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A Brief History of Clearance Time

(...with apologies to Stephen Hawking)

This effort chronicles the history and facts surrounding the Florida Keys Clearance Time – the time it takes to evacuate the Keys. Among the important issues is the declaration by the Florida Department of Community Affairs (DCA) that Monroe County had made “Substantial Progress” toward achieving a Clearance Time of less than 24 hours, stating in their 2006 Florida Keys Annual Assessment “The most recent run (September, 2006) of the hurricane evacuation model shows a projected clearance time of 18.2 hours. . .” Despite facts that refute that claim, DCA’s “Substantial Progress” position has not been rescinded, but rather it has been exacerbated by DCA declaring that Monroe County has “completed” its hurricane-evacuation Comprehensive Plan task. But as you will read, public safety has been subordinated to development pressures.

There is a great deal of confusion regarding Monroe County’s hurricane evacuation Clearance Time. There are three different definitions of hurricane-evacuation Clearance Time, only one of which is part of our Comprehensive Plan (the 1989 PBS&J and U.S. Army Corps of Engineers definition, as you will read below). There are two hurricane-evacuation “models” currently in discussion – the Miller model and the recent South Florida Regional Planning Council (SFRPC) model. Each definition of Clearance Time is different, and the differences are pivotal. A “hurricane evacuation model” is a formula or whole series of linked formulas that take data like the number of dwelling units, occupancy rates, number of vehicles per dwelling unit, participation rates, vehicles per hour capacity for choke points, etc., to calculate a Clearance Time. Our Comprehensive Plan ties the rate of development to achieving a Clearance Time less than 24 hours. Different sets of assumptions results in different Clearance Times. The most recent official change to our evacuation Policy was an amendment to Comprehensive Plan Policy 216.1.8 (September 22, 2005), making it law that Monroe County would conduct “Phased” or “Staged” Evacuations when possible – named for the practice of sending different portions of the evacuating public out in different phases or stages. By itself, this was not a big change, since we have conducted Phased Evacuations for many years.

However, the effect of that Policy amendment on Clearance Time was not transmitted and is absent in the amendment. Also absent was the potential acceleration of development that could result. Furthermore, to use Phased Evacuation to calculate a different Clearance Time is to use a radically different definition of Clearance Time than that which resides in the Comp Plan. The Comp Plan calculation of Clearance Time “...begins when the first evacuating vehicle enters the road network”. However, calculation of the often-cited 18-hour Clearance Time requires that the first evacuating vehicles (tourists) be *ignored* and that only the permanent residents be counted. As a matter of fact, for the 18-hour Clearance Time based on the SFRPC study, only 62% of the dwelling units are counted (using Miller data) or just 48% of the total evacuating vehicles (using SFRPC data). Our Comprehensive Plan requires not only that the clearance time be reduced, but also that the potential for loss of life be reduced. All of the attempts to use an “18-hour” clearance time INCREASE the potential for loss of life because they facilitate an increase in development, which would exacerbate our evacuation challenges.

Perhaps worst of all, the 2006 South Florida Regional Hurricane Evacuation Traffic Study—the source of that radically different definition—is replete with errors, it fundamentally changes the way Clearance Times are calculated and it overlooks the effects of Miami-Dade County traffic on our evacuation (despite its title). It is one of the primary references for the claim that Monroe County has reduced their Clearance Time, and yet the public has not scrutinized it. Despite assertions to the contrary by DCA when they blessed the Policy 216.1.8 amendment, pro-development interests at both DCA and the County are now using the specious 18-hour figure as justification for thousands of new development dwelling allocations.

This constitutes cooking the Clearance-Time books. If it weren't for the Area of Critical State Concern and its review of these shenanigans at the State level, we would soon be dealing with much more difficult evacuations because of worse traffic jams caused by new residents evacuating from thousands of new dwelling units. The matter was put before the Governor and Cabinet on December 5, 2006 where County Administrator Willi stated that the 18-hour clearance time was in the Comprehensive Plan and that it had been given full public scrutiny. They were confused (as were many others) about the 18.1- and 18.2-hour times cited, but nevertheless approved the finding of "Substantial Progress." Following significant protests, on December 19, the Governor and Cabinet amended the minutes of the December 5 meeting to make it clear that they did not accept the 18-hour clearance time, and that references to such were for "informational purposes only." An audio recording of the Cabinet meeting is available at <http://www.myflorida.com/myflorida/cabinet/agenda06/1219/audioindex.html>. The amendment was made and passed around minute 58:30 of the meeting.

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The three relevant hurricane evacuation studies are listed below. Each uses a different definition of Clearance Time. Only the first of these is referred to in our Comprehensive Plan:

1. 1989 U.S. Army Corps of Engineers and Post, Buckley, Schuh and Jernigan (PBS&J) "Lower Southeast Florida Hurricane Evacuation Study – Monroe County".
2. The 2001 Florida Department of Transportation and Miller Consulting "Florida Keys Hurricane Evacuation Study".
3. The South Florida Regional Planning Council (SFRPC) "2006 South Florida Regional Hurricane Evacuation Traffic Study".

Our Comprehensive Plan Technical Document uses the 1989 PBS&J study as its reference for hurricane evacuation clearance times.

In 2004, DCA Secretary Cohen established the "Florida Keys Hurricane Evacuation Clearance Working Group" that was directed to "reduce clearance time". One would have hoped that his orders were synonymous with "improve evacuation safety", but that was not the case. Using the "Miller" clearance time model, four Alternatives were considered:

- 1) Transportation Systems Management – using traffic cones, lane delineators, traffic signals, traffic cops, etc. to increase the road capacity (to make three lanes out of two). This was rejected because it was "too labor intensive", even though this is part of the County's policy.
- 2) Permanent roadway improvements that would build additional evacuating lanes at the choke points. This was rejected primarily because Islamorada would not accept another permanent lane through their village.

3) The “Phased” or “Staged” evacuation solution that simply removed a large portion of the evacuating population from the calculation, and did not start timing the evacuation until the permanent residents evacuated. This constitutes a very different definition of Clearance Time, as you will read below. Application of this different definition, using the Miller model, reduced the resulting calculation by six hours. **The Working Group selected this alternative.**

4) Sheltering throughout the Keys was rejected because there is “not enough shelter space for the entire population”. [Because of the Keys’ unique risk from storm surge, sheltering in place is unlikely to ever be accepted. The wind-resistance standards in our building code do not provide protection from storm surge.]

The only alternative that did not improve evacuation safety—but merely adjusted the mathematical result of the Miller model Clearance Time—was chosen because it was the “...the quickest and most effective means of significantly reducing the clearance time...” No kidding! The Clearance Time was *instantaneously* reduced from 24 hours to 18 hours - effortlessly - at no cost!

As a result of the Hurricane Evacuation Working Group’s recommendation, Monroe County Ordinance 023-2005 amended Comp Plan Policy 216.1.8. While it received the required public hearings, the public was *not* made aware of its impact on safety and development. “Staged” or “Phased” evacuation has been the practice of Monroe County for many years - when we have the luxury of extra time. The Policy amendment removed our safety margin and adopted the Best Case scenario, purely for the purpose of increasing development. Not even advocates of this amendment claim that it improved safety. The Policy was objected to strongly in writing by this writer at every level - Planning Commission, BOCC, DCA and finally a letter to Governor Bush detailing problematic issues, including the continued failure to address the effect of Miami-Dade traffic on our evacuations. Ultimately, only one three-paragraph reply was received - from the Department of Community Affairs.

In DCA’s three-paragraph reply, most of this writer’s objections were deferred by referring to a possible, future Regional Evacuation study that would address the Miami-Dade traffic as it affected our evacuation. So, the failure to address Miami-Dade traffic was not resolved, but the Policy amendment was nevertheless adopted by DCA. Our evacuation clearance times are based on the false assumption that there will be ZERO traffic joining the evacuation in Miami-Dade County (there is zero traffic from Miami-Dade County in the Miller model), which results in the false conclusion that adding evacuation capacity in Monroe County would deliver the full benefit of that additional capacity to our evacuation clearance time. Our Clearance Times will not be valid until they include the effects of Miami-Dade County – through which we must transit at least 40 miles to reach our nearest and official Category 3+ shelter. Ultimately, the South Florida Regional Planning Council created what purported to be a “Regional” evacuation study, ostensibly to include the effects of Miami-Dade County’s traffic on our evacuation Clearance Time.

The Comp Plan does not comment on the impact of the new policy on clearance time or the change to development that could result. However, the enabling Monroe County Ordinance (023-2005) included the following statement: “For the purposes of implementing Policy 216.1.8, this Policy shall not increase the number of allocations to more than 197 residential units a year, except for workforce housing. Any increase in the number of allocations shall be for workforce housing only.” Interestingly, that phrase did not make into the Comp Plan.

As an aside, there is only one (unrelated) reference to “workforce housing” in the Comp Plan: Item P under the Year Eight Work Plan requirements: “Provide up to \$10 million in bond financing from the Tourist Impact Tax for acquisition of land for workforce housing and affordable housing sites. Agencies: County.”

There is no definition of workforce housing in the Comp Plan. However, the Community Workforce Housing Innovative Pilot Program (CWHIP) Request for Proposal (October 6, 2006) limits the qualifying income to 150% of Area Median Income. Using this definition, all households in Monroe County making less than \$87,675 would qualify for workforce housing.

In the Staff Report for September, 2005 BOCC Agenda Item (September 22, 2005), there is a short reference to the effect on Clearance Time from using the "Phased" or "Staged" evacuation: "The primary benefit associated with this alternative is the reduction of background traffic [*this is not correct, as I will explain below*] during a mandatory evacuation of the Keys residents. This reduction would in turn reduce the estimated evacuation clearance time for residents by approximately three and a half hours if an early evacuation of tourists is implemented, and six hours for early evacuation of tourists and mobile homes." To emphasize, this Staff Report statement is not in the Comprehensive Plan, but in the backup material presented to the BOCC.

[Background traffic is not evacuating traffic, but rather the traffic involved with driving back and forth doing errands and side trips like pulling boats out of the water and buying hurricane supplies. Background traffic adds to the traffic locally, and detracts from the ability to evacuate by taking up some of the roadway capacity. Removing the tourists and mobile home dwellers does not remove any background traffic.]

Since the Clearance Time (Miller) was stated by Ken Metcalf (formerly of DCA) to have been 23:58 prior to the adjustment of removing nearly 20,000 dwelling units (representing all of the Tourists and Mobile Home dwellers), a six-hour reduction would yield approximately 18 hours.

The Governor and Cabinet were justifiably confused by the use of both the 18.1- and the 18.2-hour figures and nobody at that Cabinet meeting explained the discrepancy. Both figures are referred to in the SFRPC study on pages 75 and 76. According to SFRPC, the Clearance Time using the Miller model is 18.1 hours with the tourists and the mobile home dwellers removed from the calculation. This is a complete perversion of the Miller model, since the Miller model specifically INCLUDED the tourists and mobile home dwellers as described in the following quote: "For the purposes of this study [Miller], traffic generated by hotels and other tourist units were included in determining clearance times, rather than discounted because they will be required to evacuate early...According to the Director of Emergency Management Operations for Monroe County, and others, not all hurricanes approaching the Keys will be "considerate" enough to provide ample warning for advanced tourist evacuation." (Miller, page 7)

The 18.2-hour figure is the SFRPC-calculated Clearance Time after removing the tourists, the mobile home dwellers and then using only 75% of the permanent residents. Removing the tourists and mobile home dwelling units from the Miller Model and then counting only 75% of the permanent residents leaves only 62% of the dwelling units to be counted in the Clearance Time. **And according to the SFRPC data, the 18.2-hour Clearance Time (Scenario T8) is derived by counting only 28,445 of the 59,012 evacuating vehicles, or 48% of the total vehicles.** The SFRPC study boasts that since *one* SFRPC clearance time calculation is nearly identical to *one* Miller-derived clearance time, there is some implied validity to their method.

But this is very unlikely, since the Miller method uses a VERY detailed compilation of traffic entering the evacuation route along the length of Monroe County, including the effects of evacuees entering the traffic flow from 29 population centers on 31 different potential choke points. However, as stated, the Miller Report did not include any traffic from Miami-Dade County in their calculation. It was this fundamental flaw that ultimately precipitated the SFRPC **Regional** study. Alas, the SFRPC study does not include any of the effects on Monroe County's Clearance Time of traffic in Miami-Dade County either, even though we must drive through this rapidly growing area for 40 miles to reach our official shelter.

The SFRPC study only measured the time that results when the total number of vehicles expected to evacuate is divided by the number of vehicles per hour that can pass through the critical link (SFRPC concluded that it was Snake Creek). Thus the SFRPC study did not include ANY drive time, either to the Snake Creek Bridge or from there to a safe destination. It also did not include any of the secondary or tertiary level choke points that would degrade the flow of traffic along the entire route.

So, to emphasize, the 18.1-hour figure is the number derived using the Miller spreadsheet and its complex formula along the entire route to Florida City (but ignoring all traffic effects in Miami-Dade County).

The 18.2-hour figure is the SFRPC number derived by simply dividing the number of evacuating vehicles in the most optimistic of eight scenario by the roadway capacity of the most critical link (also ignoring all traffic effects in Miami-Dade County). This is Test Scenario T8, which counts only 62% of the dwelling units using Miller data and only 48% of the vehicles according to SFRPC data.

To say that these two figures validate each other is like saying that an apple and an orange are related because they have nearly identical circumferences. [Interestingly, when this writer performed the same calculation using the SFRPC numbers, the result was 21.07 hours, not 18.2 hours (28,445 vehicles [T8, Appendix 7, page 4] divided by 1,350 vehicles per hour for the Snake Creek critical link).]

Nevertheless, it is the 18.1-hour "Miller" number, combined with its supposed validation by the 18.2 hour "SFRPC" number that is the basis for Monroe County claiming that they have achieved "Substantial Progress", by attempting to reaffirm it at the December 5, 2006 Cabinet meeting. After all, they did reduce the Clearance Time to below 24 hours!

Please read carefully the differences in the definitions used by PBS&J, Miller and SFRPC.

1989 PBS&J Definition of Clearance Time

"Clearance Time is the time required to clear the roadways of all vehicles evacuating in response to a hurricane situation. Clearance time begins when the first evacuating vehicle enters the road network and ends when the last evacuating vehicle reaches its destination."

This is the definition cited in our Comp Plan. The Miami-Dade/Monroe County line was erroneously used by PBS&J for the "destination", a flaw that was corrected with the "Miller " study, as you will read below. It was acknowledged that the County line is not a safe destination, and is some 40 miles from the nearest—and our official—shelter at Florida International University.

2001 Miller Definition of Clearance Time

"'Clearance time', as used in this study, begins when the first evacuating vehicle in Monroe County enters the roadway network, and it ends when the last evacuating vehicle exits, or passes by the northbound entrance to Florida's Turnpike on US1 in Florida City. For purposes of determining total time to safety for evacuating vehicles, additional time was added to the clearance times in this report to reflect an approximate time to get from Florida City to the evacuation shelter at Florida International University."

That additional time was a fixed 52 minutes to represent the time it would take to drive the 26 miles from Florida City to FIU at 30 miles per hour - the speed at which the greatest number of

vehicles per hour can evacuate.

The Miller study included a canned drive time from Florida City to FIU, ignoring the traffic effects of this rapidly growing area. Again, Miller did not include ANY traffic from Miami-Dade County, substituting instead the fixed 52 minutes. After numerous complaints about this critical flaw, Miller stated that Miami-Dade County traffic would be accounted for in some future Regional study. The SFRPC study was presumably that study, although astonishingly they, too failed to account for ANY of the traffic effects in Miami-Dade County on our clearance time.

Nevertheless, the Miller study was true to the Comp Plan definition in that it included all of the tourists and mobile home dwellers, **it starts the "clock" when the first evacuating vehicle enters roadway network, and ends when the last vehicle reaches safety.** Again, it is a complete perversion of the Miller study to remove the Tourists and Mobile Home dwellers to derive an 18-hour clearance time.

The Hurricane Evacuation Working Group was aware of the flaw in their plan and noted that "If clearance time is defined as '... beginning when the first evacuating vehicle in Monroe County enters the roadway network and ending when the last evacuating vehicle exits, or passes by the northbound entrance to the Florida's Turnpike on US 1 in Florida City,' [note – this is the Miller definition] then advanced clearance times of 48-hours, 36-hours, and 30-hours would require a clarification of clearance time for policy purposes." The clarification never materialized.

It was failure of the Miller study to consider the effects of Miami-Dade traffic on our evacuation that precipitated the SFRPC study. But much more than that was changed, and yet sadly the fundamental goal of delivering a meaningful Monroe County clearance time was not achieved. Consider how different the SFRPC definition is:

2006 SFRPC Definition of Clearance Time

"Clearance time, in the 2006 South Florida Regional Hurricane Evacuation Traffic Study, is determined for the counties and the regional roadways. It is established through a critical link analysis. Clearance time is the ratio of the volume of total evacuation traffic on a roadway link to the roadway capacity of that link. County clearance time measures the amount of hours it takes total evacuating vehicles to traverse the most limiting critical link (the critical link with the highest volume to capacity ratio) in each county under a worst case scenario regional hurricane evacuation."

This radically different definition is one of many problems with the SFRPC study.

It is my belief that the SFRPC study—as it relates to Monroe County's evacuation—started out to be a legitimate analysis. Who was responsible for manipulating the numbers and failing to measure the effects of Miami-Dade traffic is unknown to this writer.

Using the SFRPC clearance times in conjunction with "Phased Evacuations" for Monroe County Growth management purposes is profoundly wrong for many reasons:

1. Nobody authorized anyone to use a different definition for "Clearance Time". This constitutes a major Comp Plan Policy amendment that was not given ANY public scrutiny.
2. Using the Clearance Time definition of the Comp Plan or that of the Miller model, the first evacuating vehicle would be the first tourist, but for the SFRPC 18.2 hour calculation and the Miller-derived 18.1-hour calculation, all of the tourists and all of the mobile home dwellers are *removed* from the calculation and not accounted for.

3. Monroe County's 2010 Comprehensive Plan requires more than simply changing the clearance time number. Item Q of our Year Eight Work Program requires the County and the Department of Community Affairs to "Complete a comprehensive analysis of hurricane evacuation issues in the Florida Keys and develop strategies to reduce actual hurricane clearance times and thereby reduce potential loss of life from hurricanes." A paper reduction of clearance time *increases* the potential for loss of life by facilitating much greater development, whose additional residents would exacerbate the evacuation challenge.
4. In the SFRPC study, there is no drive time TO Snake Creek, nor is there any drive time from there to a destination. In fact, there is no destination at all except the other side of Snake Creek link, since they only measure how many hours and minutes it would take for all of the vehicles to line up prior to the Snake Creek link and file through. **Correcting for the missing drive time alone, and not including the other errors, could easily add 4 to 5 hours to all eight SFRPC Clearance Time scenarios.**
5. The SFRPC study only analyzes the effect of one segment of the evacuation – Snake Creek, which was determined by the SFRPC study to be the Critical Link. The Critical Link is defined as the segment of the evacuation route that has the highest "volume to capacity" ratio (the greatest number of evacuating vehicles compared to the number of vehicles per hour that can transit that segment). Using only one segment to define Clearance Time ignores the complexity of actual evacuations. The much-more sophisticated and realistic Miller study examined the effects of evacuees entering the traffic flow from 29 population centers on 31 different potential choke points, and frequently identified different Critical Links, depending on the scenario.
6. The basic SFRPC model is nonsensical. The formula simply divides the total evacuating vehicles in the County by the roadway capacity of the critical link, despite the fact that roughly 1/4 of all Monroe County evacuees live *north* of Snake Creek. Are they expected to drive south first so they can drive north through the Snake Creek link?
7. The "compounded diminution" of participation is dishonest. After removing the tourists and mobile home dwellers from the calculation, SFRPC measures only 75% (lifting a figure that was used in the Miller study) of the remaining permanent population and then measures how long the resulting number of vehicles would take to squeeze through the Snake Creek link. This is particularly disingenuous since the Miller Report SPECIFICALLY included all of the tourists and mobile home dwellers in their calculation. By using the SFRPC "compounding", only 62% of the inhabitants (using Miller dwelling unit data) or 48% of the total vehicles (using SFRPC data) are included in their 18.2-hour Clearance Time.
8. Meteorologists have made significant progress forecasting the track of a hurricane, but lament that they may never be able to predict rapid intensification. According to the National Weather Service, hurricanes Wilma, Rita, Ivan and Dennis all intensified from tropical storm to evacuation-inducing Category 3+ strength in less than 24 hours - and none of those intensifications were forecast. The tourists were evacuated for hurricane Rita a mere two hours prior to the permanent resident evacuation! It is absurd and dangerous to base an acceleration of development on the assumption that we will always have 48 hours warning.
9. There is absolutely no scientific or logical justification for declaring that the smallest of the 8 times generated by the SFRPC study—even if they WERE done with valid methods—is the "Official" Clearance Time. Although the South Florida Regional Planning Council has distanced themselves from any policy positions with regard to results of their study, others have not been so restrained.

10. By using the smallest of the 8 times, the door is open to nearly 20,000 new dwelling units that would compound our evacuation problems in a very dangerous way. The 20,000 figure is derived from the number of tourist and mobile home dwelling units that have been removed from the calculation (4,987 mobile home dwelling units and 14,460 tourist dwelling units) to generate the 18.2-hour figure. Building the identical number of new units would bring the clearance time right back to 24 hours. **It is frightening to consider a future evacuation that included all of the present inhabitants and the residents of 20,000 new dwelling units. Monroe County's mayor has said he will ask the State for 3,500 additional building permit allocations. What's next?**
11. None of the Monroe County Clearance Time calculations nor critical-link analyses to date (using any model) take into consideration the effects on our evacuation of traffic in Miami-Dade County, despite the fact that we must travel at least 40 miles beyond our County line to reach the nearest Category 3 shelter. This was one of the primary reasons for the creation of the "South Florida Regional Hurricane Evacuation Traffic Study". Alas, there is no mechanism in the study to include that regional traffic into Monroe County's Clearance Time. Although the study has value for other jurisdictions, for Monroe County the study fails to deliver what should be its most fundamental product – a valid "Clearance Time."

Conclusion

It is prudent to conduct "Phased" or "Staged" evacuations whenever extra time exists, but it is gravely irresponsible to diminish public safety as result of this hopeful approach. The only valid purpose for decreasing our Clearance Time is to increase public safety, not to facilitate significantly more development that would exacerbate our hurricane-evacuation challenges. The "Clearance Time" books have been cooked and somebody should be held accountable.

It is profoundly wrong to declare that the County has achieved "Substantial Progress" when nothing was changed but the definition of Clearance Time. The erroneous DCA 2006 Annual Assessment finding must be reversed.

Sincerely,
John Hammerstrom