnpike, and toll at both locations (75 cents at each plaza in each direction.)
Option 3 - Add a bi-directional toll facility south of the Snapper Creek Expressway, and toll at both locations (75 cents at each plaza in each direction.)

4.3 Toll Collection Systems

The collection systems involved with traditional road pricing include manual toll booths (see Exhibit 4.1) in combination with automatic collection systems using pre-sold decals. Electronic Toll Collection (ETC) systems are coming of age with technological advancements in both hardware and software. One form of this technology is Automatic Vehicle Identification (AVI) systems. This technology uses both credit and debit collection systems in combination with manual collection techniques for users who do not have the automatic payment equipment installed in their vehicles (see Figure 4.5).

AVI/ETC technologies exist on several newer toll facilities in the United States, including the Oklahoma Turnpike, the Garden State Parkway in New Jersey and the North Central Tollway in Dallas, Texas. Other toll roads under construction such as SR 91 Orange Lanes in California and the Dulles Toll Road Extension (Virginia) includes this form of technology. In 5 to 10 years, ETC collection systems with a limited number of manual collection lanes will be the industry standard. With federal encouragement of universal transponder cards, this collection system will significantly advance both the popularity of non-stop toll collection facilities as well as their capacity and ensuant levels of service (LOS).

The next level of automation involves Intelligent Transportation Systems (ITS). In reality, such systems are a number of years off in terms of actual wide-spread public use. However, the federal government is funding significant research and demonstration projects in this area for the purpose of accelerating the inclusion of these technologies into everyday practical use. Current estimates indicate that by the year 2020, several major interstate highways could be operating as fully or partially automated highway systems (AHS) accepting modified "smart" automobiles in a fully computer controlled environment.

The consultant is supportive of the rapid implementation of AVI/ETC technology on all new and existing toll facilities. For the purposes of this study, it was assumed that any new toll facilities would be constructed with AVI/ETC equipment, and existing facilities would be converted to uniform AVI/ETC facilities on a countywide basis.

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Exhibit 4.1 - Existing Toll Collection Facility

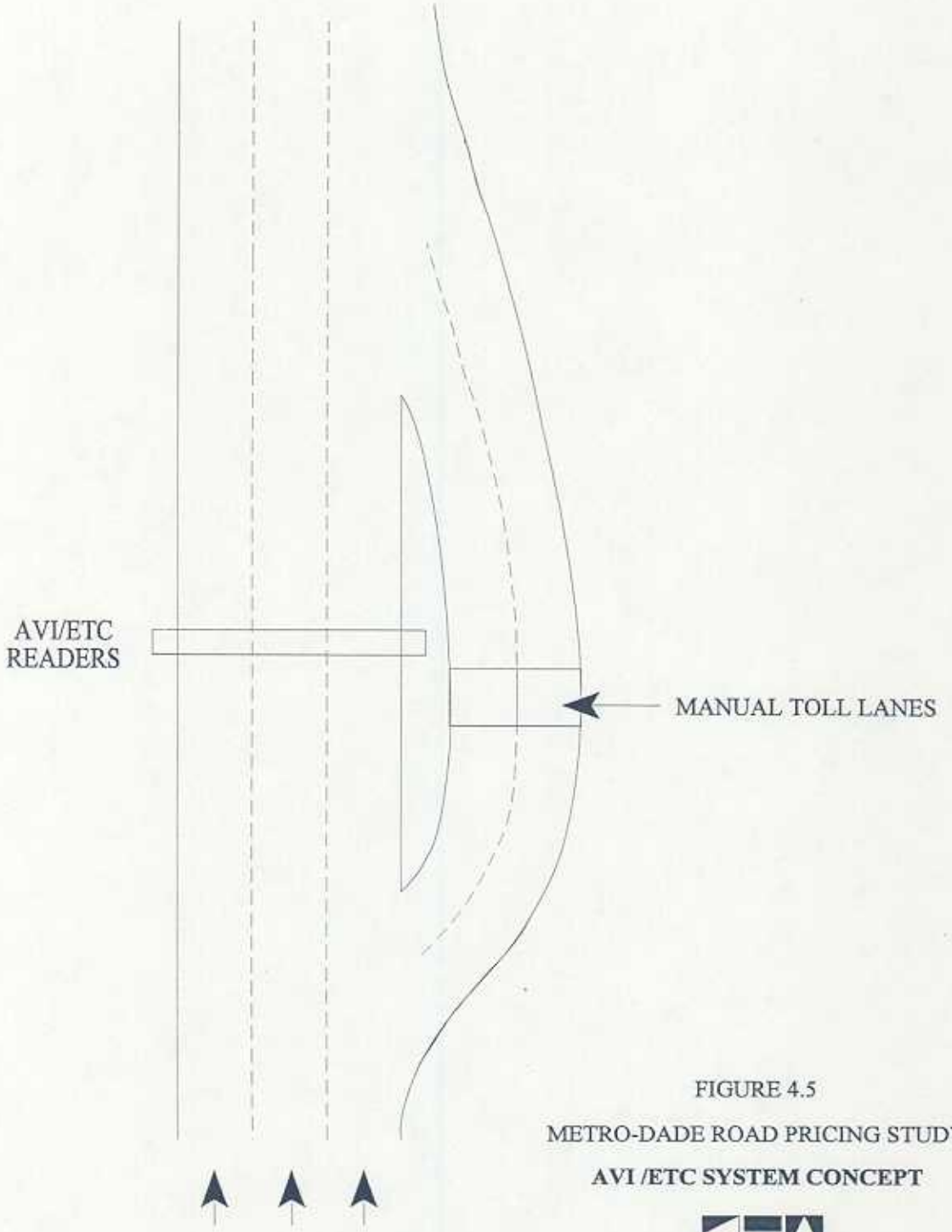

FIGURE 4.5

METRO-DADE ROAD PRICING STUDY

AVI /ETC SYSTEM CONCEPT

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4.4 Uses of Funds

Potential applications for use of road/congestion pricing revenues are many with the goal being to advance the state-of-the-art for improved congestion management. The following list summarizes some of the more popular funding opportunities with state and federal governments.

- Additional, revenue-producing road pricing projects, such as the SR112 extension or other unfunded projects.
- ITS projects, including AVI/ETC hardware and software applications, either for capital or operating costs.
- Fixed guideway transit or commuter rail, or high speed rail projects, either for capital or operating improvements.
- The acquisition or operation of express bus routes, possibly as part of an HOV lane pricing project.
- Any HOVL or busway project, especially those that promote a reduction in SOV's.

Congestion pricing revenues derived from one facility are generally used to improve operations in the immediate corridor. However, they could also be used in other corridors to promote regional improvements.

The use of pricing revenues must be placed in proper perspective during the decision-making process for selecting the appropriate strategy. The intended use of funds could mollify the degree of aggressiveness assumed for a pricing strategy.

For example, the placement of a peak period only toll on I-95 and the Palmetto Expressway would normally be considered "very aggressive" or "ultra aggressive." However, if the funds generated could change the outcome of the NW 27th Avenue extension of the Metrorail Extension from "not feasible" to "feasible," then the acceptability of the pricing strategy might be judged less harshly.

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CHAPTER 5
IDENTIFYING FACILITIES ELIGIBLE FOR ROAD PRICING

The process used to determine Metro-Dade County facilities eligible for road pricing strategies was the normal functional classification system employed by both the County and the Department. Those classifications were slightly modified for purposes of this study but, generally were as follows:

- Tolled roads versus non-tolled.
- Interstate highways versus non-interstate.
- Expressways versus arterial streets.
- Causeways versus non-water crossing bridges.
- HOV-ways versus normal expressways or arterial streets.

The exception to the classification scheme above, was the consideration of the U.S.1 and U.S.27 corridors.

After a preliminary analysis based on potential project costs, projected congestion levels and revenues, some facilities were eliminated as candidates. These were I-75, Krome Avenue, and NE 203rd Street.

Figure 5.1 depicts a map of the roadway facilities considered for congestion pricing projects. These facilities can be grouped into the following categories: Existing tolled roads (expressways, causeways and bridges), existing non-tolled roads (primarily interstates, expressways, causeways and some arterial streets) and new limited access facilities (planned and unplanned). Principal arterial streets considered as potential candidates for road pricing include U.S. 1/Biscayne Boulevard, South Dixie Highway, and Okeechobee Road/US 27 as an expressway upgrade.

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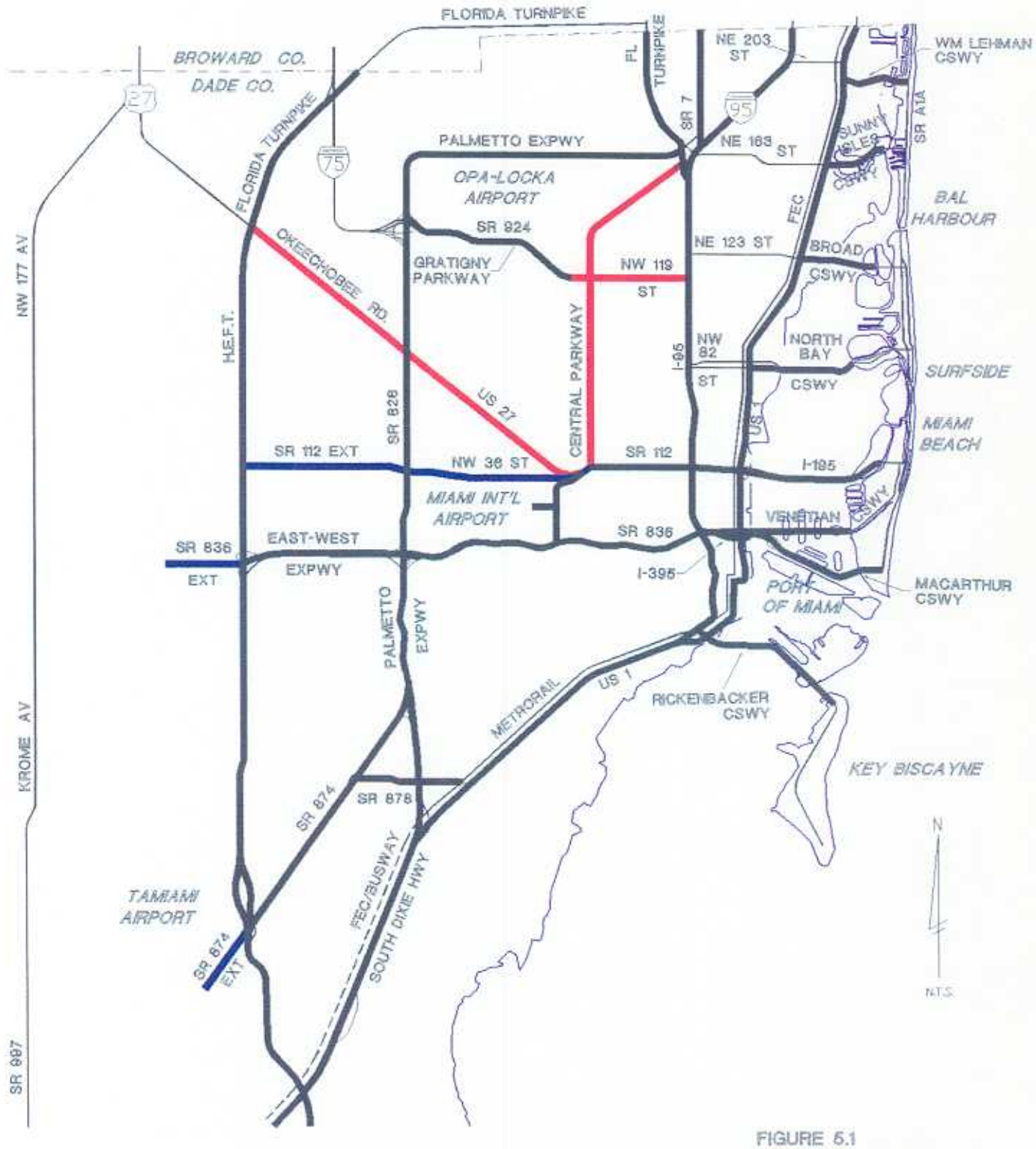

FIGURE 5.1
METRO DADE ROAD PRICING STUDY
FACILITIES CONSIDERED
FOR ROAD PRICING

LEGEND

- EXISTING
- PLANNED
- UNPLANNED

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CHAPTER 6
PACKAGING PROJECTS INTO PLANS

Numerous combinations of eligible roadway facilities and congestion pricing strategies were considered in structuring packages and sub-packages of congestion pricing projects. Initially eight packages of projects were developed from the eligible facilities previously identified. Those packages are graphically illustrated in Figures 6.1 through 6.7. The "Do Nothing" Package is not illustrated for obvious reasons.

The packages are summarized in Table 6.1, which shows the strategies and facilities to be included in each package. The strategies range from small increases of existing toll rates (Very Conservative) to applying 24 hour tolls on existing untolled facilities (Ultra Aggressive). The facilities considered include existing toll expressways in the Very Conservative plan to US 1/S. Dixie Highway and other arterial streets in the Ultra Aggressive plan.

Appendix C includes individual worksheets for each eligible facility within the packages which document the corresponding pricing strategy appropriate for that facility. For example, several different strategies might be applied to a given facility. I-95 might be combined with HOVL pricing or PPO (peak period only) pricing of the entire facility. This would constitute two (2) different road pricing "projects," which were evaluated separately. The set of strategies applied to I-95, for example, could be termed the I-95 "family" of road pricing projects. These individual tables describe advantages and disadvantages for each of the projects in a family. Those projects which survived a preliminary screening based on a subjective analysis of the cited disadvantages were further evaluated based on the study goals and on the following evaluation criteria: Revenue yield, congestion management, environmental benefits, public acceptability, and an overall rating that summarized those results.

Once strategies and facilities were packaged into plans of various levels of aggressiveness, the plans were presented to members of the project's Steering Committee. Comments were solicited, and the Steering Committee members were asked to evaluate the projects and plans. Their responses were used to make refinements to the recommended road pricing strategies.

6.1 Evaluation

The evaluation process resulted in eight different categories of aggressiveness which were cumbersome and somewhat difficult to differentiate, particularly with respect to their revenue yields. Subsequently, those categories were reduced to four by combining those that were similar. The resultant road pricing plans were: Do Nothing, Conservative, Moderate, and Aggressive. Table 6.2 summarizes the results of the evaluation process for the four "final" packages. Although somewhat subjective, this process narrowed the range of options under consideration and clarified some prior misgivings regarding the acceptability of certain strategies. Table 6.3 summarizes the strategies applied to those eligible facilities meeting the evaluation criteria and portrays the degrees of aggressiveness associated with those strategies.

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TABLE 6.1

EVALUATION OF CONGESTION PRICING STRATEGIES

Criteria	Do Nothing	Very Conservative	Conservative	Moderate	Moderately Aggressive	Aggressive	Very Aggressive	Ultra Aggressive
STRATEGIES	Toll at existing rates	Raise tolls to 7 cents/mile	Raise tolls to premium rates (10-15 cents/mile) Add planned freeway extensions and toll at premium level	HOVL Pricing - Add a lane Congestion pricing of all tolled expressways and extensions Weekend/Holiday congestion pricing	Congestion pricing of all congestion "generators" HOVL - Add a lane HOVL Pricing - Take a lane	Busway (HOV-way) pricing PPO pricing of existing non-toll freeways	PPO pricing of existing non-toll causeways Add unplanned freeway extensions Congestion pricing of tolled causeways HOVL Take a lane pricing on arterials	24-hour pricing-existing non-toll freeways 24-hour pricing on arterials 24-hour pricing on non-toll causeways
KEY FACILITIES AFFECTED	HEFT Gratigny Parkway SR 112 SR 836 SR 874 Rickenbacker Cswy Venetian Cswy Broad Cswy	HEFT Gratigny Parkway SR 112 SR 836 SR 874	HEFT Gratigny Parkway SR 112 SR 836 SR 874 SR 112 Extension SR 836 Extension SR 874 Extension	SR 826 All toll facilites from the previous strategy Rickenbacker Cswy	MIA Golden Glades Interchange SR 826 I-95 SR 826	US 1/Biscayne Blvd (FEC Corridor) I-95 SR 826 SR 878	I-195/Julia Tuttle Cswy I-395/MacArthur Cswy North Bay Cswy Port of Miami Bridge Sunny Isles Cswy William Lehman Cswy Central Parkway Gratigny Parkway Ext US 27/Okeechobee Xwy (SR 826 - HEFT) Venetian Causeway Broad Causeway US 1/S Dixie Highway	I-95 SR 826 US 1/S Dixie Highway I-195/Julia Tuttle Cswy I-395/MacArthur Cswy North Bay Cswy Port of Miami Bridge Sunny Isles Cswy William Lehman Cswy
EVALUATION								
Revenue Yield	Worst	Poor	Fair	Good	Good	Very Good	Excellent	Best
Congestion Mgmt	Worst	Poor	Fair	Good	Good	Very Good	Excellent	Best
Environ. Benefit	Worst	Poor	Fair	Good	Good	Very Good	Excellent	Best
Public Accept.	Best	Very Good	Good	Fair	Poor	Very Poor	Very Poor	Worst
Overall	Very Poor	Poor	Fair	Good	Very Good	Excellent	Good	Poor
REVENUES* (NPV, IN $M)	180	682	1,507	5,422	5,729	6,152	7,174	12,951

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HEFT: Homestead Extension of the Florida's Turnpike
MIA: Miami International Airport

PPO: Peak period only

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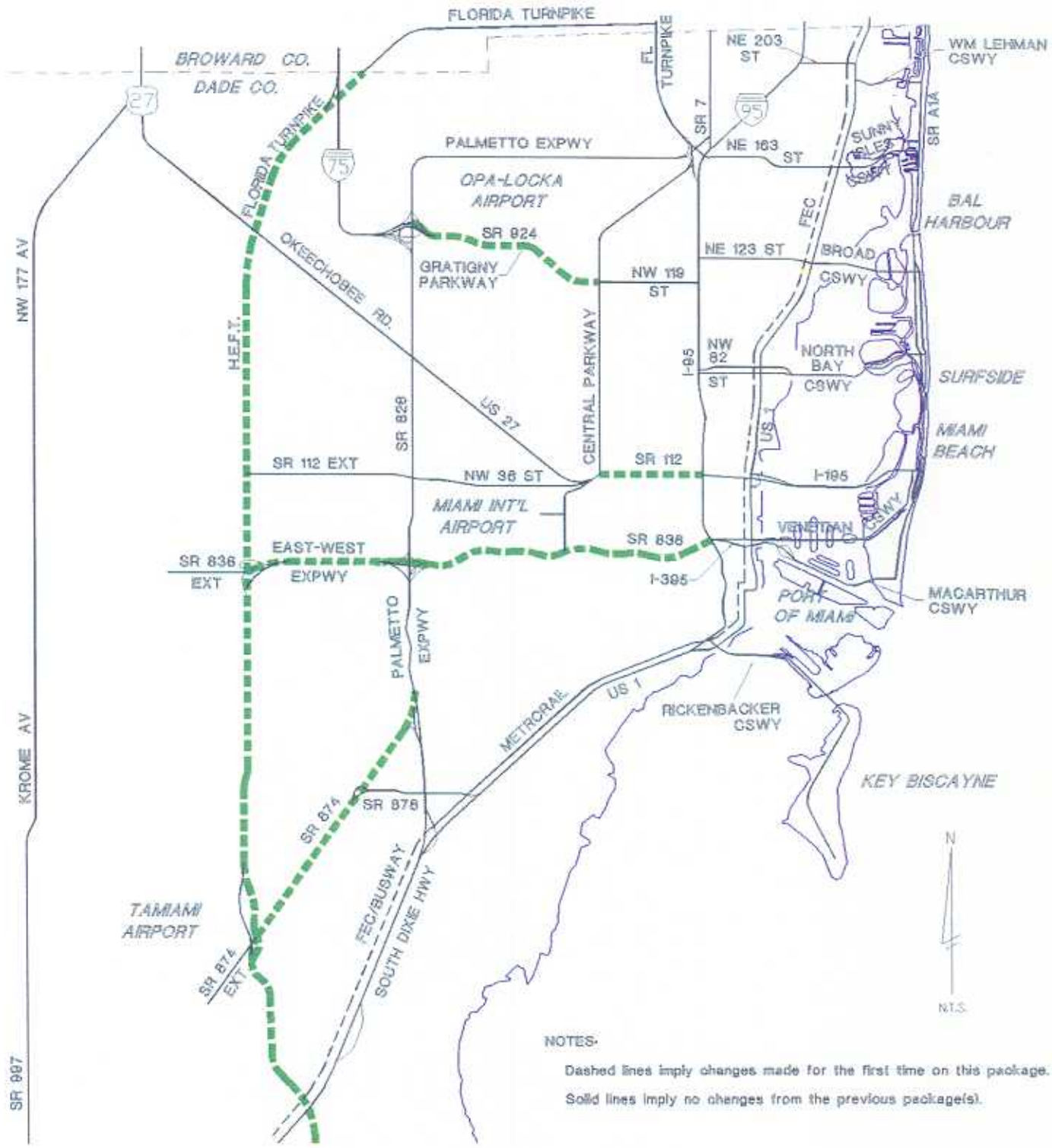
* - Revenues, in millions of dollars cumulative from one package to the next, NOT additive.

Note: Revenues based on area-wide sketch planning assumptions believed to be reasonable, but have not been verified by detailed study. Kimley-Horn and Associates, Inc. cannot assume responsibility for the accuracy of theses forecasts until more detailed due diligence studies have been exercised.



NOTES:

Dashed lines imply changes made for the first time on this package.

Solid lines imply no changes from the previous package(s).

LEGEND

24 HOUR TOLL AT 7¢ PER MILE

FIGURE 6.1

METRO DADE ROAD PRICING STUDY

VERY CONSERVATIVE PACKAGE

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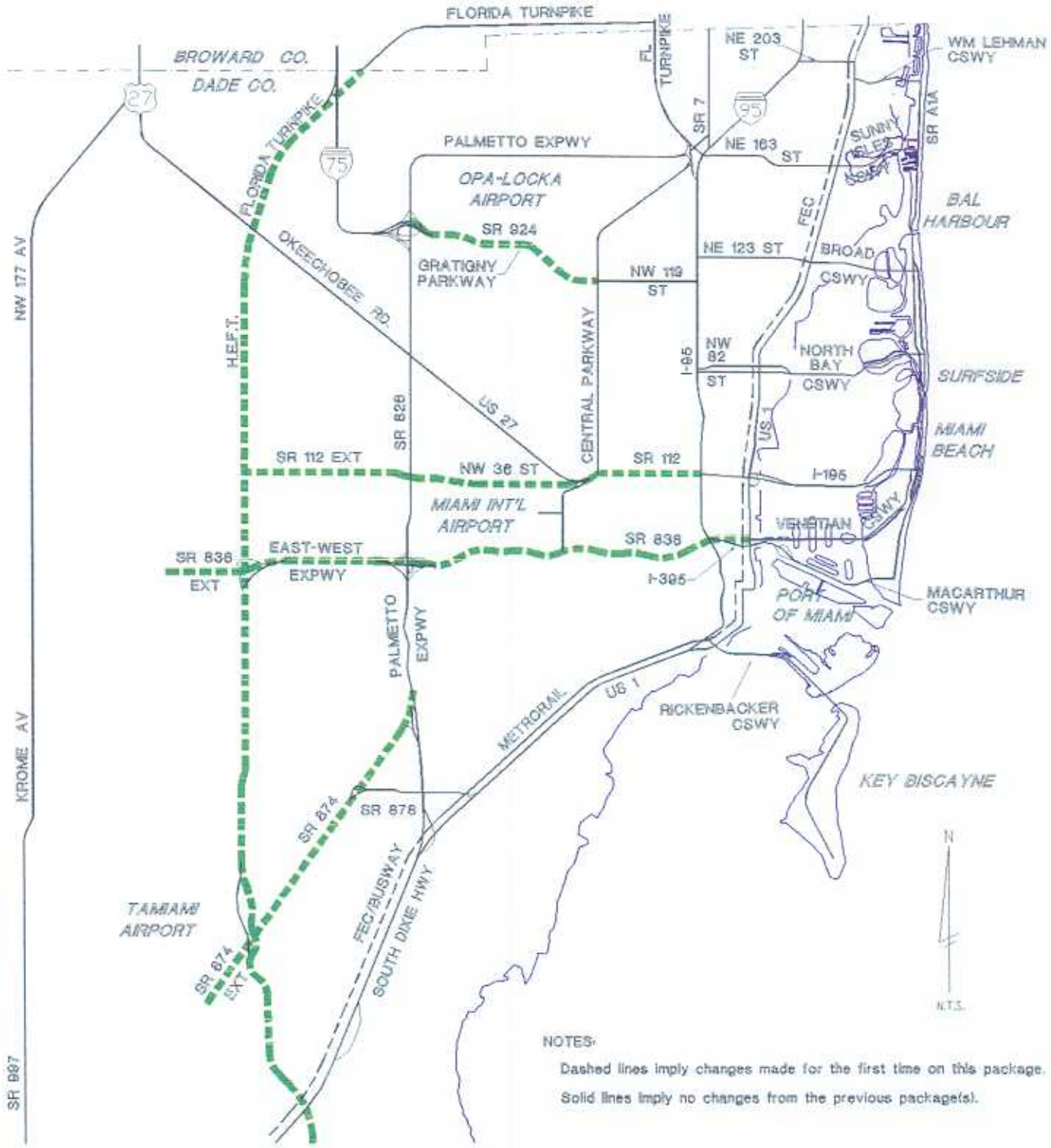

NOTES:

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Solid lines imply no changes from the previous package(s).

FIGURE 6.2

METRO DADE ROAD PRICING STUDY

CONSERVATIVE PACKAGE

LEGEND

24 HOUR STATIC TOLL (PREMIUM LEVEL)

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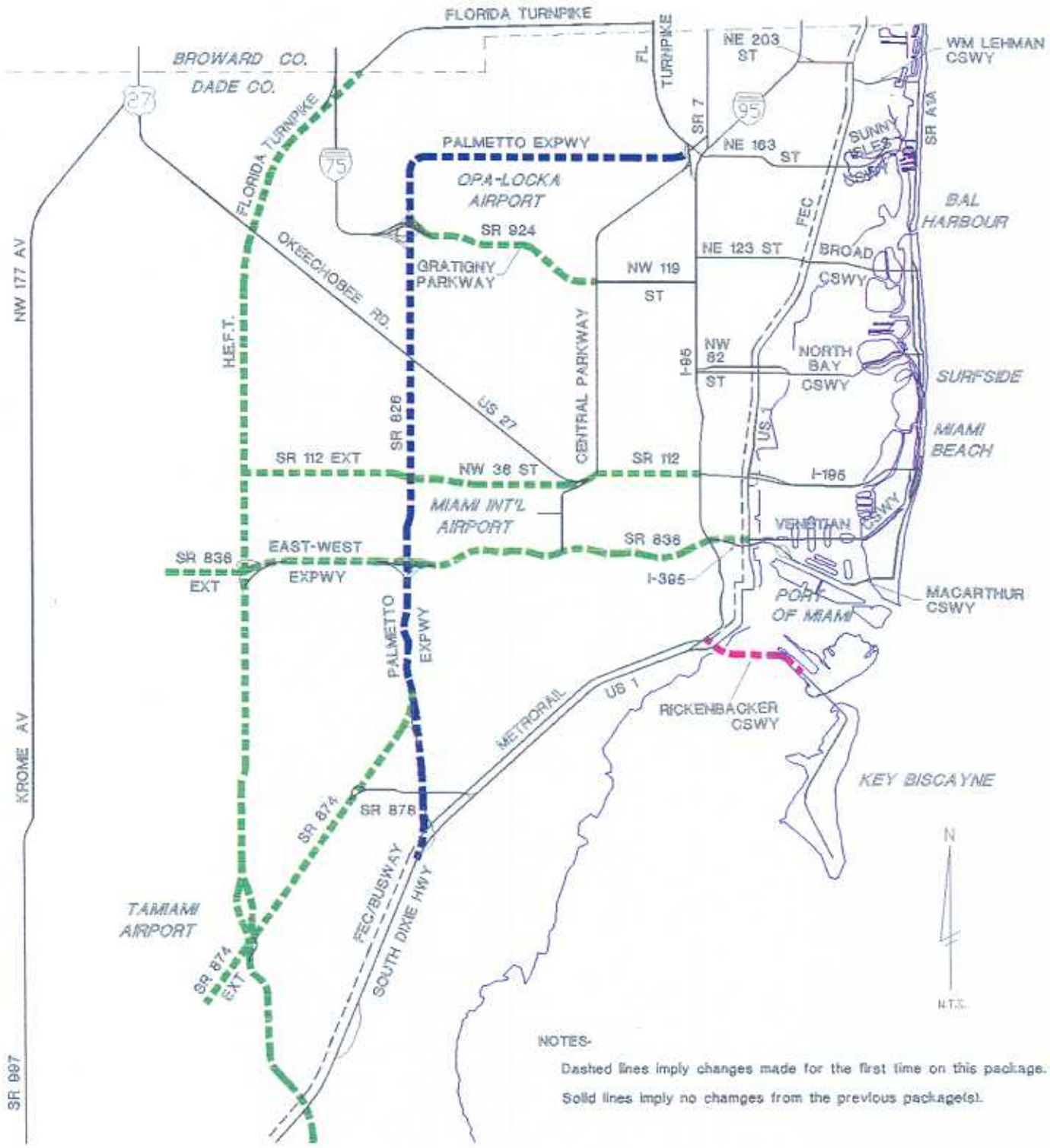

LEGEND

- 24 HOUR TOLL WITH CONGESTION PRICING
- HOVL PRICING - ADD 1 LANE
- WEEKEND CONGESTION PRICING

FIGURE 6.3
METRO DADE ROAD PRICING STUDY
MODERATE PACKAGE

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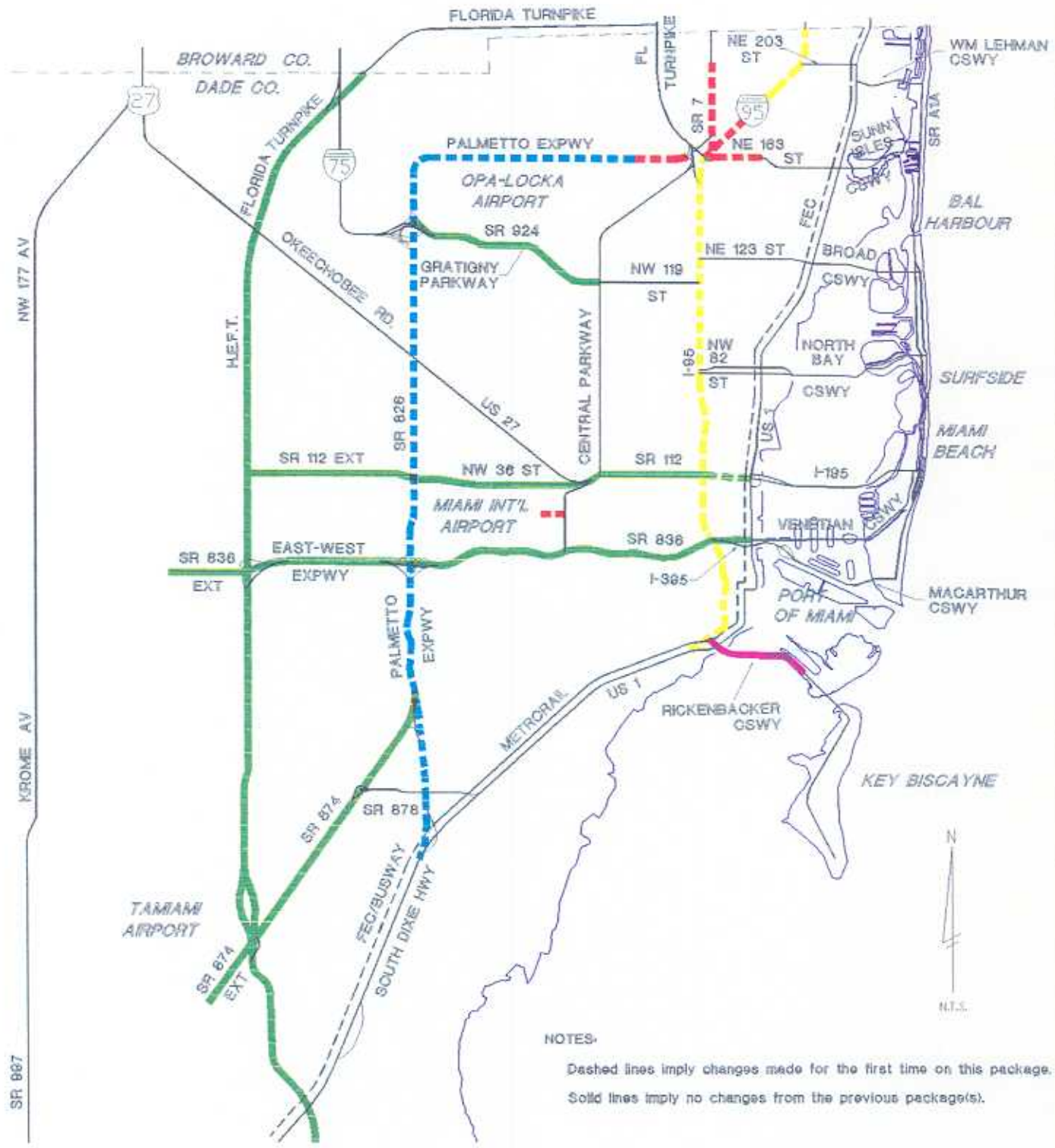

NOTES:

Dashed lines imply changes made for the first time on this package.

Solid lines imply no changes from the previous package(s).

LEGEND

- 24 HOUR TOLL (CONGESTION PRICING)
- PEAK PERIOD - ONLY PRICING
- HOVL PRICING - ADD 1 LANE & TAKE 1 LANE
- HOVL PRICING - TAKE 1 LANE
- WEEKEND CONGESTION PRICING

FIGURE 6.4

METRO DADE ROAD PRICING STUDY

MODERATLY AGGRESSIVE PACKAGE

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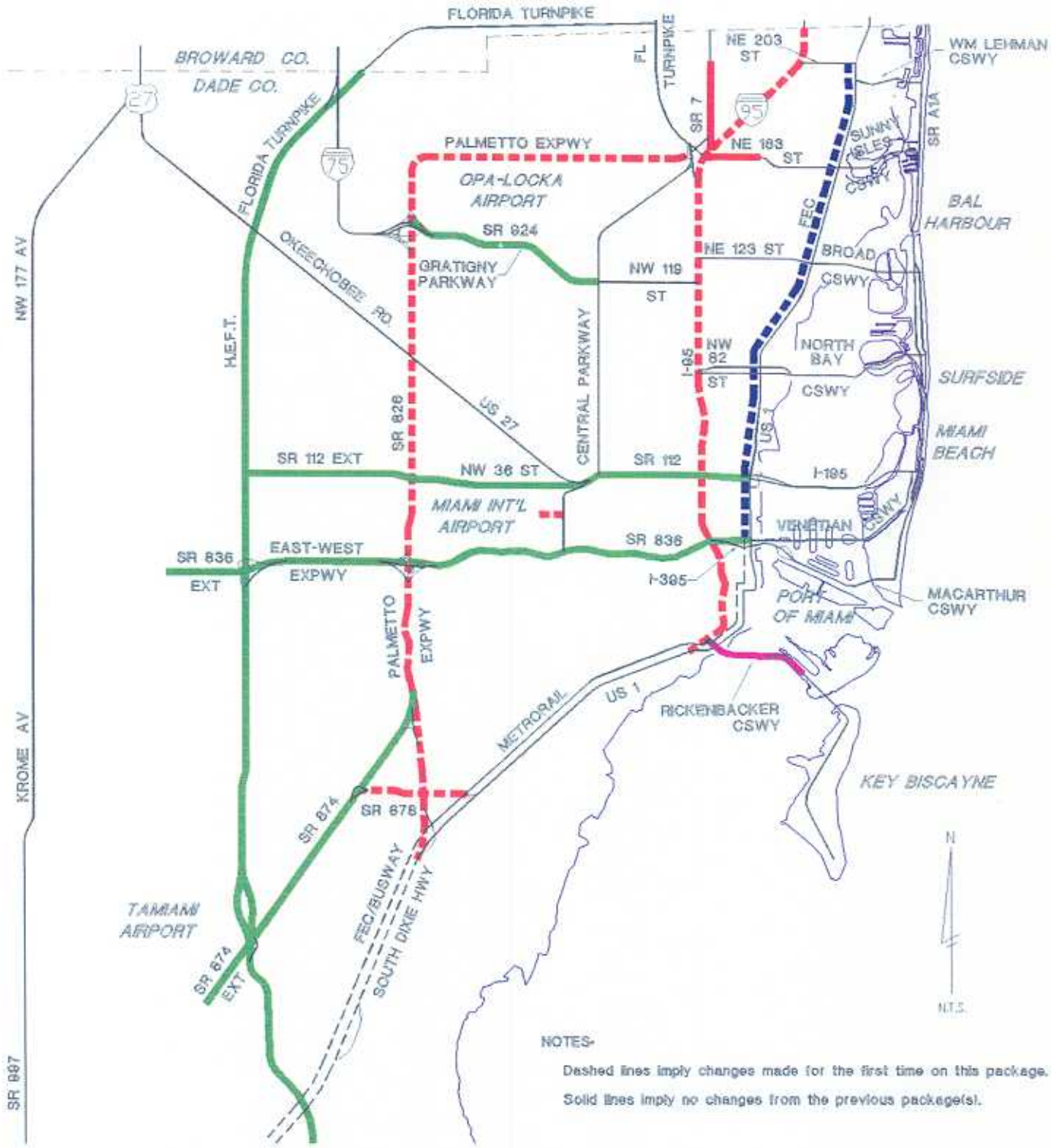

NOTES-

Dashed lines imply changes made for the first time on this package.

Solid lines imply no changes from the previous package(s).

LEGEND

- 24 HOUR TOLL (CONGESTION PRICING)
- PEAK PERIOD - ONLY PRICING
- BUSWAY/HOV WAY - ADD 1 LANE
- WEEKEND CONGESTION PRICING

FIGURE 6.5

METRO DADE ROAD PRICING STUDY

AGGRESSIVE PACKAGE

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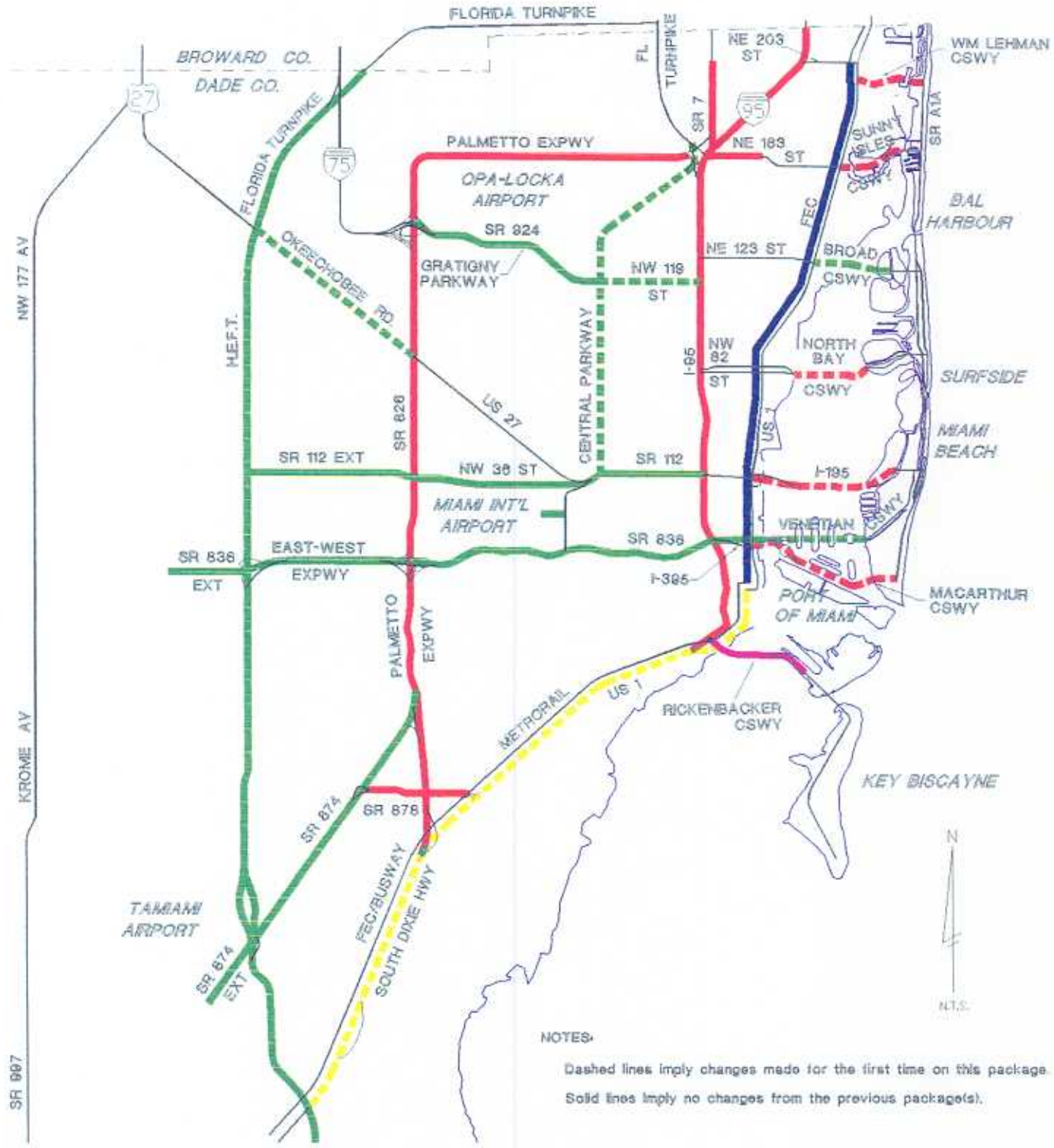

LEGEND

- 24 HOUR CONGESTION PRICING
- PEAK PERIOD - ONLY PRICING
- BUSWAY/HOV-WAY - ADD 1 LANE
- WEEKEND CONGESTION PRICING
- HOVL PRICING - TAKE 1 LANE

FIGURE 6.6
METRO DADE ROAD PRICING STUDY
VERY AGGRESSIVE PACKAGE

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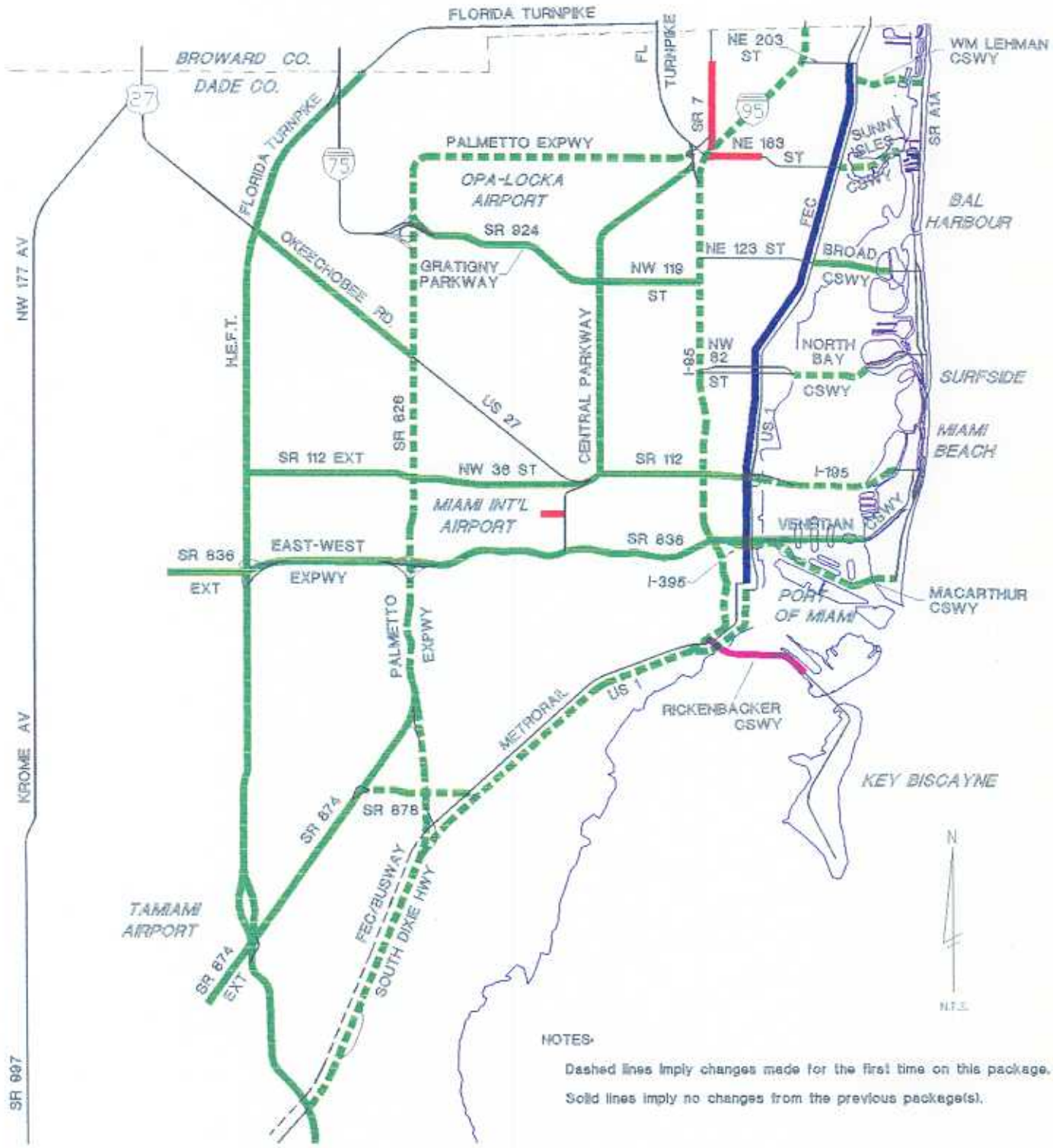

NOTES:

Dashed lines imply changes made for the first time on this package.

Solid lines imply no changes from the previous package(s).

LEGEND

- 24 HOUR CONGESTION PRICING
- PEAK HOUR - ONLY PRICING
- HOVL PRICING - ADD 1 LANE
- WEEKEND CONGESTION PRICING

FIGURE 6.7

METRO DADE ROAD PRICING STUDY

ULTRA AGGRESSIVE PACKAGE

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The following tables provide a "capsule" presentation of each plan package:

THE "DO NOTHING" PACKAGE

DESCRIPTION:	Maintain the existing toll road system.
PROJECTS INCLUDED:	Existing toll roads.
USES OF FUNDS:	Minor projects, debt service, and operations and maintenance. Upgrade toll collection systems.
EVALUATION:	This package results in poor revenue yields. Will not create a regional congestion management strategy, or manage future congestion. Few environmental benefits, since SOV's will not be discouraged. Public acceptance will not be an issue, since no new toll roads will be built.
COMMENTS:	Poor overall rating.

THE CONSERVATIVE PACKAGE

DESCRIPTION:	Increase existing tolls to 7-10 cents/mile. Construct and toll all new planned expressways. Add a toll on the existing untolled section of SR 836 west of SR 826.
PROJECTS INCLUDED:	All existing toll roads.
	SR 112/Airport Expressway extension.
	SR 836/Dolphin Expressway extension.
	SR 874/Don Shula Expressway extension.
USES OF FUNDS:	ITS Projects - capital and operating expenses.
	Finance fixed guideway (LRT or heavy rail) along SR 836.
	Fund express buses - capital and/or operating costs.
	Minor project, debt service, and operations and maintenance
	Upgrade toll collection systems.

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EVALUATION: Premium toll rates will provide good congestion management on the toll roads, but will increase traffic on non-tolled expressways. Will not have significant environmental benefits, since SOV's will still be the primary mode. Some benefits will be realized by increased LRT use along the east-west corridor and express buses.

COMMENTS: The overall rating is good since some benefits will be realized. The main objective of managing congestion will, however, not be accomplished.

THE MODERATE PACKAGE

DESCRIPTION: This package consists of items in the Conservative Package plus the following: Phased increases in toll rates up to premium levels. Implement HOVL pricing on selected non-toll freeways, and implement congestion pricing on all toll facilities and congestion "generators." PPO pricing on all non-toll freeways in the later stages.

PROJECTS INCLUDED: All projects included in the conservative package, plus:

Congestion pricing on all toll expressways.

SR 826/Palmetto Expressway HOVL Pricing-Add a lane.

HOVL Pricing-Take a lane on I-95.

Weekend congestion pricing on Rickenbacker Causeway, with residents travelling free.

AM peak hour-only congestion pricing (SB) at the Golden Glades interchange on SR 826 (W inbound), and US 441, including the Turnpike and I-95.

Miami International Airport (MIA) peak period only.

New HOV-way along FEC corridor parallel to Biscayne Boulevard/US 1 north of downtown Miami. HOV 3's travel free and HOV 2's at a discount. SOV's pay a premium rate.

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Add PPO pricing on all non-toll freeways in the later stages of the plan.

USES OF FUNDS: ITS Project - capital and operating expenses, especially on I-95 and the Palmetto Expressway.

Fixed guideway capital and operating expenses (LRT or heavy rail) along SR 836 (MIA to Port of Miami), along the Metro-rail south leg, along I-195, and the MacArthur Causeway.

Express buses - capital and operating expenses along the HOV corridors, especially along US 1 south of Metro-rail, and along the FEC HOV-way north of downtown Miami.

Airport parking and roadway projects using airport tolls.

Adding HOV lanes on SR 826/Palmetto Expressway.

EVALUATION: This package contains a region-wide congestion management strategy that will significantly provide congestion relief. All major freeways are included, so traffic cannot clog other "free" facilities. SOV's will be heavily discouraged when premium toll rates take effect, and HOV and transit use will increase. Very good revenue yields can fund major transportation projects. The environment will benefit from decreased SOV use and increased transit use. Public acceptance may be difficult, but can be mollified by the uses of toll revenues.

COMMENTS: Strategy should provide regional improvements to the entire transportation system and environment. The overall rating for this package is very good.

THE AGGRESSIVE PACKAGE

DESCRIPTION: Moderate package plus implementation of 24-hour congestion pricing on all existing non-toll expressways, causeways, and on selected arterial streets. Build and toll unplanned expressways.

PROJECTS INCLUDED: All the projects in the Moderate Package, plus:

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24-hour congestion pricing on US 1/South Dixie Highway.

24-hour congestion pricing on I-95, Palmetto Expressway.

24-hour congestion pricing on all causeways (Lehman, Sunny Isles, North Bay, MacArthur, Julia Tuttle, Venetian and Broad), with all residents travelling free.

24-hour congestion pricing on the Port of Miami bridge, except for port employees.

Central Parkway, Okeechobee Road (from SR 826 to HEFT), Gratigny Parkway extension to I-95.

USES OF FUNDS: Same as for Moderate Package.

EVALUATIONS: This package will generate excellent revenue yields, and effect a regionwide congestion management program. Environmental benefits would also be significant. However, public acceptance would be very difficult, especially with respect to 24-hour tolls on existing "free" roads. Therefore, many of the listed projects may never get approved.

COMMENTS: Overall a good plan to reduce congestion, but should not receive much public support for the aggressive projects.

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TABLE 6.2

PLAN EVALUATIONS

DO NOTHING PACKAGE

RATING / CRITERION	EXCELLENT	VERY GOOD	GOOD	FAIR	POOR
REVENUE YIELD					X
CONGESTION MANAGEMENT					X
ENVIRONMENTAL BENEFITS					X
PUBLIC ACCEPTABILITY	X				
OVERALL RATING					X

CONSERVATIVE PACKAGE

RATING / CRITERION	EXCELLENT	VERY GOOD	GOOD	FAIR	POOR
REVENUE YIELD			X		
CONGESTION MANAGEMENT			X		
ENVIRONMENTAL BENEFITS			X		
PUBLIC ACCEPTABILITY			X		
OVERALL RATING			X		

MODERATE PACKAGE

RATING / CRITERION	EXCELLENT	VERY GOOD	GOOD	FAIR	POOR
REVENUE YIELD		X			
CONGESTION MANAGEMENT		X			
ENVIRONMENTAL BENEFITS		X			
PUBLIC ACCEPTABILITY				X	
OVERALL RATING		X			

AGGRESSIVE PACKAGE

RATING / CRITERION	EXCELLENT	VERY GOOD	GOOD	FAIR	POOR
REVENUE YIELD	X				
CONGESTION MANAGEMENT		X			
ENVIRONMENTAL BENEFITS		X			
PUBLIC ACCEPTABILITY					X
OVERALL RATING			X		

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TABLE 6.3

CONGESTION PRICING PROJECTS VS AGGRESSIVENESS

Facility	Strategy	Do Nothing	Conservative	Moderate	Aggressive
Broad Cswy	24 - Hour Congestion Pricing	N	N	N	Y
Central Parkway	24 - Hour Congestion Pricing	N	N	N	Y
Florida's Turnpike HEFT	24 - Hour Congestion Pricing	N	N	Y	Y
Gratigny Parkway	24 - Hour Congestion Pricing	N	N	Y	Y
I-195 & Julia Tuttle Cswy	PPO Congestion Pricing	N	N	N	Y
	24 - Hour Congestion Pricing	N	N	N	Y
I-395 & MacArthur Cswy	PPO Congestion Pricing	N	N	N	Y
	24 - Hour Congestion Pricing	N	N	N	Y
I-95	HOVL Pricing - Take a lane	N	N	Y	N
	PPO Congestion Pricing	N	N	N	Y
	24 - Hour Congestion Pricing	N	N	N	Y
MIA	24 - Hour Congestion Pricing	N	N	Y	Y
NE 167 St / SR 826	PPO WB Congestion Pricing	N	N	Y	Y
North Bay Cswy	PPO Congestion Pricing	N	N	N	Y
	24 - Hour Congestion Pricing	N	N	N	Y
Okeechobee Rd NW of SR 826	24 - Hour Congestion Pricing	N	N	Y	Y
Port of Miami Bridge	PPO Congestion Pricing	N	N	N	Y
	24 - Hour Congestion Pricing	N	N	N	Y
Rickenbacker Cswy	Weekend Premium Cngstn Pricing	N	N	Y	Y
SR 112 / Airport Expwy	24 - Hour Congestion Pricing	N	N	Y	Y
SR 112 / Airport Expwy Ext	24 - Hour Congestion Pricing	N	N	Y	Y
SR 7 / US 441	PPO SB Congestion Pricing	N	N	Y	Y
SR 826 / Palmetto Exwy	HOVL Pricing - Add a lane	N	N	Y	N
	HOVL Pricing - Add + take a lane	N	N	Y	N
	PPO Congestion Pricing	N	N	Y	Y
	24 - Hour Congestion Pricing	N	N	N	Y
SR 836 / Dolphin Expwy	24 - Hour Congestion Pricing	N	N	Y	Y
SR 836 / Dolphin Expwy Ext	24 - Hour Congestion Pricing	N	N	Y	Y
SR 874 / Don Shula	24 - Hour Congestion Pricing	N	N	Y	Y
SR 874 / Don Shula Ext	24 - Hour Congestion Pricing	N	N	Y	Y
SR 878 / Snapper Creek	PPO WB - Congestion Pricing	N	N	Y	Y
Sunny Isles Cswy	PPO Congestion Pricing	N	N	N	Y
	24 - Hour Congestion Pricing	N	N	N	Y
US 1 / Biscayne Blvd	HOVL Pricing - Add lanes (+Busway)	N	N	Y	Y
US 1 / S Dixie Hwy	HOVL Pricing - Take a lane	N	N	N	Y
	24 Hour Congestion Pricing	N	N	N	Y
Venetian Cswy	24 - Hour Congestion Pricing	N	N	N	Y
William Lehman Cswy	PPO Congestion Pricing	N	N	N	Y
	24 - Hour Congestion Pricing	N	N	N	Y

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Finally, traditional toll revenue bond financing policies were examined in relation to privatized financing and pricing strategies. Because one of our primary objectives is to enhance transportation revenues and create capital, it is important to appreciate the significant differences between these two financing options in a congestion pricing environment. The differences are described in Table 6.4.

TABLE 6.4

TRADITIONAL PUBLIC VS CONTEMPORARY PUBLIC/PRIVATE FINANCING

Strategy	Traditional Public Financing	Contemporary Private Financing
Toll Rates	4¢ to 6¢/mile	10¢ to 15¢/mile
Congestion Pricing	No	20¢ to 25¢/mile
Toll Indexing	No	2% to 4%/year
Deferred Debt Financing	No	Yes
Equity Financing	No	Yes

Toll indexing is a process whereby tolls are adjusted annually to reflect inflationary changes in the economy. The Consumer Price Index was assumed to be 3% per annum. This is a moderately aggressive strategy and can only be implemented efficiently with ETC equipment.

During the package development and evaluation process, certain assumptions were made regarding elasticity parameters. Included in the packaging process was a realtime, dynamic pricing system for the HOV/Express lanes. This pricing system was designed to keep the HOV/Express lanes operating at LOS "C", or better, at all times. The rationale for this is two-fold: to continue to provide preferential treatment for HOV's; and to provide an incentive for low occupancy vehicles (LOVs) to pay for the privileged use of the lanes. To accomplish this, realtime pricing messages and variable pricing is recommended. It was assumed for purposes of our analysis that the average pricing structure would be designed within the pricing regimes shown in Table 6.5.

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TABLE 6.5

HOVL PRICING REGIMES IN 1994 DOLLARS (IN CENTS PER MILE)

Passengers Per Vehicle	Off-Peak Toll Rate Range	Peak Toll Rate Range	Peak Range Per Passenger
4 or more	0	0	0
3	0	0	0
2	7 to 10	10 to 15	5 to 7½
1	10 to 15	20 to 25	20 to 25

The final pricing structure will depend on the outcome of more detailed studies, the public hearing process and the actual congestion and financial performance encountered.

6.2 Evaluation Interviews

Evaluation of the various road pricing strategies and packages was also carried out in the form of interviews conducted with a sample of key policy makers. The consulting firm of Barbara Howard and Associates, Inc., was retained to conduct the interviews. Interviewees included selected Dade County Commissioners, and members of various transportation committees. A total of thirteen interviews were conducted with key transportation policymakers in Dade County. The questionnaire used for this survey is attached as Appendix D. The following is a broad overview of the responses:

1. There is strong support for increasing the toll rate on the existing Dade County Expressway system.

2. There is mixed, with a majority negative, reaction to constructing the Central Parkway as a toll facility in the CSX corridor.

3. There is support for privatized delivery of the Central Parkway concept.

4. There is support for a new expressway in the Okeechobee Road corridor.

5. There is mixed reaction to implementing congestion pricing for non-residents on the Rickenbacker Causeway.

6. There is strong support for implementing the added lanes on the Palmetto Expressway as HOV lanes.

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7. There is support for HOVL pricing, generally.

8. There is mostly negative reaction to imposing tolls on existing free causeways.

9. There is mixed, but slightly positive support for imposing a peak period toll on South Dixie, if the toll collection system is fully electronic (no toll booths) and if the revenue is used to support Metrorail.

10. There is mixed, but slightly positive support for moderate tolls on I-195 and I-395 if the tolls are used to support the east-west transit line.

11. There is positive support (coupled with small, but strong opposition to) construction of the FEC busway as a 3-lane reversible HOV-way coupled with "sale" of surplus capacity to SOV's.

12. There is support for converting existing general use lanes on I-95 or other expressways to HOV "pricing" lanes.

13. There is support for tolls on existing "free" expressways if there is a way to compensate the poor.

14. There is mixed reaction to placing tolls on existing "free" expressways, like I-95 and SR 826 in the peak period only. However, this mixed reaction becomes positive, if congestion, air quality and/or the feasibility of the Metrorail Extension is improved.

15. There is mixed, but positive support for 24-hour tolls on I-95 and SR 826 if the benefits enumerated above are created.

16. There is positive support for selling excess ramp-metering bypass capacity to SOV's at rates of 50¢ to $1.00 depending on the time of day.

The reader is cautioned that the opinions gathered above do not represent a broad cross-section of public or political opinion, and were considered, but not expressly used to dictate the conclusions and recommendations of this study.

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CHAPTER 7
COST AND REVENUE FORECASTS

Toll revenue forecasts were produced using a proprietary congestion pricing computer model developed by Kimley-Horn's Infrastructure Privatization and Finance Group.[2] The process used by the model is outlined below.

1. Input the traffic and roadway data.
2. Compute the 24-hour toll parameters.
3. Compute the peak period only toll parameters.
4. Compute the HOV lane toll-pricing, and demand parameters.
5. Calculate Year 1 revenues for all the different projects.
6. Compute the multi-year annual revenue forecasts for all the projects.
7. Compute the multi-year annual revenue forecasts for all the packages:

   Do-Nothing, Conservative, Moderate, and Aggressive.
8. Print/Display the revenue comparisons between each of the packages.

The Congestion Pricing Model is a revenue analysis model which, with given input data, will forecast annual revenues for the alternative Metro-Dade Road Pricing Plans. The model requires numerous input parameters which are described below. With these input parameters, the model calculates several outputs, which are discussed in a subsequent chapter.

7.1 Model Inputs

The revenue model requires several input variables, consisting mostly of project-specific data, traffic data, pricing/elasticity data, and financial data. The following base variables are required:

- Length of the facility.
- Total vehicle miles of travel along the entire length of the facility for the base year.
- Total vehicle miles of travel along the entire length of the facility for the future year.

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[2] *It must be noted here that all of the traffic, revenue, and Net Present Value (NPV) estimates in this report are based on gross area-wide sketch planning assumptions that are believed to be reasonable, but have not been verified by detailed study. Kimley-Horn and Associates, Inc., therefore, cannot assume responsibility for the accuracy of these forecasts until more detailed due diligence studies have been exercised.*

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7.2 Model Assumptions

Exact revenues that would be generated by any planned congestion pricing program are difficult to estimate. They vary with project location, market conditions, the state of the economy, the amount of perceived traffic congestion, transit availability and convenience, gas prices, and several other intangible factors. Every person's decision to use a toll road is influenced by a myriad of factors. However, using reasonable assumptions, along with a knowledge of the area, the projected revenues can be forecasted to a "ballpark" level of accuracy. The following assumptions were made:

- Percent HOV3's and HOV2's - Field data collected on I-95 were used to determine the percentage of vehicles with three or more occupants (HOV3's), and the percentage of vehicles with two occupants (HOV2's). The data were included in the Frederick R. Harris report on the System Maintenance of Traffic, based on trip origin/destination tables. The occupancy depends on various factors including time of the trip (AM or PM), and trip purpose (home based work, home based other, and non-home based). It was concluded that approximately 5% of I-95 traffic during the peak hours consists of HOV3's, and another 15% consists of HOV2's. These were the percentages used in the model.

- HOVL Non-Utilization Factor - It has been observed that there is a percentage of HOV's that, although eligible to use HOV lanes, choose not to do so. The model assumed a non-utilization factor of 30%. That is, 30% of eligible HOV's choose not to use the HOVL. This is during normal freeway operations, not as a result of any toll imposition. The diversions caused by implementing tolls on non-toll freeways is further discussed below.

- Diversion Percent - When a toll is imposed on a current non-tolled facility, or if the current toll rate is increased, a percentage of drivers will be diverted from the facility. That is, they would either take a different route, or if the toll is only applied during peak hours, then they may travel during a different time. The percentage diversion depends on the facility and on the time the tolls are applied. The diversion percentages that were assumed in the model are shown below in Table 7.1. The actual diversion should be less than those shown in Table 7.1. These assumptions are made to insure a level of conservatism in the revenue yield estimate.

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TABLE 7.1

DIVERSION PERCENTAGES

Type of Facility	Daily Toll Diversion	PPO Toll Diversion
Causeway	10%	10%
Existing Toll Facility	30%	N/A
New Toll Facility	45%	N/A
Existing Non-toll Facility	45%	50%
Existing Arterial Street	N/A	20%
Special Generator (MIA)	20%	N/A

- **T-Factor** - The T-factor is the truck factor, or the percentage of freeway traffic composed of trucks. This was assumed to be 3% for all the facilities. The T-factor is used to determine the truck revenues; trucks are assumed to pay three times the automobile toll rate.

- **K-Factor** - The K-factor is the percentage of the total 24-hour traffic volume that occurs during the peak hour. This number has been derived from the average daily traffic on the freeway network and a system-wide average of 8% is used throughout the model.

- **D-Factor** - This is the directional factor used in computing the revenues for HOVL pricing and for PPO pricing. This represents the effect of the peak direction, that is, during the peak hours, 60 percent of the traffic is travelling in the peak direction.

- **ADT Multiplier** - This is a multiplier that is used to factor daily revenues up to annual revenues. The factor used was 290, to account for weekends, holidays, and special events.

- **Incident Hours per Year** - This is the number of hours per year assumed to be taken up with incidents on a freeway. This value is used in the calculation of revenues for peak hour and HOVL pricing strategies. It assumes that during congestion caused by incident, more people would pay to use the HOV lanes than normal. The value for I-95 is 50 hours per year, while the value for all other facilities is 30 hours per year. A higher value on I-95 was used to reflect the high rate of incidents on the already-heavily congested facility.

- **Number of Peak-Period Hours** - This is the value used in HOVL pricing to determine the length of time in one year that HOVL pricing is applied. It assumes three hours per day, five

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days per week, fifty-two weeks per year, and then adds the number of incident hours. The net value is 890 hours per year for I-95, and 870 for all the other facilities.

- **Toll Rate Schedule** - The following toll rate schedule was incorporated into the model for freeways and arterials: SOV's are charged at the premium rate of 25 cents per mile. HOV2's are assumed to pay a discounted rate of 12 cents per mile. HOV3's travel free. Trucks are charged at three times the SOV rate, that is, 75 cents per mile. All causeway tolls were assumed to be $1.50 per transaction.

  To account for inflation and growth in tolls over time, a 4 percent per year growth factor was used for the toll rates during the first twenty years of operation. For new toll facilities, including the addition of HOV lanes, a 5 percent growth rate was used for the first twenty years. Subsequent to that time, a 3 percent growth in tolls was assumed from years 21 through 30, and 2 percent was used from years 31 onwards.

- **Causeway Residents** - It was assumed for the purposes of this analysis that beach residents using the causeways would not be charged a toll. Based on data from Dade County, the percentage of "non-emblem", or paying traffic was between 55% and 65% on the Venetian and Rickenbacker Causeways, on which there are existing tolls. The percentage assumed for this model was 50%, a conservative estimate.

- **HOVL Capacity** - This is the physical capacity of the HOV lane. Data collected in several parts of the country have suggested that due to the increasing aggressiveness of commuters, especially in urbanized areas such as Dade County, as many as 2,000 to 2,200 vehicles per hour can use a single freeway lane. This model uses a value of 1,900 vehicles per lane, which is conservative, since revenues would increase if more vehicles were to use the HOV lane.

- **Operations and Maintenance (O&M) Costs** - The O&M costs used in the model varied with the type of facility and the pricing strategy applied. It was computed at a rate of $100,000 per mile for freeways and arterial streets. For causeways, it was based on the cost per transaction. A value of 25 cents per transaction was used for all causeways except the Venetian, and Rickenbacker, where actual O&M costs were used. Based on FDOT data, O&M costs were 27 cents and 46 cents per transaction, for the Venetian and Rickenbacker Causeways respectively. The O&M costs were assumed to grow at 3% per year.

- **Growth Rates** - The annual growth rates for all the facilities were determined based on FSUTMS model runs. Traffic projections were obtained for the Base Year and Year 2010 networks, and the net growth in traffic for all links making up a facility were calculated. These were in general found to range between 1 and 3 percent, typical for a county in which there are no major increases in roadway capacity planned. The rates used in the model were the calculated rates for each facility. However, when capacity was being added, such as for a new facility, or for an add-a-lane

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project this growth rate was increased by 2% to account for the added capacity. The 2% value is a generalized growth rate for the whole county.

- **HOVL Off-Peak Direction Factor** - In general HOVL pricing would generate revenues from traffic moving in the peak direction. On I-95, for example, the peaking characteristics are fairly significant, with pronounced AM southbound and PM northbound peaks. However, some use of the HOV lanes in the off-peak direction is also expected. This model increases the revenue generated by the peak direction HOV lane by 5% to account for revenue generated in the off-peak direction.

- **Peak Period Only Revenue Factor** - The peak period-only congestion pricing strategy is assumed by the model to be applied to the entire freeway in both directions. However, it would generally be applied in such a way that the off-peak pricing rate would be set at half the peak direction pricing rate. Therefore, the revenue calculation must account for this: 60% of the traffic paying at full price, plus 40% percent of the traffic paying at half price. A net PPO revenue factor of 0.8 results.

- **Earliest Opening Year** - This is the year in which any particular project may be expected to open. It was assumed that any project which only involved the implementation of ITS elements, and not major road widening or construction, could open in 1997. These include projects with "take-a-lane" strategies, PPO, and 24-hour congestion pricing. Projects that involved "add-a-lane" pricing strategies were assumed to be operational in 1998. Major construction projects such as expressway extensions and new roadways, were assumed to open in the year 2000.

- **Capital Costs** - Capital costs for ITS implementation typically runs in the order of $1,000,000 per mile, and this was used on the model. Costs for new planned expressway extensions were obtained from the MPO and used directly in the model. New unplanned expressways were calculated based on rates contained in the FDOT cost guidelines.

7.3 Model Results

The outputs from the revenue model are presented and summarized in Appendix E. The tables include individual project revenues, plan revenues, and a summary table showing a revenue comparison of the eight plans. The project and plan sheets project revenues from 1997 through Year 2030. The individual yearly forecast of annual revenues are based on a straight-line projection between 1997 (or the actual project start date) and Year 2030. Consideration was given to accommodate annual growth in traffic and toll rates.

Table 7.2 summarizes the revenue results for the four congestion pricing packages. Included also are the net present values (NPV) of those revenues in the 1994 dollars. The NPV's were determined using an assumed discount rate of 8 percent. The total net revenues are the sum of the net annual revenues which is the difference between the annual revenue and the annual operations and maintenance (O&M) costs.

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TABLE 7.2

YEAR 1997 TO 2030 REVENUE SUMMARY

Congestion Pricing Packages	Year 1 Annual Revenues	Year 2030 Total Net Revenues	Year 2030 Net Present Values
Do Nothing	$10.4M	$0.6B	$0.2B
Conservative	$87.2M	$5.0B	$1.5B
Moderate	$301.3M	$24.5B	$6.2B
Aggressive	$610.0M	$46.6B	$13.0B

Indexing is not a factor until the Moderate package strategies are introduced. The encouraging news is that the differences in total net revenues amongst the packages agrees with the implications from the strategies constituting the packages.

In examining the several levels of revenue, it becomes readily apparent that the most significant contributors are the 24-hour congestion pricing scenarios. At the same time, these strategies are also the least acceptable from a political and social stand point. It appears that the most "implementable" rationale is the Moderate package which offers considerable revenue generation without implementation of overly controversial strategies.

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CHAPTER 8
RECOMMENDATIONS

Based on the evaluation factors previously presented in combination with the revenue analysis from the prior chapter, it is recommended that Dade County implement (in phases) the Moderate Package of congestion pricing strategies. All recommendations are being made at a sketch-planning level of analysis. Therefore, each project recommendation should be confirmed by a detailed, project-specific feasibility study prior to implementation. In general, the recommendations developed as part of this study are the result of the following considerations:

1. The MPO should adopt a road pricing policy for Metro-Dade County.

2. Certain strategies, such as raising tolls on existing toll facilities up to reasonable national norms, should be instituted as soon as possible to create more revenue for modernizing existing toll operations in the short term, and creating capital for more assets in the long term.

3. All existing toll facilities should be converted from manual operation to automated AVI/ETC operation as soon as possible to reduce operating costs and increase net revenues.

4. All toll facilities (city, county, and state) should utilize consistent AVI technology, such as that being deployed by Florida's Turnpike, to reduce operating costs and increase net revenues. A centralized computer-based management control center for all city, county and state toll facilities should be implemented to further reduce operating costs.

5. An application should be made for federal funding under the ISTEA (Section 1012(b)) Congestion Pricing Pilot Program for selected elements of the Metro-Dade Road Pricing Plan, including: AVI technology and congestion pricing.

6. To effectively deal with Year 2030 traffic volumes, Dade County must implement certain congestion pricing strategies regardless of their political and/or social "acceptability".

7. In the final analysis, the "best" package is one consisting of a good balance between public acceptability and revenue generating ability.

From the revenue tables in Appendix E (which are categorized by strategy and facility), it was determined that certain strategies are more "cost effective" in the sense that they provide considerable net revenue return. That examination provided a phasing concept for the Moderate Package which is illustrated in Figures 8.1 through 8.4. The following list summarizes the specific road pricing project by phase over the next 15 to 20 years. Table 8.1 further summarizes the recommended projects by phase within each pricing strategy.

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- Phase 1 (2 years) 1995 - 1996

  - Convert all existing tolled facilities to AVI/ETC.
  - Apply for FHWA grant under the Congestion Pricing Pilot Program and implement congestion pricing on selected facilities in 1996-1997.
  - Increase existing 24-hour tolls (first to 7¢/mile and then to 12¢/mile) on all existing tolled expressways including a new toll plaza on SR836 west of SR826 and bi-directional tolls on existing SR836/SR112 plazas.
  - Build 2 "priced" HOVLs (3 passengers or more) on S.R. 826.
  - Prepare PD&E studies and obtain location/design approval of the SR112 Extension, the SR836 Extension, and the SR874 Extension.
  - Implement weekend/holiday congestion pricing on the Rickenbacker Causeway.

- Phase 2 (4 years) 1997 - 2000

  - Implement congestion pricing on all existing tolled expressways.
  - Implement ramp-metering bypass pricing on I-95.
  - Construct the planned freeway extensions: SR 836, SR 874, SR 112 and implement congestion pricing.

- Phase 3 (5 years) 2001 - 2005

  - Take a lane on I-95 and implement HOVL pricing (2 HOV lanes in each direction, total).
  - Take a lane on S.R. 826 and implement HOVL pricing.

- Phase 4 (5 years) 2006 - 2010

  - Apply PPO congestion pricing to all "generators" including (AM peak) approaches to the Golden Glades interchange, and the entrance to the Miami International Airport.
  - PPO congestion pricing on all existing non-toll freeways.
  - Construct U.S. 1/Biscayne Boulevard busway/HOV-way and sell the surplus capacity to SOV's at a premium.

The application for federal funding under ISTEA's Congestion Pricing Pilot Program should include the following projects:

a. ETC on all toll facilities
b. Implementation of Congestion Pricing on all existing toll facilities
c. Implementation of congestion pricing on selected non-tolled facilities:
   - I-95: Ramp metering bypass pricing, or
     Ramp metering bypass pricing plus HOVL pricing
   - SR 826: HOVL pricing
   - SR 878: PPO pricing

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Further detailed study is needed to confirm or deny the sketch planning estimates of revenue and net present value. It is recommended that detailed project-specific road pricing feasibility studies, implementation plans, and project-specific concept development reports be prepared for all the projects listed above before implementation of any of these sketch planning recommendations.

A comprehensive public involvement and public relations program should be undertaken to educate and inform the affected communities. In addition to this, an administrative program to balance/equitably distribute the economic impact should also be designed in detail.

Arterial Impacts

A diversion analysis was conducted to determine the impacts that the Moderate Road Pricing Package may have on Dade County's arterial roadway network. The volumes and LOS for the Year 2000 Existing+Committed network were compared to the volumes and LOS for the Moderate Package network to determine the significance of the traffic diversion.

The diversion analysis indicates that the addition of tolls (as identified in the moderate road pricing plan) to currently untolled facilities produces significant diversions of traffic to parallel arterial streets. The amount of diversion varies substantially from facility to facility, anywhere from 20% to 70 %, largely based upon the alternative routes available.

However, the analysis shows that the LOS on the parallel arterial facilities on almost all the segments analyzed does not exceed LOS "D." There are only three segments where the LOS falls to "F" after the tolls are imposed. It can therefore be concluded that there is a significant amount of unused capacity on arterial streets that is more efficiently utilized once these tolls are imposed.

The peak hour conditions are expected to be more severe on the arterial streets, since currently, there are already some capacity problems on these facilities. In general, the amount of peak hour diversion desired can be managed by the toll rate that is in effect during these hours. Pricing can be used as an effective management tool, and the ability to control the toll rates on a real-time basis in the future will further enhance this tool. For further detail, please see Appendix F.

Concluding Remarks

The previous chapter identified numerous projects which are recommended for consideration by the Metro-Dade Metropolitan Planning Organization. In deriving these strategies, a number of considerations were involved, particularly with respect to implementation. The reasoning for this involved the following facts:

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1. Dade County's congestion problems are very severe. More funding for highway and transit assets is needed.

2. The notion of people paying for the privilege to drive alone and/or in a non-congested environment is not new, but is controversial.

3. Structuring the projects in the packages such that several strategies are implemented, achieves several objectives identified for this study:

   - It puts equity into the pricing of transportation facilities.
   - It aids in the reduction of congestion and, thus, improves the air quality.
   - It acquaints the public with the notion that these kinds of limitations on personal traveling freedom are both good for the public welfare and are here to stay.

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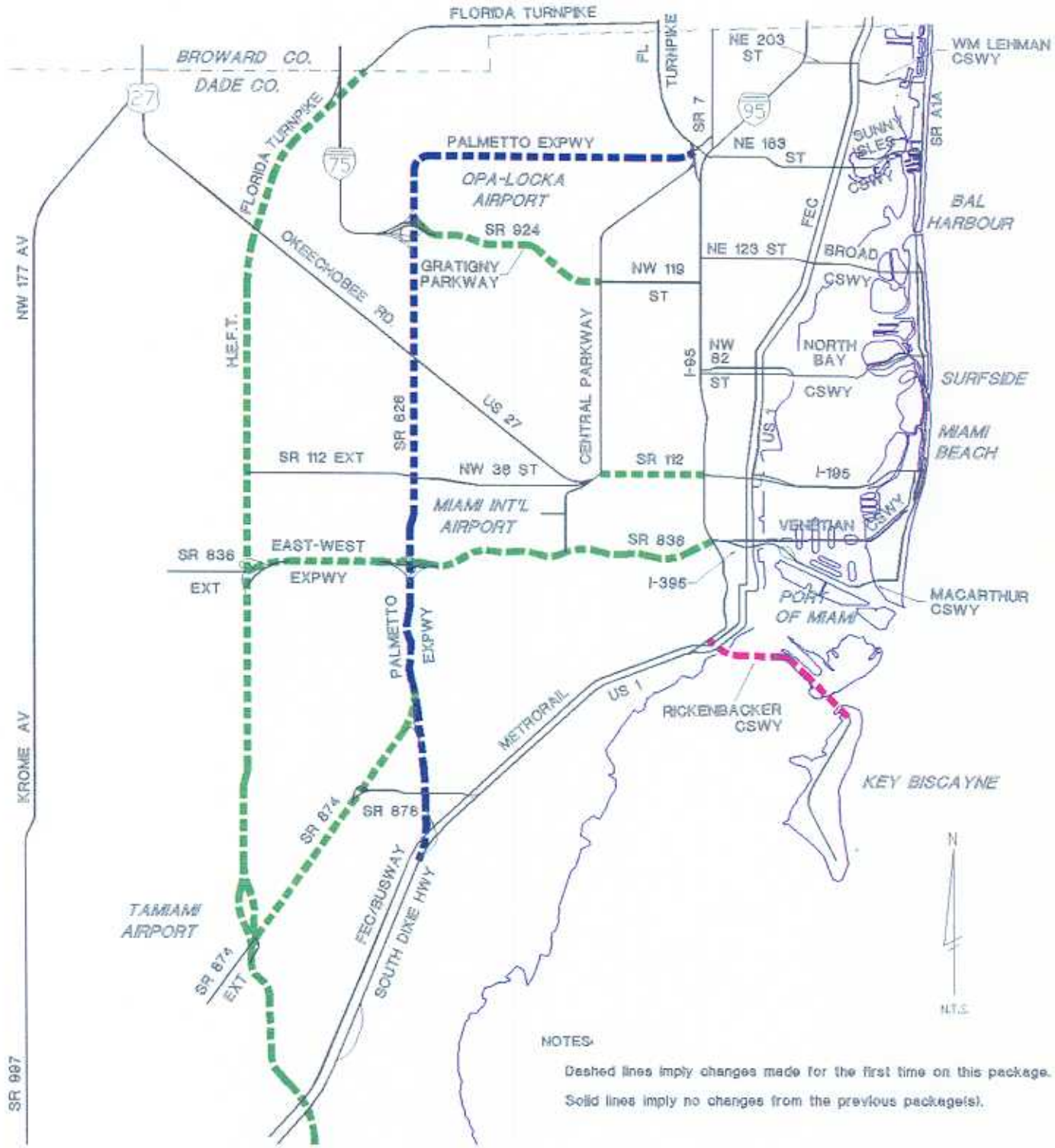

NOTES:

Dashed lines imply changes made for the first time on this package.

Solid lines imply no changes from the previous package(s).

LEGEND

- RAISE TOLL TO 7¢/MILE, THEN 12¢/MILE IN 1998
- HOVL PRICING - ADD 1 LANE
- WEEKEND CONGESTION PRICING

FIGURE 8.1

METRO DADE ROAD PRICING STUDY

MODERATE PACKAGE PHASE 1

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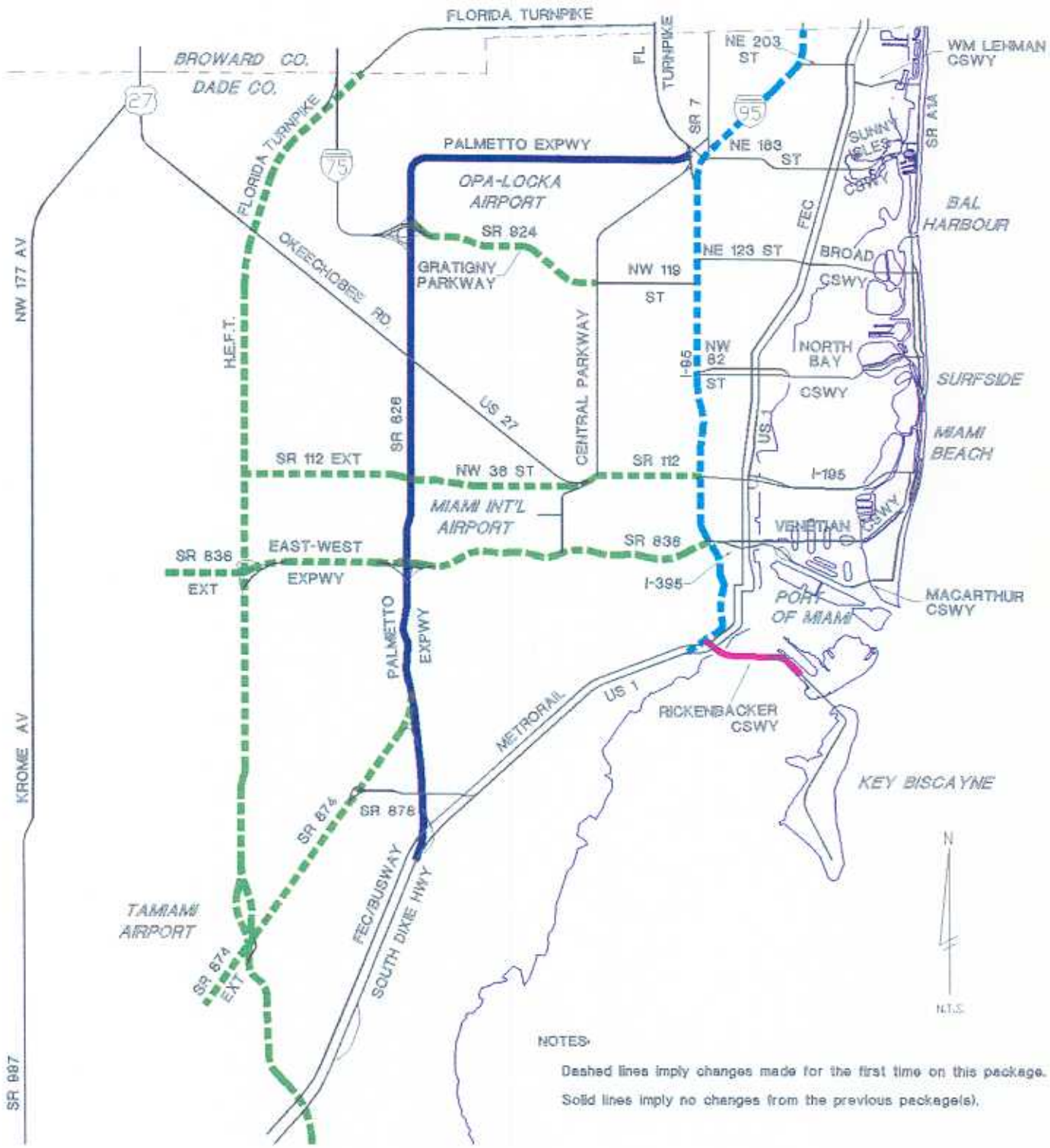

NOTES:

Dashed lines imply changes made for the first time on this package.

Solid lines imply no changes from the previous package(s).

LEGEND

- 24 HOUR TOLL AND CONGESTION PRICING
- HOVL PRICING - ADD 1 LANE
- RAMP METERING BYPASS PRICING
- WEEKEND CONGESTION PRICING

FIGURE 8.2

METRO DADE ROAD PRICING STUDY

MODERATE PACKAGE PHASE 2

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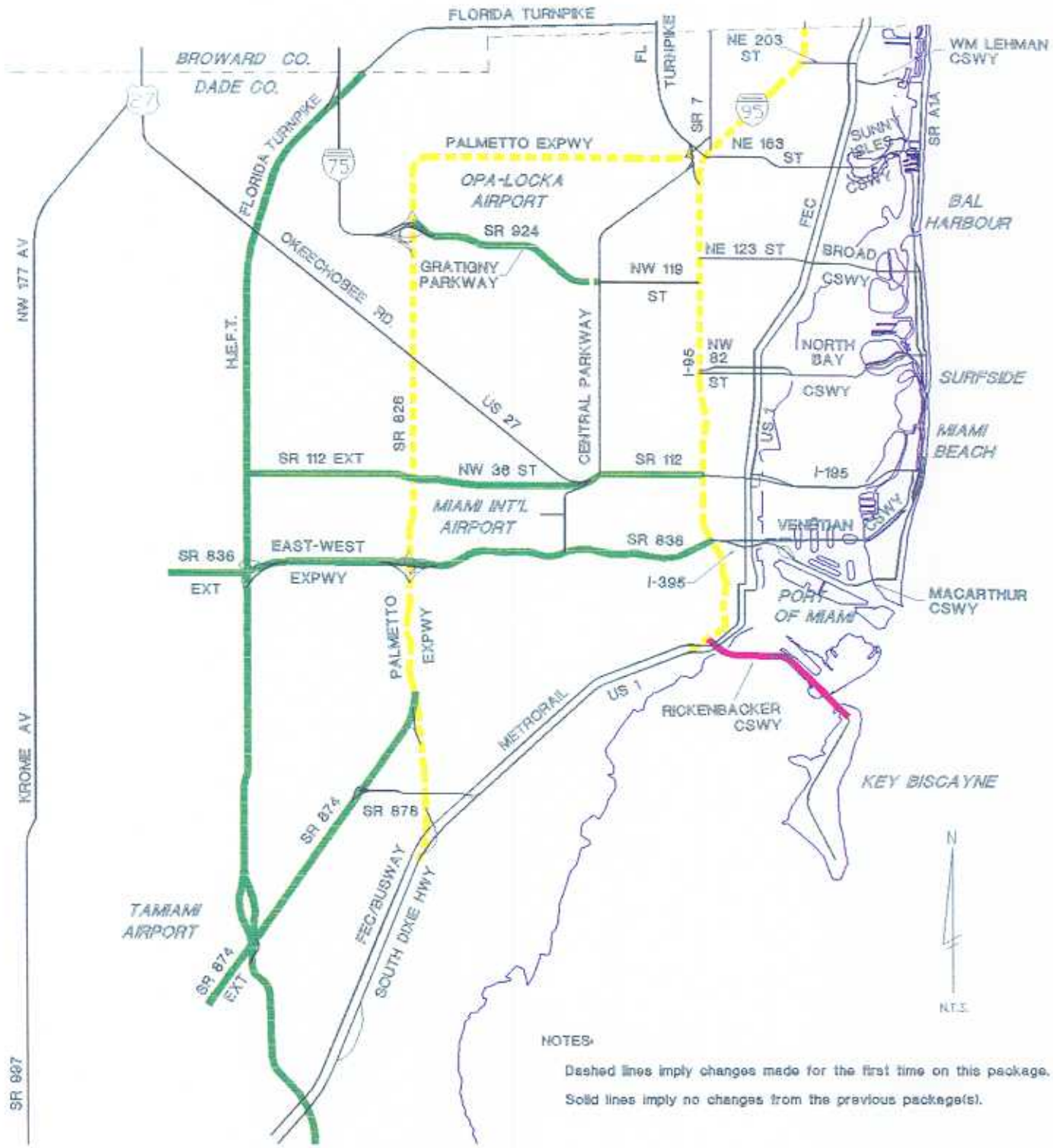

NOTES:

Dashed lines imply changes made for the first time on this package.

Solid lines imply no changes from the previous package(s).

LEGEND

- 24 HOUR CONGESTION PRICING
- HOVL PRICING - TAKE 1 LANE
- WEEKEND CONGESTION PRICING

FIGURE 8.3

METRO DADE ROAD PRICING STUDY

MODERATE PACKAGE PHASE 3

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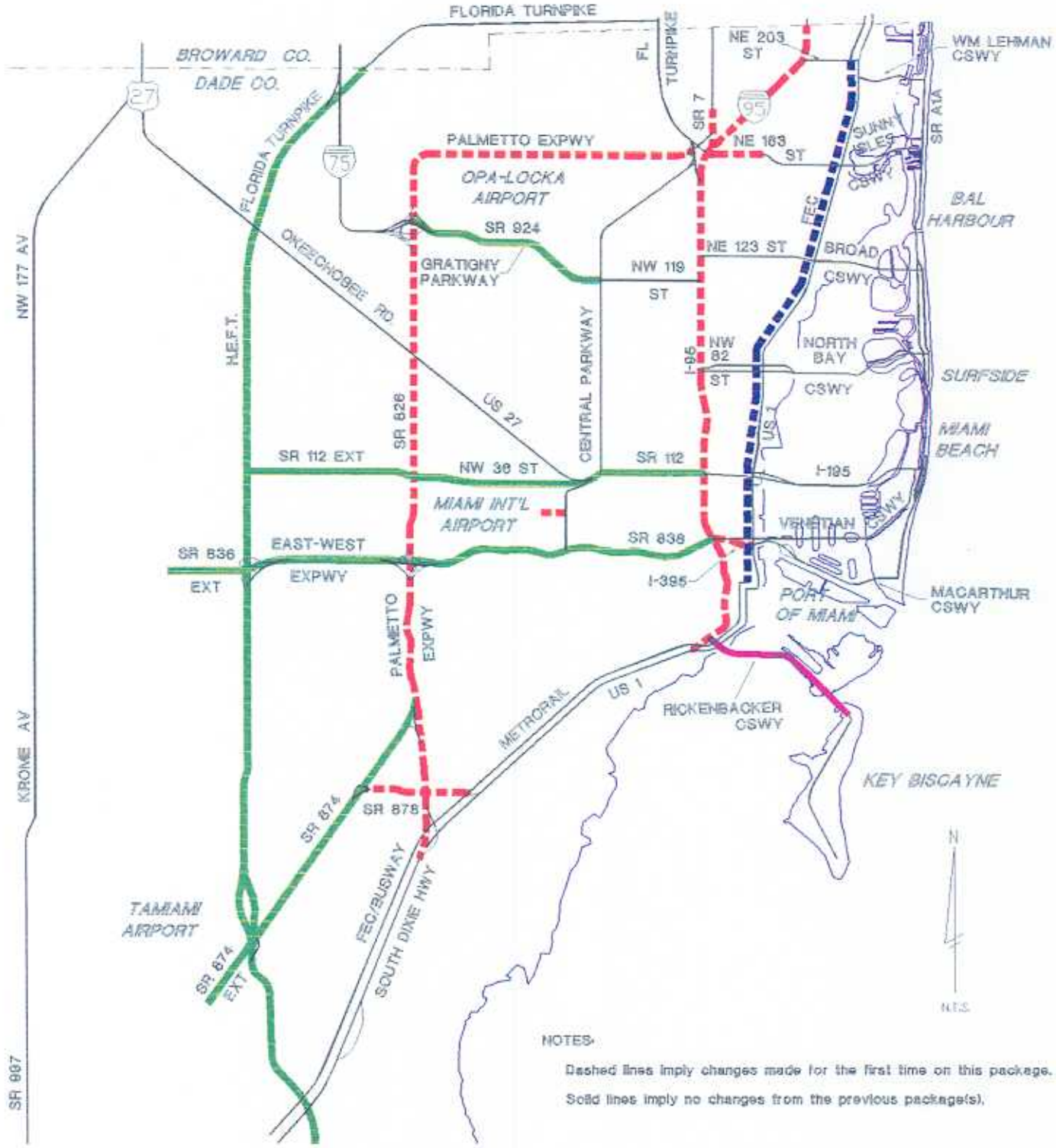

NOTES:

Dashed lines imply changes made for the first time on this package.

Solid lines imply no changes from the previous package(s).

LEGEND

- 24 HOUR TOLL (CONGESTION PRICING)
- BUSWAY/HOV-WAY - ADD 1 LANE
- PEAK PERIOD ONLY PRICING
- WEEKEND CONGESTION PRICING

FIGURE 8.4

METRO DADE ROAD PRICING STUDY

MODERATE PACKAGE PHASE 4

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TABLE 8.1

FACILITIES VS STRATEGIES BY PHASE

Facility	Raise toll to 7 cents/mile for existing tolled expwys	HOVL Pricing Add a lane	CP + Indexing of all toll facilities	Raise tolls to premium levels (12 cents/mile)	Add planned frwy extensions + congestion pricing	Ramp meter bypass pricing	HOVL Pricing Take a lane	Congestion pricing of "generators"	PPO pricing of non-toll freeways	Busway/HOV-way Pricing
Broad Cswy										
Central Parkway										
Florida Turnpike and HEFT	Phase 1		Phase 1	Phase 1						
Gratigny Parkway	Phase 1		Phase 1	Phase 1						
I-195 & Julia Tuttle Cswy										
I-395 & MacArthur Cswy										
I-95						Phase 2	Phase 3		Phase 4	
MIA								Phase 4		
NE 167 St / SR 826 at GGI								Phase 4		
North Bay Cswy										
Okeechobee Rd NW of SR 826										
Okeechobee Rd SE of SR 826										
Port of Miami Bridge										
Rickenbacker Cswy			Phase 1							
SR 112 / Airport Expwy Ext.	Phase 1		Phase 1	Phase 1	Phase 2					
SR 7 / US 441								Phase 4		
SR 826 / Palmetto Exwy		Phase 1					Phase 3		Phase 4	
SR 836 / Dolphin Expwy	Phase 1		Phase 1	Phase 1						
SR 836 / Dolphin Expwy Ext					Phase 2					
SR 874 / Don Shula	Phase 1		Phase 1	Phase 1						
SR 874 / Don Shula Ext					Phase 2					
SR 878 / Snapper Creek									Phase 4	
Sunny Isles Cswy										
US 1 / Biscayne Blvd										Phase 4
US 1 / S Dixie Hwy										
Venetian Cswy										
William Lehman Cswy										

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HEFT: Homestead Extension of the Florida Turnpike
MIA: Miami International Airport
GGI: Golden Glades Interchange

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